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U. S. COAST AND GEODETIC SURVEY
E. LESTER JONES, SUPERINTENDENT

UNITED STATES COAST PILOT

PACIFIC COAST

CALIFORNIA, OREGON, AND WASHINGTON

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DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, September 10, 1917.

This publication covers the coast and interior waters of the States of California, Oregon, and Washington. It is based mainly upon the work of the Coast and Geodetic Survey, including the results of special examinations in 1916.

The first volume covering this area, entitled "Directory of the Pacific Coast of the United States," was prepared by George Davidson, assistant, Coast and Geodetic Survey, and published in 1858. The present (third) edition has been prepared by R. S. Patton, hydrographic and geodetic engineer, Coast and Geodetic Survey.

Great courtesy has been shown by the United States Engineers, the Lighthouse Service, navigators on the Pacific coast, and local authorities in furnishing information for use in this publication.

The aids to navigation are corrected to September 10, 1917.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication or of additional matter which they think should be inserted for the information of mariners.

E. LESTER JONES,
Superintendent.

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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles* and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean lower low water*, except in Puget Sound, where the plane is 2 feet below mean lower low water.

Supplements and other corrections for this volume are issued from time to time, and will be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

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UNITED STATES COAST PILOT.

PACIFIC COAST—CALIFORNIA, OREGON, AND WASHINGTON.

NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these Publications, and Notice to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS bear three dates which should be understood by persons using them: (1) The date (month and year) of the edition, *printed* on the late charts below the border in a central position, and on the older ones on the face of the chart; (2) the date of the latest correction to the chart plate, *printed* in the lower left-hand corner below the border; (3) the *date of issue*, *stamped* below the border and just to the left of the subtitle.

Charts show all necessary corrections as to lights, beacons, buoys, and dangers, which have been received to the *date of issue*, being hand corrected since the latest date printed in the lower left-hand corner. And small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notices to Mariners, and should be applied by hand to the chart immediately after the receipt of the notices.

The date of the edition of the chart remains unchanged until an extensive correction is made on the plate from which the chart is printed. The date is then changed and the issue is known as a new edition.

When a correction, not of sufficient importance to require a new edition, is made to a chart plate the year, month, and day are noted in the lower left-hand corner.

All the notes on a chart should be read carefully, as in some cases they relate to the aids to navigation or to dangers that can not be clearly charted.

The charts are various in character, according to the objects to which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1,200,000}$ which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.

2. General charts of the coast, on scales of $\frac{1}{400,000}$ and $\frac{1}{200,000}$ intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80,000}$ by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.

4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

Coast Pilots, relating to the surveyed waters of the United States, Porto Rico, and a part of Alaska, and Sailing Directions of the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to parts of Alaska and Hawaii is published in Coast Pilot Notes.

Coast Pilots are corrected for important information received to the date of issue, which is stamped on the correction sheets accompanying the volume. From time to time, as the material accumulates, supplements are issued, containing the more important corrections since the publication of the volume. The supplements are printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C., provided the volume itself has not been superseded by a subsequent edition.

Tide Tables.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made, and contain the predicted time and height of the tides for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

Agencies for the sale of the Charts, Coast Pilots, and Tide Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C., or any of the suboffices. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Coast and Geodetic Survey." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey Office, Washington, D. C.

Other Publications.—Lists of Lights, Buoys, and other Daymarks of the United States, its Insular Possessions, and the Great Lakes, are published by the Bureau of Lighthouses. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. These publications can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHART.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide.

This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and parts of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed it may be taken for granted that the survey was not in great detail.

A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made.

Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

DREDGED CHANNELS.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary.

The actual depth of a completed channel may be greater than the charted depth shortly after dredging, and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering.

Danger Curves.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart, and regard this as a "danger curve," which is not to be crossed without precaution.

Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

Caution in Using Small-Scale Charts.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale, therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason, bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

Distortion of Printed Charts.—The paper on which charts are printed has to be dampened. On drying, distortion takes place from the inequalities of the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

Buoys.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions; it is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of soundings.

Gas buoys and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished, or, if intermittent, the apparatus may get out of order.

Lights.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet for the observer's eye. The table of distances of visibility due to height, published in the light list, affords a mean of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass.

The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility

in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

Fog Signals.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time; mariners must not, therefore, judge their distance from a fog signal by the force of the sound and must not assume that a signal is not sounding because they do not hear it.

Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

Submarine Bells have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but a bearing of the signal can not then be readily determined.

Tides.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates to or is less than the draft of the vessel and wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

The Tide Tables published by the Coast and Geodetic Survey give the predicted times and heights of high and low yaters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports.

Plane of Reference for Soundings on Charts.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water, and for Wrangell Strait, Alaska, it is 3 feet below mean lower low water.

For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs.

For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water there will generally be as many low waters or lower low waters below those planes as above them. Also the wind may at times cause the water to fall below the plane of reference.

Tidal Currents.—In navigating coasts where the tidal range is considerable, special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore.

The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence.

A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels.

Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large tidal basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside.

The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve.

Countercurrents and eddies may occur near the shores of straits, especially in bights and near points.

Tide Rips and Swirls occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current; when these conditions are at their worst the water is broken into heavy choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

Current Arrows on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner, the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

FIXING POSITION.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor sextant angles between well-defined objects on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters, also, where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand, distant objects should be used for direction because less affected by a small error or change of position.

The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a revolver, must be avoided. In case of doubt select from the chart three objects nearly in a straight line, or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position,

when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range give in general an excellent fix, easily obtained and plotted.

THE COMPASS.—It is not intended that the use of the compass to fix the position should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors.

When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

DOUBLING THE ANGLE ON THE BOW.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers so that the distance measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

DANGER ANGLE.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

SOUNDINGS.—In thick weather, when near or approaching the land or danger, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course

until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

SUMNER'S METHOD.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method should be well understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a considerable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

CHANGE OF VARIATION OF THE COMPASS.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

LOCAL MAGNETIC DISTURBANCE.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow and

the force strong the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together.

The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever an area of local magnetic disturbance is noted the position should be fixed and the facts reported as far as they can be ascertained.

Use of Oil for Modifying the Effect of Breaking Waves.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves, i. e., waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain, as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running or lying-to, or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls.

The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow, and another position farther aft, seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

2984°—17——2

PACIFIC COAST—CALIFORNIA, OREGON, AND WASHINGTON.

GENERAL INFORMATION.

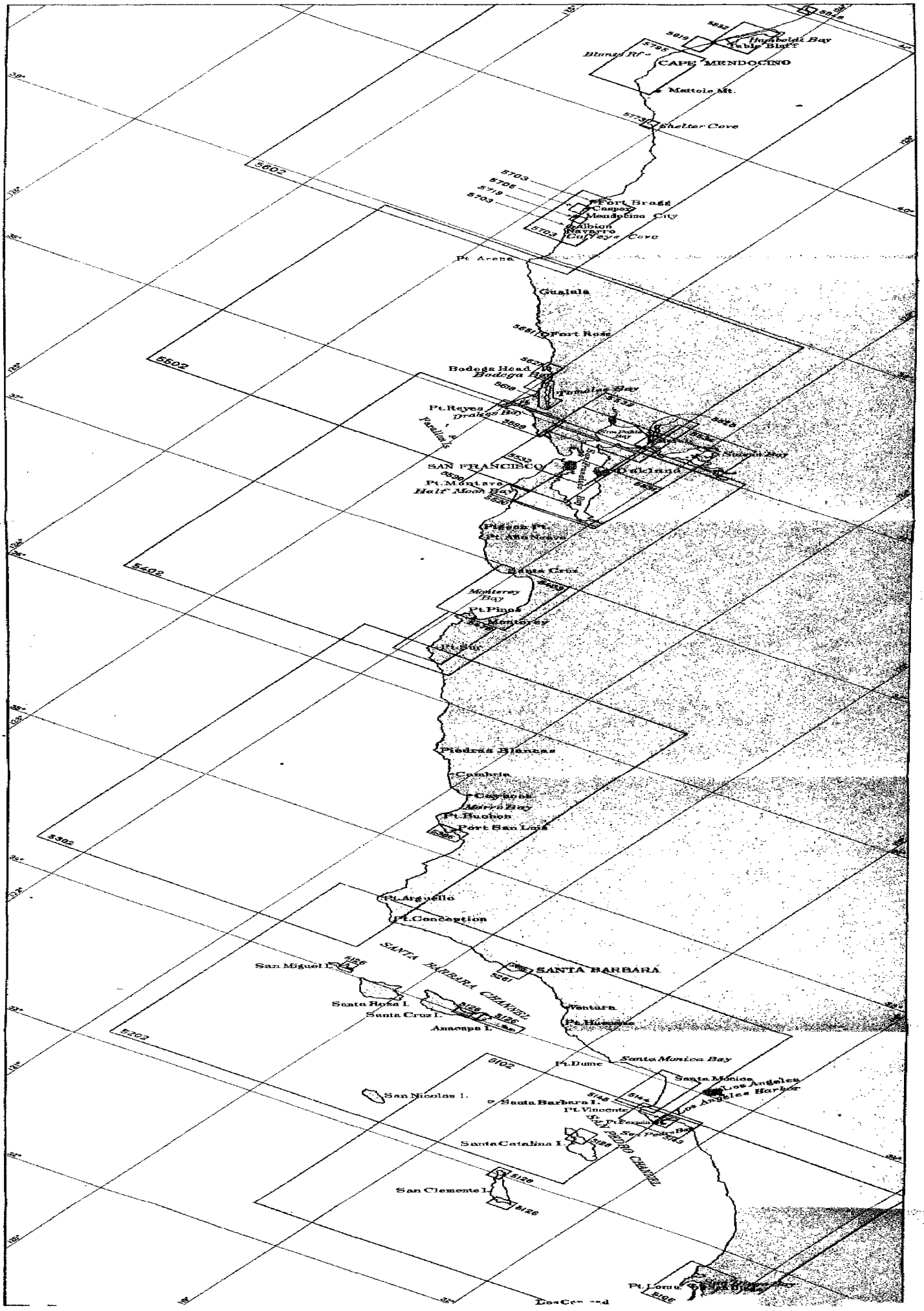
This volume, "Pacific Coast—California, Oregon, and Washington," covers the western coast of the United States between the Mexican boundary on the south and the international boundary between British Columbia and the United States on the north, including Juan de Fuca Strait and tributary waters within those limits.

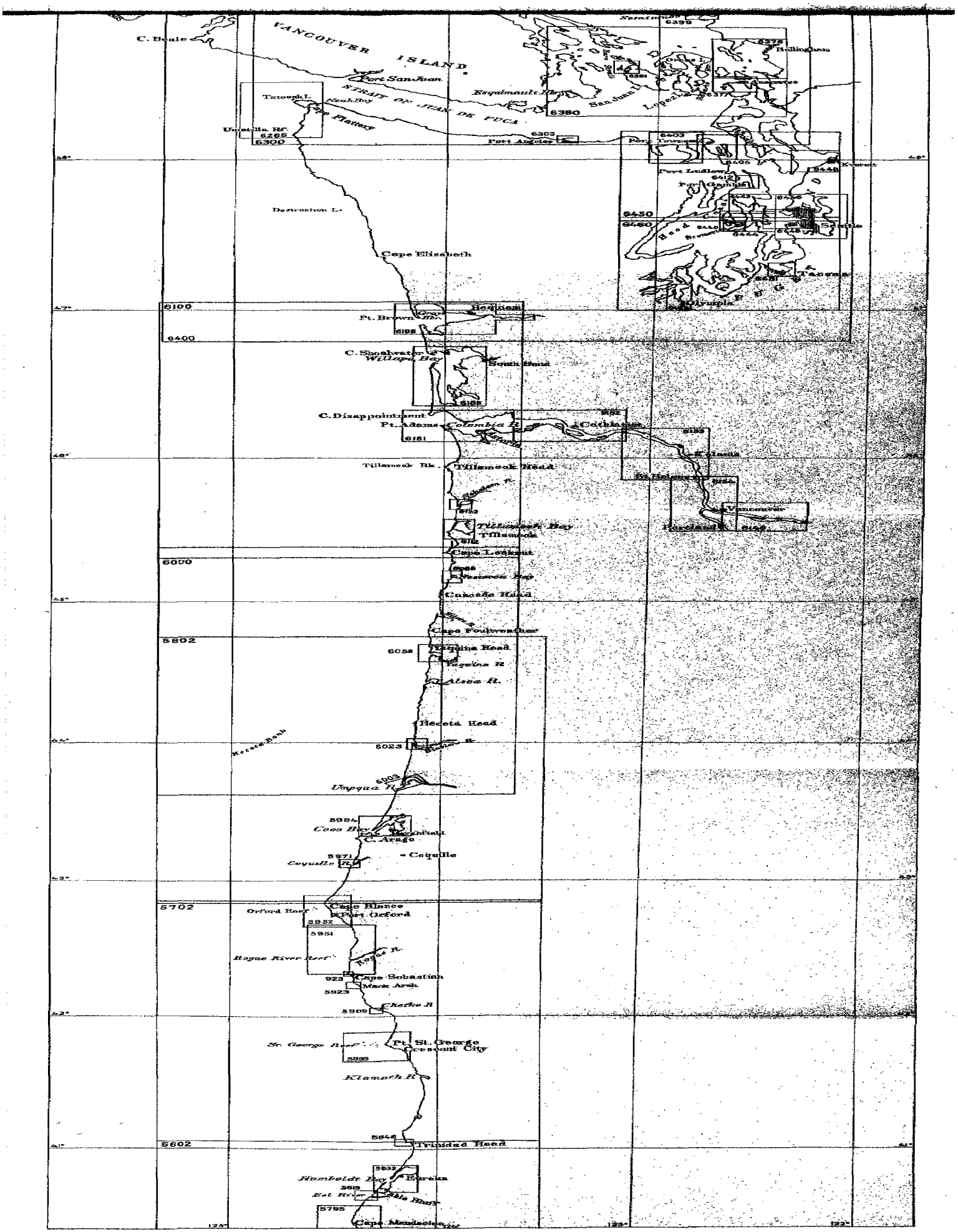
The coast, as a rule, is rugged and mountainous, the high land in many places rising abruptly from the sea. Southward of San Francisco Bay the mountains are usually bare or covered with chaparral and underbrush. Northward of San Francisco Bay they are generally well timbered, and in some places, especially northward of the Columbia River, the timber is particularly dense and heavy.

There are few outlying **dangers**, the principal ones being **Bishop Rock**, southward and westward of Point Loma; **Noonday Rock** and the **Farallones**, in the approaches to San Francisco Bay; **Blunts, St. George, Rogue River, Orford**, and **Umatilla** reefs, northward of San Francisco. These are described under separate headings in their appropriate place in the detailed description of the coast. The islands off the southern coast of California are the largest and most prominent and, except the Farallones, the farthest offshore of any along the coast.

The depths in approaching the coast are too great for the ordinary vessel to obtain soundings until within a short distance of the shores; the slope from the 100-fathom curve to greater depths is very abrupt, as is the case in many places from the 30-fathom curve to 100 fathoms. The 100-fathom curve lies at an average distance of less than 10 miles offshore, but this distance is increased in several cases, as in approaching San Francisco Bay, in the vicinity of Heceta Bank, off the mouth of the Columbia River, and at the entrance to Juan de Fuca Strait. In thick weather the greatest caution should be exercised and soundings taken frequently.

Kelp grows on nearly every danger having a rocky bottom and is particularly heavy at various points in the Santa Barbara Channel and in the vicinty of San Diego Bay. It will be seen on the surface of the water during the summer and autumn months; during the winter and spring it is not always to be seen, especially where it is exposed to a heavy sea. Kelp should always be considered a sign of danger and no vessel should pass through it unless the spot has been carefully examined and sounded. There are, however, many rocks not marked by it; a heavy sea will occasionally tear the kelp away from rocks, and a moderate current will draw it under water so that it will not be seen. When passing on the side of a patch of kelp from which the stems stream away with the current, care should be taken to give it a good berth. Dead, detached kelp floats on the water curled in masses, while live kelp, attached to rocks, streams away level with the surface.


Humboldt Bay
Table Bluff
Blunts Rf.
CAPE MENDOCINO
Mattole Mt.
Shelter Cove
Fort Bragg
Caspar
Mendocino City
Albion
Navarro
Gulch
Cuffeys Cove
Pt. Arena
Gualala
Fort Ross
Bodega Head
Bodega Bay
Tomales Bay
Pt. Reyes
Drakes Bay
Farallons
San Pablo Bay
Suisun Bay
SAN FRANCISCO
Oakland
Pt. Montara
Half Moon Bay
Pescadero Pt.
Pt. Ano Nuevo
Santa Cruz
Monterey Bay
Pt. Pinos
Monterey
Pt. Sur
Piedras Blancas
Cambria
Cayucos
Morro Bay
Pt. Buchon
Port San Luis
Pt. Arguello
Pt. Conception
SANTA BARBARA CHANNEL
San Miguel I.
SANTA BARBARA
Santa Rosa I.
Santa Cruz I.
Anacapa I.
Ventura
Pt. Hueneme
Santa Monica Bay
Pt. Dume
Santa Monica
Los Angeles
Los Angeles Harbor
San Nicolas I.
Santa Barbara I.
Pt. Vincente
Pt. Fermin
San Pedro Bay
Santa Catalina I.
SAN PEDRO CHANNEL
San Clemente I.
Pt. Loma
Los Coronados


C. Beale
VANCOUVER ISLAND
Port San Juan
STRAIT OF JUAN DE FUCA
Esquimault Harb.
San Juan I.
Lopez I.
Tatoosh I.
Neah Bay
Cape Flattery
Umatilla R.
6265
6300
6303
Port Angeles
6399
6375
Bellingham
6380
6377
6403
Port Townsend
6405
Port Ludlow
6412
Port Gamble
6448
Everett
6450
6460
Seattle
Tacoma
Olympia
Destruction I.
Cape Elizabeth
6100
Pt. Brown
Gray Hbr.
Hoquiam
6195
6400
C. Shoalwater
Willapa Bay
South Bend
6198
C. Disappointment
Pt. Adams
Columbia R.
Astoria
6151
Cathlamet
6152
6153
Tillamook Rk.
Tillamook Head
Nehalem R.
6112
Tillamook Bay
Tillamook
6112
Cape Lookout
6000
Siuslaw Bay
Cascade Head
Cape Foulweather
5802
6058
Yaquina Head
Yaquina R.
Alsea R.
Heceta Head
Heceta Bank
5023
Siuslaw R.
5903
Umpqua R.
5984
Coos Bay
Bandon
C. Arago
Coquille
5971
Coquille R.
5702
Orford Reef
Cape Blanco
Port Orford
5952
5951
Rogue River Reef
Rogue R.
923
Cape Sebastian
Mack Arch
5923
Chetco R.
5909
Sr. George Reef
Pt. St. George
Crescent City
5895
Klamath R.
5846
Trinidad Head
6602
5837
Humboldt Bay
Eureka
5819
Eel River
Mad River
5795
Cape Mendocino
125°
124°
123°
122°
48°
47°
46°
45°
44°
43°
42°
41°

Anchorage, affording shelter from the severe northwesterly winds of summer, may be had in a number of places along the coast. In southeast and southwest weather there are few places where shelter may be had; San Diego Bay, Los Angeles Harbor, the lee side of the islands off the southern coast, and Monterey Bay are the only places south of San Francisco Bay. North of San Francisco, Humboldt Bay, Coos Bay, Tillamook Bay, Columbia River, Willapa Bay, and Grays Harbor afford good shelter, but most of these places must be made before the sea rises, as afterwards the bars become impassable. Neah Bay, just inside the entrance to Juan de Fuca Strait, is used considerably by vessels in westerly or southerly weather.

Aids to navigation.—These are numerous, and there are few places along the coast where a vessel is not in sight of one or more lights. Light vessels are placed off: San Francisco Entrance, Blunts Reef near Cape Mendocino, the mouth of the Columbia River, Umatilla Reef, and Swiftsure Bank off the entrance to Juan de Fuca Strait. The dangers are buoyed as a rule and generally marked by kelp. The buoyage accords with the system adopted in United States waters. The light vessels and principal coast lights are described in the text of this volume. For a complete description of all lighted aids see the Light List, Pacific Coast of the United States, published by the Lighthouse Service, which can be obtained, free of charge, from the Division of Publications, Department of Commerce, Washington, D. C.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions, with channel ways on either side of them, and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in mid-channel, and must be passed close-to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side, and can buoys on the port side of channels.

Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Pilots will be found cruising off the principal ports, or may be obtained at many points by making signal. Extracts from the laws governing pilots and pilotage will be found under the headings of the various localities.

Towboats may be had at all the principal ports, and sailing vessels usually take one before entering Juan de Fuca Strait or as soon after as possible. Sailing vessels occasionally are towed north during the

summer months when time is an object. Many of the towboats are owned by the lumber companies at ports like Humboldt Bay, Coos Bay, etc.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the present edition being that of 1915. A supplement is issued after every session of Congress. The volume and supplements can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., price $1 for the volume and 5 cents each for the supplements.

Rules of the road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published by the Bureau of Navigation, Department of Commerce.

Pilot rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat-Inspection Service in Form 804.

Copies of these pamphlets are furnished by the officers of the Steamboat-Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

Quarantine for all ports within the limits of this volume is enforced in accordance with the requirements of the United States Public Health Service. Quarantine regulations will be found at the stations of the service and at American consulates, and will be furnished to vessels upon application, either by officers of the service or by the bureau at Washington, D. C. Every vessel should be provided with the quarantine regulations. Port sanitary statements are issued by the United States Public Health Service and may be obtained at the stations of the service or from collectors of customs in all ports of the United States. The following are the national quarantine stations within the limits covered by this volume:

CALIFORNIA:
- San Diego.
- San Pedro.
- Redondo.
- Santa Barbara.
- Port Harford.
- Monterey.

CALIFORNIA—Contd.
- San Francisco.
- Fort Bragg.
- Eureka.

OREGON:
- North Bend.
- Newport.

OREGON—Continued.
- Florence.
- Astoria.

WASHINGTON:
- Port Angeles.
- Port Townsend.

Marine hospital.—Information as to relief furnished seamen will be found in the regulations of the United States Public Health Service, which can be consulted at all stations of the service. Such stations are located at ports of any importance, and if not in charge of a service officer, relief will be provided by collectors of customs upon application.

The following stations are in charge of a service officer:

CALIFORNIA:
- San Diego.
- Los Angeles.
- San Francisco (hospital).
- Eureka.

OREGON:
- Marshfield.
- Newport.
- Astoria.
- Portland.

WASHINGTON:
- Hoquiam.
- Port Angeles.
- Port Townsend (hospital).
- Bellingham.
- Seattle.
- Tacoma.

Supplies.—Vessels usually obtain their supplies in either San Diego, Los Angeles, San Francisco, Columbia River, or Puget Sound. Coal can be obtained at a number of points. Fuel oil can be obtained at all the principal ports. Ship-chandler's stores can be had at San Diego, San Pedro, San Francisco, Humboldt Bay, Coos Bay, Columbia River, and Puget Sound, and in limited quantities at several other places.

Repairs may be made at Long Beach, San Francisco and vicinity, Humboldt Bay, Coos Bay, Astoria and Portland, Grays Harbor, and at a number of places on Puget Sound, among which Seattle has the best facilities.

Communication is by regular lines of coasting steamers and rail, and by telegraph, telephone, and radio. There are several trans-Pacific lines of steamers and a number of transcontinental railroads.

Weather.—There are two seasons—the summer or dry season, which begins about May and continues until October, and the winter or rainy season, covering the remainder of the year. These seasons vary in length in different parts of the coast as well as in different years.

Along the southern part of the coast the rainy season is comparatively short and the rainfall much lighter than in the northern portion, being so light in some years as to cause considerable damage to stock and farming industries. The winter gales from southward and southwestward are less frequent and less severe than at more northern points. The temperatures are milder and more even, and the snowfall is limited to the higher mountain peaks.

Northward of San Francisco the rainy season increases in length and amount of rainfall, and as Juan de Fuca Strait is approached showers of short duration and generally local may be looked for at any time. Snow falls at rare occasions in San Francisco and vicinity, but is frequent and at times heavy in the vicinity of Juan de Fuca Strait. From San Francisco northward the winter gales increase in severity, frequency, and duration, while in summer the northerly and northwesterly winds at times reach almost hurricane strength.

Winds.—The prevailing winds in summer are from northwest and west, on the northern part of the coast; on the southern part, from west and southwest. The northwest winds in summer frequently reach a velocity of 70 miles an hour and extend as far south as Point Conception, eastward of which their severity is much less. As a rule, the northwest wind begins about sunrise and reaches its maximum velocity about 3 or 4 p. m., moderating toward sunset and dropping to light airs or calms by daylight. The severe northwesterly gales generally last two to three days, and continue throughout the night with little or no diminution.

In winter the heaviest weather is from southeast and southwest, with an occasional northerly gale of short duration. The southeast gale occurs at any time, generally accompanied by rain and thick weather, and increasing in severity northward. These gales, with the heavy southwest swell prevailing during the winter months, cause a confused, irregular sea that taxes the weatherly qualities of a vessel to the utmost. They spring up gradually from southward, and increase in strength, with a rapidly falling barometer. When the barometer becomes stationary, the wind shifts to southwest and blows heavily, with clearing weather and frequent rain squalls. The

barometer rises when the wind hauls to southwest, from which point it generally blows from 12 to 20 hours.

When the southwest gale of winter is not preceded by southerly weather, the barometer seldom falls, but either remains stationary, when the gale may be expected to continue longer, or rises slowly, when it will gradually subside and fine weather follow.

Fog.—On the outside coast fogs are liable to occur at any time, but are more frequent in July, August, and September. On the southern part of the coast they are light and generally clear away by noon. In the northern parts of the coast they are more frequent and at times are very dense, and have been known to extend several hundred miles seaward. They continue at times for weeks, rendering navigation difficult, and frequently require considerable wind to dispel them. They are generally brought in toward sundown, from seaward, by light westerly winds, and ordinarily continue until noon of the following day and sometimes later.

The following table shows the average number of hours per month, from a record of about nine years, that the fog signals were operated at the stated light stations of the United States:

Hours of operation of fog signals.

Light station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Ballast Point, San Diego Bay	27	11	8	3	9	10	8	5	7	19	22	8	137
Point Loma	12	54	34	21	5	10	4	23	18	35	27	18	261
Los Angeles Harbor	16	49	35	37	16	13	9	47	45	63	56	38	424
Point Hueneme	10	38	22	28	19	42	35	89	60	45	31	9	428
Point Arguello	36	34	35	54	47	104	151	145	116	67	53	26	868
San Luis Obispo	33	22	33	55	48	94	162	159	146	87	50	17	906
Piedras Blancas	40	41	53	55	40	96	188	160	151	93	73	30	1,020
Point Sur	26	25	49	52	30	86	164	145	130	95	41	16	859
Ano Nuevo Island	30	39	50	33	23	52	105	92	122	116	68	37	767
Farallon	28	48	55	30	27	61	104	116	126	110	68	28	801
Bonita Point	51	51	46	29	24	59	112	108	121	118	90	49	858
Alcatraz fog signal	31	37	37	18	12	37	67	58	68	66	58	27	516
Mare Island	38	23	10	4	3	...	12	6	2	10	25	38	171
Point Reyes	68	74	65	54	63	108	189	191	175	168	97	64	1,316
Point Arena	30	49	55	30	41	82	159	168	146	125	71	30	986
Point Cabrillo	33	49	98	30	43	92	150	188	171	136	68	26	1,084
Punta Gorda	36	41	43	17	35	74	118	112	97	90	28	16	707
Blunts Reef light vessel	77	95	84	48	56	104	146	175	160	140	72	45	1,202
Table Bluff	26	77	72	24	32	81	158	156	161	137	60	30	1,014
Humboldt Bay	42	61	81	28	44	81	148	160	209	190	92	35	1,171
Trinidad Head	16	84	50	33	41	67	177	158	182	128	67	21	1,024
St. George Reef	26	59	64	26	47	92	178	200	160	118	53	14	1,037
Coquille River	21	50	23	26	38	59	90	122	128	103	46	17	723
Tillamook Rock	30	54	42	24	22	40	83	89	66	54	28	30	562
Columbia River light vessel	58	68	55	36	25	26	53	70	66	63	60	54	634
Desdemona Sands	18	17	17	9	10	7	18	17	23	23	17	10	186
Willamette River	60	32	12	1	1	...	....	....	14	40	71	61	292
Grays Harbor	69	52	57	25	25	40	83	138	92	81	82	56	800
Destruction Island	28	27	37	19	25	43	85	105	68	56	25	22	540
Umatilla Reef light vessel	51	47	50	36	40	35	76	148	89	73	60	41	746
Cape Flattery	52	34	34	22	40	67	105	168	100	52	27	21	722
Point Wilson	40	40	16	11	17	29	30	88	62	46	25	7	411
West Point	31	45	20	4	4	6	8	31	39	49	56	51	344
Browns Point	98	96	48	24	8	9	11	80	129	130	99	105	837

North Pacific weather, by months.—JANUARY is usually a stormy month on the North Pacific Ocean. Brisk to high southeast winds may be expected, with gales often lasting for many days. An area of low pressure overlies the North Pacific and is more or less permanent in character. Numerous disturbances prevail on the Washington and Oregon coasts, sometimes moving southward over California, but more generally moving eastward or southeastward across the United States. Low tule fog occurs in the morning at the mouths of rivers and harbors.

FEBRUARY is also a stormy month. High northeast winds lasting for days may be expected north of Cape Flattery, while high southeasterly winds prevail southward to Point Conception. Rainfall is heavy and frequent from Cape Mendocino northward. A rapidly falling barometer with southeast winds is generally followed by several days of stormy weather.

MARCH is a month of unsettled weather. Southerly winds frequently hauling to strong southwesterly winds may be expected. Occasionally disturbances will move northward from the California coast over Oregon and Washington. The rainfall is apt to be heavy along the coast north of Cape Blanco.

APRIL is a month of showers. Fresh westerly winds, changing to brisk northwesterly, may be expected along the entire coast. Occasionally disturbances may be expected on the Oregon and Washington coasts, passing generally to the northeast. The rainfall is less than in the preceding month.

MAY is as a rule a pleasant month. There are but few southeasterly gales. Northwest winds prevail north of Cape Mendocino. Occasionally high north to northwest winds blow steadily for several days along the coast. Gales are rare, and when they do occur are of moderate intensity.

JUNE is as a rule a pleasant month. Areas of high pressure may move from the California coast northward through Oregon and Washington. Winds are as a rule from the west or northwest. Rainfall is scant south of Cape Mendocino. More or less fog prevails along the coast.

JULY is generally a pleasant month. High northwest winds prevail along the coast of Oregon and northern California. There is also much fog in the afternoon at the entrance to San Francisco Bay, and much fog prevails along the coast.

AUGUST is usually a quiet month. Storms are infrequent. Rainfall is very light along the coast, especially south of Cape Mendocino. Fogs are frequent on the California coast. Strong north to northwest winds prevail along the entire coast. August averages the most fog of any month of the year.

SEPTEMBER is a quiet month. Occasional storms occur toward the close of the month and rainfall is heavier on the Oregon and Washington coasts. The winds are generally from the northwest, and much low fog prevails close to the shore.

OCTOBER marks the beginning of stormy weather. Occasional disturbances with high southeasterly gales may be expected from the Straits of Juan de Fuca south to Point Reyes. Rainfall is heavier and fog is less frequent except south of Cape Mendocino.

NOVEMBER is a stormy month. Southeast gales are frequent, increasing in severity toward the close of the month. This month marks the beginning of the rainy season in California.

DECEMBER is a stormy month. Southeast gales are frequent and winds from 40 to 60 miles an hour may occur with these storms. The rainfall is heavy along the entire coast. Low-lying fogs frequently occur in the morning along the coast, but are much less frequent than in summer.

Smoke from forest fires occurs in July, August, and September, in Puget Sound and Georgia Strait, and at times extends a considerable distance seaward, southward and northward of Cape Flattery. At times it is a serious hindrance to navigation and has been known to prevent it entirely in Puget Sound. In recent years its prevalence has considerably diminished, some seasons being entirely free from it; it is cleared away by rains.

MARINE REPORTING STATIONS.

Marine reports are telegraphed from the following points on the Pacific coast, under an arrangement with the Merchants' Exchange, San Francisco, Cal., the reports being prepared by agents of the exchange or by captains of coasting vessels:

Honolulu, Hawaii.
San Diego, Cal.
San Pedro, Cal.
Redondo Beach, Cal.
Hueneme, Cal.
Ventura, Cal.
Santa Barbara, Cal.
Point Conception, Cal.
Surf, Cal.
Port San Luis, Cal.
Santa Cruz, Cal.
Point Lobos, Cal.
Point Reyes, Cal.
Mendocino, Cal.
Fort Bragg, Cal.
Westport, Cal.
Table Bluff, Cal.
Eureka, Cal.
Bandon, Oreg.
Marshfield, Oreg.
Seaside, Oreg.
Astoria, Oreg.
South Bend, Wash.
Westport, Wash.
Hoquiam, Wash.
Tatoosh, Wash.
Port Crescent, Wash.
Port Angeles, Wash.
Port Townsend, Wash.
Port Gamble, Wash.
Bremerton, Wash.
Winslow, Wash.
Port Blakeley, Wash.
Seattle, Wash.
Tacoma, Wash.
Olympia, Wash.
Everett, Wash.
Bellingham, Wash.
Vancouver, B. C.
Victoria, B. C.

STORM WARNINGS.

Storm warnings are displayed by the United States Weather Bureau on the coast of the United States and the Great Lakes.

Small-craft warning.—A red pennant indicates that moderately strong winds are expected.

Storm warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennant displayed with the flag indicates the direction of the wind—white, westerly; red, easterly. The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light below a red light, westerly winds.

The following are the *storm warning display stations* within the limits covered by this volume:

CALIFORNIA:
- San Diego.
- San Diego (coal bunkers).
- Coronado Beach.
- Point Loma.
- Catelina Island.
- Long Beach.
- Redondo.
- San Pedro (South Coast Yacht Club).
- San Pedro (inner harbor).
- Venice.
- Santa Barbara.
- Point Arguello.
- Port Harford.
- San Francisco (merchants' exchange).
- San Francisco (wharfingers office).
- San Francisco (Yerba Buena Island).
- Navy yard, Mare Island.
- Point Reyes light.
- Mendocino.
- Fort Bragg.
- Table Bluff.

CALIFORNIA—Continued.
- Humboldt Bay Coast Guard station.
- Eureka.

OREGON:
- Coos Bay Coast Guard station.
- North Bend.
- Marshfield.
- Point Adams Coast Guard station.
- Astoria.

WASHINGTON:
- North Head.
- Aberdeen.
- Tatoosh Island.
- Neah Bay.
- Clallam Bay.
- Port Angeles.
- Port Townsend.
- Seattle.
- Madison Park.
- Tacoma.
- Everett.
- Anacortes.
- Bellingham.
- Blaine.

RADIO SERVICE.

The United States naval coastwise radio stations and all ships of the United States Navy equipped with radio apparatus are open for commercial business. Information concerning regulations, rates, and the commercial work of the stations may be obtained by addressing the Director of Naval Communications, Radio, Va. Hydrographic information, weather reports, storm warnings, and time signals are sent out from the stations for the benefit of shipping.

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations at noon of the seventy-fifth meridian time on the Atlantic coast and at noon of the one hundred and twentieth meridian time on the Pacific coast. The signals begin at 11.55 and continue for 5 minutes. During this interval every tick of the clock is transmitted, except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The noon signal is a longer contact after this long break. Similar time signals are also sent at 10 p. m. from some of the stations.

The supervision of radio communication in the United States is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, vessels of the United States Navy, Coast Guard cutters, and amateurs; and the radio laws and regulations of the United States are published by that bureau, and either publication can be obtained from the superintendent of documents, Government Printing Office, Washington, D. C., price 15 cents each.

Changes or additions to the stations are published in bulletins issued monthly, price 5 cents per copy or 25 cents per year. (These bulletins have been temporarily discontinued.)

The International List of Radio Stations of the World includes the stations of the United States, excepting amateurs, and contains additional information, such as geographical location, normal range in nautical miles, radio system, and rates. Persons desiring this list should communicate direct with the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. The price is 60 cents per copy, not including postage. The rates of postage are: One copy, 24 cents; 2 copies, 36 cents; 3 copies, 48 cents.

SIGNALS FOR SURVEYING VESSELS.

The following special **signals for surveying vessels** of the United States employed in hydrographic surveying, have been prescribed:

A surveying vessel of the United States, under way or at anchor in a fairway and employed in hydrographic surveying, may carry where they can best be seen, but in any case well above the rigging lights prescribed by law for preventing collisions, three lights in a vertical line one over the other and not less than 6 feet apart. The highest and lowest of these lights shall be green, and the middle light shall be white, and they shall be of such a character as to be visible all around the horizon at a distance of at least 2 miles. In the case of a small vessel the distance between the lights of such private code may be reduced to 3 feet if necessary.

By day such surveying vessel may carry in a vertical line, not less than 6 feet apart, where they can best be seen, three shapes of not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and green in color, and the middle one diamond in shape and white.

UNITED STATES COAST GUARD STATIONS.

Coast Guard stations are maintained at the places named in the following table. The stations are manned throughout the year, and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be sent free of charge upon application to the United States Coast Guard, Washington, D. C.

The Coast Guard stations are provided with the International Code of Signals. Where telephone or telegraph facilities are available, messages of passing vessels will be received and promptly forwarded.

Signals.—The following signals have been adopted by the United States Coast Guard:

Upon the discovery of a wreck by night the Coast Guard force will burn a red pyrotechnic light or a red rocket to signify "You are seen; assistance will be given as soon as possible."

A red flag waved on shore by day or a red light, red rocket, or red Roman candle displayed by night will signify "Haul away."

A white flag waved on shore by day or a white light slowly swung back and forth or a white rocket or white Roman candle fired by night will signify "Slack away."

Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night will signify "Do not attempt to land in your own boats; it is impossible."

A man on shore beckoning by day or two torches burning near together by night will signify "This is the best place to land."

Any of these signals may be answered from the vessels as follows: In the daytime, by waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time and then concealing it.

Cautions.—Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 years offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go after entering the breakers, as is frequently done, and the chances of saving life correspondingly lessened.

Official designation.	State.	Locality.
306	Washington...	Baaddah Point, opposite south end of Waaddah Island, Neah Bay.
307	.....do.....	Grays Harbor, just south of Grays Harbor light.
308	.....do.....	Willapa Bay, near lighthouse boat landing.
309	.....do.....	Klipsan Beach, 10 miles north of Cape Disappointment.
310	.....do.....	Cape Disappointment, Bakers Bay, ½ mile northeast of light.
311	Oregon.....	Point Adams, ¾ mile southeast of Fort Stevens.
312	.....do.....	Tillamook Bay, north side of entrance.
313	.....do.....	To be established at Siuslaw River.
314	.....do.....	Yaquina Bay, north side of harbor entrance.
315	.....do.....	Umpqua River, north bank, 1 mile inside entrance.
316	.....do.....	Coos Bay, south side.
317	.....do.....	Coquille River, in town of Bandon.
318	California....	Humboldt Bay, north side, near old lighthouse.
319	.....do.....	Arena Cove, 3 miles southeast of Point Arena light.
320	.....do.....	Point Reyes, 3½ miles north of light.
321	.....do.....	To be established at Duxbury Reef.
322	.....do.....	Point Bonita, near the light.
323	.....do.....	Fort Point, ¾ mile east of light.
324	.....do.....	Golden Gate, Golden Gate Park, ¾ mile south of Point Lobos.
325	.....do.....	Southside, 3⅜ miles south of station No. 324.

VARIATION OF THE COMPASS.

The magnetic variations for 1920, and annual increase, at points mentioned are as follows:

Locality.	Compass variation.	Annual increase.
	° E.	′
Point Loma, Cal	15½	4
Point Fermin, Cal	16	4
Point Arguello, Cal	16¾	4
Point Sur, Cal	17¾	3½
Farallon lighthouse, Cal	18¼	3½
Point Arena, Cal	19	3
Cape Mendocino, Cal	20	3
Point St. George, Cal	20¾	3
Cape Blanco, Oreg	21¼	3
Heceta Head, Oreg	22	3
Cape Lookout, Oreg	22¾	3
Cape Disappointment, Wash	23½	3
Cape Elizabeth, Wash	24	2½
Cape Flattery, Wash	25	2½
Point Wilson, Wash	24½	2½
West Point (Seattle Harbor), Wash	24	2½

TIDES.

A very important characteristic of the tides on the western coast of the United States is the large inequality in the heights of the two high waters and of the two low waters of each day. On the outer coast the average difference between the heights of the two high waters of the day is from 1 to 2 feet, and the average difference in the heights of the two low waters from 2 to 3 feet. It was because of this large difference in the low-water heights that the mean of the lower low waters, rather than the mean of all low waters, was adopted as the plane of reference for the charts of this region.

This inequality changes with the declination of the moon. When the moon is near the equator the inequality is relatively small; but when the moon is near its greatest north or south declination, the difference in the heights of the two high waters or of the two low waters of each day reaches a maximum. The tides at this time are called "Tropic tides."

Off the **outer coast** the mean lunitidal interval for the high waters increases from 9½ hours near San Diego to about 12½ hours near Cape Flattery. The latter interval may be expressed also as zero hour when referred to the nearest transit. The mean rise of the tide above the plane of reference off the outer coast varies from 5 feet off southern California to about 7½ feet off the coast of Washington. Extreme variations from 2½ feet below to 10 feet above the datum may reasonably be expected.

At the entrance to **San Francisco Bay** the mean high-water lunitidal interval is 11½ hours and the mean rise of the tide is about 5 feet above the plane of reference. At the southern end of the bay the tide occurs about 1½ hours later, and the mean rise is about 2½ feet greater than at the entrance to the bay. Passing northward into **San Pablo Bay**, the tide occurs from 1 to 2 hours later than at the Golden

Gate, with a mean rise of 1 foot greater than at the latter place. In **Suisun Bay** the time of tide is about 3 hours later than at the Golden Gate, with a mean rise 1 foot greater. It requires about 5½ hours for the tide to pass from Suisun Bay to Stockton on the San Joaquin River, and about 7½ hours from Suisun Bay to Sacramento on the Sacramento River. The mean rise of the tide above the plane of reference at Stockton is about 2 feet, and at Sacramento about 1 foot.

In Humboldt Bay the tide differs very little from that off the outer coast. The mean high-water lunitidal interval is approximately 12 hours and the mean rise is about 6 feet above the plane of reference.

In Coos Bay the tide is from 1 to 2 hours later, and the rise of high water about 1 foot less than in Humboldt Bay.

In Yaquina Bay the mean lunitidal interval is about 12 hours, and the mean rise about 7 feet above the plane of reference.

At the entrance to the **Columbia River** high water occurs near the time of the transit of the moon and the mean rise is about 7½ feet above the plane of reference. It requires about 7 hours for the tide to pass from the entrance to the Columbia River to the mouth of the Willamette River. In passing up the Columbia River the range of tide decreases until it is only about 1 foot at the mouth of the Willamette. Above this point the tidal range becomes too small to be of practical importance. There are, however, large fluctuations in the level due to meteorological conditions. An extreme variation of 24½ feet has been noted at St. Johns on the Willamette River. The river is usually highest during the months of May, June, and July, and lowest during the months of September, October, and November.

The tide in **Willapa Bay** and in **Grays Harbor** occurs about ½ hour after the transit of the moon and the mean rise is about 9 feet above the plane of reference.

Passing through the **Strait of Juan de Fuca** the tide occurs about 3½ hours later at Port Townsend than at Cape Flattery. The mean rise increases from 7 feet above the datum at Cape Flattery to 8 feet at Port Townsend. There is an increase in the average inequality between the two low waters of each day from 3 feet at Cape Flattery to 5½ feet at Port Townsend, and a smaller and less important increase in the high-water inequality.

In Puget Sound the tide is about ½ to 1 hour later than at Port Townsend. The mean rise increases from 8 feet above the datum of mean lower low water at Port Townsend to 14 feet at Olympia. In Puget Sound the average difference between the two low waters of each day is 6 feet. At Seattle an extreme range from 4½ feet below the datum of mean lower low water to 14½ feet above the same datum has been observed. At Olympia, in the southern part of the sound, an extreme high water 18 feet above the datum has been noted. Because of this excessive range, the plane of reference adopted for Puget Sound charts is 2 feet below the plane of mean lower low waters.

In Washington Sound high water occurs from 4 to 5 hours after the transit of the moon, and the mean rise of the tide is about 8 feet above the plane of reference. In this sound an extreme range from 4½ feet below the plane of reference to 12 feet above the same datum may reasonably be expected.

Tide Tables for the Pacific coast of the United States, including Alaska and British Columbia, are published annually in advance by the United States Coast and Geodetic Survey. This volume furnishes, at the nominal cost of 10 cents, full tidal data for the Pacific coast of North and Central America.

It contains a table of full daily predictions of the times and heights of high and low waters for certain standard or principal ports along the coast; full explanations for the use of this table are given on page 8. The use of Table 2 of the Tide Tables should be known to every navigator. By means of this table the predictions given for the standard ports are extended so as to enable one to obtain complete tidal data for each day for stations only a few miles apart for the greater part of the coast, and with almost the same accuracy as though full predictions were given for all of these points.

Instead of using the height differences of Table 2, however, a more accurate method is that of multiplying both high and low water heights at the standard port by the ratio of ranges for the given port to obtain the heights of the corresponding high and low waters. The ratio of ranges is given in Table 2 of the Tide Tables. The minus sign before the predicted heights in the tide tables indicates that the water is below the plane of reference, which is mean lower low water.

The time of high or low water at any given port in Table 2 is found by taking the time of the corresponding tide for that day from the standard port for reference and applying to it the time difference for the given port from the third column of Table 2, adding it if the sign is plus and subtracting if minus.

Caution.—In using the Tide Tables, slack water should not be confounded with high or low water. For ocean stations there is usually but little difference between the time of high or low water and the beginning of ebb or flood current; but for places in narrow channels, landlocked harbors, or on tidal rivers the time of slack current may differ by 2 or 3 hours from the time of high or low water stand, and local knowledge is required to enable one to make the proper allowance for this delay in the condition of tidal currents.

The figures given in Tables 1 and 2 of the Tide Tables are the times of high and low water, and these times are not necessarily the times of slack water.

To obtain the times of slack water, reference should be made either to figures given for various places in this volume of the Coast Pilot or to Table 4 of the Tide Tables, where the predicted times of slack water are given for a number of points.

CURRENTS.

An offshore current with an estimated width of 200 to 300 miles or more flows nearly south-southeast, following the trend of the coast, from about 50° north of Point Conception, where it bends southward and westward. The estimated velocity is about ¾ mile, but this is largely influenced by prevailing winds; prevailing northerly winds increasing its velocity and southerly winds diminishing it.

Generally speaking, the offshore currents set southerly throughout the year, but during the autumn months, north of the forty-fifth parallel, the set is easterly.

Except in northerly winds a weak northerly setting current will generally exist close inshore known as the Davidson inshore current. This is especially noticeable at Swiftsure Bank light vessel and along the southwestern coast of Vancouver Island, setting in a northwesterly direction.

This current, increased in width, extends southward as far as San Francisco in the three winter months when the prevailing wind is southerly, but in other seasons of the year there is little evidence of it except on the coast of Washington, where it exists on southerly winds and sometimes on winds from other quarters at all seasons of the year.

Currents at light vessels.—Current observations have been made at San Francisco, Blunts Reef, and Columbia River light vessels for about 16 months from February, 1915, to June, 1916, and at Umatilla Reef and Swiftsure Bank light vessels for about six months in the summer of 1915. These observations are sufficient to permit of the prediction of the tidal currents at the light vessels, but a longer series of observations must be obtained before the predictions can be extended to include the wind currents.

The greatest observed velocities at the light vessels are: San Francisco, 2.9 knots; Blunts Reef, 3 knots; Columbia River, 3.4 knots; Swiftsure Bank, 3 knots; and Umatilla Reef, 3.3 knots.

A detailed discussion of these observations is given in the appendix to this volume.

Wind currents.—This subject is so complex, and there is so little data available at present, that no definite predictions regarding it can be made. The outstanding facts are that currents of velocities up to 3 knots may be encountered at any time: that their occurrence is not confined to periods of local heavy winds; and that their effect upon a vessel following the usual coastwise track is usually not merely to retard or accelerate its speed, but also to set it on or offshore. For a more detailed discussion of this subject, see "Coastwise navigation" following.

COASTWISE NAVIGATION.

Navigation along the coast of California, Oregon, and Washington presents to the mariner a problem of unusual difficulty. The courses in general are long and must be traversed during frequent periods of thick weather, with the vessel subject to the action of currents whose velocity and even direction are uncertain.

A statement on the subject of fog, including a table showing the prevalence at different seasons of the year, and a general statement on currents are given in the preceding pages.

An inquiry into the subject of coastwise navigation, including interviews with navigators, and a study of the investigations made by the Steamboat-Inspection Service into the causes of strandings, indicates the following:

1. As a preliminary, it may be stated that the currents are frequently blamed for disasters for which they probably are in no way responsible. In a large percentage of the above strandings, total lack

of knowledge of the compass deviation was the most striking fact brought out in the investigation. The course was shaped from the log of some previous voyage, and no one knew what the corresponding magnetic course might be.

The factors which cause deviation from the track are changing and uncertain. On no two voyages are they identical. Therefore, to rely blindly on a course merely because it was made good on some previous occasion is to invite certain ultimate disaster. Yet cases of this sort were so common as to justify special mention even in a publication which does not, as a rule, take into account the shortcomings of the navigator.

2. Although a knowledge of the compass error is essential, in thick weather the navigator should never rely on that instrument alone. There are undoubtedly many periods when the currents are not in operation, and the magnetic course steered will be made good. But there is no way of telling when such periods occur. As a rule, navigators can not count on making their courses and distances good, or assume that even though such courses lead, in general, from 6 to 10 miles off the nearest shores they have allowed an ample margin of safety. It is by no means uncommon for vessels to be set 10 or 12 miles off their courses in as many hours, and to have their speed made good, accelerated or retarded by considerably greater amounts.

3. The majority of the strandings have occurred in foggy but comparatively calm weather. Indeed, considering the large number of strandings on record, it is surprising that the loss in lives and property has been so small. Various reasons may be advanced in explanation of this fact; one of them undoubtedly being the failure of the navigator to realize that currents of considerable velocity are frequently encountered when there are no other unfavorable local conditions to warn him of their existence.

4. The commonly accepted rule among navigators regarding the currents is that they follow the prevailing winds, setting, in general, southward in summer and northward in winter. This rule appears reliable for times when the local winds attain any great velocity, but it is not safe to accept it for periods of calm or light airs. The records of strandings under the latter conditions show numerous cases which were undoubtedly caused by northerly currents in summer or southerly ones in winter. In short, the currents are subject to variation, not only from season to season but from day to day.

5. In the majority of the cases where the strandings appear to have been directly due to currents, the currents have been against the vessel. Most of the strandings have happened to deeply laden, southbound vessels to the northward of the projecting points like Capes Blanco, Mendocino, and Arena. The consensus of opinion among the navigators of the coast is that the currents follow the curves of the shore. If this is true, a vessel southbound against a northerly current would experience a tendency to set in to the northward of the points and out to the southward of them. As a specific instance, one navigator states: "If you have seen Blanco and Northwest Seal Rocks and find you have been set off a little and the speed made good retarded some, then you can be sure you will be set in toward Mendocino, or if you have set in toward Seal Rocks and your speed has been accelerated, then you can be sure you will be set off on nearing

Mendocino." The general configuration of the coast tends to support this theory. As already stated, wrecks to southbound vessels occur to the northward of Capes Blanco, Mendocino, and Arena. More northbound vessels have been lost in the vicinity of Punta Gorda than at any other point along the coast. It is in these localities that the deviation of the coast from its general north and south direction is greatest.

There is one serious objection to this theory that the currents follow the curves of the shore. It can readily be seen how a current flowing in a general north or south direction would be deflected to the westward by the points projecting in that direction, resulting in a tendency to set the vessel offshore; a set experienced as she approached the point if traveling with the current, or after passing it if the current was against her. But it is difficult to conceive of any agency which could redeflect that current to the eastward after it had passed a point which had already caused it to swing off to the west, although such conditions would undoubtedly cause a local eddy current of considerable extent.

There are, however, some reasons for believing that the phenomena which have been observed are caused by currents which originate well offshore and flowing in strike the coast and are deflected to the north or south. This theory would explain the fact, already noted, that currents are so frequently encountered in relatively calm weather. It would also explain the fact that vessels have frequently experienced a considerable set directly inshore caused by currents acting so squarely across the track that they had no effect on the speed made good. Sets of this character appear to be particularly frequent between Heceta Bank and Cape Arago, between Trinidad and Cape Mendocino, and off Monterey Bay.

Under the conditions above described, it is obvious that there is only one method of safe navigation on this coast in thick weather. That is by means of the lead. It is the method which has been relied upon by the men who have navigated the coast in safety for years; its neglect has contributed directly to the great majority of the strandings which have occurred.

The master must assume the possible existence of a current which is setting his ship into danger, and take his precautions accordingly. The vessel's progress should be checked by an occasional sounding on each course where the depths permit, and in approaching each important danger or turning point soundings should be taken frequently for some time both before and after the change of course, unless in the meantime a reliable fix has been obtained. The soundings after the change are of the greatest value as revealing any error in the reckoning on which the change of course is based, and it may conservatively be stated that had such soundings been taken, the great majority of the past disasters would have been prevented.

Navigation by means of soundings renders imperative a careful study of the chart. The navigator must learn what, for any given locality, are the critical characteristic features revealed by his lead which insure his safety or indicate the proximity to danger. What depths to follow and what to avoid; localities where soundings may

be taken to advantage to obtain a check on the position; information revealed by the character of the bottom; and perhaps most important of all, as being the condition most likely to cause trouble even for the careful navigator, certain areas which duplicate the critical depths of the track, so that if the former were mistaken for the latter, the result might be most serious; all these are items of the utmost importance.

In using the charts it is well to remember that the surveys on which they are based were made many years ago, and are, in some localities, incomplete. The absence of soundings on the chart of any given locality is an indication of lack of surveys, and not that the locality is free from dangers.

Since the safety of all concerned must frequently depend on the soundings alone, it is essential that to the operation should be devoted a degree of skill and care commensurate with its importance. It is usually impossible for the master to give his personal attention to the task, but he should see that the man to whom he intrusts it is so carefully trained and so impressed with the importance of his duty that a mistake is next to impossible.

There is a method in common use on the coast of sounding without using pressure tubes; the depth being estimated from the amount of wire out. Such a method is perhaps justified for every other cast while feeling for the bottom as the vessel approaches soundings from deep water, but once the bottom has been picked up, it should never be trusted. There are too many factors to be considered, and all of them uncertain and variable; the speed of the ship, the smoothness with which the reel is working and, above all, the "personal equation" of the operator. He will be too much influenced by the depths which he thinks he should find. If he expects bottom in 30 fathoms he will pay out the wire so slowly that he probably will not find the bottom in a depth of 60 or 70 fathoms. If he expects 80 to 100 fathoms he may get bottom in 25 or 30 and never know it. The records clearly show that this method of sounding has resulted in the loss of vessels through mistakes which could not have gone undetected if a tube had been used.

So, for every sounding, a pressure tube should be used and the lead should be armed to bring up a sample of the bottom. The amount of wire out should, of course, be reported, for that does give a general idea of the depth some moments before the tube can be reeled in. But this estimated depth should be verified by the tube and the sample of bottom obtained should be compared with that shown on the chart.

Finally, it is important to realize that under certain conditions pressure tubes are subject to considerable errors, with which the navigator should be familiar if he is to get full value for them. In view of the universal use of such tubes on the coast, a detailed statement on this subject is here given.

USE OF SOUNDING TUBES.

Although of undoubted value as a navigational instrument, the sounding tube is subject to certain defects which, operating singly or in combinations, may give results so misleading as to seriously

endanger the vessel whose safety is entirely dependent upon an accurate knowledge of the depths.

Efforts have been made from time to time by the Coast and Geodetic Survey to utilize tubes for surveying operations. The results obtained, however, have been so unsatisfactory that the general use of such tubes for surveying work has been discouraged.

In practical tests, carefully made by surveying parties, where up-and-down casts of the lead were taken with tubes attached to the lead, errors in the tube amounting at times to as much as 25 per cent of the actual depths have been noted. Errors of 10 to 12 per cent of the actual depth were quite common.

It is also worthy of note that in the great majority of cases the tubes gave depths greater than the true depths, which, in actual use in coastwise navigation, would usually have resulted in the conclusion that the ship was farther offshore than was really the case.

There are various types of tubes in common use which are too well known to require detailed description here. They are all based on the general principle that air is elastic and can be compressed, and that if a column of air in a tube be lowered into the water in such a way that the air can not escape, yet, at the same time, the pressure of the water can be transmitted to it, the amount by which the air is compressed furnishes a measure of the depth to which it was lowered.

Theoretically this principle is sound, but when we come to apply the theory to actual practice certain elements enter which result in errors in the depth determination. It is important to note that the amount of these errors depends on the depth; the greater the depth, the greater the numerical value of the error.

The causes which produce these errors are as follows:

1. In order to give correct results, the bore of the tube must be exactly cylindrical; in other words, the volume of air in any one inch of length of the tube must be exactly the same as in an inch in any other part. But because of the way in which glass tubes are made, it is very difficult to accomplish this. The bore may taper slightly, or vary in other ways from a true cylinder. If tapering, the minimum diameter of bore may be at the top, middle, or bottom of the tube as submerged. If the minimum diameter be at the top, the tube will register depths less than the actual depths of water, and if at the bottom the registered depth will be greater than the true depth.

This defect may be detected in a suspected tube by introducing a small quantity of mercury into the tube and comparing its length at different points along the bore. For satisfactory results, the length of this column should not vary more than 5 per cent.

2. In order that even a perfect tube should give accurate results, the conditions of barometric pressure and air and water temperatures under which the sounding is being taken must be the same as those under which the scale for reading the depths was made.

In making the scale, a barometric pressure of 29 inches is usually assumed as normal.

Then, if in actual use the barometer registers above normal, the air in the tube is already partly compressed, and when lowered to any

given depth the amount of compression due to water pressure is correspondingly diminished. With a barometer below normal, the reverse is true, and it therefore follows that when the barometer reads above normal the tubes will register less than the true depths, whereas if the barometer reads below normal the registered depths will be greater than the true. The amount of error introduced from this cause is about 3 per cent of the depth for each inch of barometric pressure above or below normal.

The density of the air in the tube also depends directly upon its temperature. Therefore, the difference between the temperature of the air in the tube before and after submergence will affect the accuracy of the sounding. Where the temperature of the tube in the air is greater than that of the tube in the water, the depth recorded will be greater than the actual depth, and, conversely, when the temperature of the air is lower than that of the water the depth recorded will be less than the true depth. Also, the temperature of the water may vary at different depths, so that the actual amount of this error depends on the difference between the temperatures of the tube in the air and at the bottom.

The amount of error introduced from this cause is about 1 per cent of the depth for each 3 degrees Fahrenheit difference in temperature.

3. While the tubes are usually 24 inches long, and the scales are designed for that length of tube, the manner of closing the upper end of the tube may introduce an error. The thickness of the caps used for this purpose varies considerably in different makes of tubes, even when such caps are made of the same material. This variation in thickness results in moving the tube slightly up or down in the scale. Thus, with a thin cap the sounding read from the scale will be too deep, with a thick cap the sounding read will be less than the true depth.

Copper caps put on with sealing wax have been found to vary sufficiently to produce errors of about 5 per cent of the depth in depths of 50 to 70 fathoms. Rubber caps seem to be more nearly uniform and to give better results when new. Rubber, however, deteriorates, and when used too long there is apt to be leakage of air.

When removable caps are used care should be taken to see that they are pushed home thoroughly before sounding.

4. The integrity of the air in the tube should be carefully preserved. Even a slight leakage of air will result in showing a sounding considerably in excess of the true depth.

The conditions under which tubes are used on the Pacific coast make it particularly important to guard against errors from this cause.

Vessels approach dangers at a few points, coming from depths of over 100 fathoms. As they approach, they begin feeling for the bottom, sounding at infrequent intervals to pick up depths of 75 to 100 fathoms. So long as they get no bottom in such depths navigators feel secure. But a leaky tube may show no bottom at 100 fathoms when the ship is actually in much less depths, possibly resulting in disaster before the error is discovered.

Special precautions should, therefore, be taken on this point. Copper caps should be sealed in place with sealing wax, and rubber caps should be supplied with wire clamps giving a tight fit.

5. Accumulated salt on the inner surface of the tube will cause the watermark to creep up, and register greater than true depths.

The type of tube exemplified by the well-known Bassnett sounder is based on the same principle as the ordinary glass tube, but is more complicated in design. It consists essentially of a metal case containing a glass tube closed at the upper end. Inside the glass tube is a metal tube through which the water enters and is trapped by a valve at the top of the metal tube.

In this device the scale is graduated directly on the glass tube, thus eliminating those errors due to thickness of cap, but, on the other hand, the possibility of errors increases directly with the number of working parts of which the sounder is made.

In using sounders of this type care should be exercised to preserve perfectly gasketed joints between the bottom of the glass tube and the metal case and to keep the outlet valve well oiled and water-tight.

Leaking valves and water remaining in the tube before a sounding is taken will give increased depths, while deficient depths may be recorded as a result of loss of water through suction at the inlet as the tube is being reeled in.

The Bassnett type, in common with all other forms of pressure tube, is subject to the above-described errors due to variations in temperature and barometric pressure.

It will be noted that wherever the amount of the various errors can be stated they are all small. Their importance lies in the fact that two or more of them, acting together, may result in considerable errors. As already stated, actual experiments show that errors of 10 to 12 per cent are not uncommon and that considerably greater errors may occur.

There are certain precautions which can be taken to eliminate or reduce these errors:

1. In purchasing tubes a type should be selected which can be used until broken or lost. The navigator can then make a study of the results obtained from each individual tube and thus gain a fair idea of its accuracy under known conditions. This necessitates some permanent means of identifying the various tubes used, which may readily be accomplished in the case of the glass tubes by means of various colored paints or threads.

2. Before undertaking the sounding necessary to make any particular landfall the vessel should be stopped for an up-and-down cast of the lead in order to test the accuracy under the prevailing conditions of the tubes which are to be used. For this purpose it is not necessary to get bottom; simply run out 60 to 80 fathoms of wire and then see how closely the tubes register that amount. A number of tubes can be sent down at one time and it is then possible to select one or two which register most nearly correct.

It is well to keep a permanent record of the results of each tube tested. By so doing the navigator will soon obtain valuable information as to the performance of the various tubes and the degree to

which they may be trusted. Such a record should, of course, take into account the various conditions affecting the result.

It will be noted that the factors which produce errors may be divided roughly into three groups:

(*a*) Inherent: Those which occur as a result of permanent defects in the tube, such as the variation of the bore from a true cylinder, variation in the thickness of the cap, etc.

(*b*) External: Those which occur as a result of the conditions under which the sounding was taken, variations of temperature or barometric pressure from the normal, etc.

(*c*) Accidental: Those which affect a single sounding, due to the failure of the tube to register properly, leakage of air, loss of water from leaky valves, errors due to the presence of salt in the tube, etc.

These accidental errors are probably the most serious of the three types, both because they are apt to be larger in amount and because it is impossible to foresee when they will occur. But, on the other hand, they occur only as a result of a few known causes, already enumerated, and therefore by the exercise of proper caution in the use of the tubes they may be to a large extent eliminated. If the ordinary glass tube is used see that the bore is thoroughly dry and free from salt and that the cap makes a tight fit. If using a sounder see that the tube is free from water and that the valves are tight and well oiled.

And, above all, during the course of the sounding take an occasional up-and-down cast as a check, for by that means alone can one be sure that the proper results are being obtained.

The smallest possible number of tubes should be used. It is obviously much better to use, over and over again, one tube which is giving good results than to use a number whose errors are uncertain. This is particularly desirable where sounders involving valves are used.

If a tube shows no bottom at 100 fathoms, examine the arming to make sure that the lead actually failed to find bottom.

Finally, beware of overconfidence. Tubes which have been working properly for a number of soundings suddenly develop errors. It is chiefly for this reason that they have been discarded for surveying operations.

Assuming that the accidental errors can be reasonably controlled, the inherent and external errors present no serious difficulty.

As already indicated, the bore of a tube (or at least of any tube which is capable of constant use) can be tested with mercury, and those tubes rejected which show variations in bore greater than about 5 per cent.

Errors due to variations in the thickness of caps can be eliminated by using a scale graduated for a true length of 24 inches (the length of the glass tube) and removing the cap before the sounding is read.

Errors due to differences between air and water temperatures can be reduced to a minimum which can usually be neglected by immersing the tube before using in a bucket of sea water, newly drawn, so that its temperature has not had time to change. Care should, of course, be taken to see that no water enters the tube. When this is done, there may still remain an error due to the difference in

temperature of the water at the surface and at the bottom. This may, if desired, be corrected by sending down a self-registering thermometer with the lead, but for the ordinary purposes of navigation this is a refinement which may be ignored.

There is no ready method available for correcting the error due to variations in the barometric pressure. The correction should be applied to the sounding recorded.

It is interesting to note that sounding tubes which give good results can readily be made from plain glass or metal tubes aboard ship—gauge glasses, for instance. One end of the tube is closed with a cork and sealing wax. A narrow strip of chart paper of uniform width, on which a line has been ruled with an indelible pencil, is inserted the entire length of the tube. The paper is held in place by bending the projecting lower end upward along the outside of the tube and securing it with a rubber band. The height to which the water rises in the tube will be indicated by the blurring of the pencil line.

If the air column in the tube is 24 inches long, the sounding may be read from any scale graduated for tubes of that length. If of a different length, a special scale must be prepared; its graduations, compared to those of the 24-inch scale, will be proportional to the comparative lengths of the two tubes.

If certain precautions are taken, these tubes will give results which compare favorably with commercial tubes. The paper should be inserted uniformly in the tube, and its upper end, or a mark from which the measurement is taken, should coincide with the top of the air column. Metal tubes have the advantage of uniform bore, but if metal tubes are used the paper, in order to insure uniformity, should be fastened at the upper end when that end is being sealed and then stretched lightly at the bottom. The depth should always be read from the dry portion of the paper, as the wet portion is subject to considerable change in length.

DIRECTIONS, SAN DIEGO TO THE STRAITS OF FUCA.

Having in mind the above statement, vessels may use the following directions, which give approximately the track followed by the high-powered steamers plying regularly between San Diego, Los Angeles, San Francisco, Columbia River, and Puget Sound ports. These courses are used by such vessels in preference to others farther offshore by reason of the fact that they lead well within range of the various fog signals and in so far as possible over depths where the lead may be used to obtain a check on the position.

Low-powered local steamers usually keep close inshore, following, in general, the curves of the land, in order to escape the full effect of wind and sea. In clear weather strangers may readily follow this inshore track by means of the chart; in thick weather they are advised not to use it, as the fog signals are few and far apart, and the currents variable and uncertain, making detailed local knowledge essential to safety. For that reason no directions for this track are given.

A detailed description of the coast, including landmarks, dangers, etc., follows these directions, beginning on page 44.

SAN DIEGO TO SAN FRANCISCO.

	Course.		Distance, nautical miles.
	True.	Magnetic.	
San Diego to Los Angeles:			
1. From 2 miles southwestward of Point Loma lighthouse to 300 yards eastward of Los Angeles Harbor lighthouse.	322	NW ¾ W....	80
Los Angeles to San Francisco:			
1. From ¼ mile southeastward of Los Angeles Harbor lighthouse to ¼ mile off Point Fermin whistling buoy.	252	SW by W....	2
2. To ¼ mile off Point Vincente gas and whistling buoy.	290	W ⅜ N.....	7
3. To 2 miles off Point Hueneme lighthouse.....	299	WNW ⅞ W..	47
4. To 2 miles off Point Conception lighthouse....	286	W.....	66
5. To 2¾ miles off Point Arguello lighthouse....	307	WNW ⅛ W..	12½
6. To 2½ miles off Point Sur lighthouse.....	329	NW ¼ W....	121
7. To 2 miles off Pigeon Point lighthouse.....	336	NW ¼ N.....	58
8. To San Francisco light vessel.....	341	NW ¾ N.....	37

The following brief summary of the methods actually employed in thick weather, by the ablest masters on the coast, indicates the methods and precautions by which safety is assured.

Northbound.—From San Diego to Los Angeles the conditions are seldom such as to cause any deviation from the track. If uncertain of the position in approaching San Pedro Bay, steer so as to make sure of being to the eastward of the breakwater. Continue to a depth of 9 to 10 fathoms, and then haul to the westward in that depth, and the fog signal will be made without difficulty.

Bound for San Francisco, the departure is taken from Los Angeles lighthouse, and the buoys at Point Fermin and Point Vincente are made close to. Crossing Santa Monica Bay, the possibility of a northerly current setting into the bay should be borne in mind, and shortly after passing Point Dume the lead should be started, as the depths, over alternating banks and submarine valleys, are characteristic.

Having made Point Hueneme in this way, the lead may be given a rest until approaching Point Conception. Here it should be used to guard against an inshore set, and the depths should not be shoaled to less than 50 fathoms. From Point Conception, Point Arguello will readily be made.

The track from Point Arguello to Point Sur is a long one, on which currents of considerable velocity are frequently encountered, and to the southward of Point Sur depths of over 100 fathoms extend so close to the beach that a vessel can not count on getting bottom with the lead in time to prevent disaster. Point Sur, therefore, should be given a wide berth. If, on this track, the weather has not cleared by the time Piedras Blancas has been reached, the vessel should be hauled out 2° or 3°, and great caution should be exercised as Point Sur is approached.

The lead should find bottom off Point Sur, but even if it does not, no difficulty should be experienced in making a landfall northward of Monterey Bay, as the depths shoal very gradually from the 100-fathom curve to the beach. The track to the lightship may then be followed by means of the lead.

Detailed local knowledge is necessary for entering the Golden Gate in thick weather, because of the strong irregular currents and tide rips. At times, however, it will be clear within the Heads when it is foggy outside. It is well, therefore, to stand in cautiously as far as the whistling buoy; if from that point Point Bonita can not be seen, the vessel should be anchored until the weather clears.

Southbound.—The courses from the bar to Point Sur are short and should be easy to make good, especially as the 100-fathom curve extends well offshore to the northward of Point Sur, affording ample opportunity for checking the vessel's position by the lead as the point is approached.

Likewise, on the long course from Point Sur to Point Arguello—northward of Point Arguello the soundings extend well offshore and the point may be reached without difficulty. If the lead shows 30 fathoms, haul to a south-southeast (mag.) course, keeping in that depth, and if the water deepens to over 40 fathoms the vessel will be past the point, and may be hauled up for Point Conception.

Again, in approaching Point Hueneme, the lead may be used to guide the vessel to within sound of the fog signal, as the depths are characteristic. A fix should be obtained off Hueneme before attempting to approach Point Vincente.

Point Vincente is the most difficult point to make on the southbound track. The only fog signal is a whistling buoy, and deep water extends so close to the point that the navigator will get an echo from his whistle before he gets bottom with the lead. Therefore, no attempt should be made to locate the point; from Hueneme the course should be shaped to pass about 2 miles off Vincente, using the lead rapidly as the latter point is approached, and when the log shows it abeam the vessel should be hauled up to pass ½ mile off Point Fermin whistling buoy, and the lead will soon pick up bottom between Point Vincente and Point Fermin. Guided by the soundings. Los Angeles Harbor lighthouse can then be made.

Strangers should not attempt to enter Los Angeles inner harbor in thick weather without a pilot.

Vessels bound from Los Angeles to San Diego usually experience little difficulty in making Point Loma. If in doubt, the course may be shaped to pick up the 30-fathom curve to the northward of the point, and that depth followed to the fog signal. The presence or absence of kelp just inside the 30-fathom curve is a good guide in deciding whether the vessel is north or south of the point.

Strangers should not attempt to enter San Diego Bay in thick weather without a pilot.

SAN FRANCISCO TO COLUMBIA RIVER AND THE STRAITS OF FUCA.

	Course.		Distance, nautical miles.
	True.	Magnetic.	
	°		
1. From Point Bonita to San Francisco light vessel	250	SW ⅝ W	8
2. To 1½ miles off Point Reyes	308	WNW ¼ W	22
3. To 5 miles off Point Arena	327	NW ½ W	67
4. To 1 mile off Blunts Reef light vessel	341	NW ⅝ N	97
5. To 8 miles off Cape Blanco	356	NNW ¼ W	144
6. To Columbia River light vessel	7	N by W ⅜ W	203
7. From 8 miles off Cape Blanco to Umatilla Reef light vessel.	359	NNW ⅛ W	320
8. To Cape Flattery lighthouse bearing 145° true (SE by E ⅜ E mag.) distant 2¾ miles.	10	N by W ⅜ W	16

The following brief summary of the methods actually employed in thick weather by the ablest masters on the coast indicates the methods and precautions by which safety is assured.

Northbound.—Taking the departure from Point Bonita, there should be no trouble in making the lightship and very little in making Point Reyes, if the track is checked by the lead.

Approaching Point Arena, start sounding when off Gualala and continue until assured that the ship is not inside the track. The differences in the bottom characteristics north and south of the point are a good guide. Point Arena fog signal will nearly always be heard north and south of the point, but seldom when abeam if over 2 miles distant.

When within 10 miles of Punta Gorda the lead should be started and soundings taken as rapidly as possible, as the depths shoal abruptly; also, with soundings taken about half an hour apart, there is a possibility that the lead will drop in the successive submarine valleys, entirely missing the shoal areas in between and resulting in the dangerous erroneous conclusion that the vessel is wide of the point. If Punta Gorda is passed in not less than 50 fathoms the vessel will also clear Blunts Reef. If, however, the course is changed at Cape Mendocino without making the light vessel the lead should be kept going long enough after the change to make certain that the vessel is not behind her reckoning.

The lead need not be used again until approaching the shoal off Rogue River. Here the bottom should be searched for in the same manner as in approaching Punta Gorda, as the soundings obtained on this shoal give a check on the latitude and indicate any change of course necessary in approaching Orford Reef, 20 miles beyond. If less than 60 fathoms is obtained the ship should be hauled out at least a point and, in any case, the lead should again be used in approaching Orford Reef. The lead may find no bottom off the reef, but to the northward of Cape Blanco bottom, fine, gray sand will be found in 70 to 80 fathoms if the vessel is near the track.

If bound for the Columbia River the vessel, after passing Cape Blanco, will be within soundings for practically the entire distance. If uncertain of the position, edge in to a depth of 32 to 35 fathoms

anywhere between Cape Meares and Tillamook Rock and steer northwest in that depth and the fog signal on Tillamook Rock will usually be heard. At times difficulty may be experienced in hearing this fog signal, even when passing it in that depth. However, if the vessel keeps outside the 30-fathom curve she can not get into trouble, and the change in direction of that curve is a good indication of the time at which the vessel passes Tillamook Rock. The light vessel can then be made by following the 30-fathom curve.

Vessels bound for the Straits of Fuca frequently steer one course from Cape Mendocino, applying to the true course the mean of the variations. This causes the track to curve away from the shores during the first half of the distance, approaching them during the remainder. Approaching the straits, if the position is uncertain, stand in to pick up the 30-fathom curve in the vicinity of Cape Elizabeth or Destruction Island and follow that depth to Umatilla Reef light vessel. Thence the short distance to Tatoosh Island may be traversed without difficulty.

Southbound.—Taking the departure from Umatilla Reef light vessel steer one course for Cape Mendocino as described above. Use the lead to pick up Heceta Bank, as vessels may overrun their distance, particularly during the summer. The time required in crossing the bank gives a good determination of the vessel's position at the time the lead drops again into deep water.

Because of the lack of surveys in the approaches to Cape Blanco the point should be given a wide berth. If the lead shows less than 60 fathoms haul out parallel to the coast and run until you lose bottom; the vessel will then be past Blanco. It has been reported that inside the 60-fathom curve the bottom is lumpy and uneven and should the lead strike a deep spot it might be mistaken for the deep water south of the cape. For this reason soundings should be continued for some time after the vessel is supposed to be safely past the point.

Vessels from the Columbia River should use the lead frequently to guard against an inshore set. Vessels at times have encountered a strong set on or offshore in the region between Heceta Bank and Cape Arago, when none was apparent farther northward. Cape Blanco should be rounded as described in the preceding paragraph.

After passing Orford Reef there are no dangers until in the vicinity of Cape Mendocino. Currents setting the vessel directly on or offshore have been reported between Trinidad Head and Cape Mendocino and for that reason, as the former point is approached, an occasional deep cast should be taken, and from the time the vessel is abreast of Table Bluff the lead should be used frequently. If in doubt as to the position the vessel should be hauled inshore to pick up the 30-fathom curve somewhere off Table Bluff; then hauled out parallel to the shore, keeping in depths of 30 to 35 fathoms until the light vessel is made.

Reports indicate the probable existence of a submarine valley which heads near the 30-fathom curve some miles north of Cape Mendocino. Surveys in this vicinity are incomplete, and too great reliance should not be placed on the chart. If the navigator, in following the 30-fathom curve, finds no bottom without having made the light vessel he should not at once assume that he has reached the

deep water south of the point, but instead should hold his course awhile longer to see whether he picks up bottom again. The stretch between Cape Blanco and Cape Mendocino is considered the worst on the coast with respect to currents; the position of a vessel approaching either point is subject to great uncertainty, and extreme caution is necessary. Here, also, soundings after the change of course are imperative.

Approaching Point Arena, start sounding 10 or 15 miles north of the point, and if at any time the lead shows 30 fathoms or less haul out on a south magnetic course in not less than 30 fathoms. In this way the fog signal will usually be made; if not, and the water deepens to 60 fathoms, the vessel will be past the point and the course may be changed for Point Reyes.

Point Reyes fog signal should be made before proceeding beyond it and if the vessel's position has been located off Point Arena little difficulty should be experienced in doing so as the soundings are distinctive if started early. But if the vessel has passed wide of Arena without obtaining a fix, caution is necessary, as the soundings may be misleading. Practically the same chain of soundings can be obtained in the vicinity of Cordell Bank as on the regular track passing Point Reyes, and vessels, although sounding frequently, have been known to find themselves in the midst of the Farallones while still anxiously trying to pick up Point Reyes. An occasional sounding should, therefore, be taken after passing Point Arena to verify the distance off the land.

In the immediate vicinity of Point Reyes the character of the bottom is a better indication of the position than are the depths. North of the point the lead will bring up a muddy substance; south of it, gray sand. This indication is particularly valuable in the area to the northward and eastward of the point.

Having made Point Reyes fog signal there should be little difficulty experienced in making the light vessel, provided the lead is used to check the course.

Detailed local knowledge is necessary for entering the Golden Gate in thick weather, because of the strong irregular currents and violent tide rips. At times, however, it will be clear within the heads when it is foggy outside. It is well, therefore, to stand in cautiously as far as the whistling buoy; if from that point Point Bonita can not be seen the vessel should be anchored until the weather clears.

SAN DIEGO BAY AND APPROACHES.

The entrance to San Diego Bay (chart 5106) lies about 10 miles northwestward from the boundary between the United States and Mexico. The bay is the best natural harbor south of San Francisco and affords perfect protection in any weather. From the entrance, which is about ¼ mile in width, it expands to a width of 1½ miles, curving sharply eastward for 5 miles, where it contracts to ⅜ mile between San Diego and Coronado. From this point it extends southeasterly for 7½ miles, expanding to a shallow basin 2 miles wide, through which a well-marked channel leads to a powder factory 5 miles above San Diego. The head of the bay is separated from the ocean by a low, narrow, sand spit, which at its northern end expands

to a width of 1 mile and is nearly divided by **Spanish Bight**, dry at low water.

San Diego, on the eastern shore about 5 miles from the entrance, is the principal city on the bay. The depths at the wharves vary from 18 to 33 feet at mean lower low water according to locality. There is a large amount of foreign and domestic commerce by water and rail. Lumber, iron, cement, guano, and general merchandise are imported; fruit, farm produce, and general merchandise are exported. The customhouse landing is at the municipal pier.

National City, on the eastern shore, 3½ miles southward of San Diego, is of no maritime importance; it is connected with San Diego by rail.

Coronado, a summer and winter resort opposite San Diego, is of no commercial importance. It is connected with San Diego by ferry. The Coronado Hotel is prominent from seaward; a tower on the hotel is usually lighted during the first half of the night.

North San Diego and **Roseville** are small villages situated on the bay between San Diego and the entrance. They are within the city limits of San Diego.

Channels.—The following improvements have been completed by the Government:

1. A channel 750 feet wide, 35 feet deep at mean lower low water, and marked by a lighted range and by buoys, has been dredged through the bar at the entrance. A jetty has been built southward across Zuninga Shoal a distance of 7,500 feet. The outer 1,800 feet of this jetty is at present submerged.

2. A channel having a least width of 900 feet and a depth of 32 feet at mean lower low water has been dredged through the middle ground north of Ballast Point. These constitute the controlling dimensions to San Diego.

The channel for deep-draft vessels leading through the bay varies from 300 yards to ⅓ mile wide, with an average depth of 7 to 8 fathoms, except in the dredged sections, as far as San Diego, beyond which point it shoals to 3 and 4 fathoms. It is well marked by beacons (a number of which are lighted) and buoys.

The channel above San Diego has a least depth of 20 feet and least width of 230 yards between the 2-fathom curves to a powder factory 5 miles above San Diego, and is well marked by lighted beacons and buoys to this point. The powder factory wharf has a depth of 22 feet at the end. There is a depth of 12 feet in an unmarked channel for nearly 1 mile above the powder factory to within 1½ miles of the head of the bay, but vessels do not go above the powder factory.

PROMINENT FEATURES.—**Table Mountain**, 2,244 feet high, lies in Mexican territory, about 24 miles southeastward from Point Loma and about 6 miles inland; it is flat topped and a prominent landmark.

The Coronado Islands, in Mexican territory, are a group of three bare, rocky islands extending 4½ miles in a west-northwest and east-southeast direction, about 7 miles offshore. The northwestern island, 467 feet high, lies nearly 14 miles 192° true (S ¼ E mag.) from Point Loma; the southeastern and largest is 672 feet high. These are prominent in clear weather. The channel between them and the mainland is commonly used by steamers.

Point Loma, the western point at the entrance, is the southern point of a ridge about 400 feet high and 5½ miles long in a north and south direction. It is bare of trees, except in the gullies, and where planted around the houses built near the summit; otherwise sparsely covered with grass, sagebrush, and cactus. At a distance it is usually raised as an island. **Point Loma lighthouse**, situated on the southern extremity of the point, is a white skeleton tower; the light is flashing white (flash 3 seconds, eclipse 12 seconds), 88 feet above the water, and visible 15 miles; the fog signal is an air siren (blast 3 seconds, silent 17 seconds).

On a nearer approach the old tower, on the highest part of the hill immediately back of the point, the Bennington Monument, 1½ miles, the tall masts of the wireless-telegraph station, 2½ miles, and the buildings of a theosophical seminary, 3¼ miles northward from the lighthouse, will be distinguished on the crest of the hill. A thick bed of kelp extends 1½ miles southward from Point Loma and northward of the point for nearly 5 miles, parallel to the beach and about 1 mile offshore.

Ballast Point, low and sandy, projects ⅜ mile northeastward from the eastern side of Point Loma, 1 mile northward from the lighthouse. **Ballast Point lighthouse** and buildings are situated on the extremity of the point. There is deep water close to the outer end of the point.

Anchorage can be had anywhere in the channel and off San Diego, except in a lane 1,000 feet wide, the center line of which extends southward from the south end of Atlantic Street (street along west water front of San Diego and leading to a long wharf) to the ferry wharf at Coronado opposite. Anchorage can be had in the channel eastward of this lane in depths of 3 to 7 fathoms. A fairway must be left clear for passing vessels. Vessels outside the entrance, waiting for a pilot, will find good anchorage in 6 to 9 fathoms anywhere eastward of the line joining the bell and whistling buoys.

Pilots are usually employed by strangers. The pilot station is at Ballast Point, and pilots may be obtained by signaling to the light station at Point Loma. The following are extracts from the laws concerning pilotage:

The rates of pilotage for all vessels into or out of the harbor of San Diego shall be such reasonable rates as the board of pilot commissioners of San Diego shall from time to time fix and establish and not in any case to exceed $2.00 per foot draft and two cents per ton for each and every net ton of registered measurement (for vessels having cargoes to be laden or unladen solely at the port of San Diego), and $1.00 per foot registered measurement (for vessels having cargoes to be laden or unladen partly at the port of San Diego and partly elsewhere), and every vessel spoken inward or outward bound, except as hereinafter provided, shall pay said rates. A vessel is spoken by day by a pilot displaying a union jack, or by night displaying a torch or flare-up within a distance of one mile of the vessel; in all cases where inward bound vessels are not spoken until inside the bar, the rates of pilotage herein provided shall be reduced 50 per cent.

All vessels sailing under enrollment and licensed and engaged in the coasting trade, between the port of San Diego and any other port of the United States, shall be exempt from all pilotage, unless a pilot is actually employed.

All foreign vessels and vessels from a foreign port or bound thereto, and all vessels sailing under a register between the port of San Diego and any other port of the United States, shall be liable for pilotage as provided above.

Towboats.—There are no towboats available at present (1916).

Harbor regulations are enforced by a harbor master, with offices in the municipal dock.

The rates for dockage (the charge made for vessels occupying berths at the wharves or moored in the slips) are as follows:

For the first 200 tons or less, 1 cent per ton (net tonnage); for each additional ton above 200 tons, three-eighths of 1 cent per ton per day of 24 hours or fraction thereof.

Half rates shall be charged as follows:

1. Vessels with no cargo on board while lying idle at a wharf.
2. Vessels while receiving or discharging ballast or receiving stiffening.
3. Vessels discharging, loading, or lying idle while occupying outside berths.
4. Vessels while moored in docks, slips, basins, or canals.
5. Vessels engaged in towing and vessels not engaged in carrying freight and passengers not entitled to half rates.
6. Vessels with no cargo on board while undergoing repairs.

Toll rates (the charge made against merchandise passing over city premises) and **wharfage charges** (charge made on merchandise left on city premises) vary with the class of freight. Rates will be furnished on application to the harbor master.

A **light** is maintained by the city of San Diego on the northern edge of the channel 800 yards west-northwestward of the outer end of the municipal dock. This light shows fixed green between 90° and 270° and fixed white between 270° and 90°.

Quarantine.—National regulations only are enforced. Vessels must not pass above a line between beacons 3 and 4 until boarded by the quarantine officer, which is usually done between the bar and the station at La Playa.

Marine hospital.—At San Diego there is a relief station of the United States Public Health Service in charge of a service officer.

Supplies.—Fuel oil can be obtained in any quantity, water at the wharves or by water boat, and provisions and ship chandler's stores in San Diego.

Repairs.—Minor repairs only to hulls and machinery are possible. There is a marine railway with an original capacity of 1,500 tons, but it is limited by its present condition to about 400 tons.

Storm warning displays of the United States Weather Bureau are shown from a staff on the Keating Building, plainly visible from the harbor, and at the coal bunkers on Spreckels wharf.

Communication with points north and south may be had by rail and regular coasting steamers; with the interior by rail. There are also telegraph, telephone, and radio facilities.

Fogs are unusual; occasionally, in the early mornings or in late fall, they occur for about an hour or more at Point Loma, clearing shortly after sunrise.

Winds.—The prevailing winds are from the northwest and west; the heaviest, from the southwest, occur generally in the spring or fall. They rarely exceed 25 miles an hour, and shipping in the harbor is safe at all times.

Currents.—The currents set generally in the direction of the channels and vary from 1 to 2.5 knots, depending upon the stage of the tide. Westward of the Middle Ground north of Ballast Point is an

inshore eddy of 0.1 to 0.3 knot on both flood and ebb. On the flood the current sets northwestward over the Middle Ground and on the ebb in the opposite direction. South of the end of the jetty there is a slight set toward Zuninga Shoal on the ebb. The average central surface velocity in the channel east of Ballast Point at the time of strength is 1.9 knots.

Tides.—See the tide tables published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year.

GENERAL REMARKS ON APPROACHING SAN DIEGO BAY.

From seaward.—In clear weather vessels approaching from seaward will raise San Clemente Island, the southernmost of the Santa Barbara Islands, before the distinguishing features of the coast can be seen. This will check the vessel's position and indicate the subsequent shaping of the course for Point Loma. Upon a nearer approach, Mount Cuyamaca and the high land of the interior, the Coronado Islands, and Point Loma will be distinguished. When up with the whistling buoy 3⅝ miles 165° true (SSE ⅝ E mag.) from Point Loma lighthouse, follow directions, San Diego Bay.

Tanner Bank covers an area about 15 miles long west-northwest and east-southeast, and about 4 miles wide. The least depth as far as known is 28 fathoms. The northwestern end of the bank lies about 27 miles southeastward from the eastern end of San Nicolas Island.

Cortes Bank, lying southward of Tanner Bank, covers an irregular area about 25 miles long and 8 miles wide. The depths are irregular, from 100 fathoms to 15 feet; this latter depth being found over Bishop Rock, near the southern end of the bank. The southern end of the bank lies 38 miles southwestward from the southern end of San Clemente Island.

Bishop Rock, with but 15 feet over it, is the shoalest point on Cortes Bank, and is approximately in latitude 32° 25′ north and longitude 119° 07′ west. Westward of the rock for several miles the depths range from 9 to 11 fathoms. This rock is the farthest outlying danger on the coast. The currents in this vicinity are variable in direction and have a velocity of 1 to 2 knots. These create considerable swell, and even in moderate weather the rock shows a breaker. Navigators should exercise great caution when in this vicinity. The rock is marked by a gas and whistling buoy.

A **bank** of considerable extent has been reported about 65 miles south-southwestward of the southeastern end of San Clemente Island. Two casts of the lead gave 50 and 60 fathoms, but breakers were also reported.

From southward.—Vessels from southward in clear weather will make Table Mountain and the high land in its vicinity and the Coronado Islands before raising Point Loma. The passage eastward of the Coronado Islands can be used with safety, and coasting steamers bound to or from Mexican ports frequently do so. The depth in the vicinity of the Coronado Islands are irregular, and in thick weather or at night great caution must be exercised when near them. The passages between them should not be attempted. When up with the whistling buoy follow the directions for San Diego Bay following.

From northward.—Follow the directions for southbound vessels, page 41, to a position 2 miles southwestward of Point Loma Lighthouse. Then proceed as directed in the following section.

DIRECTIONS, SAN DIEGO BAY.

The following directions are good for a draft of 28 feet. Strangers of deeper draft should take a pilot.

Having made the whistling buoy or Point Loma lighthouse, proceed as convenient to a position 250 yards eastward of the outside bar bell buoy, keeping clear of the kelp which extends southward from Point Loma. This position is on the range through the dredged channel across the bar. Follow this range, course 359° true (N by W ½ W mag.), until abreast of buoy No. 4, then steer 350° true (NNW ¼ W mag.), heading for the light on the outer end of the quarantine wharf. On this course pass 150 yards off Ballast Point lighthouse and 100 yards eastward of buoy No. 5.

When San Diego entrance rear range light is in range with beacon No. 4, haul to a 43° true (NNE ½ E mag.) course, and pass in midchannel between the aids, which are arranged in pairs, to a position 300 yards northward of beacon No. 8. In order to safely make the turn off the quarantine station, proper allowance must be made for the current.

From the position 300 yards northward of beacon No. 8, steer 96° true (E ¾ N mag.), heading for the light (maintained by the city) on the north side of the channel, until abreast of beacon No. 10. From this point a course may be shaped for the desired berth or to an anchorage off the city.

COAST FROM POINT LOMA TO POINT VINCENTE.

The stretch of coast between San Diego and San Pedro Bays has been extensively settled in recent years. There are numerous small towns or resorts along the beach, with buildings which show up well from seaward. Communication, however, is entirely by rail; there is at present (1916) no traffic by water to any point in this region.

From Point Loma the coast trends northward for 5½ miles to the entrance of **False Bay**, a small lagoon full of shoals and of no importance.

Point La Jolla (False Point), 11 miles northward from Point Loma, is a rounding rocky point, the seaward termination of a spur from Soledad Mountain, 820 feet high, the first high land northward from Point Loma. The cottages and buildings at La Jolla and at Pacific Beach, on the north shore of False Bay, are prominent from seaward.

From Point La Jolla the coast extends northward for 38 miles to San Mateo Point as a low, flat table-land, with abrupt cliffs seaward, 60 to 130 feet high, and broad, low-water beaches. The table-land is intersected by numerous steep valleys containing streams that are usually dry in summer. In the northern portion the high mountain ridges of the interior approach much nearer to the coast.

Pine Hill, 346 feet high, 4 miles northward from Point La Jolla, is the only pine-covered hill along this section of the coast.

Oceanside, 22 miles northward from Point La Jolla, is a small town on the railroad skirting the coast. The buildings of the town are prominent from seaward, one with a cupola, on the hill, being particularly noticeable.

The bridge and trestlework of the railroad crossing Santa Margarita River, 3 miles northward from Oceanside, are also prominent.

San Onofre Mountain lies 1 mile from the coast 35 miles northwestward from Point La Jolla, or 3 miles eastward from San Mateo Point. Its highest point is 1,720 feet above the sea.

San Mateo Point, terminating in cliffs about 60 feet high, is the north head at the mouth of San Mateo Creek. Both San Mateo and San Onofre Creeks are crossed by trestleworks.

From San Mateo Point to San Juan Point, about 8 miles, the land is higher and more rugged, and is broken by the San Juan Capistrano valley and river, about 1½ miles eastward of San Juan Point. The railway runs along the beach under the bluffs in this stretch of coast to San Juan Capistrano Valley.

San Juan Point, 54 miles northwestward from Point Loma, is the seaward end of a high ridge. The point is 281 feet high, with a broken, precipitous face; outlying rocks and ledges extend offshore for 350 yards. San Juan Rock, 10 feet high, is about 50 feet in extent, and lies 340 yards southward of the highest point of the cliff.

San Juan Capistrano Anchorage, now seldom used, lies 1½ miles 116° true (E by S mag.) from San Juan Point, ¾ mile off the opening of the valley, in about 5½ fathoms outside the kelp. Small vessels with local knowledge may anchor inside the kelp in 3 fathoms ⅜ mile from the beach with San Juan Point bearing 279° true (W ½ S mag.).

From San Juan Point to Newport Bay, 12 miles, the coast is bold, with rocky cliffs 40 to 100 feet high, which are the seaward ends of ridges transverse to the coast, separated by narrow, deep valleys. **Laguna,** a summer resort, lies midway in this stretch; there is a pier built out for convenience of bathers.

Santiago Mountain, 5,685 feet high, double headed and dark in contrast with the immediate coast range, is the dominant feature of this part of the coast. It lies 17 miles north-northeastward from San Juan Point and is visible 80 miles, or from 10 miles southward of San Clemente Island and 10 miles westward of Point Dume.

Newport Bay is an extensive shallow lagoon of no commercial importance. The bar shifts frequently with storms, and is not crossed by vessels.

Newport Landing, 14 miles westward from San Juan Point and 19 miles eastward from Point Fermin lighthouse, is at the head of a narrow submarine valley, with a depth of 40 fathoms ½ mile from the beach. In the past there has been considerable domestic trade, lumber and general merchandise being received and farm and dairy produce shipped. **Newport Beach** is the post office. It is connected by rail with Santa Ana, about 20 miles in the interior. The wharf and warehouses in its vicinity are the most prominent features. The depths alongside the wharf are 37 to 45 feet at the end, 45 to 13 feet on the western, and 37 to 9 feet on the eastern side of the wide part. Severe storms are rare, and vessels as a rule can load and discharge throughout the year. The prevailing winds are westerly, and heaviest

from west and southwest. The anchorage is open, but good holding ground can be had westward of the wharf in 7 fathoms, sticky blue mud. This landing was not used in 1916.

From Newport Landing to Point Fermin, nearly 20 miles, the coast is low, with several lagoons in the vicinity of the beach, the largest of which, Wilmington Lagoon, now a part of Los Angeles Harbor, has been extensively improved, and is connected by a dredged channel with San Pedro Bay. The country is treeless, except in the valleys and gulches, and is covered with grass and sagebrush, green during the rainy season, but brown in summer.

Point Lasuen, 6 miles westward from Newport Landing, is a low bluff, the seaward end of a long, low ridge, Las Bolsas, with low land on each side.

Long Beach and **Alamitos Beach,** about 5 miles eastward of San Pedro, are seaside resorts, and there are several piers built out from the beach to beyond the surf line.

San Pedro Bay and **Harbor** and **Wilmington Lagoon,** now combined under the name Los Angeles Harbor, are described under a separate heading following.

San Pedro Hill, 1,479 feet high, is a prominent landmark and the distinguishing feature for making San Pedro Bay from eastward or westward. It terminates seaward in steep, rocky cliffs about 60 feet high, with several horizontal terraces between them and the summit.

Point Fermin, the southeast extremity of San Pedro Hill, is a bold cliff 100 feet high. **Point Fermin lighthouse** is a white square tower on dwelling, situated near the end of the point. The light is group occulting white (light 5 seconds, eclipse 2.5 seconds, light 10 seconds, eclipse 2.5 seconds), 154 feet above the water and visible 18 miles. A **rock,** with 3 feet over it, lies ¼ mile 137° true (SE by E ¼ E mag.) from the lighthouse and is marked by a whistling buoy which lies ½ mile 150° true (SE mag.) from the lighthouse.

From Point Fermin the coast trends in a general westerly direction about 6½ miles to Point Vincente, the southwest termination of San Pedro Hill, and forms the northern shore of San Pedro Channel, 17 miles wide, that lies between the mainland and Santa Catalina Island.

Portuguese Bend, a small, unimportant bight, lies 2¼ miles eastward from Point Vincente. It is used chiefly by fishermen, and a boat landing can be made at times.

Between Point Fermin and Point Vincente the coast is free from outlying dangers and is well marked by kelp.

Point Vincente is a steep rocky cliff, 120 feet high, white and red, with the red predominating. A low, black rock, awash, lies 250 yards southwestward from the point, with kelp extending 100 yards farther. A small, black, pyramidal rock, 25 feet high, lies ⅓ mile eastward from Point Vincente, close inshore. Point Vincente gas and whistling buoy lies a little over ¼ mile 218° true (SW mag.) from the point. Vessels should not attempt to pass northward of this buoy.

SAN PEDRO BAY AND LOS ANGELES HARBOR.

The portion of San Pedro Bay (charts 5143 and 5145) lying just eastward of Point Fermin, which formerly afforded good shelter

only in northerly or westerly winds, has been converted into a safe harbor in all weathers by the construction of a breakwater which extends in an easterly direction from the eastern end of Point Fermin for a distance of 1,900 yards, thence in a northeasterly direction a farther distance of 1,800 yards. The outer end of this breakwater is marked by **Los Angeles Harbor lighthouse,** a white cylindrical tower. The light is flashing white (flash 1 second, eclipse 14 seconds). 73 feet above the water and visible 14 miles; the fog signal is an air siren (blast 2 seconds, silent 16 seconds, blast 2 seconds, silent 16 seconds, blast 4 seconds, silent 20 seconds).

The sheltered area inside this breakwater is being dredged to a depth of 35 feet at mean lower water, the work at present (1917) being practically complete. This area is known as the **outer harbor**.

The natural **channel** leading to San Pedro and Wilmington has been improved by dredging a channel 30 feet deep at mean lower low water throughout; 400 feet wide from the outer harbor up to the lower end of the wharves, for full width (averaging 500 feet) between the wharves at San Pedro and East San Pedro, thence widening to a turning basin 1,600 feet in diameter opposite Smiths Island. This waterway is locally known as the **main channel.**

Above the turning basin a channel 200 feet wide has been dredged to depths of 20 to 30 feet past Wilmington, and basins dredged to 30 feet afford ample berthing facilities. This locality is known as the **east basin.**

Another channel of similar dimensions is being dredged into the shallow lagoon to the westward of the turning basin. This area is known as the **west basin.** The channel leading from the turning basin to the west basin is crossed by a 180-foot-span bascule railway bridge. The signal for opening this bridge is one long blast of the steam whistle, followed quickly by one short and one long blast.

The area described in the last three paragraphs, consisting of the waters above Reservation Point, is known as the **inner harbor.**

Westward of the dredged channel leading from the outer to the inner harbor are two slips, locally known as the **east** and **west channels,** dredged to 35 and 30 feet, respectively.

San Pedro and **Wilmington** are now included within the limits of the city of Los Angeles, and are the port for the city proper. They have extensive traffic, both foreign and coastwise, with ample facilities for the largest vessels on the Pacific, and provision is being made to take care of extensive future increases in traffic. A radio station is located here.

Long Beach Harbor, eastward of Wilmington, is largely artificial. It consists of a jettied entrance, with channel dredged to 20 feet between the jetties, short interior channels or slips, and a turning basin, all dredged originally to a depth of 20 feet, but at present (1917) so filled in by recent floods as to suspend navigation. The work of redredging is at present under way. The entrance is marked by a bell buoy.

The channel leading from sea to Long Beach Harbor is crossed by a railway drawbridge. The signal for opening the bridge is one long, one short, and one long blast of the whistle.

There is a shipyard at **Long Beach** where repairs to hulls and machinery can be made. The dry dock has a capacity of 3,000 tons and a length of 280 feet over the blocks. The present depth in front

of the plant is only 11 feet at low water, due to recent shoaling, but the original 20-foot depth will shortly be restored.

Terminal (formerly **Rattlesnake**) **Island** separates Los Angeles inner harbor from San Pedro Bay. The western end of the island has been extensively improved and **East San Pedro**, opposite San Pedro, handles a considerable amount of the freight passing through the port.

Fish Harbor, on the south side of Terminal Island, near its western end, has been formed by dredging to a depth of 12 feet at mean lower low water and by the construction of a protecting breakwater. This harbor is intended for the use of small fishing craft.

Reservation Point, 40 feet high, was formerly Deadmans Island, but is now connected to Terminal Island by jetties and material dredged from the adjacent channels. It forms the eastern entrance point to the inner harbor.

Weldt Rock, with 17 feet over it, lies ¾ mile 331° true (NW mag.) from Los Angeles Harbor light. It is marked by a bell buoy situated 100 yards southward of it.

The **inner harbor fog signal**, consisting of a bell, one stroke every five seconds, is maintained at the southeast corner of the reclaimed area on the west side of the dredged channel leading to the inner harbor.

Regulations for Los Angeles Harbor are prescribed by a board of harbor commissioners. The following are the principal items:

Anchorage may be had anywhere in the outer harbor except in areas within 1,000 feet of the established pierhead lines. Anchoring or mooring in any channel of the harbor is prohibited unless the vessel be securely moored both fore and aft. Anchoring or mooring in the turning basin is forbidden under all circumstances.

Pilotage.—Pilots are usually employed by strangers in entering the inner harbor. Vessels are met outside, and if waiting for a pilot, anchor inside the breakwater. The pilots are in the employ of the city of Los Angeles.

Vessels under enrollment are not required to pay pilotage unless a pilot of the city of Los Angeles has actually been employed.

All other vessels entering or leaving the port under the pilotage of any person other than the master, thereunto duly licensed, are required to pay to the city of Los Angeles $1 per foot draft, and 1 cent per net registered ton inward bound, and the same outward bound.

Such vessels, however, which call for the purpose of taking on water, fuel, or stores, or for receiving orders or reporting, without discharging or receiving passengers or cargo, are required to pay one-half of the above amounts.

Pilotage must be paid by any vessel under register which enters or purposes to leave the harbor in the charge of any person other than the master.

Speed limits are prescribed as follows:

Outer harbor, all steam vessels must not exceed 10 nautical miles per hour; motor boats must not exceed 15 nautical miles per hour. Inner harbor, vessels over 20 feet draft must not exceed 6 nautical miles per hour; under 20 feet draft must not exceed 7½ nautical miles per hour; motor boats must not exceed 10 nautical miles per hour.

Quarantine.—National quarantine regulations are in force. There is no prescribed anchorage; vessels subject to quarantine usually anchor in the outer harbor.

Marine hospital.—There is a relief station of the United States Public Health Service at Los Angeles in charge of a service officer.

Supplies.—Fuel oils, coal, water, provisions, and ship chandlery may be obtained in any quantity. The station for loading fuel oils is near the inner end of the breakwater.

Repairs to hulls and machinery can be made at Long Beach, as described above. There is a marine railway on Mormon Island, capable of handling small boats only.

The **customhouse landing** is at the end of the Southern Pacific Railroad wharf, foot of Fifth Street.

Storm-warning displays of the United States Weather Bureau are shown at Long Beach, on Terminal Island, and in the inner harbor.

Communication is by rail and trolley with the interior and by regular coasting steamers with points north and south; there are also telephone and telegraph facilities.

Fogs are not common. They occur generally in spring, coming in with light westerly winds at night or early morning, but clearing shortly after sunrise.

The prevailing **winds** during summer are from northwest, and in winter from southward and westward; the heaviest winds for each season come from the prevailing direction. Southeast gales occur five or six times during the winter, and are dangerous to vessels anchored outside the breakwater. The summer winds are sometimes quite strong but not dangerous. The "Santa Ana" is a local and exceptional wind of considerable strength from eastward, and is the only wind dangerous to vessels inside the breakwater.

The **tidal currents** follow the channel; they rarely exceed 1 knot and are generally negligible.

DIRECTIONS, LOS ANGELES HARBOR.

These directions are good for a draft of 28 feet at mean lower low water, and lead to the wharves at San Pedro.

Rounding Los Angeles Harbor lighthouse at a distance of 300 yards, steer 90° true (ENE ⅝ E mag.). When lights Nos. 2 and 4 are in range, haul to a 342° true (NW by N mag.) course, passing 75 yards westward of light No. 2 and 100 yards westward of light No. 4. When the Southern Pacific Railway Co.'s slip (off Timms Point) opens full, haul to a 334° true (NW ¼ N mag.) course, passing 100 yards westward of light No. 6 and continue to a mid-channel position between the wharves. From this point mid-channel courses may be followed to the desired berth.

COAST FROM POINT VINCENTE TO POINT ARGUELLO.

From Point Vincente to Point Dume, about 25 miles, the coast forms a broad, open bight about 10 miles wide, known as **Santa Monica Bay** (shown on chart 5144). Its eastern shore is comparatively low, consisting of sand dunes about 100 feet high, but backed by the high

mountains of the Sierra Madre far in the interior. The northern shore is bold, rocky, and rugged, with steep cliffs rising abruptly from the water's edge, thence gradually in 3 or 4 miles to the summits of the Santa Monica mountain range, about 3,000 feet high, the seaward termination of which is at Point Mugu, 14 miles westward of Point Dume. From this point it changes to a series of sand dunes and beaches, with lagoons and marshes behind them, which extend 8 miles westward to Point Hueneme. The shores of Santa Monica Bay are free from outlying dangers, and the soundings are comparatively shoal, the 10-fathom curve lying as a rule at a distance of about 1 mile from shore, except at Redondo Beach where a deep submarine valley heads close to shore and a depth of 10 fathoms is found 400 yards from the beach.

Rocky Point, 2 miles northwestward of Point Vincente, is a bold, bluff point, 120 feet high, rising rapidly to the western extremity of San Pedro Hill. There are no dangers off the point but heavy kelp extends out about 5/8 mile.

Malaga Cove, 2½ miles northward from Rocky Point, sometimes used by small vessels with local knowledge, affords shelter from all but westerly and southwesterly winds, with which a heavy swell sets in. There is a break in the kelp through which vessels enter and anchor inside of in 6 to 7 fathoms, with the south point of the bight bearing 207° true (S by W mag.).

Redondo Beach is situated 4 miles northward from Rocky Point and 23 miles eastward from Point Dume. It has some domestic commerce by water, lumber for local use being received. The wharves have 36 to 48 feet of water at the ends. Anchorage may be had in about 10 fathoms with the large gray building of the electric-power plant bearing 49° true (NE by N mag.). Here the holding ground is good, with some protection from southeast gales, but it is open to southerly or westerly weather.

Fuel oil, water, and provisions can be obtained, and coal on short notice. There are no pilots or tugboats. Communication is by rail, and by telephone and telegraph. There is no passenger traffic by water. In addition to the electric-power plant, the hotel on the bluffs is prominent. Storm warnings are displayed by the United States Weather Bureau, plainly visible from the harbor.

About 1½ miles west-southwestward from the wharves, oil from a submarine spring covers an area 1½ miles long by ½ mile wide.

From Redondo Beach the coast trends northwestward for 12 miles to Santa Monica. The sand dunes are continuous as far as Ballona Lagoon, 4 miles southeastward from Santa Monica.

Between Redondo Beach and Santa Monica are a number of seaside resorts lighted with electric lights and with piers built out beyond the surf line. **Hermosa Beach** is 1½ miles, **Manhattan Beach** 3 miles, **North Manhattan Beach** 4 miles, and **Pecks Beach** 5½ miles, northwestward from Redondo Beach. At the end of the sand dunes on the south side of Ballona Lagoon is **Playa del Rey** and on the north side of the lagoon is **Venice**. **Ocean Park** is 1 mile southeastward from Santa Monica and there are two piers at the latter place. None of these piers are used by vessels or for commercial purposes.

Santa Monica is a town and seaside resort; the buildings, and particularly a large hotel on the edge of the bluff, are prominent from seaward.

Port Los Angeles, about 2 miles westward from Santa Monica, was formerly of considerable importance as a shipping port. It is now entirely abandoned, however, and the wharf is out of repair.

Kellers Shelter, 7 miles northeastward from Point Dume, is an open bight which affords protection from northerly and westerly winds in 5 to 7 fathoms, sandy bottom. A reef, marked by kelp, extends a short distance offshore about ½ mile westward of the anchorage. A wharf is built out from the beach abreast the anchorage.

Dume Cove, about 2 miles northeastward from Point Dume, affords protection similar to Kellers Shelter. The anchorage is abreast the fourth break or arroyo in the cliffs from Point Dume, with the point bearing 240° true (SW mag.). A high railway trestle crosses this gulch and the grade of the road slopes gradually to the beach eastward from it. Kelp should be avoided on account of possible dangers.

Point Dume is the seaward end of a rather low plateau that terminates in a dome-shaped head, 200 feet high, rising from a bold, rocky bluff. The bluff is reddish with white cliffs eastward and westward. There is a small rock lying 220 yards southward of the point, and a reef which bares at low tide 150 yards farther out. A whistling buoy is placed ½ mile off the point, and vessels must not go inside of it.

Between Point Dume and Point Mugu, about 14 miles, the coast is very rugged with no outlying dangers.

About 2 miles eastward of Point Mugu is a sand dune, 60 feet high, on the beach at the foot of a very high bluff. This is quite prominent and can be made out on clear, moonlight nights.

Point Mugu is the seaward termination of the Santa Monica Mountains, and is prominent on account of the lowland of the Santa Clara Valley westward. Mugu Lagoon, immediately westward of Point Mugu and parallel with the beach, is about 5 miles long, shoal, and of no importance.

Laguna Point and **Middle Point** are merely wider portions of the sand beach separating Mugu Lagoon from the sea; they are not prominent from seaward.

Ormond Beach is a seaside resort laid out on the beach 1 mile eastward of Hueneme. A pier 250 yards long is built out beyond the surf line.

Hueneme Landing has a large amount of domestic trade, receiving general merchandise and shipping grain and farm produce from the Santa Clara Valley. The wharf is about 1,600 feet long. There is a depth of 23 feet at the outer end, decreasing gradually to 21 feet at the inner end of the wide part. Mooring buoys are placed off the wharf. The best anchorage is southward of the wharf in 6 to 7 fathoms, mud and sand, good holding ground. Artesian water is piped on the wharf and fresh provisions can be obtained. The prevailing winds are westerly, but southeast or southwest gales occur five or six times during the year. During these gales vessels generally make Prisoners Harbor, Santa Cruz Island, for shelter. Communication may be had by irregular coasting steamers with points north and south. A branch of the Southern Pacific Railroad runs to the warehouses at the landing. The lighthouse and buildings, and the wharf with warehouses near the inner end, are the most prominent features in approaching.

Point Hueneme, low, rounding, and sandy, is the outermost point of the lowland at the mouth of the Santa Clara Valley. **Point Hueneme lighthouse** is prominent. It is a white square tower on dwelling; the light is flashing white (flash 1 second, eclipse 4 seconds), 52 feet above the water, and visible 13 miles; the fog signal is an air siren (blast 4 seconds, silent 26 seconds).

From Point Hueneme to Point Conception the coast forms the northern shore of the Santa Barbara Channel, which is about 66 miles in length in an east and west direction with an average width of 20 miles. The islands forming its southern boundary are described under a separate heading.

From Point Hueneme the coast, consisting of low sand beaches and sand dunes, trends northwestward for 9 miles to the mouth of the Ventura River.

Ventura Landing, lying about 8½ miles northwestward from Point Hueneme lighthouse and 23 miles 111° true (E ⅜ S mag.) from Santa Barbara lighthouse, has a considerable amount of domestic commerce, receiving general merchandise and shipping petroleum and farm produce. As a result of floods in 1914, extensive flats have formed off the mouth of the river and in front of the town. The wharf has been extended to a total length of 1,700 feet, and has a depth of 17 feet at the end. The prevailing winds are westerly and light, and southerly gales are rare. The westerly winds when heavy are the most dangerous. Vessels anchor anywhere in the bight with good holding ground, but there is no protection. The buildings in the town, the oil tanks at the inner end of the wharf, and the railroad trestle crossing the **Ventura River** immediately westward of the town are prominent features in approaching. Several houses may be seen near the beach southward of the town.

From the Ventura River the **Santa Inez Mountains** extend to Point Conception and Point Arguello. For about 10 miles westward from the river to Rincon Point the coast is very rugged, elevations of over 2,000 feet being found within 1 mile of the beach. The dangers do not extend over ½ mile from the beach, which is well fringed with kelp.

Point Las Pitas is the first bold point westward of the river. A very steep arroyo or gulch is on its western side.

Point Gorda, 3½ miles westward of Point Las Pitas, is low at the extremity, but rises rapidly to **Mount Hoar,** a prominent mountain about 2,100 feet high.

Rincon Point, low and sandy, is 10 miles westward from Ventura and the same distance eastward from Santa Barbara.

Sand Point, 3½ miles westward from Rincon Point, is low and rounding, with the narrow opening to Carpinteria Lagoon (shoal and of no importance) lying close under and eastward of it.

Carpinteria is 7 miles eastward of Santa Barbara. The post office on the railroad is **Serena.** There is no traffic by water at present and the wharf is gone.

Summerland is a small settlement 4½ miles eastward from Santa Barbara. There are a number of wharves in its vicinity for oil derricks, but none at which steamers can land.

La Vigia Hill, 592 feet high, is the distinguishing feature in approaching Santa Barbara from eastward or westward, and can be

seen before either the lighthouse or mission. Point Castello, its northeastern extremity, terminates in an almost perpendicular cliff about 50 feet high. **Santa Barbara Point**, its southeastern extremity, is a high cliff and the eastern limit of a narrow table-land upon which is located **Santa Barbara lighhouse**, a white tower on dwelling. The light is flashing white (flash 1 second, eclipse 14 seconds), 17(feet above the water, and visible 20 miles.

Santa Barbara (chart 5261) is situated immediately northeastward from La Vigia Hill. It is 40 miles eastward from Point Conception and 30 miles west-northwestward from Point Hueneme. Lumber and general merchandise are received, and fruit, farm produce, and abalone meat shipped. An extensive wharf has been built, which has 25 feet at its outer end. There is generally a kelp bed in front of the wharf with a break in it that is usually kept clear by steamers. The prevailing winds are westerly. During the winter southwesterly storms occur five or seven times during the season. Good anchorage may be had anywhere inside the kelp, but large vessels usually anchor outside on account of better holding ground. In bad weather they generally run over to the islands for a lee. Coal can be obtained in limited quantities, but the handling is inconvenient. Water and provisions may be had. Communication can be had by rail and regular coasting steamers, and there are telegraph and telephone facilities.

Storm warnings are displayed by the United States Weather Bureau near the inner end of the wharf, plainly visible from the harbor.

A whistling buoy is placed 1¼ miles 181° true (S by E ⅜ E mag.) from the wharf.

The **Mission**, a large building with two towers, situated above the town on the north side of the valley, is prominent in the approaches. The most conspicuous building is the Potter Hotel, near the beach westward of the wharf. At the western end of the sand beach a pier, used by bathers and pleasure boats, is built out beyond the surf line. The electric lights are conspicuous at night when approaching from the eastward, but are hidden by La Vigia Hill from westward.

Goleta Point, 6½ miles westward from Santa Barbara Point, is low and terminates in a cliff about 30 feet high.

From Goleta Point to Point Conception, 32 miles, the coast is more rugged than that eastward. **Gaviota Canyon**, 26 miles westward from Santa Barbara lighthouse, is conspicuous as it is the only decided break in the range of mountains extending to Point Conception. A railroad skirts the shore, with trestles and embankments across the mouths of the numerous gulches and arroyos. The kelp grows quite heavily, and in some places extends over 1 mile offshore.

Coal Oil Point, 2 miles westward of Goleta Point, is low, and may be distinguished by the strong odor of petroleum discharged by a spring; this odor is noticeable over 2 miles offshore.

A rock, with 15 feet over it, lies 5½ miles westward from Goleta Point and ⅞ mile offshore. It is surrounded by kelp.

Alcatraz Landing, 13½ miles eastward from Point Conception, has a wharf built out to deep water to carry oil pipes. Large steamers load here both crude and refined oil. They lie moored to their own anchors and to mooring buoys, with lines to the wharf. The buildings and tanks are prominent.

Coxo Anchorage, 1½ miles eastward of Point Conception, affords protection from moderate westerly and northwesterly winds, in 5 to 10 fathoms, hard sandy bottom, off the mouth of the Coxo Valley. The cove 1¾ miles eastward of this anchorage, known as **Little** or **Old Coxo,** affords somewhat similar advantages.

Point Conception is a bold headland, 220 feet high, at the western end of Santa Barbara Channel, and marks an abrupt change in the trend of the coast. There is comparatively low land immediately behind it. At a distance, when coming from northward or eastward, it is usually made as an island. **Point Conception lighthouse,** near the western part of the point, is a white tower behind dwelling. The light is flashing white (flash 4.5 seconds, eclipse 25.5 seconds), 133 feet above the water, and visible 18 miles. The fog signal is an air diaphone (blast 3 seconds, silent 4 seconds, blast 3 seconds, silent 50 seconds). A low, black rock, nearly awash at high tide, lies 220 yards offshore southward and westward of the lighthouse.

From Point Conception the coast trends in a gentle curve northwestward for 12 miles to Point Arguello, and consists of bold, rocky cliffs 100 to 400 feet high. The coast railway runs along these cliffs and through several tunnels between Point Conception and Point Arguello.

Espada Bluff is a prominent cliff, 360 feet high, 5½ miles northward from Point Conception; the cliffs on each side drop sharply to less than 100 feet in height. It is quite prominent from seaward.

Point Arguello is a narrow, jagged, rocky projection, extending 800 yards westward from the general trend of the land, with an outlying rock 200 yards seaward. The extremity of the point overhangs the water's edge and 200 yards back is nearly divided by gullies from the north and south sides. These form a saddle, which, from northward and southward, makes it appear like two small heads. The western extremity of the point is marked by **Point Arguello lighthouse,** a white square tower. The light is group flashing white (flash 0.2 second, eclipse 2 seconds, flash 0.2 second, eclipse 5.1 seconds), 100 feet above the water, and visible 16 miles. The fog signal is an air siren (blast 2 seconds, silent 28 seconds). There is a United States naval radio station (call letters NPK) near the lighthouse.

Mount Tranquillon, near the seaward end of the Santa Inez Mountains, is prominent in clear weather. It terminates in Rocky Point, Point Arguello, and Point Pedernales, which are separated by a little over 1 mile.

Rocky Point and **Point Pedernales** have numerous detached rocks, extending in some cases 300 yards offshore. Point Pedernales and the largest rock off it are very dark and conspicuous, as sand dunes commence immediately northward of the point.

ISLANDS OFF THE COAST OF SOUTHERN CALIFORNIA.

SAN CLEMENTE ISLAND

is 1,964 feet high and its southeastern end lies 60 miles 280° true (W ½ S mag.) from Point Loma, from which it is visible in clear weather. It is 18 miles long in a northwest and southeast direction, with an average width of 2½ miles, the broader and higher part of

the island being near the southeast end. The northeast side of the island is straight and bold, with rocky, precipitous cliffs. The southwest side is lower and more broken. There is no kelp along the north shore, but the south shore is well fringed. The island is of little commercial importance, and is used mainly for raising sheep. The depths in approaching the island from northward are great, the 100-fathom curve lying in many places but little over ¼ mile from the beach. On the south side the depths are less, the 100-fathom curve near the southeast extremity lying over 3 miles offshore.

Pyramid Head, the eastern point of the island, is about 900 feet high, sharp and jagged; it is a prominent feature in making the island.

Northwest (Clemente) **Harbor** (chart 5126), on the north side of the western end of the island, affords shelter in southerly weather, but is uncomfortable, as the swell makes around the point. It is open northward, and is unsafe in heavy northwesterly weather. The kelp extends to 10 fathoms.

Wilson Cove, on the north shore, 2½ miles eastward of the western end of the island, affords fair shelter in southerly weather. The anchorage is about 200 yards off the mouth of a small valley in 7 to 8 fathoms. Kelp grows close inshore. There are two or three houses on the beach. Wilson Cove, which is now locally known as Gallaghers Bay, is the principal anchorage where a steamer from San Pedro occasionally calls with supplies for the sheepherders.

Pyramid (Smugglers) **Cove** (chart 5126) is under the eastern point (Pyramid Head) of the island, about 2½ miles westward of the point on its southern shore. A windmill and corral are near the western end of the sand beach. Protection is afforded from northwesterly weather in 10 to 15 fathoms, sandy bottom, about ⅓ mile offshore, at the western limit of the kelp, with the windmill bearing 341° true (NW by N mag.). Good water may be obtained in barrels.

SANTA CATALINA ISLAND

lies 18 miles southward from Point Fermin. It is 18½ miles long in an east and west direction with a greatest width of 7 miles. About 6 miles from the western end is a deep cut in a north and south direction that almost divides it. The coves on each side of the island formed by this cut are less than ½ mile apart at their heads, the land separating them being a low isthmus, so that at a distance of a few miles the island appears as two. The island is rugged and mountainous with steep, precipitous shores, intersected occasionally by deep gulches and valleys, and is covered with a thick growth of brush and some scrub oak. The highest peak, 2,109 feet, lies about in the middle of the eastern part of the island. Sheep and cattle are raised to some extent. The shores are free from kelp, except in a few places on the south side. The island rises abruptly from deep water, the 30-fathom curve lying close inshore.

Dakin Cove, generally known as **Avalon**, is on the north shore of the island 2½ miles from its eastern end. It is about ½ mile by ¼ mile in extent, and affords indifferent anchorage in 8 fathoms, sandy bottom. There is a depth of 20 fathoms immediately outside the points of the cove. The shelter is good in southeasterly and southwesterly

weather, and fair in northwesterly weather if the wind is not too strong. **Avalon**, a summer resort and post office, is situated here. The depth at the outer end of the wharf is 18 feet. A steamer makes daily trips from San Pedro. Water and a limited amount of provisions may be obtained. A commercial radio station is located here.

White Cove, 3½ miles westward from Avalon, affords an anchorage in 8 fathoms; the protection is similar to that at Avalon.

Isthmus Cove (chart 5128), on the north shore 6 miles eastward from the western end of the island, affords shelter for small vessels in southerly weather but is dangerous in northwesterly weather. A wharf has been built to 12 feet of water, and other improvements are in progress and contemplation with a view of making a summer resort. **Fisherman Harbor** is a small cove in the eastern part of the bight; it is only available for small craft and is little used. The deep cut in the island is the prominent feature in making the cove. **Bird Rock**, 66 feet high and of small extent, lies ¾ mile off the entrance to the cove. It shows as a black haystack from the channel, and the top is generally white with bird droppings. **White Rock**, 30 feet high and 170 yards in extent, lies ¼ mile off the eastern part of the cove; it is covered with sand and grass. Two rocks, with 7 and 18 feet over them, lie 100 yards northwestward from White Rock, and a shoal extends 100 yards from the southern face. A rock, with 6 feet over it, lies about 100 yards southeastward from the eastern end of White Rock. **Harbor Reefs**, ¼ mile southwestward from White Rock, are 350 yards long in an east and west direction and less than 100 yards wide; they are generally well marked by kelp. At low water a portion is exposed at the eastern end. The anchorage is 300 yards off the end of the wharf with the eastern end of White Rock bearing 46° true (NNE ¾ E mag.). **In entering**, bring Bird Rock to bear 10° true (N ½ W mag.) astern and steer 190° true (S ½ E mag.) until the eastern end of the White Rock bears 46° true (NNE ¾ E mag.). The western point of the cove should be favored to avoid Harbor Reefs.

Catalina Harbor (chart 5128), on the southern side of the isthmus separating it from Isthmus Cove, affords shelter, except in southerly weather, for small vessels. It is funnel shaped, about ¾ mile long, and at the entrance ⅜ mile wide. It is free from hidden dangers and easy of access. **Pin Rock** is a small rock above water lying close inside the eastern head; it is about 100 yards offshore with deep water around it. The anchorage is in 4 to 5 fathoms, soft bottom, abreast the long, low point on the eastern shore known as **Ballast Point**; the head of the harbor is shoal. The 3-fathom curve is marked by kelp, and vessels entering should give the shores a berth of 150 yards. If the wind is northwesterly vessels are likely to lose it at the heads and be obliged to tow in by boats. No directions are necessary.

SANTA BARBARA ISLAND

lies 21 miles 270° true (WSW ¾ W mag.) from the western end of Santa Catalina Island; it is 1½ miles long in a north and south direction, with a greatest width of 1 mile. The profile of the island is saddle shaped and at a considerable distance it appears as two. The greatest elevation is 547 feet, and the island is visible for over

25 miles in clear weather. The shores are bold and precipitous and well marked by kelp, which extends to 10 fathoms at irregular distances from the shore. Westward, the kelp makes out over 1 mile, covering irregular bottom with a rock awash in the outer and southern edge. The water around the island is deep except where kelp indicates foul or rocky bottom. A rocky islet, 257 feet high and surrounded by kelp, lies ⅓ mile southwestward from the southwestern point of the island; its northern face is steep. A smaller rock, 125 feet high, lies 200 yards offshore about ¼ mile westward from the northern point of the island.

An indifferent **anchorage** may be had near the eastern shore about midway between the north and south points, in 8 fathoms, hard bottom. A poor landing place between the reefs and outlying rocks is abreast the anchorage, and another landing equally poor is on the northern side of the northwestern point.

SAN NICOLAS ISLAND

lies 53 miles off the nearest point of the coast and is the outermost island of the group. It is 43 miles westward from San Clemente and 24 miles southwestward from Santa Barbara Island. It is 8 miles long in an east-and-west direction, with an average width of 3 miles; the highest point is 890 feet, and the island is visible about 38 miles. Two-thirds of the island is covered with sand, the remainder with coarse grass and a few patches of scrub oak. It is surrounded by kelp except about 2 miles at the northwestern extremity. At the western end of the island the kelp extends westward about 3 miles, covering very irregular bottom. Two reefs lie in the kelp, 1½ miles west-southwestward from the western point of the island. In thick weather great caution must be exercised in approaching from westward, and vessels should in no case pass inside the kelp. No dangers are known to exist outside the kelp.

Anchorage may be had under the lee of the sand spit making out from the northeast point of the island in 9 to 10 fathoms, hard, sandy bottom. This is a good lee from the prevailing westerly wind, and the boat landing, though poor, is improving owing to the extension of the sand spit. **Corral Harbor**, on the north side of the island 3½ miles from the western point, affords a good boat landing. The entrance is 20 feet wide with a basin 60 feet in diameter inside, having a smooth sand beach protected from all swell.

Begg Rock, 15 feet high, lies 8 miles west-northwestward from the western point of San Nicolas Island, and is visible about 10 miles in clear weather. It is surrounded by kelp, with a reef extending northward and southward of it a little over 100 yards in each direction. The rock rises abruptly from 50 fathoms close-to.

THE SANTA BARBARA ISLANDS,

Anacapa, Santa Cruz, Santa Rosa, and **San Miguel,** form a chain about 55 miles long, extending in a general westerly direction from the eastern point of Anacapa Island. These form the southern boundary of the Santa Barbara Channel. The passages between them, while navigable, are not much used.

Anacapa Passage, between Anacapa and Santa Cruz islands, is 4 miles wide and free from dangers, with deep water close to either shore. This passage should not be attempted in thick weather, as the lead gives no warning of a close approach to the islands.

Santa Cruz Channel, between Santa Cruz and Santa Rosa islands, is 8 miles long and 5 miles wide, with good water close in to both islands; the rocks off the western and southwestern points of Santa Cruz Island and the eastern and northeastern points of Santa Rosa Island are so close inshore that they can not be considered as dangers in the channel.

San Miguel Passage, between Santa Rosa and San Miguel islands, is 2½ miles wide between the ledges which project from the opposite points of the two islands. There is much broken water and many current rips in the vicinity of these ledges. To avoid **Talcott Shoal** (described on p. 65) vessels using this passage should not allow the outer rock off the western point of Santa Rosa Island to bear southward of 184° true (S by E mag.). Sailing vessels should avoid this passage as the light airs and calms under the lee of San Miguel Island and the currents frequently combine to set a vessel toward Talcott Shoal.

The **currents** in the vicinity of the islands generally follow the directions of the wind, with counter eddies under the lee of the islands and the projecting points. In northwest weather a current of considerable velocity sets eastward from Cardwell Point toward Talcott Shoal, and is frequently felt near and eastward of it.

ANACAPA ISLAND

(chart 5126) is the eastern one of the Santa Barbara Islands and consists of three islands separated by two very narrow passages, the eastern one being filled with rocks and the western one affording a passage only for small boats. The eastern point of the island lies 10¾ miles 223° true (SSW ⅜ W mag.) from Point Hueneme, and is marked by **Anacapa Island light,** a pyramidal skeleton tower. The light is group flashing white (flash 1 second, eclipse 3 seconds, flash 1 second, eclipse 10 seconds), 185 feet above the water, and visible 12 miles. A whistling buoy is located ⅜ mile northeastward of the lighthouse.

From the point the island extends 4½ miles in a general westerly direction. The eastern and lowest one is 1 mile long, ¼ mile wide, and about 260 feet high, and rather level on top. The middle one is nearly 1¾ miles long, ¼ mile wide, and 320 feet high. The western and largest island is 2 miles long, ¾ mile wide, and rises to a peak 980 feet high. This is visible at a distance of 35 miles in clear weather, and the other two at 15 to 20 miles. The shores are perpendicular and filled with numerous caves. The eastern extremity terminates in an arch rock, with a pyramidal rock just southward of its eastern end. The island is surrounded by kelp, except in a few small places.

The best **anchorage** is on the northern side about ¼ mile northward of the middle of the middle island, in 11 to 12 fathoms, with the eastern passage open. Anchorage may also be had on the southern side about ¼ mile 219° true (SSW mag.) from the western passage in 11 fathoms, and also about ¼ mile 163° true (SE by S mag.) from

the eastern passage in 12 fathoms. Boat landings may be made on the northern side of the eastern and western extremities. The island rises abruptly from deep water and in thick weather in its vicinity vessels should not shoal the depths to less than 50 fathoms.

Anacapa Passage, separating Anacapa Island from Santa Cruz Island, is described on page 63.

SANTA CRUZ ISLAND

is the largest of the Santa Barbara Islands, and its western point lies 21½ miles 207° true (S by W mag.) from Santa Barbara light. Its eastern end, San Pedro Point, is 4 miles 286° true (W mag.) from the western end of Anacapa Island. It is 21 miles long in an east and west direction, with an average width of 5 miles. The highest peak, in the western part, is 2,407 feet high, and in the eastern part 1,770. The eastern part is very irregular, barren, and destitute of water; the western part has a few trees, is well covered with grass, and has several springs. Sheep are raised to a considerable extent. The shores are high, steep, and rugged, with deep water close inshore, and there is much less kelp than around the other islands. There are no outlying dangers, except **Gull Island**, 150 feet high, which is the largest and outermost of a group of small, rocky islets, ¼ mile in extent, lying nearly ¾ mile southward of the southern point of the island. A field of kelp stretches offshore from the southwest point of the island and surrounds Gull Island, terminating 1 mile eastward of it. The bottom is foul in the vicinity of these islets and between them. The shores of the island are indented by numerous coves and small bays, affording boat landings and shelter for small craft.

Chinese Harbor, in the eastern part of the broad bight in the northern shore about 4½ miles from the eastern point of the island, affords anchorage in the kelp in 5 to 6 fathoms. Fresh water may be obtained ¾ mile eastward of the anchorage.

Prisoners Harbor (chart 5126), in the western part of the same bight, about 8 miles from the eastern point, affords shelter from all winds except those from northeast to west; some protection in northwest weather is afforded by the kelp, but a heavy swell rolls in. In northeast weather the anchorage is unprotected and dangerous. A wharf extends to 16 feet. The best **anchorage** is in 12 to 15 fathoms, sandy bottom, abreast a white rock on the western shore of the bight, with the outer end of the wharf and the buildings at the inner end in range. Fresh water can be obtained. There are said to be orange groves, vineyards, and much cultivated land in the valley opening southwestward from Prisoners Harbor. Wine is shipped occasionally.

There are several other little coves on the north shore, but these are only available for small craft owing to their limited extent.

Smugglers Cove, immediately southward of the eastern point of the island, affords shelter in northwesterly weather in 5 fathoms, sandy bottom. Water may be obtained from wells on shore.

Alamos Anchorage, on the southern shore 3¾ miles eastward from Gull Island, is available for small craft in northwesterly weather and affords a good boat landing.

Forney Cove, 1 mile eastward of Fraser Point at the western end of the island, affords shelter in northerly weather in 7 to 8 fathoms. The surf is heavy on the beach, but the rocky islet westward and the reef connecting it with the shore lessen the swell at the anchorage.

SANTA ROSA ISLAND

lies 5 miles westward from Santa Cruz Island, the two islands being separated by Santa Cruz Channel. The island is 15 miles long in an east and west direction, with a greatest width of nearly 10 miles. The highest point, near the middle of the island, is 1,562 feet high, being visible for over 40 miles. Water is plentiful, and the island is well covered with vegetation, but there are no large trees. The shores are bold, high, and rocky, and kelp surrounds the greater part of the island. The depths in approaching shoal more abruptly from southward than from northward, where the 100-fathom curve is over 5 miles and the 20-fathom curve about 2 miles from the beach.

East Point, the eastern extremity of the island, is moderately high, sharp, and bold. A rock, with 16 feet over it, lies in the kelp ⅔ mile 16° true (N mag.) from East Point, and a shoal, with 4¼ fathoms over it, lies 3° true (N by W ¼ W mag.), distant 2 miles from the point.

Skunk (Channel) **Point,** 2½ miles northward from East Point, is low and formed by drifting sand, with sand beaches westward and southward; the sand dunes behind it are 250 feet high.

Carrington Point, the northern point of the island, has a seaward face ¾ mile in length; it is bold and rocky, and rises rapidly to an elevation of 440 feet.

Foul ground extends about ⅓ mile northward from Carrington Point, terminating in **Beacon Reef**; there is from 3 to 4 fathoms over it, with spots of 10 to 15 feet. The reef rarely breaks and there is no safe passage inside of it.

Brockway Point is high, bold, and rounding, and about midway between Carrington Point and the western end of the island.

Rodes Reef, marked by kelp, is a patch of three sunken rocks lying 1¾ miles 73° true (NE by E mag.) from Brockway Point, and about ¾ mile offshore; it breaks in nearly all weather.

Sandy Point, the western extremity of the island, is moderately bold and rocky, with a detached rock lying close inshore and sand dunes 400 feet high extending inland. These white sand dunes are prominent when approaching from southward or westward.

Talcott Shoal, with 11 feet over it, lies on the edge of the kelp, 1½ miles 26° true (N ⅞ E mag.) from Sandy Point; a detached kelp patch lies 1 mile northward of the shoal. The soundings in the vicinity of the shoal range from 4½ to 12 fathoms; the shoal breaks only in heavy weather.

South Point, the south point of the island, terminates in a rocky bluff 100 feet high, and rises rapidly to a height of 460 feet; the southwestern face of the point is formed by ½ mile of cliffs several hundred feet high.

Bee Rock lies ¾ mile off the southern shore of the island, 3½ miles eastward of Sandy Point; it is low and not easily seen but is sur-

rounded by kelp which stretches from South Point to Sandy Point. Several rocks and shoals exist inside the kelp, which should not be entered.

There are no harbors around the island, but anchorage may be made in Becher Bay and Johnsons Lee; there are several good boat landings.

Becher Bay is a broad, semicircular bight on the northeast shore of the island, about 4½ miles long by 1½ miles wide, lying between Skunk and Carrington points. **Northwest Anchorage** is in the western part of the bight about 1¾ miles from Carrington Point; it affords fair shelter in northwesterly weather. A wharf has been built with 16 feet at its outer end. The best anchorage is in 6 to 7 fathoms off the end of the wharf. **Southeast Anchorage** is 1½ miles westward from Skunk Point, and affords protection in southeasterly weather in about 6 fathoms, sandy bottom.

Johnsons Lee is an open roadstead immediately eastward of South Point; it affords fair shelter from westerly and northwesterly winds but is dangerous in southerly weather. The anchorage is in the kelp in 5 to 9 fathoms, sandy bottom, with **Slay Rock** (low, black, with a central peak) bearing between 309° true (WNW mag.) and 354° true (NNW mag.); no dangers have been discovered in the kelp. The bottom west of Slay Rock is rocky and dangerous to ground tackle. Fresh water may be obtained on the beach.

Sandy Point Anchorage, on the south side of the point, affords shelter to small vessels of 20 to 30 tons from northerly and northwesterly winds, but local knowledge is necessary to avoid outlying rocks.

San Miguel Passage, separating Santa Rosa and San Miguel Islands, described on page 63.

SAN MIGUEL ISLAND

is the westernmost of the Santa Barbara Islands, and is the most dangerous to approach. Its western point lies a little over 25 miles 178° true (S by E ⅝ E mag.) from Point Conception light, and its eastern point is 3 miles westward from Santa Rosa Island, the passage separating them being known as San Miguel Passage. The island is irregular in shape and 7½ miles long in an east and west direction, with an average width of 2 miles; the highest points, 861 and 850 feet, are about the middle of the island near the southern shore, nearly 1¼ miles apart, and are visible about 35 miles. The island is covered with long grass but there are no trees. The western part has more sand dunes upon it than any of the other islands in the group. The shores are bold, broken, and rocky, with a few short stretches of beach, the southern shore being more precipitous than the northern. Several anchorages and boat landings may be made at different points on the northern and southern shores.

Cardwell Point, the eastern point of the island, terminates in a broad cliff 40 feet high. A dangerous reef extends ½ mile eastward from the point, and foul ground extends ¾ mile north-northwestward.

Prince Island, 303 feet high, lies 2½ miles northwestward from Cardwell Point, and ½ mile off the eastern head of Cuyler Harbor; it is dark in color, and rocky, with a precipitous seaward face.

Harris Point, the northern point of the island, is bold and precipitous, rising to a hill, 550 feet high, 1 mile southward; there are no outlying dangers and the water is bold close-to.

Wilson Rock, 15 feet high, lies 2¼ miles 321° true (NW ⅞ W mag.) from Harris Point; a reef, showing two points at low water, extends 1 mile 292° true (W ½ N mag.) from the rock, with foul ground a short distance northward of the reef. There is foul ground southward and southwestward of the rock. These dangers are unmarked by kelp, and this locality should not be approached in thick weather, as the dangers rise abruptly from deep water and the lead gives no warning of their proximity.

Point Bennett, the western point of the island, is a long, narrow, jagged bluff, 40 feet high, rising rapidly to 380 feet; high sand dunes extend inland from the point for 2 miles. There are three rocky islets south of and close under the point, and foul ground extends ¾ mile westward and northward of the point, but inside the limit of the kelp. A bell buoy is situated ¾ mile southwestward of Point Bennett.

Castle Rock, 145 feet high, is a three-headed islet lying 1½ miles 26° true (N ⅞ E mag.) from Point Bennett in the middle of the kelp field and ½ mile offshore. A shoal spot lies ½ mile 273° true (W by S mag.) from the rock near the edge of the kelp.

Wescott Shoal, with 8 feet over it, lies a little over ¾ mile 352° true (NNW ⅛ W mag.) from Castle Rock, and ⅔ mile 44° true (NNE ½ E mag.) from the shoal is a 4-fathom spot near which is an oil well.

From the southwest head of **Simonton Cove**, 2¼ miles northeastward from Point Bennett, foul ground extends northwestward for nearly 1 mile.

Crook Point, the southern point of the island, is low and irregular. A shoal, with 3½ fathoms over it, lies ¾ mile eastward of the point and ⅓ mile offshore.

Wyckoff Ledge, with 15 feet over it, lies 1½ miles 278° true (W ¾ S. mag.) from Crook Point and ½ mile offshore.

Cuyler Harbor (chart 5126) lies on the northern shore, 1¼ miles southeastward from Harris Point. The bight is 1 mile by ⅔ mile in extent, the anchorage being in the western part; the eastern part is foul. It affords good shelter in southerly weather, but the holding ground is poor, and in heavy northwesterly weather, or with northerly or easterly winds, the protection is poor; these latter winds, however, are rare. Water may be obtained at a small spring abreast the anchorage. **Prince Island** and **Harris Point** are prominent in the approaches. **Middle Rock**, small and low, lies ½ mile 241° true (SW mag.) from the western point of Prince Island; foul ground surrounds it for about 100 yards. **Clan Rock**, low, lies ⅜ mile 211° true (S by W ¼ W mag.) from the western point of Prince Island; there is foul ground between it and the south shore of the harbor. Kelp grows profusely all over the bight.

To ENTER, bring Harris Point to bear 261° true (SW by W ¾ W mag.), distant 1¾ miles, and the western point of Prince Island to bear 186° true (S ⅞ E mag.), distant 1¼ miles; then steer 209° true (S by W ⅛ W mag.), heading midway between Middle Rock and the western point at the entrance and when the southern point of Prince Island bears midway between Middle and Clan Rocks, anchor

in 7 to 8 fathoms. The course heads for Judge Rock, small and black, near the western end of the sand beach; the western point at the entrance should be given a berth of not less than ¼ mile to avoid the shoal extending eastward for over 300 yards. If desired, anchorage may be made about ⅛ mile farther westward, where better protection is afforded in northwesterly weather. The passage between Prince Island and the eastern head should not be attempted.

A boat landing may be made on the southern shore of the island in a small cove immediately westward of Crook Point, but there is no anchorage.

Tyler Bight, on the southern shore, 1¾ miles eastward from Point Bennett, affords shelter in northwesterly weather in the northwestern part of the bight under the high bluff, in 6 to 8½ fathoms, with the western point bearing 260° true (SW by W ⅝ W mag.), distant ½ mile. A large field of kelp lies southward and eastward.

Anchorage for small craft may be had at Adams Cove, immediately eastward of Point Bennett, and at several places along the southern shore, but local knowledge is necessary.

Richardson Rock, 50 feet high and of small extent, lies 5¾ miles 319° true (NW by W ⅛ W mag.) from Point Bennett; two smaller and lower rocks lie close-to on the eastern side. The rock rises abruptly from deep water, 30 to 40 fathoms being found within ⅓ mile. This rock is marked by a light on a skeleton tower. The light is flashing white (flash 0.3 second every 3 seconds), 120 feet above the water, and visible 12 miles. The rock is prominent in clear weather, but in thick weather the locality should be avoided, as the lead gives no warning of a near approach.

COAST FROM POINT ARGUELLO TO POINT BUCHON.

From Point Arguello to Point Sal the coast trends northward for 19½ miles in two shallow bights, separated by Purisima Point, 10¾ miles northward from Point Arguello. From Point Sal the coast continues northward for 14 miles and then bends sharply westward for a little over 6 miles to Point San Luis, forming San Luis Obispo Bay. From Point San Luis to Point Buchon, about 9 miles, the direction is northwest. The lead is a good guide on this stretch of the coast; between Point Arguello and Point San Luis the 20-fathom curve can be followed with safety in thick weather, but between Point San Luis and Point Buchon the depths should not be shoaled to less than 30 fathoms. In clear weather the headlands and other natural features can be easily recognized.

The **Canada Honda**, 2 miles northward of Point Arguello, is a deep gulch crossed by a railroad trestle easily distinguished when abreast the mouth.

From Canada Honda the coast to Purisima Point consists of a low tableland and sand dunes that contrast strongly with the dark cliffs southward.

Purisima Point is low and rocky, with reefs extending southwestward for ¼ mile; the northern side of the point is bare sand.

From Purisima Point to Point Sal the coast is sandy and lower than that southward.

Point Sal is a bold, dark headland marked by stretches of yellow sandstone. From northwestward it appears as a low, conical hill, with two higher conical hills immediately behind it, and rising gradually to a ridge 1,637 feet high, in 3 miles to the eastward; from southward the hills are not so well defined. **Seal Rock,** 45 feet high, a large rocky islet lies 200 yards off the south face with a small rock close to the point. Breakers and reefs extend nearly 600 yards southward and westward from Point Sal and 200 yards southwestward from Seal Rock.

Anchorage may be had under Point Sal with some protection from northwesterly winds in 7 to 9 fathoms, sandy bottom, but subject to swell. Shoal water extends nearly ½ mile westward from the southeast point of the anchorage. The best anchorage is in 7 fathoms, with the northern end of Seal Rock just open from the extremity of Point Sal, bearing 303° true (WNW ⅝ W mag.), distant 500 yards from Seal Rock.

From Point Sal northward the coast consists of sand beach backed by low sand dunes for 14 miles, and then changes to bold, rocky cliffs that curve sharply westward to Point San Luis and form the northern shore of San Luis Obispo Bay. There are several seaside resorts, with large hotels near the beach, between Point Sal and San Luis Obispo Bay.

San Luis Obispo Bay and Port San Luis are described under a separate heading following.

Point San Luis, the western point at the entrance to San Luis Obispo Bay, is bold and rocky and is marked by **San Luis Obispo lighthouse,** a white tower on dwelling. The light is flashing white (flash 4 seconds, eclipse 16 seconds), 130 feet above the water, and visible 17 miles. The fog signal is an air siren (blast 4 seconds, silent interval 36 seconds).

A small rock lies close inshore and nearly abreast the lighthouse. **Whaler Island,** 75 feet high, lies 125 yards eastward from the point, to which it is connected by a jetty. A breakwater, of which the outer 100 yards is submerged, extends 650 yards east-southeastward from the island, and Port Harford gas and whistling buoy lies 450 yards 158° true (SE ½ S mag.) from the end of the breakwater.

North Whaler Island, 52 feet high, lies 400 yards northward from Whaler Island and 150 yards offshore. There are several small fishermen's houses on it.

Souza Rock, with 16 feet over it, lies a little over 2 miles 148° true (SE ¼ E mag.) from San Luis Obispo lighthouse. It rises abruptly from depths of 19 fathoms. A bell buoy is placed 350 yards southward from the rock.

From Point San Luis to Point Buchon the coast trends northwestward for 9 miles and consists of cliffs 40 to 60 feet high with numerous outlying rocks. The land rises rapidly from the cliffs to Mount Buchon. There are numerous outlying rocks and sunken ledges, in some cases over 1 mile from the shore.

A rock with 8 fathoms over it lies 1⅜ miles 197° true (S mag.) from San Luis Obispo lighthouse.

Westdahl Rock, with 18 feet over it, is a dangerous pinnacle rock lying a little over 1¼ miles 234° true (SW ¾ S mag.) from San Luis Obispo lighthouse; it rises abruptly from depths of 9 and 10

fathoms. A black buoy is placed about 150 yards southwestward from the rock. Vessels should not pass northward of the buoy.

Santa Rosa Reef, with a least depth of 18 feet, lies 1⅜ miles 261° true (SW by W ¾ W mag.) from San Luis Obispo lighthouse; this shoal rises abruptly from depths of 9 and 10 fathoms.

Lone Black Rock, 6 feet high and of small extent, lies ½ mile westward from the lighthouse and ¼ mile offshore.

Pecho Rock, 31 feet high, lies 3 miles 292° true (W ½ N mag.) from the lighthouse and ½ mile offshore; a smaller rock lies nearly on the same bearing ⅜ mile eastward from it. Foul ground marked by kelp lies between them and the shore.

Lion Rock lies 2¾ miles southeastward from Point Buchon and 600 yards offshore; it is 240 yards long in a northwest and southeast direction and 112 feet high. A high rock lies between it and the shore, and a small, low rock lies 200 yards westward.

Point Buchon terminates in an overhanging cliff 40 feet high with a low table-land behind it, which rises rapidly to a bare hill 1,280 feet high, 1 mile eastward from the point. There are a few detached rocks close under the cliffs.

Mount Buchon is a rugged mountain mass lying between San Luis Obispo Bay, Esteros Bay, and the valley of San Luis Obispo, and is a prominent landmark from either northward or southward.

Saddle Peak, 1,833 feet high, is the highest point and is visible over 40 miles.

SAN LUIS OBISPO BAY AND PORT SAN LUIS.

San Luis Obispo Bay (chart 5386), is a broad open bight immediately eastward of Point San Luis, 3½ miles long, nearly east and west, and 1 mile wide. The west shore is high, rocky bluffs for 1½ miles to the mouth of San Luis Obispo Creek, where there is a sand beach ¼ mile long to the town of Avila; thence eastward for 1 mile are irregular cliffs 40 to 100 feet high. Beyond these for 1½ miles is a narrow table-land, terminating in cliffs about 40 feet high to the east point of the bay. The bay has been examined by means of the wire drag, and the dangers are shown on the chart.

The bay has been improved by the Government; a breakwater has been built from Point San Luis to Whaler Island, and from the island about 650 yards southeastward to the ledge which partly bares at low water. This has improved the shelter for vessels at anchor, or at the wharf, from the heavy westerly or southwesterly swells.

Mount Buchon and **San Luis Hill**, the latter 700 feet high, are prominent at a considerable distance in approaching from southward; and from northward **Lion** and **Pecho Rocks** and **Point Buchon** are distinguishing features.

The eastern part of the bay is foul, and vessels should avoid the area eastward of a line between the Avila wharf and Buoy No. 2. Of these dangers the outermost is **Howell Rock**, with 14 feet over it, which lies 1⅝ miles 94° true (ENE ⅞ E mag.) from the lighthouse.

Port San Luis (Port Harford), the principal seaport for San Luis Obispo, about 12 miles inland, and connected with it by railway, is ¾ mile northward from Point San Luis in the most sheltered part of the bay, where a wharf over ½ mile long is built out southward.

There is a large warehouse and railway station about midway of its length and a hotel at its base. Near the gulch, ¼ mile from the hotel, are a few small houses and a number of oil tanks.

The wharf is built out to 27 feet, but the bottom in its immediate vicinity is lumpy, and vessels drawing over 23 feet should not attempt to approach it at low water. A number of heavy mooring buoys, planted near its outer end, are used by vessels for breasting off in heavy weather.

To reach the wharf, deep-draft vessel passing 300 yards southeastward of the gas and whistling buoy steer for the stack at Avila, course 29° true (N by E ⅛ E mag.) until the end of the wharf is abeam; then steer for the end of the wharf, course 299° true (WNW ⅞ W mag.).

Because of the lack of sufficient depths in the approaches to the above wharf, the oil company is at present building a second wharf south-southeastward from Fossil Point. This wharf, which was practically complete in the fall of 1916, has a length of 3,150 feet, and depths of 32 to 34 feet at low water at its outer end. About 200 yards inside its outer end the wharf crosses a rocky patch having 17 feet over it, and care should be exercised in that vicinity. The oil carriers, which are the only deep-draft vessels entering the bay, will load at this dock.

Avila, 1½ miles northeastward of Point San Luis, is a small settlement of no commercial importance. A county wharf has been built to a depth of 25 feet, but it has never been used. There are four mooring buoys for breasting off in bad weather.

The plant at **Oilport**, 1½ miles eastward of Avila, has been closed for some years, and the wharf is gone.

Anchorage.—The best anchorage for small vessels is in 3½ to 4 fathoms, muddy bottom, midway between the end of the Port San Luis wharf and North Whaler Island. Large vessels can anchor anywhere between the Port San Luis and the Fossil Point wharves, avoiding the 18-foot spot 250 yards eastward of the warehouse near the middle of the former. This anchorage affords good shelter in northerly or westerly weather, but is exposed in southerly or southeasterly weather. Southeast gales occur two or three times during the winter season.

Supplies.—Fuel oil, water, and provisions can be obtained. Coal is not kept on hand, but can be procured on short notice.

Communication is by irregular coasting steamers, and by rail and stage. There are telephone and telegraph facilities.

DIRECTIONS, SAN LUIS OBISPO BAY.

These directions are available for vessels of any draft, and lead to the anchorage.

From southward.—From a position 2 miles 242° true (SW mag.) from Point Arguello lighthouse, steer 356° true (N by W ⅞ W mag.) for 34 miles. This course made good should lead to the bell buoy southward of Souza Rock. Pass 100 yards or more westward of the bell buoy and head for the middle dock, course 2° true (N by W ⅜ W mag.) for 2 miles, until the end of the Port San Luis wharf is abeam. Then haul to 318° true (NW by W ¼ W mag.), passing midway be-

tween the ends of the two wharves, and select anchorage according to the draft.

From northward.—From a position with San Luis Obispo lighthouse bearing 52° true (NE ⅞ N mag.), distant 3½ miles (which position may be reached in thick weather by following the 30-fathom curve to the fog signal abeam), steer 65° true (NE ¼ E mag.) for 4 miles, passing 200 yards southeastward of the gas and whistling buoy, and to a position with the middle dock bearing 2° true (N by W ⅜ W mag.). Then proceed as directed in the preceding paragraph.

COAST FROM POINT BUCHON TO POINT SUR.

From Point Buchon to Point Sur the coast trends northwestward for 80 miles with but one marked indentation, **Estero Bay**, immediately north of Point Buchon. Above Estero Bay the coast is bold and rugged, elevations of 2,000 to 5,000 feet being found within less than 3 miles from the shore. The dangers do not extend over 1 mile from the shore, which is generally fringed with kelp, and except at a point 10 miles from Point Sur the 30-fathom curve is a good guide in thick weather. Several of the higher mountain peaks are distinguishing landmarks, and the features alongshore are easily recognized.

From Point Buchon the coast trends in a general northerly direction for 11 miles and then turns sharply westward for 5 miles to Point Esteros, forming Estero Bay. The southeastern shore of the bay is low.

Morro Bay, a shoal lagoon several miles in extent, is separated from Estero Bay by a narrow strip of sand beach. The entrance is near Morro Rock, but is available only for light-draft vessels in smooth weather. Once inside, good protection may be had. The post village of **Morro** is situated on the eastern shore of the bay near the entrance; it is of little commercial importance. Water and a limited amount of provisions can be obtained. A draft of 8 feet can be taken over the bar in smooth weather, but only 5 feet can be taken to the wharf. On account of the shifting channel a pilot is necessary. One may be obtained by making signal off the town.

Morro Rock, 573 feet high, is a prominent, conical rock 7 miles northward from Point Buchon and about 300 yards offshore. It is off the entrance to Morro Bay, and is visible from a considerable distance in clear weather. **Pillar Rock**, 100 feet high, lies about 50 feet from its northern side.

Northward of Morro Rock the shore becomes bolder, the seaward faces of **Cayucos Point** and **Point Esteros** consisting of cliffs 50 to 90 feet high.

Cayucos Landing is 11 miles northward from Point Buchon in the northeast corner of Estero Bay. Grain and produce are shipped and general merchandise and lumber received. A wharf has been built out to 16 feet; during the winter the depth may be reduced to 14 feet. Vessels of 15 feet draft can lie at the wharf in smooth weather. The channel leading to the wharf is marked by buoys, and has a depth of 24 feet, but is narrow, leading between sunken ledges, and should not be attempted by strangers. Pilots may be obtained by making signal. **Mouse Rock**, the outer danger, is marked by a bell buoy. The best anchorage is southward of the bell buoy. South-

erly storms occur six or seven times during the winter season; northwesterly gales occur during the summer, causing a heavy swell that breaks on the reefs and outside the end of the dock. During these storms vessels can not enter, and if at anchor or at the dock are compelled to leave. A limited amount of provisions can be obtained, but no other supplies. There is a somewhat irregular freight, but no passenger traffic by water. Travel is by stage to San Luis Obispo.

FROM SOUTHWARD.—From Point Buchon whistling buoy steer 2° true (N by W ⅜ W mag.) for 10½ miles; this course made good leads to the bell buoy southward of Mouse Rock. Then signal for a pilot.

FROM NORTHWARD.—From a position 1½ miles 233° true (SW ¾ S mag.) from Piedras Blancas lighthouse steer 132° true (SE by E ¾ E mag.) for 20 miles, passing 1 mile southwestward of Von Helm Rock whistling buoy and Point Esteros.

When Point Esteros bears 354° true (NNW mag.) distant 1¾ miles, steer 95° true (E by N mag.) for 4 miles, passing ½ mile southward of Constantine Rock buoy; this course made good leads to a position ¾ mile 199° true (S ¼ W mag.) from the bell buoy in line with the village of Cayucos. Now haul up for the bell buoy and, if a stranger, signal for a pilot.

Constantine Rock, with 8 feet over it and marked by kelp, lies ½ mile off Cayucos Point, 3 miles eastward from Point Esteros; it is marked by a buoy placed 600 feet southward of the rock.

From Point Esteros northward to abreast of Von Helm Rock, 7 miles, the coast consists of bluffs 20 to 60 feet high, backed by a steep range of grassy hills 500 to 700 feet high. The beach is well fringed with kelp, with a number of small rocks lying close inshore, of which **White Rock**, 6 miles northward from the point, is the most prominent.

Von Helm Rock, with 15 feet over it, lies abreast of a wooded point 7½ miles west-northwestward from Point Esteros and 11½ miles east-southeastward from Piedras Blancas lighthouse; it is nearly 1 mile offshore. A whistling buoy is placed 150 yards west-southwestward from the rock; vessels should not pass eastward of the buoy.

Santa Rosa Creek empties 8½ miles northwestward from Point Esteros; the town of Cambria is located 1 mile inland and can not be seen from seaward.

From Santa Rosa Creek to San Simeon Point the cliffs are 20 to 30 feet high and backed by low, rolling hills, here and there covered with trees.

Cambria Rock, about 10 feet high, lies ½ mile offshore, a little northward of the mouth of Santa Rosa Creek. It is small and sharp, with a breaker 125 yards southward and eastward.

Pico Rock, 12 feet high, lies 2 miles northward from Cambria Rock and ½ mile offshore. There is foul ground northward and southward of the rock, but not extending more than ½ mile from the beach.

San Simeon Point is low, with a group of houses and trees on the inner side 300 yards from the point. The trees show well from northward, but from southward the warehouses and buildings in the village are more prominent. From northward the point itself is not easily recognized unless familiar with it.

San Simeon Bay and landing lie immediately eastward of San Simeon Point. It affords good shelter in northerly weather, but a slight swell makes around the point. It is exposed in southerly weather. Farm produce is shipped and general merchandise received. A wharf has been built out to 18 feet. Provisions can be obtained, and water has been piped to the head of the dock and can be taken aboard with a long hose. The best anchorage is in the middle of the bight in 5 to 8 fathoms, hard sand. Southeasterly and southwesterly storms are liable to occur any time during the winter, compelling vessels to leave. Communication may be had by regular coasting steamers and occasional schooners and there is a daily mail by stage to San Luis Obispo.

From Southward.—From a position ½ mile southwestward of Von Helm Rock whistling buoy steer 334° true (NW ¼ N mag.) for 7 miles, with the wharf at San Simeon ahead, which leads to the anchorage.

From Northward.—From a position 1½ miles 232° true (SW ⅞ S mag.) from Piedras Blancas lighthouse steer 106° true (E mag.) for 6 miles to a position ¾ mile south-southeastward of San Simeon Point. Round San Simeon Point at a distance of over ½ mile, steer 337° true (NW ½ N mag.) for the wharf, and anchor in the middle of the bay. San Simeon Point should be given a berth of over ¼ mile and the eastern shore of the bay a berth of ½ mile.

From San Simeon Point to Piedras Blancas, 5 miles, the coast is low, with numerous detached rocks, lying in some cases ½ mile offshore. These are usually well marked by kelp.

Point Piedras Blancas is a low, rocky point projecting about ½ mile from the general trend of the coast and is marked at its end by **Piedras Blancas lighthouse**, a white conical tower. The light is group flashing white (flash 0.5 second, eclipse 3 seconds, flash 0.5 second, eclipse 11 seconds), 158 feet above the water, and visible 19 miles. The fog signal is an air siren (blast 3 seconds, silent 17 seconds). Sand dunes extend northeastward from the point. Two prominent white rocks lie off the point, the higher rising 130 feet, close under it to the westward, and the other, a double rock 82 feet high, about ¾ mile to the eastward and 500 yards offshore. These rocks give the name, Piedras Blancas (Spanish for White Rocks), to the point.

Anchorage for a small vessel, with protection from northwesterly winds, may be had under Point Piedras Blancas in 4 to 5 fathoms, sandy bottom, with the lighthouse bearing 280° true (W ½ S mag.), distant about ¼ mile.

A break is reported to have been seen in a heavy westerly swell about 3 miles (W ½ N mag.) from Piedras Blancas lighthouse. The least depth found on subsequent search was 14 fathoms.

From Piedras Blancas Point to the mouth of the San Carpoforo Valley, 8.6 miles, the coast continues low, with numerous outlying rocks, and is well fringed with kelp. **Harlech Castle Rock**, with 1 foot over it, lies 1½ miles 326° true (NW ½ W mag.) from Piedras Blancas lighthouse and nearly ¾ mile offshore; this rock is usually marked by kelp.

Point Sierra Nevada, 3¼ miles northward from Piedras Blancas, is a low, bluff point covered with sand dunes. **La Cruz Rock**, 48 feet high, lies ½ mile southward of the point, and 400 yards off the mouth of **Arroyo La Cruz**.

Ragged Point, ½ mile southward of the mouth of the San Carpoforo Valley, is a low projecting point, with visible rocks and ledges extending ¼ mile westward.

From the San Carpoforo Valley northward to the Big Sur River, 41 miles, the coast is very bold and rugged. The cliffs are 200 to 500 feet high, and the land rises rapidly to elevations of 2,500 to 5,000 feet in 2 to 3 miles. There are few beaches and few outlying rocks.

Salmon Cone, about 500 feet high, is 10 miles northward from Piedras Blancas. It is a prominent rocky butte close to the beach. A conspicuous white rock, 39 feet high, lies just southward of the butte ½ mile offshore.

From Salmon Cone to Cape San Martin, 6 miles, the coast is intersected by several narrow, deep gulches or canyons, **Villa Canyon** and **Alder Creek** being the most prominent. A white rock, 64 feet high, lies ¼ mile offshore 1 mile southward of the mouth of Villa Canyon.

Cape San Martin, 16 miles northward from Piedras Blancas, presents a ragged, precipitous seaward face for a distance of 3 miles, with numerous detached rocks. **San Martin Rocks,** three in number, lie off the northern extremity of the cape, the outer one, 44 feet high, being about ½ mile offshore. The inner one, 168 feet high, lies 100 yards offshore, and the middle and lowest one, 34 feet high, about halfway between the other two.

From Cape San Martin to Lopez Point the coast forms an open bight 10 miles long and 2 miles wide, with rugged shores intersected occasionally by deep, narrow valleys. There are a few detached rocks, but with one exception they do not extend far from the beach. **Tide Rock,** awash and usually showing a break, is a small, black rock 4 miles northward of Cape San Martin and ⅔ mile offshore.

Lopez Point is a narrow table-land, 100 feet high, projecting a short distance from the high land. **Lopez Rock,** 20 feet high, lies ¼ mile offshore and ¾ mile northwestward from Lopez Point.

An open **anchorage,** affording some protection from northwesterly winds, may be had southeastward of Lopez Point in about 5 fathoms, sandy bottom. The swell is broken considerably by the large bed of kelp extending about 1 mile southward from the point.

In clear weather Junipero Serra Peak and Twin and Cone peaks are prominent in this vicinity. **Junipero Serra Peak,** 5,853 feet high, lies about 10 miles northeastward from Lopez Point. There are pines on and near the summit. It is more prominent when well offshore than close in, owing to the high land between it and the coast.

Twin Peak, 4,700 feet high, and **Cone Peak,** 5,020 feet high, known to coasting mariners as **Twin Peaks,** are about 3 miles back from the coast and 4 miles northeastward from Lopez Point. Both peaks are in line when bearing 104° true (E ¼ N mag.). They have scattered trees on their summits and are good landmarks even at night.

A deep submarine valley makes in from the southward toward the shore in the bight 13½ miles northwestward from Lopez Point and 4½ miles southeastward from Pfeiffer Point. For 1 mile at the head its direction is parellel with the shore and the 100-fathom curve only 500 yards from it. At the head 51 fathoms is found 220 yards from the beach.

Pfeiffer Point, 17½ miles northward from Lopez Point and 6 miles southward of Point Sur, is 400 to 500 feet high, and the seaward

termination of a long ridge 2,000 feet high 1½ miles northeastward from the point. A deep gully lies immediately northward of the point. From southward the point is less prominent than from northward.

Anchorage, affording some protection in northwesterly weather, may be had about 1 mile eastward of Pfeiffer Point, and ½ mile from shore, in 9 to 10 fathoms, sandy bottom. In making this anchorage take care to avoid a sunken rock lying just inside the 10-fathom curve ⅔ mile 122° true (ESE ¾ E mag.) from Pfeiffer Point and ¼ mile offshore.

From the mouth of the Big Sur River, 3½ miles northward of Pfeiffer Point, to Point Sur the shore is low, with sand beaches and sand dunes extending eastward. Numerous sunken rocks and ledges, extending in some cases 1 mile offshore, lie between Cooper Point, 1½ miles northward from Pfeiffer Point, and Point Sur.

Point Sur is a black, rocky butte, about 400 feet high, with low sand dunes extending eastward from it for over ½ mile. From northward or southward it is raised as an island and in clear weather is visible about 25 miles. The northwestern extremity is marked by **Point Sur lighthouse,** a graystone tower on building. The light is flashing red and white (red flash 2.5 seconds, eclipse 12.5 seconds, white flash 2.5 seconds, eclipse 12.5 seconds), 270 feet above the water, and visible 23 miles. The fog signal is an air siren (blast 5 seconds, silent 35 seconds).

False Sur, 210 feet high, is a hillock close to the beach, 1 mile southeastward from Point Sur; the north side is sandy.

Sur Rock, 1¾ miles 152° true (SE mag.) from Point Sur lighthouse, is a rock awash nearly ¾ mile offshore. About ½ mile 236° true (SW ⅝ S mag.) from Sur Rock is a shoal with 4½ fathoms over it that breaks in heavy weather. Extending ⅞ mile from Sur Rock toward Point Sur are a number of sunken rocks and dangers that show breakers in even ordinary weather; foul ground lies between them and the beach. These dangers are as a rule well marked by kelp, but it is a dangerous locality in thick or foggy weather, and when in this vicinity vessels should not shoal the depths to less than 30 fathoms.

A bank with 24 and 33 fathoms over sand and broken shells lies 3½ miles southwestward from Point Sur. There is slightly deeper water between it and the point.

A careful search has failed to reveal any indication of **Alert Bank,** which had been reported to exist about 10 miles westward from Point Sur. The 100-fathom curve extends out 8½ miles to the westward from the point, and at a distance of 12½ miles there is a depth of 400 fathoms.

COAST FROM POINT SUR TO POINT SAN PEDRO.

From Point Sur the coast trends north-northwestward for 17 miles to Point Cypress, with Carmel Bay, a small open bight immediately southward of the latter point.

Monterey Bay (described on page 81) is a broad, open bight 20 miles long, between Point Pinos and Point Santa Cruz, and 9 miles wide. The shores decrease in height and boldness as Point Pinos is ap-

proached, while those of Monterey Bay are as a rule low and sandy. The valleys of the Salinas and Pajaro Rivers, which empty in the eastern part of Monterey Bay, cause a marked depression in the coast range of mountains that is prominent from a considerable distance seaward. From Point Santa Cruz the coast trends in a gentle curve westward and northward for 23 miles to Pigeon Point, and then extends for 25 miles in a general north-northwesterly direction to Point San Pedro, the southern headland of the Gulf of the Farallones.

Southeastward of Monterey Bay the coast is bold, the 30-fathom curve lying in many cases less than 1 mile from the shore. A deep submarine valley extends into Carmel Bay, and another enters about the middle of Monterey Bay, extending to the eastern shore with a depth of over 50 fathoms within ½ mile of the beach. Northward of Monterey Bay the soundings are more regular, and in thick weather the lead is a good guide. There are few dangers and these extend less than 1 mile offshore.

Little Sur River empties 1¾ miles northward from Point Sur, its valley being quite noticeable from seaward.

Ventura Rocks, 2¼ miles northward from Point Sur, are two high, prominent rocks, close together, about ½ mile offshore. A sunken rock lies 200 yards northeastward from them.

From Little Sur River to Soberanes Point, a little over 7 miles, the coast, although moderately straight, is bold, rugged, and broken, with numerous detached rocks and sunken ledges lying close inshore.

Soberanes Point projects but slightly from the general trend of the coast. An isolated, grassy hillock, 200 feet high, lies immediately behind, with a grassy ridge extending back and rising to 1,600 feet elevation.

Lobos Rocks, a group of small, rocky islets, lie nearly ½ mile westward from the point. From seaward they rise abruptly from 20 fathoms, but there is foul ground between them.

Pico Blanco (Sur Peak), 3,680 feet high, lies 4½ miles east-northeastward from Point Sur. It is pointed and white-topped, and is prominent in clear weather.

Boulder Peak (Mount Carmel), 4,417 feet high, lies 7¼ miles northeastward from Point Sur, and is round and bare on the summit. Boulder Peak and Pico Blanco can sometimes be made when the lower land is shut in by fog or haze.

From Soberanes Point to Point Carmel, 4½ miles, the coast in the vicinity of the shore is rugged and broken, with innumerable rocks and ledges extending in some cases over ¼ mile offshore. The rise from the beach to the high land back becomes less abrupt as Point Carmel is approached.

Yankee Point, 2½ miles northward of Soberanes Point, projects ¼ mile from the general trend of the coast. The seaward face is irregular and broken, with numerous detached rocks, one of which lies 125 yards westward from the point. A sunken rock, generally showing a breaker, lies ⅜ mile southward from the point and the same distance offshore.

Point Carmel, the southern point at the entrance to Carmel Bay, is an irregular, jagged, rocky point, 100 feet high. **Whalers Knoll,** 200 feet high and rocky, lies on the northern side ½ mile from the western extremity of the point. Numerous detached rocks lie off the

point, **Whaler Rock**, ½ mile southwestward, being the farthest offshore.

Carmel Bay is an open bight between Point Carmel and Point Cypress. It is 2¾ miles long and 1½ miles wide. It affords shelter in northerly and southerly weather to small craft with local knowledge. In northerly weather anchorage may be had in a contracted cove on the northern shore, but local knowledge is necessary to avoid the dangers. In southerly weather anchorage may be had in Carmel Cove, a small indentation on the southern shore 1 mile eastward from Point Carmel, but there is a rock with 9 feet over it about the middle of the cove that contracts the anchorage. A deep submarine valley heads in the southeastern part of the bay, with 50 fathoms within less than ¼ mile of the beach. This bay is not recommended for strangers, and no directions can be given that would be of value.

Point Cypress, the northern point at the entrance to Carmel Bay, is a comparatively low point extending about 2 miles beyond the general trend of the coast. The cliffs are steep, with numerous detached rocks close under them; the point is heavily wooded to within 400 yards of its extremity. **Cypress Rock** lies 450 yards northwestward from Point Cypress, and is prominent from either northward or southward.

From Point Cypress to Point Pinos the coast trends northward for 4 miles, formed by low, rocky cliffs closely bordered by numerous small rocks. The height of the cliffs decreases toward Point Pinos, and the northern part is covered with **sand dunes** that are conspicuous, even in moonlight, when contrasted with the dark trees behind them.

Point Pinos, the southern point at the entrance to Monterey Bay, is low, rocky, and rounding, with visible rocks extending offshore for less than ¼ mile. It is bare for about ¼ mile back from the beach, and beyond that is covered with pines. **Point Pinos lighthouse**, near the northern end of the point, is a white tower on dwelling. The light is occulting white (light 20 seconds, eclipse 10 seconds), 89 feet above the water, and visible 15 miles. Point Pinos whistling buoy is ¾ mile northwestward of the lighthouse.

Point Santa Cruz, lying 19½ miles 347° true (NNW ¾ W mag.) from Point Pinos, is flat, rising in terraces to higher land, and terminating in cliffs about 40 feet high, with two flat rocks close under the point, the outer one being the higher. **Santa Cruz lighthouse**, a white tower on dwelling, is situated near the southern extremity of the point, and is a good leading mark. The light is occulting white (light 3.5 seconds, eclipse 1.5 seconds), 67 feet above the water, and visible 14 miles.

About 2 miles westward from the point a water tank supported by a skeleton structure is prominent by day from either northward or southward.

Needle Rock Point is 4 miles westward of Santa Cruz lighthouse; a slender pillar of rock stands a short distance seaward from the face of the cliffs; another lower pinnacle stands about 200 yards eastward. Neither is distinguishable when abreast it.

Sandhill Bluff lies 6½ miles westward from Santa Cruz lighthouse and 12 miles southeastward from Año Nuevo Island lighthouse. It is composed of sandstone cliffs about 50 feet high, with a rounding irregular hillock of white sand near the edge of the cliffs; this is

white on the northwestern side and covered with brush and grass on the southeastern side, and is an excellent landmark.

About 3½ miles northwestward from Sandhill Bluff, and 8½ miles southeastward from Point Ano Nuevo, are large cement works near the shore. The buildings are conspicuous from seaward. Smoke from the works can be seen a long distance off by day, and numerous electric arc lights at night. A village for the workmen is ½ mile northwestward from it.

Point Año Nuevo is formed by sand dunes 20 to 100 feet high; a low, black, rocky islet lies ¼ mile off the point. **Año Nuevo Island lighthouse**, a black skeleton tower, is located on the islet. The light is occulting white (light 15 seconds, eclipse 5 seconds), 73 feet above the water, and visible 14 miles. The fog signal is an air siren, sounding a group of three blasts every 60 seconds, silent interval 52 seconds. Foul ground extends northwestward and southeastward from the islet. **Anchorage** with protection from northerly and northwesterly winds may be made in the bight southward of the point in 8 fathoms with the lighthouse bearing 276° true (WSW ⅞ W mag.) distant ⅞ mile. The kelp bed and reef extending a little over ½ mile southeastward from the islet break the force of the swell.

Big Gulch, eastward of Point Año Nuevo, is a narrow, steep-sided valley; the high, whitish bluffs immediately northward are quite prominent.

Pigeon Point is about 5 miles northwestward from Point Año Nuevo, the coast between them being low and rocky. This point is about 50 feet high and rises in a gentle slope to the coast hills; several moderately large, detached rocks extend 350 yards southwestward. **Pigeon Point lighthouse** is a white conical tower. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 148 feet above the water, and visible 18 miles. The fog signal is an air siren (blast 2 seconds, silent 6 seconds, blast 2 seconds, silent 20 seconds). The light is situated on the extremity of the point, and several other buildings and a wire cable landing are located near it.

Pigeon Point light can not be seen in the bight eastward of a line joining Pigeon Point and Pillar Point, 19½ miles north-northwestward from it.

From Pigeon Point to **Pescadero Point**, 4 miles, the coast is nearly straight and composed of reddish cliffs, with numerous outlying sunken and visible rocks. About 1 mile southward of the latter point is a prominent white hotel. A rock with 14 feet over it lies ⅓ mile offshore, ½ mile southward of the hotel, and well outside the 3-fathom curve. Another rock, with 17 feet over it, lies 650 yards south-southwestward from the point.

From **Pescadero Creek**, 1½ miles northward of Pescadero Point, the coast for 8 miles northward becomes more broken and rugged, with yellow or white vertical cliffs. A prominent whitish cliff over 100 feet high lies 7½ miles northward of Pescadero Point. The coast is broken by several small streams with deep, steep-sided valleys. A short distance northward of the high cliff, a low, flat table-land begins that extends northward for 9 miles and then bends sharply westward to Pillar Point, forming Half Moon Bay.

Pillar Point, the southeast extremity of a low ridge 2½ miles long, lies 19½ miles northwestward from Pigeon Point; it is 180 feet high,

with several black rocks extending over 300 yards southward. From northward these show as three or four rocks, but from southward appear as one. **Sail Rock** is the largest and southernmost rock, a pillar being situated at its southwestern point. Foul ground, well marked by kelp, extends southeastward for over 1 mile; a black buoy is placed in 9 fathoms about 350 yards southeastward from the end of the reef.

Southeast Reef is a sunken reef 650 yards in length in a general northwest and southeast direction, with an average width of about 100 yards. It has from 14 to 18 feet over it except on the southeast end where there is a rock with only 4 feet. The northern extremity lies 1⅝ miles southeastward from Sail Rock; depths of 5 fathoms and less extend northwestward from the reef for over ⅜ mile. A red buoy is placed about ¼ mile northwestward from the northern end of the reef, and a black buoy is placed about ¼ mile southeastward from the southern end.

Masters of coasting steamers bound for San Francisco do not use the South Channel over the bar if they see breakers on this reef.

Half Moon Bay (chart 5520), lies eastward of Pillar Point, and affords good shelter in northerly and northwesterly weather, but is exposed and dangerous in southerly weather. There is no shipping, all traffic being by rail to San Francisco. A wharf has been built out from the eastern shore of the bight at **Amesport**; there is 12 feet at the end in summer but only 9 to 10 feet in winter. There is another wharf, 800 feet long, built out from the north shore of the bay. The town of Half Moon Bay lies about 2 miles southward of Amesport wharf and nearly a mile inland. The buildings in the town are prominent, especially a church with a large tower. A limited amount of provisions can be obtained, but no coal or water. The best anchorage is under Pillar Point but vessels must be prepared to leave on the approach of southerly weather.

From Southward.—From a position 3 miles 245° true (SW ⅛ W mag.) from Pigeon Point lighthouse steer 358° true (N by W ¾ W mag.) to a position ¼ mile eastward of black can buoy No. 3. Then steer 334° true (NW ⅛ N mag.), heading for the wharf at the mouth of Denniston Creek, and select anchorage as desired.

From Northward.—Round Point Montara at a distance of 2 miles and steer 141° true (SE by E ⅛ E mag.) for 4 miles, passing 1 mile southwestward of Pillar Point. When Amesport wharf bears 57° true (NE ⅝ N mag.) steer for it on that bearing and pass between buoys Nos. 2 and 1, leaving the black buoy about 100 yards on the port hand. After passing the black buoy, haul northward and anchor in the northern part of Half Moon Bay, as desired.

Montara Mountain, 1,940 feet high, lies 4½ miles northward of Pillar Point and 2½ miles inland. It is covered with grass and bare of trees. From the southward it shows as a long ridge with several small elevations upon it, but from the northwestward as a flat-topped mountain with four knobs on the summit. It is a prominent feature in approaching the entrance to San Francisco Bay.

Point Montara, 2¾ miles northward from Pillar Point, is the seaward end of a spur from Montara Mountain, and the northwestern end of the ridge forming Pillar Point. It terminates in cliffs about 60 feet high with numerous outlying rocks. Sunken rocks and ledges

lie ¾ mile westward from the point, and extend in a northwest and southeast direction for 1½ miles. This is a dangerous locality in thick weather, and the depths should not be shoaled to less than 30 fathoms in its vicinity. **Point Montara lighthouse** is a white square tower. The light is occulting white (light 2.5 seconds, eclipse 2.5 seconds), 70 feet above the water, and visible 14 miles. The fog signal is a steam whistle (blast 5 seconds, silent 25 seconds).

From Point Montara to Point San Pedro the coast is bold and rugged, rising sharply from the sea to the spurs from Montara Mountain: there are no outlying rocks or dangers other than those off Point Montara.

Point San Pedro is a dark, bold, rocky promontory, 640 feet high; it is the seaward termination of Montara Mountain and an excellent mark in clear weather from either northward or southward. A large, triple-headed rock, about 100 feet high and white on its southern face, projects ¼ mile westward from the point. A rocky area, on which the sea breaks in a heavy swell, is reported to exist 1 mile northward of the point.

MONTEREY BAY

(chart 5403) is a broad, open roadstead 20 miles long between Point Pinos and Point Santa Cruz and 9 miles wide. The shores are low, with sand beaches backed by sand dunes or low, sandy bluffs. The low land extending eastward from about the middle of the bay is a prominent feature from seaward, as it forms the break between the Santa Lucia mountain range southward and the high land of the San Francisco Peninsula northward. The bay is free from dangers, the 10-fathom curve lying at an average distance of ¾ mile offshore; the lead is a good guide in thick weather. A submarine valley heads near the middle of the bay with a depth of over 50 fathoms about ⅜ mile from the beach near Moss Landing. Shelter from northwesterly winds is afforded at Santa Cruz Harbor and Soquel Cove, on the northern shore of the bay, and from southeasterly winds at Monterey Harbor on the southern shore.

Monterey Harbor, 3 miles southeastward from Point Pinos, affords good shelter in southerly weather. There is a small amount of domestic trade, general merchandise and lumber being received, and oil, fish, fruit, and farm products being shipped. There are two wharves used for commercial purposes. The steamboat wharf, owned by the city, is built out in the southernmost part of the bight to a low water depth of 25 feet, and the oil wharf, ½ mile nearer Point Pinos, has 36 feet alongside. Large vessels load fuel oil here. With a heavy westerly swell vessels at the dock must be breasted off, for which purpose mooring buoys are provided. There are two wharves eastward of the steamboat wharf used only by fishermen and bathers. The best anchorage is ½ mile northeastward of the steamboat wharf, in about 6 fathoms, sandy bottom. Water is piped to the wharves, provisions can be had, and fuel oil. Communication may be had by regular coasting steamers and by rail; there are telegraph and telephone facilities. A bell buoy is placed ½ mile off Mussel Point.

FROM SOUTHWARD.—From a position 2½ miles southwestward from Point Sur lighthouse steer 350° true (NNW ½ W mag.) for 17¾ miles, when Point Cypress and Cypress Rock should be abeam, distant 1½ miles, and Point Pinos lighthouse should bear 47° true (NNE ⅝ E mag.), distant 5 miles. Then steer 34° true (N by E ⅜ E mag.) for 5¾ miles, passing over ¼ mile outside the whistling buoy. Round Point Pinos at a distance of a little over 1 mile from the lighthouse and steer 128° true (ESE ¼ E mag.), so as to leave the bell buoy close-to on the starboard hand. When about ½ mile past the bell buoy steer 169° true (SSE ⅝ E mag.) and anchor as desired.

FROM NORTHWARD.—From a position 2 miles southwestward from Año Nuevo Island lighthouse steer 140° true (SE by E ⅛ E. mag.) for 40 miles, which should lead to a position 1¼ miles northeastward of Point Pinos lighthouse. Continue the course so as to leave the bell buoy on the starboard hand and when about ½ mile past it steer 169° true (SSE ⅝ E mag.) and anchor as desired.

Moss Landing, on the eastern shore of the bay, at the head of the great submarine valley, lies 12 miles 36° true (N by E ⅝ E mag.) from Point Pinos and 14½ miles 128° true (ESE ¼ E mag.) from Santa Cruz lighthouse. It has a small amount of domestic trade—lumber and general merchandise being received and grain, fruit, and farm products shipped. A wharf has been built out to deep water, the depth at the end varying from 30 to 50 feet, according to the season of the year, being less in winter. The anchorage is unprotected, but the holding ground is good; vessels anchor southward of the wharf to avoid the deep water off the end. The prevailing winds are northwesterly, with a few southeasterly gales during the winter; the latter are dangerous to vessels at anchor. No supplies can be obtained except by previous arrangement. Communication is had by regular coasting steamers and by rail.

Soquel Cove and **Landing** are in the northeastern part of Monterey Bay, eastward of Santa Cruz Harbor. Fair shelter is afforded in northwesterly weather but vessels are obliged to leave in southerly weather. The best anchorage is southeastward of the mouth of Soquel Creek in 5 to 6 fathoms, sandy bottom. **Capitola** is a summer resort and post office. The large hotel is prominent in approaching. Provisions may be had in limited quantities, but no coal or water. Communication is had by rail. There are telegraph and telephone facilities.

Santa Cruz Harbor, on the northern shore of Monterey Bay, has a small amount of domestic trade, general merchandise being received, and cement, lime, fruit, and farm produce shipped. There are two wharves; the municipal wharf, built out to a depth of 31 feet at low water, and the railroad wharf, which has a low-water depth of 14 feet. A bar, however, has formed in front of the latter wharf, so that vessels drawing over 8 feet can reach it only near high water. All traffic at present is over the municipal wharf.

Good shelter is afforded in northerly weather, but with northwesterly winds a heavy swell sometimes sweeps around the point into the bay. In southerly weather there is no protection and vessels are obliged to leave. There is good anchorage anywhere off the wharves in 5 to 6 fathoms, sandy bottom. The town of **Santa Cruz** is situated

on the northwest shore; **Vista del Mar** and **Seabright** are suburbs of Santa Cruz on the beach eastward. Provisions and water may be obtained, but no coal. Communication is by rail and stage; there are also telegraph and telephone facilities. There is regular freight, but no passenger, traffic by water.

Santa Cruz lighthouse is a white square tower on dwelling. The light is occulting white (light 3.5 seconds, eclipse 1.5 seconds), 67 feet above the water, and visible 14 miles. It is situated near the southern extremity of **Point Santa Cruz**, the western point at the entrance to the cove. A whistling buoy is placed in 10 fathoms, 1⅜ miles 124° true (ESE ⅝ E mag.) from the lighthouse.

From Southward.—From a position 2½ miles southwestward from Point Sur lighthouse steer 350° true (NNW ½ W mag.) for 17¾ miles, when Point Cypress and Cypress Rock should be abeam, distant 1½ miles, and Point Pinos lighthouse should bear 47° true (NNE ⅝ E mag.), distant 5 miles. Then steer 359° true (N by W ¾ W mag.) for 23 miles and pass midway between the whistling buoy and Santa Cruz lighthouse; the course made good leads to the anchorage off the wharves.

From Northward.—From a position 2 miles southwestward from Año Nuevo Island lighthouse steer 132° true (SE by E ⅞ E mag.) and give the coast a berth of over 1½ miles. Continue this course 15 miles, and when Santa Cruz lighthouse bears 76° true (NE by E ⅛ E mag.) steer 85° true (ENE mag.) for the whistling buoy and pass nearly 1 mile southward of the lighthouse. When the lighthouse is abeam round up to the anchorage off the wharves.

SAN FRANCISCO BAY AND APPROACHES.

The approaches to San Francisco Bay are included in the area bounded on the north by Point Reyes, on the west by the Farallones, and on the south by Point San Pedro. This body of water, known as the **Gulf of the Farallones**, is about 35 miles long in a northwest and southeast direction, with a greatest width of 23 miles, and communicates eastward by a narrow entrance, the Golden Gate, with San Francisco Bay. The prominent and easily distinguished landfalls, and the numerous natural and artificial aids, make the navigation of the approaches comparatively simple in clear weather. In thick weather the currents, variable in direction and velocity, render the approaches difficult and dangerous, and strangers should either lie off and wait for clear weather or take a pilot. Point Reyes, Mount Tamalpais, the Farallones, Point San Pedro, and Montara Mountain are all prominent in clear weather, and can frequently be used to locate a vessel's position when the lower land near the beach is shut in by fog or haze. Drakes Bay, eastward of Point Reyes, and Bolinas Bay, eastward of Duxbury Point, are open bights affording shelter in northwesterly weather, but exposed in southerly weather.

Point Reyes is a bold, dark, rocky headland, nearly 600 feet high, and the western and higher extremity of a ridge running east and west for 3 miles. There is low land northward of it, so that from northward and southward it is usually made as an island, and also from seaward in hazy weather. It is visible for over 25 miles, and can be seen off Point Bonita, the northern headland at the entrance to the Golden Gate.

Point Reyes lighthouse, situated on the western extremity of the point, is a white pyramidal tower. The light is flashing white (flash 1 second, eclipse 4 seconds), 294 feet above the water, and visible 24 miles. The fog signal is an air diaphone (blast 5 seconds, silent 40 seconds). The fog signal sounds 5 or 6 short, sharp blasts, and blast of 15 seconds to warn the coast-guard crew when vessels are in distress. A storm warning display and seacoast telegraph and reporting station is situated on the northwesterly end of the high ridge back of the lighthouse. The station is equipped for signaling with the international code, and will transmit messages of passing vessels.

Mount Tamalpais, about 7 miles northward from Point Bonita, is a prominent mountain 2,604 feet high. In clear weather it is visible for over 60 miles. From southward and westward it shows three summits, of which the western is the highest and the eastern the sharpest. It is covered with bushes and scrub trees, giving it a dark appearance, which contrasts strongly with the surrounding hills, especially in summer, when the latter assume a light reddish color.

The **Farallones** are a group of rocky islets extending about 7 miles in a northwest and southeast direction. The **Southeast Farallon,** the largest of the group, lies 18 miles 177° true (S by E 7/8 E mag.) from Point Reyes lighthouse, and 23 miles 252° true (SW 3/4 W mag.) from Point Bonita. It is really two islands, separated by a narrow gorge impassable even for boats. The eastern one is the larger, pyramidal in shape, 350 feet high and surmounted by **Farallon lighthouse,** a white conical tower. The light is flashing white (flash 4.5 seconds, eclipse 55.5 seconds), 358 feet above the water, and visible 26 miles. The fog signal is an air diaphone, sounding a group of three blasts of 2 seconds' duration every 60 seconds, silent intervals 4, 1, and 49 seconds. The fog signal, keeper's dwelling, and a Navy radio station are located on the lowland on the south side, and the fog signal can seldom be heard northwestward of the island.

The western and smaller island known as **Maintop** is 220 feet high. There are several rocky islets lying close-to, the largest of which, **Sugarloaf,** 200 feet high, lies northwestward from the lighthouse and forms a small cove where anchorage can be had in 8 fathoms on the line between the points, and having a boat landing on a small sand beach in it. A submarine cable is laid from this cove to Drakes Bay. There is another boat landing on the south side of the island. Both are marked by derricks and landing stages. **Hurst Shoal** lies 5/8 mile 152° true (SE 1/8 E mag.) from the lighthouse. It is of small extent, with a least depth of 6 fathoms, and breaks only in heavy weather. The **Middle Farallon** lies 2 1/4 miles 319° true (NW by W 1/4 W mag.) from the lighthouse. It is a single black rock 50 yards in diameter and 20 feet high. A rock, with 5 1/2 fathoms over it, lies 1/2 mile southwestward from it. The **North Farallones** lie 6 1/2 miles 311° true (WNW mag.) from the lighthouse, and 14 miles 195° true (S 1/4 E mag.) from Point Reyes. They consist of two clusters of bare, precipitous islets and rocks extending in a west-northwest and east-southeast direction for 7/8 mile, with an average width of 1/4 mile. The highest rock, 155 feet, is in the southeastern group. **Noonday Rock,** with 14 feet over it, lies 3 miles 296° true (W 5/8 N mag.) from the northernmost rock of the North Farallones and 14 miles 209° true (S by W mag.) from Point Reyes. It rises abruptly from

depths of 20 fathoms and over, and is the principal danger in approaching from northward. It is marked by a red and black horizontally striped whistling buoy placed in about 28 fathoms, 400 yards southwestward from the rock, which is the shoalest point of **Fanny Shoal**; the latter is about 2 miles in extent, having depths of 20 to 30 fathoms.

Point San Pedro is described on page 81.

From Point San Pedro to Point Lobos, the southern headland at the entrance, the coast extends 11½ miles in a north-northwesterly direction, the first 8 miles consisting of whitish bluffs which at a point 5 miles northward of Point San Pedro reach a height of 600 feet. Between Point Lobos and these bluffs is a broad, sand beach extending back to high sand dunes, the latter terminating abruptly at Golden Gate Park 1½ miles southward of Point Lobos. These whitish sand dunes are prominent from a considerable distance seaward.

Point Lobos is high, rocky, and rounding, with black, rugged cliffs at its base. A marine lookout and reporting station is on the ridge back of the point, and the summit has upon it several houses and a large water tank on a high scaffolding. **Seal Rocks**, a group of high, rocky islets, lie close under its western face. The **Cliff House** and a number of other prominent buildings are situated on and near the southern point of its western face.

From Point Reyes to Point Bonita the coast extends in a general easterly direction for 26 miles. From the former point the coast trends eastward for about 3 miles and then bends sharply northward and eastward forming Drakes Bay.

Drakes Bay (chart 5599) affords shelter in northwesterly weather in 5 to 6 fathoms, sandy bottom. From the western headland, which is the eastern end of the ridge forming Point Reyes, high, white cliffs extend northward and eastward in a gentle curve for 6 miles, terminating in high, white sand dunes. Several lagoons on the northern shore empty through a common channel which is navigable by light-draft vessels with local knowledge. The western point is 230 feet high, with a detached rock lying close under the eastern extremity. A reef, which breaks in moderate weather, extends more than ½ mile eastward from the point. The harbor is used extensively by vessels in heavy northwesterly weather. Shelter has been obtained in southeasterly weather, close under the western point, in 4 fathoms, sticky bottom, the force of the swell being broken by the reef off the point; this anchorage is not recommended. No directions for entering are necessary, further than to give the point a berth of not less than ¾ mile to avoid the reef previously mentioned. The telegraph cable to Farallon Island is laid close around the inside of the reef off the point and landed abreast the first depression in the ridge westward. Vessels should avoid anchoring near it.

From the sand dunes near the eastern part of the bight, rocky cliffs 100 to 200 feet high extend eastward and southward for 6 miles to Double Point.

Double Point is formed by two bold, rocky cliffs, nearly ½ mile apart. They are about 300 feet high. Two rocks lie off the northern cliff; one, 125 yards long, 250 yards southwestward from the bluff, and the other and smaller one 200 yards westward from the point.

The southern cliff has a rock close under the point and nearly connected with it at low water.

From Double Point to Bolinas Point, 3½ miles, the coast is bold with high, rocky cliffs bordered by narrow sand beaches and no outlying dangers.

Bolinas Point, 160 feet high, is the western point of the comparatively level table-land extending eastward to Bolinas Lagoon. Owing to its proximity to Duxbury Point it is not particularly prominent.

Duxbury Point, 160 feet high and yellowish in color, is 5 miles southeastward from Double Point and 9½ miles northwestward from Point Bonita. It is the southern extremity of the table-land westward of Bolinas Lagoon. **Duxbury Reef** is a long, narrow reef, partly bare at low water, extending 1¼ miles southeastward from Duxbury Point. A ledge, with 5 to 6 fathoms over it, extends southward from the reef, its outer end lying 1⅜ miles 183° true (S by E ⅜ E mag.) from the point. A gas and whistling buoy is placed in 12 fathoms, 2 miles 172° true (SSE ⅜ E mag.) from Duxbury Point. Vessels should not pass northward of the buoy.

Bolinas Bay lies immediately eastward of Duxbury Point. It is an open bight 3½ miles long between Duxbury and Rocky Points and a little over 1 mile wide. It affords shelter in northwesterly weather in 4 to 6 fathoms, sandy bottom, with Duxbury Point bearing about W by S mag. distant 1½ miles, but is little used. A rock awash at low water, with another rock awash 250 yards northward of it, lies ¾ mile 96° true (E by N mag.) from Duxbury Point. A rock, with 2 feet over it, lies 150 yards westward of the first rock. A rock awash, and a rock having 13 feet over it 250 yards northeastward, lies nearly 1⅛ miles 138° true (SE by E ⅜ E mag.) from Duxbury Point. No directions are necessary other than to keep clear of Duxbury Reef and the dangers previously described.

Bolinas Lagoon is separated from the bay by a narrow strip of sandy beach that is cut by a narrow shifting channel near the bluffs about the middle of the bight. The lagoon is shoal and of little commercial importance. It is entered by small, light-draft vessels with local knowledge. The small settlement of Bolinas is located a short distance inside the entrance on the western shore.

Rocky Point, 3½ miles eastward from Duxbury Point, is 100 feet high and shelving. Numerous detached rocks lie within 200 yards of the cliffs, which on the southern side of the point are high and precipitous.

From Rocky Point to Point Bonita the coast is very rugged and broken. The cliffs, which are the seaward termination of spurs from Mount Tamalpais, rise to heights of over 500 feet and are intersected by deep, narrow valleys stretching inland.

Point Bonita, the northern point at the entrance, is a black, sharp, narrow, precipitous cliff 100 feet high, increasing in height to 300 feet on its seaward face ¼ mile northward. From northwestward it shows at three heads, the southern one being cut down to form a place for **Bonita Point lighthouse**, a white square tower. The light is occulting white (light 25 seconds, eclipse 5 seconds), 124 feet above the water, and visible 17 miles. The fog signal is a steam siren (blast 5 seconds, silent 35 seconds), and sounds five or six short

sharp blasts, and blast of 15 seconds duration, to warn coast-guard crews when vessels are in distress. In the summer the cliffs are white with bird droppings, but the first heavy rain restores them to their natural black color. There are a few detached rocks surrounding the point, but these do not extend over 200 yards offshore.

THE BAR.

The bar outside the entrance is semicircular in form, the area, with 6 fathoms or less, extending from a point ½ mile westward from Point Bonita to a point nearly 1 mile offshore 3 miles southward from Point Lobos. The extreme outer point is 5½ miles southwestward from Point Bonita. This is also the narrowest part, the distance between the inner and outer 6-fathom curves being little over ¼ mile. The northern part is the shoalest and is known as **Four Fathom Bank,** within the limits of which is a small area of less than 4 fathoms, locally known as the "**Potato Patch.**" The outer end of the Four Fathom Bank lies 5 miles 254° true (SW by W mag.) from Point Bonita, and at its widest part, near the inshore end, the bank is more than 1 mile wide. The Potato Patch is about 1 mile long and ¼ mile wide. Over the remainder of the bar the depths range from 31 to 36 feet, the deepest water being found near the southern end, which is nearly 1 mile wide. The depths as a rule vary but little from year to year, with a slight tendency to increase. The depths in approaching are regular and decrease gradually to about 8 fathoms and then abruptly to the crest of the bar. Inside the bar the depth increases slowly and regularly to the entrance.

CHANNELS.—In smooth weather the bar can be crossed anywhere southward of the western end of the Four Fathom Bank, but in heavy weather use is made of one of the following channels.

The Main Ship Channel is the one in general use, and is included between the range of Fort Point and Alcatraz lighthouses, bearing 71° true (NE ⅝ E mag.), and Fort Point lighthouse bearing 77° true (NE by E ¼ E mag.). This channel has a width of ¾ mile, and is only a little over ¼ mile between the outer and inner 6-fathom curves. The least depth is 33 feet at low water.

San Francisco light vessel is situated about 3 miles outside the bar, just northward of the Fort Point and Alcatraz range, and in thick weather this channel is easily entered owing to the short run from the light vessel to the bar. The light vessel has a red hull with "San Francisco" on each side, and two masts with a black circular galley at each masthead. The light is flashing white (flash 5 seconds, eclipse 10 seconds), 57 feet above the water, and visible 13 miles. If flashing light is inoperative, a less brilliant fixed light will be shown. The fog signal is a steam whistle (blast 2 seconds, silent 28 seconds); if whistle is disabled, a bell will be struck by hand, 2 strokes every 30 seconds. The submarine bell strikes "7" every 15 seconds.

The **South Channel,** marked on its eastern side by two red buoys, is parallel with the beach southward of Point Lobos at a distance of ¾ mile from it, and at its southern end is ⅜ mile wide. Vessels entering this channel and heading for Point Bonita lighthouse, bearing 358° true (N by W ⅞ W mag.), will find nothing less

than 6 fathoms and as a rule deeper water. Deep draft vessels may be taken through this channel with a southwesterly swell, and although they may roll considerably they pitch but little and lessen the possibility of touching from that cause. The South Channel, however, should not be used when the bar is rough and inclined to break, as heavy breakers, forming on the bar, sometimes sweep across the channel. (See remarks under Southeast Reef, p. 80.)

The **Bonita Channel** lies between the eastern end of Four Fathom Bank and the shore northward of Point Bonita. It is about 2 miles in length, and varies in width from ¼ mile at its southern end abreast Point Bonita to ½ mile at the northern end. The navigable width is reduced to less than ¼ mile by several rocky patches on the north side, the outer being **Centissima Rock,** with 33 feet over it, and marked on its southwest side by a black gas and bell buoy, lying 1¼ miles west-northwestward of Point Bonita.

Sears Rock, with 18 feet over it, lies 200 yards north-northwestward of Centissima Rock; several rocky patches, with less than 6 fathoms, lie inside and close to Sears Rock. Vessels should not attempt to pass northward of the gas and bell buoy. The eastern end of Four Fathom Bank is marked by a horizontally striped buoy.

The western entrance to Bonita Channel is marked by a red gas and whistling buoy placed near the northern edge of Four Fathom Bank. Another red buoy is placed off the northwest edge of Four Fathom Bank, 2⅛ miles 261° true (SW by W ⅝ W mag.) from the last-named buoy, as a guide to vessels from the southward and westward making for the Bonita Channel. This channel is used by a large number of vessels, especially coasting steamers northward bound, and by deeply laden vessels when the Main Ship Channel or South Channel are impassable. A depth of over 8 fathoms can be carried through, and it has never been known to break, but in heavy weather breakers, forming on the Potato Patch, sometimes sweep across the channel, and vessels have been swamped by them. The channel is not recommended at night or in thick weather.

THE GOLDEN GATE

is the connecting passage between the ocean and San Francisco Bay. The western end is 2 miles in width between Point Bonita and Point Lobos, or narrowed to 1½ miles by Mile Rocks, off Point Lobos; from this it contracts to less than ⅞ mile between Lime Point on the northern shore and Fort Point on the southern. The depths increase from 23 fathoms at the western end to over 60 fathoms near the eastern end; these depths, combined with the currents, render the lead of little value in thick weather. The northern shore is bold and rugged; the cliffs, reddish in color, rising abruptly from the water's edge to heights of over 600 feet.

Bonita Cove, immediately eastward of Point Bonita, is occasionally used as an anchorage by small vessels. The anchorage is close under Point Bonita in about 6 fathoms and is used considerably by the pilot boats. There are two wharves built out in the western part of the cove, both belonging to the Government and used for landing lighthouse and military supplies. A Coast Guard station is located there.

Point Diablo, about midway between Point Bonita and Lime Point, projects sharply into the strait for about 1/8 mile. It rises abruptly to a height of over 200 feet, with deep water on all three sides.

From Point Diablo to Lime Point the shore forms a shallow bight with steep, precipitous cliffs; near the middle of the bight the cliffs are cut by a narrow valley which terminates in a low beach at the shore.

Lime Point is high and precipitous, and rises abruptly to a height of nearly 500 feet in less than 1/4 mile. The southern face shows the effect of blasting. The lighthouse and fog-signal buildings are situated on the extremity of the point; the light is fixed white, and the fog signal is a steam whistle (blast 10 seconds, silent 30 seconds). A wharf has been built a short distance northward of the lighthouse, inside the point.

The south shore of the Golden Gate extends in a gentle curve eastward and northward to Fort Point, forming a shallow bight known as **South Bay**. The cliffs rise abruptly from narrow beaches except near the middle of the bight, where a valley terminates in a sand beach about 1/4 mile long. Sailing vessels are sometimes obliged to anchor here from lack of wind, or, on an ebb current, to avoid drifting on Mile Rocks, but the anchorage is uncomfortable and it is difficult to get under way from it.

Mile Rocks are two small, black rocks lying 3/8 mile northwestward from the sharp projecting point on the north face of Point Lobos. They are 20 feet high and about 100 feet apart, with reported deep water between them. A lighthouse (white cylindrical tower on dwelling) and fog signal are situated on the outer and larger rock; the light is group occulting white (two eclipses every 20 seconds), and the fog signal is an air whistle (blast 3 seconds, silent 27 seconds).

A rock with 6 feet over it lies 130 yards eastward of the lighthouse. The passage between Mile Rocks and Point Lobos should not be attempted, as a rock with 15 feet over it lies 300 yards 164° true (SE by S mag.) from Mile Rocks lighthouse, nearly in the middle of the passage, and sunken and visible rocks extend over 300 yards from the shore.

Fort Point projects slightly from the high cliffs, and is marked by a red brick fort with a stone sea wall in front. The fort is the distinguishing feature, and is surmounted by a lighthouse and fog signal, on a white, pyramidal tower. The light is occulting white (light 1 second, eclipse 1 second), and the fog signal is an air diaphone (blast 2 seconds, silent 18 seconds).

Fort Point Ledge is a dangerous sunken ledge extending 200 yards northward from the point. The outer end is marked by a red buoy placed in 7 1/2 fathoms 200 yards westward of the ledge and 400 yards northwestward from Fort Point lighthouse.

Presidio Shoal, with 3 1/2 to 4 3/4 fathoms and rising abruptly from deep water, is about 5/8 mile long in a 76° true (NE by E mag.) direction, with an average width of 100 yards, and is marked near its middle by a horizontally striped gas buoy. The western end of the shoal is a little over 5/8 mile 76° true (NE by E mag.) from Fort Point, the shoal extending about parallel with, and 1/2 mile off, the sand beach in front of the Presidio.

Anita Rock, bare at low water, lies about 300 yards northward from the Presidio wharf. It is marked by a red nun buoy on the east side and a horizontally striped bell buoy on the west side.

SAN FRANCISCO BAY.

This is the most important as well as the largest harbor on the Pacific coast of the United States. It is landlocked and affords good shelter and anchorage in all weather. It is the terminus of several trans-Pacific lines of steamers and transcontinental railroads, and its commerce, both foreign and domestic, is extensive. Much of the local navigation is carried on by means of light-draft river steamers and barges, and by flat-bottomed scow schooners that ascend the Sacramento and San Joaquin Rivers. A large amount of grain is exported, together with other native products.

From its junction with San Pablo Bay between Point San Pedro and Point San Pablo, about 10 miles above the entrance, it extends southeastward nearly 40 miles. The eastern shore as a rule is low, and in the southern part is composed of extensive marshes intersected by numerous winding sloughs. For 4½ miles southeastward from Point San Pablo the shore is formed by a ridge of rolling, grassy hills. The western shore, north of the entrance, is much bolder, with only a few stretches of low marsh. From Fort Point the shore trends eastward for nearly 4 miles, and then rounds sharply southward for 10 miles, from which point marshes and flats, intersected by numerous sloughs, extend to the head of the bay. The San Francisco water front extends from 1 mile eastward of Fort Point around to Point Avisadero, a distance of 8 miles of this stretch. The first two points within the bay are Point Cavallo on the north side, and Black Point on the south. Beyond these the islands within the bay are the most prominent features.

Point Cavallo is a sharp rocky point with some visible and sunken rocks close under its west side. It lies ½ mile north-northeastward from Lime Point and between them is **Horseshoe Bay**, a shallow bight within the area of forbidden anchorages. From Point Cavallo the rocky, steep shore trends northward ¼ mile to Yellow Bluff, thence northwestward to Sausalito, abreast of which many vessels anchor while awaiting cargoes.

Black Point is the first prominent rocky point on the south shore after passing Fort Point and lies 2⅓ miles 93° true (ENE ⅝ E mag.) from it. It marks the western limit of the quarantine ground beyond which vessels must not pass before obtaining pratique. Beyond Black Point and showing just to the left of it when entering the bay is a large and prominent gas tank. This is located at the foot of Powell Street and marks the eastern limit of the quarantine ground.

Alcatraz Island, 2½ miles eastward from Lime Point and 1 mile northward from Black Point, is prominent in the approaches and is one of the leading marks in entering from outside. It is small and 148 feet high, with numerous buildings of the military post located upon it. The lighthouse is situated on the highest part of the island. Fog signals are located on the extreme northwestern and southeastern ends of the island. The light, shown from a gray tower, is flashing

white (flash 0.5 second, eclipse 4.5 seconds) and forms, with Fort Point lighthouse, a range for crossing the bar by the Main Ship Channel. Both fog signals are electric sirens, the one on the southeast end sounding two blasts, each of 4 seconds duration, every 30 seconds, and the one on the northwest end sounding a single blast of 5 seconds duration every 20 seconds.

A rock awash, marked on its westerly side by a horizontally striped bell buoy, lies 125 yards westward of the northwest end of Alcatraz Island. Spots with depths of 29 to 31 feet lie northwestward of Alcatraz Island, the most northwesterly being a 29-foot spot, 1¼ miles 300° true (W by N mag.) from Alcatraz lighthouse.

Blossom Rock lies nearly 1 mile 113° true (E ½ S mag.) from the southeastern end of Alcatraz Island and has a depth of 30 feet over it. Heavy tide rips occur in the vicinity of the rock.

Goat Island, about 345 feet high, lies 2½ miles eastward from Alcatraz Island; it is of rather small extent and irregular in shape. The southeastern point is marked by a lighthouse and fog signal on a white octagonal tower. The light is fixed white, and the fog signal is a steam whistle (blast 4 seconds, silent 16 seconds). The northeastern point terminates in a small knob 160 feet high. The knob slopes back to a low neck of land on which are the buildings of the naval training station. The wharves of the Lighthouse Service, naval training station, and Army engineers are in the small cove on the eastern face of the island. On the summit of the island is a tall mast of a wireless telegraph station. A shoal extends 1½ miles northwestward from the island; the northwestern end is marked by a red buoy.

Angel Island, partially wooded, is 1½ miles northward from Alcatraz Island, and is separated from the mainland by Raccoon Strait on its northern side. The island is irregular in shape, its greatest length being 1⅜ miles in an east and west direction with a width of over 1 mile. The highest point, 782 feet, is about the center of the island.

Point Knox, the southwestern point of Angel Island, is marked by a lighthouse and fog signal; the light, shown from a white dwelling, is fixed red, and the fog signal is a bell sounding two strokes every 15 seconds. A shoal, with 16 feet at its outer end and marked by a red buoy, extends 400 yards southward from Point Knox. A wharf for the military post is situated in the bight about ¼ mile northwestward from it.

Point Blunt, the southeastern point of Angel Island, terminates in a knob 60 feet high, connected by a low neck of land with the island; a shoal with visible and sunken rocks upon it extends southeastward ⅛ mile. The tide rips and swirls are heavy around Point Blunt, especially on the ebb of a large tide. **Point Blunt light,** shown from a white house, is group flashing white (two flashes every 20 seconds), and the fog signal is an electric siren (blast 2 seconds, silent 13 seconds).

Quarry Point, the eastern point of the island, is a bold bluff with deep water close-to. A wharf is built out from this point for the United States detention camp located abreast of it. Just northward of Point Simpton, the northeast point of the island, are the wharf and buildings of the United States immigration station; there is a light and electric fog bell on the end of the wharf.

Hospital Cove is a small bight on the northern shore of Angel Island; the wharf for the national quarantine station is on the eastern shore of the cove.

Point Stuart, the westerly point of Angel Island, has a light (occulting white) and a fog signal (electric siren, two blasts every 20 seconds) on the end.

Raccoon Strait, on the northwest side of Angel Island, is nearly ½ mile wide, and is sometimes used by vessels bound northward in San Francisco Bay from Lime Point. The strait is free from dangers, but the tidal currents have considerable velocity and the rips and swirls are heavy at times. A mid-channel course can be followed with safety.

Southampton Shoal extends in a northwest and southeast direction for 2 miles, with an average width between the 18-foot contours of ¼ mile. On the western side the slope is abrupt from 6 fathoms to 9 and 12 feet, while on the eastern side the shoaling is gradual. The least water is 9 feet on the western edge of the shoal, about midway between the northern and southern points. The southern end is marked by a light (fixed white on a white wooden building) and fog signal (bell), and the northern end, lying 1¼ miles southeastward from Red Rock, by a horizontally striped buoy. The channel eastward of the shoal has a depth of 3 to 4 fathoms, and is little used, except by vessels bound for the wharves between Point Richmond and Point San Pablo.

Point Richmond, on the eastern shore of the bay, nearly 4 miles southeastward from Point San Pablo, is the ferry terminal of the Santa Fe Railway system. The wharf has been built out from the western extremity of the point.

Red Rock, 169 feet high, in the northern part of the bay, is visible in clear weather from the anchorage near Goat Island. It is reddish in color and of small extent. It lies 1 mile from the eastern shore and 2¼ miles southward of Point San Pablo.

A shoal, with depths of 3¾ to 5 fathoms, extends 1¼ miles southward from Red Rock. The bottom rises gradually toward the shoal, and the usual course of vessels leads over ¼ mile westward of the 5-fathom curve surrounding it. It is marked by a red buoy placed in about 5 fathoms near the western edge.

Castro Rocks are small and low, and lie ⅜ mile off Castro Point on the eastern shore abreast Red Rock. The southwest edge of the surrounding shoal is marked by a red gas buoy. Vessels should not pass eastward of this buoy.

The Brothers are two small, low, flat-topped islands ¼ mile westward from Point San Pablo. The eastern one is surmounted by a lighthouse and fog signal.

Invincible Rock, with 7 feet over it, lies ½ mile 216° true (S by W ½ W mag.) from East Brother Island lighthouse, and is marked on its western side by a red gas buoy.

Whiting Rock, with 12 feet over it, lies northward of Invincible Rock and nearly ⅜ mile 229° true (SSW ¾ W mag.) from East Brother Island lighthouse. It is marked on its western side by a red buoy.

The channel eastward of Red Rock and The Brothers is frequently used by the river steamers on the ebb, as the current has less velocity although the rips and swirls are at times heavy.

Point San Quentin, on the western shore 3 miles southward from Point San Pedro, is prominent on account of the low land on either side. The buildings of the State Prison, and the wharf built out from the eastern extremity of the point are prominent.

The **Marin Islands**, 1¼ miles northward from Point San Quentin, are two small islands lying close together about 1 mile offshore. There is shoal water around them and all the way inshore.

Point San Pablo is the northwest extremity of a low ridge of hills on the eastern shore of the bay at the junction with San Pablo Bay. The point rises abruptly to a height of 140 feet. A railway wharf with warehouse upon it is built southward from the point, parallel with the channel.

Point San Pedro, the western point at the junction with San Pablo Bay, is prominent from either northward or southward. It rises rather abruptly to a knoll about 300 feet high with a small saddle behind it. There are wharves on the east and south sides of this point. **The Sisters**, two small, bare, rocky islets, about 100 yards apart, lie a little over ¼ mile northeastward from the point.

San Pablo Bay and tributaries are described under separate headings following.

Southward of San Francisco, **Point Avisadero** (the eastern extremity of Hunters Point), **Sierra Point**, **Point San Bruno**, and **Point San Mateo**, all on the western shore, are the prominent natural features. Quite an extensive area is under oyster cultivation, and the stake fences inclosing the oyster beds and the quarters for the men—houses built on piling—are prominent. Near the southern part is a long flume crossing the marshes, inclosing water pipes that cross the bay at **Dumbarton** (Potrero) **Point**. A few small houses and a wharf, with a depth of 18 feet at the end, are near the end of the point. A railroad bridge crosses the bay from Dumbarton Point. The draw in it is 125 feet long with a clear height of 10 feet above extreme high water. Towage through the draw is furnished without expense. The railroad company operates a fog bell on the draw during foggy weather.

San Francisco, the largest city on the bay, is situated on the northern end of the peninsula separating the southern arm of the bay from the ocean. The depths at the wharves are ample for deep-draft vessels, and are maintained by dredging. The wharves, or piers, are designated by numbers beginning at the ferry building. All piers northwestward from it are given odd numbers, and all southeastward even numbers.

Oakland, the second largest city on the bay, is situated on the eastern shore opposite San Francisco. About 20 feet can be taken to the wharves at low water. Access to the water front is obtained by means of **San Antonio** (Oakland) **Creek**, which has been dredged and is confined between jetties. A lighthouse and fog bell and a lighted beacon are placed close-to off the ends of the north and south jetties, respectively. The creek is being improved under a project to obtain a channel 500 feet wide and 30 feet deep to a turning basin 3½ miles above the ends of the jetties, 300 feet wide and 25 feet deep around the turning basin, and 300 feet wide and 18 feet deep through **Oakland Tidal Canal** to **San Leonardo Bay**, a farther distance of about 4 miles. In 1916 the channel had a depth of 27 feet to Oakland, about 20 feet around the turning basin, 18 feet about halfway through Oakland Tidal Canal, and 10 feet to San Leonardo Bay.

The creek is crossed by two drawbridges near the eastern end, and Oakland Tidal Canal by three drawbridges. A long railroad wharf and mole extends from the western part of the city to within 5/8 mile of Goat Island; it has a dredged channel along its north side. Another railroad wharf extends along the north side of the north jetty to the lighthouse. From the northern part of Oakland a long wharf extends southwestward to within 1/2 mile of Goat Island for ferry traffic only.

Alameda, immediately southward of Oakland, is of little commercial importance. A railroad mole and wharf, parallel to and southward of San Antonio Creek, projects about 2 miles westward from the western part of the town, and forms a part of the south jetty of San Antonio Creek.

Berkeley is a rapidly growing town northward of and adjoining Oakland and practically a part of it.

West Berkeley and **Emeryville**, on the bay shore northward of Oakland, are small manufacturing towns. Several wharves, accessible for light-draft vessels at high water, are built out within their limits.

Point Richmond is a town 1 mile northward from the point of the same name. In addition to the railroad wharf at the point a long wharf for loading oil extends westward to the channel about 1 mile northward of Point Richmond.

Port Orient and **Winehaven** are shipping points located southward of Point San Pablo, and have wharves built out to the channel. At the former large vessels load refined oil, and at the latter is a large winery.

Sausalito, on the western shore about 2 miles northward of Lime Point, is the terminus of a railroad connecting with interior northern points; otherwise it is of little commercial importance. **Richardson Bay**, northward of Sausalito, is shoal.

Belvedere, on the eastern shore of Richardson Bay opposite Sausalito, is a summer resort and of little commercial importance.

Tiburon, near Point Tiburon, is the terminus of a railroad connecting with interior northern points.

Several small towns and villages, of little commercial importance, on both shores of the bay south of San Francisco, are reached at high water by narrow sloughs winding through the marshes.

The **United States Military Reservations**, embracing Fort Point and Black Point, are on the northern shore of the peninsula.

Channels.—From the Golden Gate to the anchorage off San Francisco and southward to Point Avisadero, and northward to the entrance of San Pablo Bay, the channels are wide, and have ample depth at low water for deep-draft vessels. The most important dangers are described above.

From Point Avisadero, the southern end of the bay is reached by a rather narrow channel, marked by beacons, following the western shore, and gradually decreasing in width from 2 1/2 miles at its northern end to less than 1/4 mile at its junction with Alviso Slough near the southern end. This channel is used principally by light-draft steamers and sailing vessels, engaged in carrying oysters from the different beds or in transporting farm produce from some of the landings reached by the sloughs connecting with the channel.

An occasional small power vessel enters **Redwood City Slough** at high water. The slopes of the channel are very abrupt, and rise rapidly from depths of 6 and 7 fathoms to depths of a few feet. A channel 5 feet deep at low water and 125 feet wide to the wharf ¾ mile below the town of **Redwood**, has been obtained by dredging. The channel at the entrance is marked by beacons. The usual draft of vessels does not exceed 6 feet.

Anchorage.—The usual anchorage for vessels is westward of Goat Island and in the vicinity of Mission Rock, off the southern part of San Francisco. Government vessels usually anchor in the triangular area included between the railroad-car-ferry route and the passenger-ferry route. In southeast weather and spring tides considerable sea is raised, and vessels at times anchor under the lee of Black Point and vicinity, where the force of the wind and sea are broken. For the limits of the forbidden anchorage see "Harbor rules and regulations" following.

Harbor rules, regulations, and rates are prescribed by the board of State harbor commissioners, and their enforcement is in charge of the chief wharfinger and his assistants, who will furnish copies of the rules on application. The following are extracts from them:

1. Vessels must not be anchored nor moored between a line drawn from the outer end of Jackson Street wharf (pier No. 5) to the most southerly point of Yerba Buena Island, locally known as "Goat" Island; thence following northerly along the shore line of said island to the most northerly point thereof; thence easterly to the westerly pier of the San Francisco, Oakland & San Jose Railroad Company's wharf on the Oakland side of the bay; thence southerly, following the 3-fathom contour to the northerly pier of the Southern Pacific Company on the Oakland side of the bay; thence southerly, following the 3-fathom contour to the westerly end of the Southern Pacific Company's ferry slip near the westerly end of the southerly training wall of Oakland Harbor, and a line drawn from the outer end of Mission Street No. 1 (pier No. 2) to the above mentioned ferry slip of the Southern Pacific Company. Nor must they be anchored so as to permit them to swing over these lines and into the space formed between these lines.

2. Vessels must not be anchored nor moored between a line drawn from the outer end of the Hay Wharf to the lighthouse near the westerly end of the northerly training wall of Oakland Harbor and a line drawn from the outer end of the most southerly wharf of the dry dock wharves at Central Basin to the westerly end of the Southern Pacific Company's ferry slip near the westerly end of the southerly training wall of Oakland Harbor; nor must the vessel be anchored so as to permit them to swing between said lines.

3. Vessels must not be anchored nor moored between a line drawn from the most easterly point of Point Blunt (on Angel Island), passing over Blossom Rock as marked by buoy, and intersecting the 500-yard limit at a point directly north of the outer end of Lombard Street wharf (pier No. 27). This line if projected would touch the outer end of Washington Street wharf (pier No. 3) and a line drawn from the northwesterly end of the grain shed of section 1 of the sea wall, with the light on Alcatraz Island, and from there to Blunt Point on Angel Island; nor must vessels be anchored so as to permit them to swing between said lines.

4. Vessels must not be anchored nor moored between a line drawn from the outer end of Mission Street wharf No. 1 to the westerly point of Point Richmond; and a line drawn from the outer end of Lombard Street wharf through the buoy anchored at the southerly spit of Southampton Shoal and prolonged to opposite Point Richmond; nor must they be anchored so as to permit them to swing between said lines.

5. Vessels must not be anchored nor moored within 500 yards of a line drawn from the extreme northerly end of the sea wall, southerly through the extreme outer ends of the piers, to the outer end of Berry Street wharf; nor must they be anchored so as to permit them to swing between said lines.

6. Vessels must not be anchored nor moored between a line drawn from the westerly end of the brick fort at Fort Point to the westerly end of the lighthouse station on Lime Point and a line drawn from the Fulton iron works to Yellow Bluff; nor must they be anchored so as to permit them to swing inside of these lines.

7. Vessels must not be anchored nor moored between a line drawn from Yellow Bluff to Point Knox and a line drawn from the southerly end of cove (south of Sausalito Point) to Point Stuart; nor must they be anchored so as to permit them to swing inside of these lines.

7½. Vessels must not be anchored nor moored in an area bounded on the seaward side by a straight line from Point Bonita to a point on the shore of South Bay, ½ statute mile to the seaward of the large cable sign at Baker's Beach, on the inside of a straight line running from a point in Bonita Cove, ½ statute mile from the Fort Barry wharf (which is the only wharf in Bonita Cove) to a point on the shore of South Bay, ½ statute mile inside, or north by northeast of the large cable sign at Baker's Beach; nor must they be anchored so as to permit them to swing into this forbidden area.

7¾. Vessels must not be anchored nor moored in an area extending from the water front of the city and county of San Francisco to the mouth of Oakland Creek; bounded on the southerly side by a line extending from the intersection of the northerly line of Islais Creek channel with the water front of the city and county of San Francisco, to the westernmost point of the wharf at the end of the Alameda mole; on the northerly side by a line parallel with the said southerly line and 500 yards distant therefrom; nor must vessels be anchored so as to permit them to swing into this forbidden area.

8. Vessels propelled by steam must not run inside of a line 500 feet distant from and parallel to a line drawn through the outer ends of the piers.

9. Vessels propelled by steam, except when going to or leaving the sea wall, must not run inside of a line 800 feet distant from, and parallel with, the said sea wall.

10. A vessel will not be entitled to a berth until an application shall have been made to the chief or assistant chief wharfinger; and such application must state the length, draft of the vessel, kind of cargo, and locality desired. No application shall be entertained unless the vessel be in the harbor and ready to be docked. Berths shall be assigned in the order of application, provided that vessels ready to discharge cargo shall have preference over those ready to receive cargo. No one except the chief or assistant chief wharfinger has authority to assign berths to vessels.

11. Vessels must haul or go into the stream at their own expense when ordered to do so by the chief or assistant chief wharfinger. Upon failure to obey such order the chief or assistant chief wharfinger shall have power to cause such removal at the expense of such vessel or vessels.

12. Vessels of all kinds, of 1,000 net tons or over, are prohibited from using the dolphins on the outer ends of the wharves to break or warp around when making a landing. The master, agent, or owner of a vessel refusing or neglecting to obey this rule will be required to pay for all damage caused to the wharf.

13. Vessels when being moved into a slip or alongside the wharf must approach "head on," and when at the wharf must lie head toward the shore.

Dockage charges (the charge made for vessels occupying berths at the wharves, or moored in any slip or channel) vary with the size and class of vessel, and **toll charges** (the charge made for merchandise passing over State premises) vary with the class of merchandise.

Pilotage.—Two power pilot vessels cruise northward and southward between the light vessel and the bar. The signal for a pilot is four long blasts of the whistle, and in foggy weather vessels should approach the light vessel as closely as possible before sounding the signal.

The following are extracts from the political code of California concerning pilotage:

SEC. 2465. The pilotage inside the heads to the anchorage opposite San Francisco and about the harbor, or between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, must be at such rates as agreed on between the parties, not to exceed five dollars per foot draught.

SEC. 2466. The following shall be the rates of pilotage into and out of the harbor of San Francisco: All vessels under 500 tons, $2 per draft foot; all vessels over 500 tons, $2 per draft foot and 2 cents per ton for each and every ton registered measurement; and every vessel spoken inward or outward bound, except as hereinafter provided, shall pay the said rates. A vessel is spoken by day by a pilot boat displaying a union jack or by night displaying a torch or flare-up within a distance of 3 miles of the vessel. In all cases where inward-bound vessels are not spoken until inside of the bar the rates of pilotage herein provided shall be reduced 50 per cent. Vessels engaged in the whaling or fishing trades shall be exempt from all pilotage except where a pilot is actually employed.

SEC. 2466a. In the event a vessel not carrying cargo to the port of San Francisco, nor seeking any thereat, is compelled to enter said port solely by reason of her being in distress or requiring either repairs, provisions, or fuel, the rates of pilotage into said harbor shall be as follows: All vessels under 500 tons, $1 per draft foot; all vessels over 500 tons, $1 per draft foot and 1 cent per ton for each and every ton registered measurement; and every vessel spoken inward bound shall pay the said rates. There shall be no reduction of rates of pilotage to vessels in distress where the vessel is spoken inside of the bar. In the event that the said vessel shall leave the port of San Francisco without carrying any cargo therefrom, she shall pay the last-mentioned rates of pilotage out of the harbor of San Francisco.

SEC. 2467. Any vessel in tow of a steam tug, between the harbor of San Francisco and the ports of Mare Island, Vallejo, or Benicia, shall be exempt from all charges for pilotage, unless a pilot be actually employed.

SEC. 2468. All vessels sailing under an enrollment, and licensed and engaged in the coasting trade between the port of San Francisco and any other port of the United States, shall be exempt from all pilotage unless a pilot be actually employed. All foreign vessels, and all vessels from a foreign port or bound thereto, and all vessels sailing under a register between the port of San Francisco and any other port of the United States shall be liable for pilotage as provided in section 2466 of this code.

SEC. 3014. No captain or other officer in command of any vessel sailing under a register, arriving at the port of San Francisco, nor any owner, consignee, agent, or other person having charge of such vessel, must, under a penalty of not less than $100 nor more than $1,000, land, or permit to be landed, any freight, passengers, or other persons from such vessel until he has reported to the quarantine officer, presented his bill of health, and received a permit from that officer to land freight, passengers, or other persons.

Towboats may be had at San Francisco, and several will generally be found cruising off the bar. Under favorable conditions of wind and tide sailing vessels do not require them when entering, but strangers are advised to take them.

Quarantine regulations for San Francisco Bay are prescribed by the Secretary of the Treasury and are embodied in the national quarantine regulations. The **National Quarantine Station** is at Angel Island. The quarantine anchorage is situated in the channel leading to San Pablo Bay, midway between Bluff and San Quentin Points, and 3 miles north-northwestward of Angel Island; it is marked by yellow buoys. Vessels are boarded near Alcatraz Island and, if subject to inspection, must not pass beyond the line drawn from Angel Island to the northern end of the sea wall.

The **Marine Hospital** is situated in the western part of San Francisco. The service has an officer and dispensary in the appraiser's building where out-patients are treated by an officer of the service, who is also the proper person to whom to apply for admission to the hospital.

Supplies.—Coal, fuel oils, provisions, and ship chandler's stores may be had in any desired quantity. Coal can be had at the wharves or in lighters. Water can be obtained on the wharves or by water boat.

Repairs to vessels and machinery of all kinds can be made. Docking facilities are ample. The largest dock is at Hunters Point; length 750 feet; width at top 122 feet, at bottom 74 feet; depth over sill at high water 32 feet. There is also a smaller dock here. Several other docks, floating and hydraulic, are located in San Francisco, and several marine railways are situated on San Antonio Creek and on the San Francisco water front.

A **time ball** is dropped daily except Sunday from the staff on the roof of the Fairmont Hotel at San Francisco exactly at noon of the one hundred and twentieth meridian; that is, at 8h. 0m. 0s. Greenwich mean time. The instant of noon is marked by the beginning of the fall of the ball. A notice is furnished for publication in the San Francisco daily papers stating whether the ball has fallen at the correct time, or giving the amount of error if any.

A **Coast and Geodetic Survey suboffice** is located at 306 Customhouse, San Francisco, where information relating to the coasts of the United States, Alaska, Hawaii, and Philippine Islands is furnished on application without charge.

A **United States branch hydrographic office** is established in the Merchants' Exchange Building, San Francisco. Bulletins are posted here giving information of value to seamen, who are also enabled to avail themselves of publications pertaining to navigation, to compare barometers and chronometers, and to correct their charts from standards. No charge is made for this service.

Storm-warning displays of the United States Weather Bureau are shown from a staff on the Merchants' Exchange Building, and from a staff on the chief wharfinger's office, just north of the ferry building, San Francisco, and can be seen by vessels at anchor in the harbor.

A commercial **radio station** is located here.

Buoy depot.—One of the depots of the twelfth lighthouse district is situated on Goat Island.

For variation of the compass see page 8.

CURRENTS, SAN FRANCISCO BAY AND TRIBUTARIES.

The main set of the waters off the coast is from the northwestward. Immediately **outside the bar** there is a slight current to the northward and westward, known as the coast eddy current. The currents at the San Francisco light vessel are described in detail under coastal currents, page 31. The currents most affecting navigation in this vicinity are the tidal currents. **Across the bar** the flood current converges toward the entrance, with a preponderance from the

southward, so that it is felt sooner around Point Lobos than around Point Bonita, and around both points earlier than across the Main Ship Channel. The ebb current spreads from the entrance over the bar, but the main strength is west-southwestward, parallel with the southern edge of the Four Fathom Bank, and through the Main Ship Channel. It is not strong across the Four Fathom Bank, and is hardly felt at all in the Bonita Channel, where, on the contrary, during the middle of the ebb a slight eddy current has been observed setting east-southeastward.

In the Golden Gate the flood current sets straight in, with a slight tendency toward the north shore, and with heavy overfalls both at Lime Point and Fort Point when strong. It causes an eddy in the bight between Point Lobos and Fort Point. The ebb current has been observed to have a velocity of more than 6½ knots between Lime Point and Fort Point and sets from inside the bay on the north side toward the latter point. Like the flood current, it causes an eddy in the bight between Fort Point and Point Lobos, and a heavy rip and overfall reaching about ¼ mile southward from Point Bonita. In the vicinity of Mile Rocks the currents attain a velocity of 2½ knots a few minutes after slack on both flood and ebb.

In the Golden Gate the current attains its average maximum rate (3.3 knots) inward 1.8 hours before the time of high water at Fort Point and its average maximum rate (3.4 knots) outward 1.4 hours before the time of low water.

Slack water in the Golden Gate occurs 1.3 hours after the time of high water at Fort Point and 1.7 hours after the time of low water. When the diurnal inequality in the tide is considerable, the ebb stream turns to flood about two hours after the time of higher low water. Daily predictions of the times of slack water in the Golden Gate and factors for obtaining the times of slack water at other points in San Francisco Bay are given in the tide tables.

Inside the Golden Gate the flood current sets mainly north-northeastward and northeastward and causes swirls from the Golden Gate as far eastward as Alcatraz and Angel Islands and through Raccoon Strait, northward of the latter island. The ebb current, inside the Golden Gate, is felt first along the south shore. In the Golden Gate the duration of the ebb stream is somewhat greater than that of the flood, but the amount of this excess has not been ascertained. At periods of great freshets in the Sacramento and San Joaquin Rivers, there have been instances of very slight surface current, or none at all, on the small flood in the Golden Gate.

Along the water front of San Francisco the current turns from flood to ebb 36 minutes after the time of high water at Fort Point, from ebb to flood one hour after the time of low water.

Along the channel, from the Golden Gate to the central portion of San Francisco Bay, the currents are nearly simultaneous.

When the land water discharge is small, the time of the currents in **San Pablo Bay**, off **Mare Island**, and in **Suisun Bay**, follow the times of the currents in the Golden Gate by one, two, and three hours, respectively.

The velocities in knots of the flood and ebb streams at average strength in various parts of San Francisco Bay are as follows:

Locality.	Velocity.	
	Flood.	Ebb.
Golden Gate	3.3	3.4
Three-fourth mile southeastward of Point Cavallo	2.0	2.0
One mile eastward of Yellow Bluff	1.9	1.9
Five-eighth mile northward of Black Point	2.1	2.4
Between city water front and Goat Island	1.7	2.3
Channel east of Goat Island	1.9	2.0
Eastern side of Southampton Shoal	1.4	1.8
Between Point Richmond and Southampton Shoal	1.9	2.1
Raccoon Strait	3.3	3.4
Off Pinole Point	1.7	1.9
Off Mare Island	1.7	2.2

GENERAL REMARKS ON APPROACHING SAN FRANCISCO BAY.

Vessels approaching San Francisco Bay in clear weather, by day or night, will experience no difficulty in making a landfall, as the aids to navigation, both natural and artificial, are prominent and easily distinguished. **From northward,** vessels will make Point Reyes, and when up with the point can lay a course for the light vessel, observing proper care to avoid Noonday Rock northward of the North Farallones, or use the Bonita Channel, as prudence and inclination direct. **From seaward,** vessels should make the Southeast Farallon and shape a course for the light vessel. **From southward,** vessels should make the light vessel, or if desiring to cross the bar southward of the Main Ship Channel make Point Bonita lighthouse and use the South Channel, or cross westward of the channel, as prudence and the condition of the bar warrant.

In thick weather, which prevails during a considerable portion of the year, vessels approaching from any direction must exercise great caution. The currents are variable and uncertain, at times attaining considerable velocity. A detailed description of the conditions which may be encountered and the precautions which should be observed is given on page 31.

From northward vessels endeavor to make Point Reyes fog signal. This signal may not be heard in the bight northward of the point, but the lead will indicate the position. If inside the 30-fathom curve and the signal is not heard, the vessel should be put broad offshore. Under certain conditions of foggy weather it has sometimes been found difficult to locate the signal owing to deflection in the direction of the sound, but by following the 30-fathom curve closely a vessel can round the point safely.

Cordell Bank lies about 20 miles 277° true (W by S mag.) from Point Reyes. Within the 30-fathom curve it is about 2 miles long in a northwest and southeast direction, with a width of about 2 miles. The least water given on the bank is 25 fathoms, rocky bottom, but 19 fathoms has been reported. Between the bank and Point Reyes

the depths increase to 66 fathoms; outside the bank the depths increase rapidly to 100 fathoms in 2 miles, and over 200 fathoms in 3 miles. Vessels from northward are sometimes guided by soundings on Cordell Bank, provided they can verify their soundings by the depths and characteristics of the bottom.

Strangers are advised not to use the Bonita Channel in thick weather. The approaches lead past Duxbury Reef, on which many vessels have been lost under similar conditions, and after passing the reef, unless the buoys are plainly seen and distinguished, the channel, on account of its comparatively narrow width, is dangerous to those not thoroughly familiar with it.

From westward vessels should exercise the greatest caution when inside of 100 fathoms, and if inside of 50 fathoms should head offshore and wait for clear weather or a pilot, unless the fog signal on the Southeast Farallon can be made. This signal can not be heard well from northward, especially during northerly or northwesterly winds. If northward of the Farallones, the 50-fathom curve followed southward should lead within sound of the fog signal, after making which a course can he shaped for the light vessel.

From southward vessels make the fog signal at Pigeon Point or Point Año Nuevo and lay a course to pass about 3 miles off Montara Point. when the fog signal at that point should be made: the depths should not be shoaled to less than 25 fathoms. When abreast Montara Point a course can be shaped for the light vessel, and the lead will be a good guide in approaching it and the bar.

Strangers without a pilot, after crossing the bar, are advised to anchor in about 10 fathoms and wait for a pilot or clear weather. Unless one is thoroughly familiar with the characteristics of the fog signals in the entrance and the peculiarities of the currents, entering in thick weather is hazardous, as the lead is of little value in the Golden Gate.

DIRECTIONS, SAN FRANCISCO BAY.

In the choice of the channel to be used in entering strangers should be guided by the following considerations:

The **South Channel** should be used only in clear weather and with a smooth or only moderately rough bar.

The **Main Ship Channel** should be used in thick weather unless the bar is inclined to break.

The Bonita Channel should not be used in thick weather. It may be used at any time when the aids can readily be seen, and at such times, if the bar is breaking, should be used in preference to the Main Ship Channel.

In thick weather and with the bar breaking strangers should stand offshore and wait for more favorable conditions.

Having these considerations in mind, the following directions, which connect with the coastwise directions given on page 40, may be used to enter by any of the above channels.

1. **By the South Channel.**—From a position 2 miles west-southwestward of Pigeon Point lighthouse, steer 344° true (NW by N mag.) for 22½ miles to Point Montara lighthouse abeam, distant 2 miles. Then steer 7° true (N by W mag.) for 13 miles to a position 400

yards west-southwestward of red buoy No. 2 S. Then steer 357° true (NNW mag.) for 2⅜ miles, passing 100 yards westward of buoy No. 4, and when Seal Rocks are abeam, distant ½ mile, change to 33° true (N by E ¼ E mag.) for 1⅛ miles to Mile Rocks light abeam, distant ¼ mile. Tnen steer 51° true (NE by N mag.) for 2½ miles to Lime Point light abeam, distant ⅜ mile, and proceed as directed in section 4 following.

2. **By the Main Ship Channel.**—Having made the light vessel, bring Fort Point lighthouse to bear 74° true (NE by E mag.) and steer for it on that bearing until Point Bonita lighthouse bears 344° true (NW by N mag.). Then make good a 63° true (NE mag.) course until Lime Point is abeam, distant ⅜ mile. Then proceed as directed in section 4 following.

3. **By the Bonita Channel.**—From a position 1½ miles southwestward of Point Reyes, steer 114° true (E ½ S mag.) for 18 miles to a position ¼ mile southwestward of Duxbury Reef gas and whistling buoy. Many vessels have been lost on Duxbury Reef, and great caution is essential on this course. The lead should be used constantly, and the vessel should be stopped a little short of her distance to the buoy to listen for its fog signal. Under no conditions should the vessel proceed beyond this point until the buoy has been located.

From the buoy steer 103° true (E ½ N mag.) for 6⅝ miles to ¼ mile northward of Bonita Channel gas and whistling buoy. Then steer 134° true (SE by E ¾ E mag.) for 2¼ miles, passing 100 yards southwestward of Bonita Channel gas and bell buoy, ¼ mile southwestward of Bonita Point lighthouse, and to a position with the light bearing 356° true (NNW mag.) distant ⅜ mile. Then steer 76° true (NE by E ⅛ E mag.) for 2⅝ miles to Lime Point lighthouse abeam, distant ⅜ mile.

Steamers leaving San Francisco Bay through the Bonita Channel on the ebb tide must mind their starboard helm when crossing the tide rip off Point Bonita. When the bow passes the rip the stern is thrown to port and, unless promptly met, the vessel is headed straight for the rocks off the point.

4. **If bound to the anchorage off San Francisco,** from a position about ⅜ mile southeastward of Lime Point lighthouse, steer 93° true (ENE ⅝ E mag.) for 2¾ miles, heading for the northeastern point of Goat Island and passing a little over ¼ mile northward of Presidio Shoal gas buoy and ½ mile southward of Alcatraz Island lighthouse. Then haul southward and follow the water front of San Francisco at a distance of about ½ mile. Anchor as desired outside the forbidden anchorage limits given under harbor regulations preceding.

If bound to San Pablo Bay or Mare Island Strait, vessels can use the following courses, which lead over a rocky area with a least depth of 30 feet westward of Alcatraz Island in a least depth of about 24 feet (1916) in the dredged channel through San Pablo Bay and about 25 feet (1916) in Mare Island Strait.

From a position ⅜ mile southeastward of Lime Point lighthouse steer 63° true (NE mag.) for about 3¼ miles, giving Point Blunt a berth of ½ mile. Round Point Blunt at this distance and steer 335° true (NW ⅛ N mag.) for 4⅜ miles heading for the western one of the Marin Islands, passing ¼ mile northeastward of Quarry Point

and Point Simpton (Angel Island) and 3/8 mile southwestward of Red Rock Bank buoy to a position with Red Rock abeam, distant 7/8 mile. Then steer 3° true (N by W 3/8 W. mag.) heading for the western one of The Sisters, off Point San Pedro, and passing westward of Invincible Rock and Whiting Rock buoys to East Brother Island lighthouse abeam, distant 1/2 mile.

From this position, steer 40° true (NNE mag.) for 5 3/8 miles to the gas and bell buoy at the southwestern end of the dredged channel. The courses through the dredged channel are 58° true (NE 1/2 N mag.) for 2 1/4 miles to the bend, then 79° true (NE by E 3/8 E mag.) for 2 1/4 miles to the gas and bell buoy at the eastern end.

If **bound to Mare Island Navy Yard,** from this position steer 74° true (NE by E mag.) for 1 5/8 miles, to a position 1/4 mile south-southwestward of the entrance to the strait, with a black buoy 1/8 mile on the port beam. Then steer north-northeastward for 1/4 mile to a position midway between the ends of the jetties and then 18° true (N mag.) for 1/4 mile to a position 50 yards westward of a red buoy. From here swing to a 333° true (NW mag.) course with the buoy astern until 3/4 mile from it, passing midway between the wharves at South Vallejo and those opposite, then bring the southwest side of the Starr mill at South Vallejo astern on a 321° true (NW by W 1/8 mag.) course to the navy yard, passing southwestward of a red buoy, and about 140 yards off the ends of the dikes on the southwest side.

SAN PABLO BAY

(chart 5533) is a nearly circular basin of water about 10 miles long in a northeast and southwest direction, with a greatest width of about 8 miles. The northern part consists of low marshes intersected by numerous sloughs with a large area of shoal water and mud flats that bare at extreme low tides. The southern shore is bolder, except between Point San Pablo and Pinole Point, where it is low and marshy for about 3 miles. At its eastern end it communicates with Suisun Bay by Carquinez Strait, and by Mare Island Strait northward with Napa Creek. There is considerable traffic through the bay; deep-water vessels pass through to load grain at points on Carquinez Strait, and to South Vallejo to load flour and discharge lumber; light-draft vessels, sail and steam, pass through for points on Suisun Bay and the Sacramento and San Joaquin Rivers, and on Petaluma and Napa Creeks.

The **main channel** through the bay extends in a gentle curve northward and eastward from the entrance to the eastern end of the bay. The average width between the 18-foot curves is a little over 1 1/4 miles, being a little wider at the southern end and about 3/4 mile wide at the eastern end. The channel across Pinole Shoal is being improved under a project to obtain a channel 500 feet wide and 30 feet deep. The controlling depth in 1916 was 24 feet. The dredged channel is marked on the north side by gas and bell buoys at each end, and by gas buoys between.

Point San Pedro and Point San Pablo are described on page 93.

There are several small landings on the southern shore of San Pablo Bay used by light-draft vessels; on the northern shore **McNears Landing,** near Point San Pedro, is the most important.

Petaluma Creek enters San Pablo Bay at its western end. It is being improved under a project to obtain a channel 6 feet deep and 50 feet wide across the flats to the entrance, and 4 feet deep and 50 feet wide to the head of navigation, 16 miles above the entrance, and these depths existed in 1916. A considerable amount of farm and dairy produce is carried in small vessels, sail and steam, and some general merchandise is received. The usual draft of vessels using the creek is 5 to 8 feet. The channel across the flats at the entrance is marked by lighted beacons, and above the entrance the chart is the guide. The creek is crossed by a railroad drawbridge near the mouth.

Pinole Point is a moderately high, rocky bluff projecting about 1 mile from the southern shore of San Pablo Bay, with a wharf built out from the east side of it to 10 feet. Powder works are located on this point. Shoals and flats, bare at low water, extend from Point San Pablo to Pinole Point, and from Pinole Point northeastward to Lone Tree Point.

The buildings of the **Selby Smelting Works**, on the southern shore abreast Mare Island, are quite prominent.

The high, white, pyramidal **skeleton towers** on each side of Carquinez Strait that carry electric-power cables across the strait are prominent in clear weather. The cables are too high to interfere with passing vessels.

Mare Island Strait (chart 5525) opens into San Pablo Bay at its eastern end, on the eastern side of Mare Island. It leads to South Vallejo and Vallejo on its eastern side and the navy yard on its western side, 2 miles above the entrance. A channel about 30 feet deep and 600 feet wide, widened to 1,000 feet abreast the navy yard, has been dredged from the entrance to the navy yard. It is subject to some shoaling and is redredged at intervals. The depth in 1916 was about 25 feet. It is well marked by lighted beacons and buoys. The channel is contracted by jetties on each side at the entrance (both marked by a lighted beacon on the end) and in several places above the entrance. For direction see page 102.

Carquinez Strait lighthouse (cream-colored tower on dwelling) is on the jetty on the eastern side of the entrance to Mare Island Strait, 230 yards from its end; there is a lighted beacon and fog signal (air siren) on the end of the jetty.

South Vallejo, on the eastern shore of Mare Island Strait inside the entrance, is the terminal of a railroad connecting with interior northern points. A large flour mill is located southward of the railroad wharf, and lumber wharves northward; they are prominent in entering. From 10 to 21 feet at low water can be taken alongside, depending on the locality. Communication may be had by rail and steamers with other points on the bay; there are also telegraph and telephone facilities.

Commission Rock, ¼ mile above the upper wharves at South Vallejo and a little eastward of mid-channel, was formerly awash, but the section inside the limits of the dredged channel 600 feet wide has been removed to a depth of 30 feet, and the section outside the channel to a depth of 20 feet. A red buoy marks the eastern side of the dredged channel at this point.

Vallejo, about 1 mile above South Vallejo, is a town of little commercial importance. It supplies a large amount of fresh provisions to the naval station and affords residences for the employees and others attached to it; it also serves as a distributing point for a considerable agricultural area in its vicinity. Communication with San Francisco and other points may be had by rail and steamer; a ferry makes regular trips to the navy yard.

At the **United States Naval Station**, on the western side of Mare Island Strait, is a large stone dry dock and extensive facilities for repairs in wood or iron. A time ball is dropped from a building near the ferry gate at noon, one hundred and twentieth meridian, or 8h. 0m. 0s. Greenwich mean time.

Napa Creek, the continuation of Mare Island Strait above the navy yard, has been improved by dredging to obtain a channel 4 feet deep and 75 feet wide to **Napa**, 17 miles above the entrance to Mare Island Strait. This depth has been obtained, but the channel is subject to considerable shoaling, and 2 feet at low water is the greatest depth that may be expected at some seasons of the year. The mean tidal range is about 5 feet. A considerable amount of farm and dairy produce is carried in vessels of 4 to 6 feet draft, steam and sail, to and from various points on the creek. The channel is marked by lighted beacons and buoys, and is easy to follow with the aid of chart 5533.

Directions through San Pablo Bay and Mare Island Strait to the navy yard are given on page 103.

For currents see page 99.

CARQUINEZ STRAIT

(chart 5534) connects San Pablo and Suisun bays and is about 6 miles in length in a general easterly direction. For the first 3½ miles it is a little less than ½ mile in width, and then expands to a width of about 1 mile. It is deep throughout with the exception of a small stretch of flats on the northern shore, and a smaller area in the bight on the southern shore near the eastern end. There are several small settlements on both shores.

Benicia, on the northern point at the eastern entrance, is the largest town. The United States Army reservation and arsenal are located at the eastern end of the town. The car ferry of the Southern Pacific Railroad between Port Costa and Benicia lands at the western part of the town.

Port Costa, on the southern shore, ships a large amount of wheat. Extensive warehouses for storing the grain occupy a considerable portion of the southern shore of the strait.

Martinez, on the southern shore, in the bight near the eastern entrance, is a small town of little commercial importance. This bight is used considerably by vessels for laying up. It affords excellent shelter with good holding ground, and the water is practically fresh.

SUISUN BAY

(chart 5534) is a broad, shallow body of water with marshy shores, and filled with numerous marshy islands, a large number of which have been reclaimed and are now under cultivation. It is practically the delta of the Sacramento and San Joaquin Rivers, which empty in

the eastern part of the bay. Two narrow, winding channels (northern and southern) lead to the mouths of the rivers. They are well marked by buoys and beacons and several lights. The rivers and the channels near their mouths have been improved by the Government with a view of increasing the depth, removing obstructions, and providing relief during seasons of freshet. The bay is used almost entirely by light-draft vessels, steam and sail, most of which possess local knowledge for its navigation. Strangers should take a pilot if bound above Benicia.

Sacramento River had a depth in 1916 at low river stage (middle of July to middle of November) of 7 feet to **Sacramento**, 4 feet to **Colusa**, 3 feet to **Chico Landing**, and 2 feet to **Red Bluff**, distant 52, 130, 175, and 220 miles, respectively, above the mouth. There is regular steamer communication between San Francisco and river landings as far as Colusa.

San Joaquin River had a depth in 1916 of 8 feet at mean lower low water to **Stockton**, 40 miles above the entrance, and 5 feet at high river stage (April to August) to **Hills Ferry**, 112 miles above the entrance.

Suisun Slough, emptying into the northwest side of Suisun Bay 5½ miles northward of Benicia, has been improved by dredging a channel 6 feet deep at mean lower low water to the head of navigation at the town of **Suisun**, 15 miles above the entrance, with a turning basin of the same depth at the head. The range of tide is about 7 feet. The commerce consists mostly of fuel oil, carried in vessels of not over 6 feet draft.

COAST FROM POINT REYES TO POINT ARENA.

This section of the coast trends in a general northwesterly and southeasterly direction for about 67 miles, with the exception of the first 10 miles, which trends nearly north and south. There are but few dangers, and these do not extend over 1 mile from the shore, and in thick weather the 30-fathom curve may be followed with safety. During the summer months the rocks are generally well marked by kelp, which extends in some cases to the 10-fathom curve. During the winter gales much of this is torn away. It is a safe rule to avoid all kelp.

In clear weather the mountains inland may be readily seen, and at times are visible when the lower land is shut in by haze or fog. In thick weather soundings should be taken frequently, as the currents are extremely irregular in both direction and velocity.

Lumber, farm, and dairy produce are shipped from several small landings, at most of which the loading and unloading of vessels is accomplished by the use of a wire cable.

Protection from the prevailing northwesterly winds of summer may be had at several places, but there is no shelter from the winter winds, which are usually accompanied by a heavy westerly swell.

Point Reyes is described on page 83.

From Point Reyes the coast trends in a general northerly direction for about 10 miles as a broad, white, sand beach backed by high grassy sand dunes. The entrance to a small lagoon lies 7½ miles north of Point Reyes, the northern point at the entrance being about 140 feet high.

A **coast guard station** is located near the beach 3 miles northward from Point Reyes, the buildings and flagstaff showing prominently from seaward.

From the northern end of the sand beach the coast curves northwestward for 6 miles in high, yellow, rocky cliffs, terminating in **Tomales Point**, the south point at the entrance to Bodega Bay. A small, rocky islet, 60 feet high, lies 5/8 mile southward from the point, about 1/4 mile offshore.

Bodega Head, 240 feet high, lies 4 1/2 miles northwestward from Tomales Point. The summit is rounding and grassy, with steep, rocky cliffs on the southern and western ends. **Bodega Rock**, low, lies 1/3 mile southeastward from the southeastern face of the head. Foul ground extends 3/8 mile southward and southeastward from the rock. A gas and whistling buoy (flashing white light) is placed 1 1/8 miles southwestward from Bodega Rock.

Bodega Bay (chart 5627), included between Tomales Point and Bodega Head, is about 6 miles in length in a northwest and southeast direction, with a width of 1 1/2 miles. It affords shelter from northwesterly weather at its northern end, but is dangerous in southerly or westerly weather. Northward of the bay, and separated from it by a narrow strip of sand beach, is a shallow lagoon connected with the bay by a narrow channel. The depths over the bar at the entrance to this channel are from 7 to 8 feet at low water, but are variable and subject to change during heavy southeasterly or southwesterly gales. Some farm produce and fish are shipped in light-draft vessels to San Francisco. Local knowledge is necessary for the bar and inside channels.

To ANCHOR in Bodega Bay, round Bodega Rock, giving it a berth of 3/4 mile, until Bodega Head bears 280° true (W 3/4 S mag.) just open northward of Bodega Rock; then steer 333° true (NW mag.) for about 3/4 mile and anchor in 5 to 6 fathoms, 1/2 mile from the beach, with Bodega Rock bearing about 215° true (S by W 1/2 W mag.). Anchorage may be had closer to the beach if the vessel's draft permits. On the approach of southerly or westerly weather vessels should leave at once.

Tomales Bay (chart 5618) enters in the southern part of Bodega Bay immediately eastward of Tomales Point and extends southeastward for 12 miles with an average width of 1/2 mile. It is much obstructed by shoals, through which are several channels used by light-draft vessels with local knowledge. The depths on the bar at the entrance to the bay are from 8 to 9 feet at low water, but are variable and subject to change in heavy weather. Some farm produce, fish, and clams are shipped from here to San Francisco. Communication may be had by rail and telegraph from several points near the head of the bay. No directions can be given that would be of value to a stranger.

Northward of Bodega Head the cliffs are about 200 feet in height for 2 miles, and are then succeeded by a broad sand beach 2 miles long, backed by sand dunes 120 feet high. From this point the coast northward consists of abrupt, rocky cliffs, broken by gulches, to the mouth of the **Russian River**, 10 miles northward of Bodega Head.

Numerous rocks, from 20 to 130 feet high, lie offshore in some cases over 1/4 mile. **Gull Rock**, 100 feet high, lies 1 1/4 miles southeastward

from the mouth of Russian River and ¼ mile offshore. About ½ mile northwestward from Gull Rock and 400 yards offshore is a large arched rock, 85 feet high and flat on top. This is the largest arched rock on this part of the coast.

Ross Mountain, 2,205 feet high, is the highest knob on the ridge backing the coast northward of Russian River and lies 3 miles inland northward from its mouth. It has a few bunches of trees near the summit. The slopes are bare of trees and the gulches are wooded.

From Russian River to Fort Ross Cove the coast is high, consisting of bare, steep spurs from Ross Mountain. A sunken reef extends ¾ mile from shore 4½ miles northwestward of Russian River. It is marked by a whistling buoy placed about ¼ mile southward of the reef. Vessels should not attempt to pass eastward of the buoy.

Fort Ross Reef (Pinnacle Rocks) lies about 5¾ miles northward from the Russian River and nearly 1 mile eastward from Fort Ross Cove. The rocks are 35 feet high, about 600 yards offshore, and connected with the beach by a reef, which is partially marked by kelp.

Fort Ross Cove (chart 5651), 15 miles northward of Bodega Head and nearly 33 miles northward from Point Reyes, affords fair shelter in northwesterly weather. The holding ground is poor and the anchorage contracted by a rock awash in the middle of the cove and a sunken rock about 50 yards northward of it with but 14 feet over it. The cove is divided into two bights, the western one being slightly the larger. A landing chute extends eastward from the western point with 16 feet at its outer end. Some lumber and dairy produce are shipped and general merchandize received. Communication by wagon road and telephone may be had with the interior. This anchorage is suitable for small vessels only, and if used by strangers should be entered with caution, as no directions can be given that would be of value.

From Fort Ross Cove the coast extends northwestward and is nearly straight. It is bold and wooded to the crests of the hills, which approach it closely. It is cut by numerous gulches and bordered by many rocks, which, as a rule, are close inshore. Several landings, some abandoned, are on this stretch of the coast. The 30-fathom curve is an average distance of ¾ mile from shore from Fort Ross Cove to near the Gualala River.

Salt Point, 5 miles northward from Fort Ross Cove, is about 35 feet high, very rocky, and bare of trees. It is bordered by outlying rocks for about 200 yards. The 30-fathom curve is less than ½ mile off this point.

Gerstle Cove, or **Salt Point Landing**, is a contracted cove and landing under Salt Point, now practically abandoned.

Fisk Mill Cove, with a post village (**Fisk**), 2½ miles northward from Salt Point, affords fair northwest shelter for small vessels. The bottom is rocky, but there are no hidden dangers.

Horseshoe Point, 3 miles northward from Salt Point, is a cliff 180 feet high, with a depression of 60 feet immediately behind it. It is bare of trees, but the summit is marked by several projecting rocks.

From Horseshoe Point the coast trends about NW by W mag. for 12½ miles to the Gualala River, and consists of cliffs about 60 feet high, bordered by numerous outlying rocks. The tree line is from ⅛ to ½ mile back from the edge of the cliffs.

Stewarts Point Landing is a post village 3 miles northward from Horseshoe Point. Some lumber and a small amount of farm and dairy produce are shipped. Communication may be had by stage and telephone. Vessels are loaded by wire cable, mooring buoys being placed in the cove in 5 to 6 fathoms. About 350 yards off the southern point of the cove are two sunken rocks, each of which is well marked by kelp. The buildings are readily made from seaward. There is fair shelter for a small vessel in northwesterly weather in 5 to 6 fathoms, hard sandy bottom. No directions are considered necessary.

Black Point Landing is 5½ miles northwestward from Horseshoe Point. It is unprotected and wire cable is used for loading.

About 4 miles northwestward from Black Point and 3 miles southeastward from the Gualala River is a sand beach ½ mile long, backed by high sand dunes parallel with the beach; these dunes are quite prominent.

Del Marr Landing is located 5 miles northwestward from Black Point, and 2 miles southeastward from the Gualala River. It is unprotected, and wire cable is used for loading.

Gualala Point Island lies 15¾ miles southeastward from Point Arena, and 1 mile south of the Gualala River. It is 42 feet high, about 300 yards offshore, and connected with the bluff by a rocky reef; sand dunes extend behind the bluff for 600 yards.

The **Gualala River** enters 15 miles southeastward from Point Arena. A long sand beach extends 1 mile southward from the mouth. The smoke from the sawmills can sometimes be seen. The old landing is abandoned and the lumber is now shipped from Bowens Landing.

Robinson Reef lies northward of the mouth of the Gualala River, and 1⅛ miles northward of Gualala Point Island. It is a cluster of twenty-five or thirty rocks above water about 600 yards offshore, with a sunken rock, 70 yards west-northwestward from the outer visible rock.

Bowens Landing is 1½ miles northwestward of the Gualala River. It is connected by railway with the mills on the Gualala River, and exports considerable lumber, ties, shingles, and some tan bark. Communication may be had by stage and telegraph. Vessels are loaded by wire cable. The anchorage is exposed and can be used only in summer. A reef projecting a short distance westward from the point breaks the force of the swell for vessels loading at the moorings, which are heavy. There are 5 to 6 fathoms at the outer moorings, and about 17 feet at the inner buoys. Local knowledge is necessary on account of several sunken rocks in the approaches.

Fish Rock Landing (Havens Anchorage) is 12 miles southeastward from Point Arena, and 4 miles northwestward from Gualala Point Island. Some lumber, ties, and tan bark are shipped from this point. Communication may be had by stage and telegraph. Shelter from northwest winds may be had in the cove southward of Fish Rock. Vessels of 200 tons may use the cove, which is contracted by rocks and sunken ledges extending 250 yards southeastward from western head. Strangers should approach the anchorage with caution.

Fish Rocks are two rocky islets, connected at low water and surrounded by numerous smaller ones, 4¼ miles northwestward of Gualala Point Island. The outer one is 150 feet high, and the inner

100 feet high and 100 yards offshore; a rock, 40 feet high, lies 175 yards southeastward from the outer rock.

Havens Neck is a prominent head 145 feet high, 5/8 mile northwestward from Fish Rock; it is bare of trees and connected with the bluffs by a low neck.

Gualala Mountain, 2,210 feet high and heavily wooded, is a prominent feature in clear weather. It is about 5 miles inland northeastward from Havens Neck.

Sail Rock, 44 feet high, is a sharp, pyramidal rock 800 yards offshore 2 3/4 miles northwestward from Fish Rock. From off Point Arena it resembles a small vessel under sail.

Saunders Reef, 4 1/2 miles northwestward from Fish Rock, lies a little over 1/2 mile offshore. It shows several rocks awash at low water and is well marked by kelp. Foul ground exists between it and the shore. A whistling buoy is placed in 17 fathoms 3/8 mile southwestward from the outer rock and 7 1/2 miles southeastward from Point Arena. Vessels should not pass inside the buoy.

Arena Cove lies 2 1/2 miles southeastward from Point Arena, and is a slight indentation affording shelter to small vessels in northwesterly weather. The southern head is a high yellow cliff that under favorable circumstances is visible for a considerable distance seaward. A wharf is at the head of the cove, with 13 feet at its outer end. There are mooring buoys and a wire cable in addition to the wharf. Considerable farm and dairy produce are shipped; general merchandise is received. Some provisions may be had and water obtained by hose. The post village of **Point Arena** is situated about 1 mile back from the landing. Communication may be had by stage and telegraph; a coasting steamer makes regular weekly trips. A coast guard station is located in the cove.

A bell buoy is placed 5/8 mile southwestward from the end of the wharf.

To ENTER, make the bell buoy; then bring the end of the wharf to bear 74° true (NE 7/8 E mag.) and stand in on this course. This leads about 150 feet southward of a rock, with 13 feet over it, that lies 300 yards 264° true (SW by W 3/4 W mag.) from the end of the wharf. In thick weather during the summer, in approaching the cove from northward or southward the edge of the kelp may be followed, which will lead to within 300 yards of the bell buoy.

A break is reported in heavy southwest swell about 3/4 mile west-southwestward from the north point of Arena Cove, and scattered kelp extends almost out to that position.

Point Arena is the first prominent point north of Point Reyes. It consists of a long, level plateau, diminishing in height to the end of the point, which is 60 feet high. It is bare of trees for about 1 mile back of the point and is marked at its extremity by **Point Arena lighthouse,** a white cylindrical tower. The light is group flashing white every 6 seconds (flash 0.5 second, eclipse 1 second, flash 0.5 second, eclipse 4 seconds), 155 feet above the water, and visible 19 miles. The fog signal is an air siren, sounding a group of four blasts, each of 2 seconds' duration, every 60 seconds, silent intervals 28 seconds. This fog signal is not as efficient as desirable, and the navigator should not count on hearing it at a greater distance than 2 miles when abeam.

A sunken reef, usually showing breakers, extends ⅝ mile northwestward from the extremity of the point.

Arena Rock, with 13 feet over it, lies a little over 1¼ miles 340° true (NW ½ N mag.) from Point Arena lighthouse, and shows a breaker except in very smooth weather.

COAST FROM POINT ARENA TO CAPE MENDOCINO.

From Point Arena the coast extends in a general north-northwesterly direction for about 50 miles and then trends west-northwest for nearly 35 miles to Punta Gorda, from which point it trends north-northwest for 10 miles to Cape Mendocino. The southern portion is less bold and rugged, and the mountains are neither so high nor so close to the coast. The dangers are all included within the 30-fathom curve, and with the exception of Blunts Reef and the other reefs in the vicinity of Cape Mendocino do not extend more than 1 mile offshore. Between Point Delgada and Cape Mendocino are several deep submarine valleys, heading in some cases within ½ mile of the beach; great caution and frequent use of the lead are necessary in thick weather when in the vicinity, owing to the irregularity of the currents and soundings.

In clear weather the mountains are good landmarks and can frequently be seen when the lower land is obscured by fog or haze.

Lumber and farm and dairy produce are shipped from several points, the loading and unloading of vessels being accomplished in the majority of cases by wire cable.

Protection from the prevailing northwesterly winds of summer may be had in a few places, but there is none from southward or westward.

Point Arena is described on page 110.

From Point Arena the cliffs of the point extend ½ mile northeastward to the mouth of the Garcia River, from which sand dunes and beaches extend northward for about 4 miles. Beyond this for 40 miles to Ten Mile River beach the coast is rugged, with high, bold cliffs bordered by numerous outlying rocks.

Mal Pass is a steep gulch 5¼ miles northward from Point Arena; the bluffs on each side are nearly 280 feet high.

Red Bluff, a prominent, reddish cliff about 200 feet high, is 8 miles northward of Point Arena.

A rocky islet, 93 feet high and ½ mile offshore, lies 1¼ miles north of Red Bluff.

The coast from Greenwood Landing to Fort Bragg is shown on chart 5703.

Greenwood Landing (Elk P. O.) is 10½ miles northward from Point Arena. An incline runs from the cliff down to a cluster of three rocks, from which a wire cable leads for loading and discharging. Vessels ride to mooring buoys on the north side of the rocks in 6 to 7 fathoms; the shelter is only fair. Considerable lumber is shipped, together with tan bark, farm and dairy produce; general merchandise is received. Communication may be had by stage and telegraph; small coasting steamers call here several times a month. Provisions may be had in limited quantities. The buildings in the town are prominent by day from seaward; at night the glare from the electric lights is conspicuous.

A bell buoy marking the approach is placed ½ mile west-southwestward of the outermost rock.

No directions that would be of value to a stranger can be given.

Cuffeys Cove, ¾ mile northward from Greenwood Landing, is a small, contracted anchorage affording fair shelter in northwesterly winds. The outer point at the entrance to the cove is 140 feet high, with a rocky islet 46 feet high 450 yards westward. The approaches are obstructed by several sunken rocks and should not be attempted without local knowledge. The landing and village are abandoned.

From Cuffeys Cove to the Navarro River, about 3 miles, the coast consists of cliffs 200 feet high, bordered by outlying rocks.

Navarro Landing, at the mouth of Navarro River, is now abandoned. Shelter is only fair from northwesterly winds.

Navarro Head, on the north bank of the Navarro River, is 405 feet high.

Salmon Point, the south point at the entrance to Whitesboro Cove, 1¼ miles northward from the Navarro River, is a treeless cliff 100 feet high. Detached rocks extend westward from the point for ¼ mile, with a sunken ledge usually showing a breaker ½ mile 283° true (W ½ S mag.) from the extremity of the point. This ledge is locally known as **Bull Rock**; in heavy swell there are breaks showing between it and the visible rocks off the point.

Albion River and landing (chart 5703) are 2 miles northward from Navarro Head and 16½ miles northward from Point Arena. The cove affords good shelter in northerly weather, but is open southwestward. The south point at the entrance rises to a knoll 179 feet high, and lies ⅔ mile from Salmon Point. Low rocks extend nearly ¼ mile westward from the point. The north point is a rocky islet 80 feet high lying close to the point, which has the same elevation. Both are bare. Small visible rocks lie 200 yards westward from the islet and sunken rocks, showing breakers in a moderate swell, extend out more than ¼ mile west-southwestward from it. Two hundred and fifty yards southward from the islet, and fairly in the middle of the entrance, lies a sunken rock, usually showing a breaker, which is the principal danger in the approach.

In the middle of the cove, as seen from seaward, lies a pyramidal rock about 30 feet high, known as the **Mooring Rock,** from which small rocks stretch to a point on the north shore. These protect a wharf built out northwestward from the north side of the river and curving to almost due west to within 160 yards of the Mooring Rock. Small steamers lie to moorings off the end of the wharf in 13 to 14 feet and load from it. Larger vessels are moored southward from the rock in 28 to 30 feet and load by means of a wire cable from the end of the wharf.

A whistling buoy is placed off the cove nearly ⅔ mile 261° true (SW by W ½ W mag.) from the Mooring Rock, and in line with it and the end of the wharf.

The post village of **Albion** is situated on both high banks of the river; the sawmill and several buildings are on the low flat on the north side of the mouth.

Considerable lumber is shipped to both foreign and domestic ports. Communication may be had by stage and by telegraph and telephone. Water and some provisions may be had, but no coal.

To Enter.—From the whistling buoy head for the Mooring Rock, course 81° true (NE by E ½ E mag.), until within 200 yards of it, which is where the outer mooring buoys are laid.

Northward of Albion River, between it and Colby Reef, breakers are seen in heavy swell nearly ½ mile from shore, and vessels should not approach closer than 1 mile.

Stillwell Point is a bold, sharp cliff, 190 feet high, 1½ miles northward from Albion River. A rocky islet, 150 feet high, lies close inshore on its northwestern side.

Colby Reef, 1¼ miles northward from Albion River, lies ⅝ mile offshore abreast Stillwell Point. It consists of three sunken rocks, two of them close together with 6 feet over them, and a third awash at low tide about ¼ mile southward of the others. They lie about on the line of the 20-fathom curve with 7 to 15 fathoms close-to. There is foul ground between the reef and the shore.

Little River lies 4¾ miles northward from Navarro Head and 19 miles northward from Point Arena. The northwest shore of the cove is bluff and rocky, and bare of trees for over ½ mile. Good shelter from northwestward and fair protection from southward is afforded by the reef and rock on the southern side of the cove, which are well marked by kelp. It is open westward, and bad, especially for sailing vessels, owing to the narrow entrance and heavy undertow when in the vicinity of the rocks. The anchorage is about 300 yards in diameter, with depths of 4 to 5 fathoms. Some lumber and farm produce were formerly shipped, but there is no traffic at present, and the wharf is out of repair. No supplies are obtainable. Communication may be had by stage and telephone. The channel in entering is 125 yards wide and is obstructed by two sunken rocks which reduce it to about 60 yards in width abreast the inner visible rock. In entering bring the end of the wharf to bear 37° true (N by E ⅝ E mag.) and stand in on that bearing, passing 30 yards northward of the inner visible rock. After passing this rock anchor in from 4 to 5 fathoms. Strangers should not enter without a pilot.

From Little River to Mendocino Bay the coast is a broad tableland with a seaward face of cliffs, 40 to 60 feet high, bordered by numerous low rocks; the tree line is over ½ mile from the cliffs.

Mendocino Bay (chart 5719) lies 21 miles northward from Point Arena, and affords fair shelter in northwesterly weather, but vessels are obliged to leave in southerly or westerly weather. In heavy southwesterly gales the sea breaks clear across the entrance. It is ⅞ mile long in a north and south direction with a width of a little over ¼ mile. The northern point at the entrance is a broken cliff, 60 feet high, bordered by numerous rocks close inshore. The southern point is a rocky, irregular cliff 100 feet high, bordered by numerous rocks, with a reef extending 150 yards northwestward toward the northern point. A continuation of this reef, in the form of a rocky area having a least depth of 20 feet at low water, extends northwestward from the outermost bare rock a farther distance of 500 yards. This area could be avoided when there is any swell running.

A knoll, 156 feet high, lies 300 yards back from the point. The town of **Mendocino** is situated on the northern shore of the cove. **Big**

River enters in the northeastern part of the cove; a sawmill is situated ½ mile above the mouth on the north bank. Vessels load and discharge under a wire cable from the northeast face of the north point, where at low water there is a depth of 36 feet. Considerable lumber is shipped, together with farm and dairy produce; general merchandise is received. Provisions, fresh meat, and water can be had, but no coal. The bulk of the carrying trade is handled by steam schooners. Large steamers load here occasionally for foreign ports. Mooring buoys are placed for warping into position under wire cable, and for riding-to in case the landing is occupied by other vessels. Communication may be had by stage and telegraph or telephone. The buildings in the town are the prominent features when in the vicinity of the bay.

To ENTER, bring the south point of the river to bear 68° true (NE ⅜ E mag.) and stand-in on that bearing, giving the north point at the entrance a berth of 250 yards. When this north point is a little abaft the beam, anchor in from 5 to 6 fathoms, or make fast to the outer mooring buoy. This course clears the dangerous sunken ledge, lying 500 yards northwestward from the outer visible rock off the southern point.

In **Russian Gulch**, 2 miles northward of Mendocino Bay is a wire cable loading place on the north side, used in summer only, for loading ties, fence posts, and split timber.

Point Cabrillo is 3 miles northward of Mendocino City and 24 miles northward of Point Arena. It is a flat-topped point, 50 to 60 feet high, terminating seaward in nearly vertical cliffs; numerous low rocks extend offshore over 200 yards and the 30-fathom curve is barely ¼ mile outside of them. The point is bare, with the tree line about ½ mile back.

Point Cabrillo lighthouse, a white tower on dwelling, marks the point. The light is flashing white (flash 1 second, eclipse 9 seconds), 84 feet above the water, and visible 15 miles. The fog signal is an air siren (blast 2 seconds, silent 2 seconds, blast 2 seconds, silent 24 seconds).

From Point Cabrillo the coast trends northward for 9 miles to Laguna Point as a nearly straight line of bluffs with numerous rocks close under the cliffs. It is moderately high, wooded to the face of the cliffs, and is broken by several indentations and small streams. The 30-fathom curve is an average distance of 1 mile from shore.

Caspar Anchorage (chart 5705), ¾ mile northward from Point Cabrillo, is a small cove, about ⅜ mile wide, at the head of which is the mouth of Caspar Creek. Fair shelter, except from westward, is afforded. The anchorage is contracted, and is used only by coasting steamers when the sawmill is in operation. There is a chute with 14 feet at the end, projecting from the north shore of the cove, and wire cable is also used. Mooring buoys are placed for warping into position. The post village of **Caspar** is situated on the north bank of the creek near its mouth. Communication may be had by stage and by telegraph and telephone. Provisions may be had in limited quantities, and water can be obtained at the chute.

To ENTER, local vessels steer for the slab fire at the mill just open of the north point at the mouth of the river, course 110° true (E mag.). This course leads to the moorings.

From Caspar Creek to Noyo Anchorage the coast consists of broken, irregular cliffs, 40 to 60 feet high, with numerous rocks extending in some cases 400 yards offshore. These are fairly well fringed by kelp, especially in summer.

Noyo Anchorage, about 5 miles northward from Point Cabrillo, is less than ½ mile long and ¼ mile wide, and while affording fair shelter from northward or southward, is open westward. The anchorage is limited to an area about ¼ mile long and less than ⅛ mile wide, with depths of 3½ to 7 fathoms. Heavy mooring buoys are placed for vessels to ride-to while loading. This anchorage is used by the lumber company at Fort Bragg for loading vessels whose draft is too great to permit of their reaching the Fort Bragg wharf. Such vessels are generally towed in and out by the local steam schooners, or a pilot may be obtained at Fort Bragg. Loading is by means of wire cable from the north point, the vessels being moored in a depth of 35 feet. This anchorage is more exposed than the one at Fort Bragg, and is generally used only from about March 1 to November 1.

Noyo River enters at the head of the cove, and the post village of **Noyo** is situated on the north bank of the river near the mouth. The lumberyard and loading station on the north point at the entrance are prominent from seaward. Supplies may be obtained at Fort Bragg, from which point there is communication by rail, and by telephone and telegraph.

To ENTER, bring the south point at the entrance to the river to bear 109° true (E mag.) and head in on that bearing until the north point at the entrance to the cove is a little abaft the beam, then head for the outer mooring buoys, or head a little southward and anchor in the middle of the cove in about 4½ fathoms. The 109° true (E mag.) course in entering passes 100 yards northward of a rock, with 10 feet over it, lying 400 yards 332° true (NW ¼ W mag.) from the south point at the entrance, and about 75 yards southward of a rock awash lying a little over 100 yards southward from the north point at the entrance to the cove. Strangers should enter with caution.

From Noyo River to Fort Bragg Landing, about ⅔ mile, the coast consists of rocky cliffs, 40 to 60 feet high, bordered by rocks and sunken ledges extending 100 to 400 yards offshore.

Fort Bragg Landing (chart 5703) is 30 miles northward from Point Arena in the small cove formerly known as Soldiers Harbor. The cove is ⅜ mile long and ¼ mile wide, but is contracted to much less by the rocks and ledges extending from both points, and there is no room to anchor. The clear channel leading to the wharf is about 125 yards wide at the entrance between the breakers, but once inside is smooth and affords fair shelter in northwesterly and southeasterly weather; in westerly weather it is wide open. A rocky reef, partly bare at high water, extends southwestward from the northern head and breaks the force of the swell from northwestward.

The town of **Fort Bragg** is near the head of the cove. It is now the largest coast town between San Francisco and Eureka. Considerable lumber is shipped, with some farm and dairy produce. Shipments normally average 5 cargoes a week, and are continued throughout the year, with an occasional interruption due to bad weather. Vessels load and discharge at the wharf, which extends 600 feet

from the head of the cove to a depth of 20 feet at low water. The bottom on the north side of the wharf is rocky; on the south side, sandy. Mooring buoys are provided for breasting off from the dock when necessary on account of the swell entering the cove. Such action does not interfere with the handling of cargo, which is done entirely from the wharf.

There is communication by rail, and by telegraph and telephone. There is no passenger traffic by water. Provisions and water can be obtained, but no coal. There is a machine shop at the sawmill, where minor repairs to machinery can be made.

Quarantine is enforced in accordance with national regulations; there is also a good private hospital.

Pilots may be obtained by making signal off the town.

Storm warnings are displayed by the United States Weather Bureau, plainly visible from the harbor.

The buildings of the town are prominent by day and the electric lights by night.

A whistling buoy is placed ¾ mile west-southwestward from the wharf.

To Enter.—From a position 200 yards southward of the whistling buoy steer 83° true (NE by E ¾ E mag.), keeping the west gable of the mill in range with a square white bell tower surmounted by a small open cupola. This range leads midway between the reefs and to the wharf, but great caution must be used on account of the undertow.

From Fort Bragg Landing to Laguna Point, about 3 miles, the coast is moderately low and rocky, and cut by two small streams. The tree line is within ¼ mile of the beach.

Laguna Point is 8½ miles northward from Point Cabrillo, near the southern end of Ten Mile River beach. It is a small, projecting cliff 30 feet high, flat-topped, and bare of trees for 600 yards; it is noticeable only when close inshore. A bare reef extends 300 yards northwestward from the point.

Cleone (Laguna Landing) immediately northward of Laguna Point, is of little commercial importance. It is exposed and only available for small steamers. It affords fair protection in southerly weather, and is occasionally used in winter. Some lumber was formerly shipped, but this is now carried by rail to Fort Bragg.

Bald Hill, 810 feet high, lies 2½ miles 120° true (E by S mag.) from Laguna Point and is a prominent landmark on account of its top and southwest slope being bare of timber.

For ½ mile northward from Laguna Point the bluffs are low, and northward of these a straight sand beach extends for 3 miles to the mouth of Ten Mile River. The beach is backed by sand dunes for ½ mile inland, with the tree line about 1½ miles from the beach.

From Ten Mile River the coast extends in a general northwesterly direction for 52 miles to Punta Gorda. This stretch of the coast is particularly bold and rugged, bordered by numerous rocks, and as far as Point Delgada is heavily timbered. Northward of Point Delgada the tops of the ridges are generally bare or only partly covered with trees and brush. The cliffs along the shore range from 40 to 100 feet in height. The high, rugged mountains in the vicinity of the coast, which reach elevations of 3,000 to 4,000 feet, are prominent.

Bruhels and **Bells Points** are two small points, 3 and 4½ miles, respectively, northward of Ten Mile River. They are not noticeable unless close inshore.

Bells Mountain, ½ mile eastward from Bells Point, is 1,040 feet high, bare on top, and with a few trees on the ocean side. It is the principal landmark for Westport Landing.

Westport Landing, 12 miles northward from Fort Bragg Landing, is at present practically abandoned. It is exposed, and suitable only in summer and in smooth weather when an occasional small steamer calls for a cargo of ties. There are a few houses on the small flat at the foot of the hills, but little or no business is transacted. Mooring buoys are placed for warping into position and a wire cable is used for loading. There is from 24 to 26 feet at the moorings, but this is subject to change, depending on the prevailing winds and swell; at times there are 3 to 4 feet less. Communication may be had northward by wagon and telephone, and southward by stage and telegraph and telephone. The buildings in the village, especially a yellow hotel and a white church, are the most prominent features from seaward. No supplies of any kind are available and provisions in limited quantities only.

Gordons Hill, 772 feet high, lies 6½ miles northward from Ten Mile River; it is bare to the summit and terminates seaward in **Abalone Point,** 60 feet high, with low, outlying rocks.

Union Landing and **Hardy Creek Landing,** about ½ mile apart, at the mouths of Juans Creek and Hardys Creek, respectively, are 2½ miles northward of Abalone Point. Both are wire cable landings used by steam schooners.

From Abalone Point the coast trends northwestward for 4 miles to **Cape Vizcaino,** which is a broad, irregular line of precipitous cliffs, 100 feet high, very broken and bordered by low rocks, 200 to 300 yards offshore. A rocky islet, **Island Knob,** 200 yards long and 100 feet high, lies close-to and almost connected with the point. A breaker lies 275 yards westward and southward from the northwest point of the islet.

Cottaneva Rock, 20 feet high, is a small rock about 500 yards southeastward from Island Knob, and 275 yards offshore. Several smaller rocks lie inside of it, and two others about 160 yards northwestward.

Cahto Mountain, about 4,231 feet high, is 11½ miles eastward from Cape Vizcaino, and in clear weather is prominent as a landmark.

Between Cape Vizcaino and Point Delgada are several small, exposed landings available for use only in the summer and in smooth weather. These landings ship ties, tan bark, and shingles, and then only when they can be handled at a profit, and the landings are abandoned or revived according to commercial demands. Wire cables are used in loading and discharging, mooring buoys being placed where necessary. Supplies are not obtainable and communication is irregular. The principal landings are **Rockport, Monroe Landing, Ussal, Bear Harbor,** and **Needle Rock.**

Double Rocks, 15 and 20 feet high, lie 3½ miles northward from Cape Vizcaino, and 300 yards offshore.

Ussal Rock, 5½ miles northward from Cape Vizcaino, is 50 feet high and always black in color. It lies 200 yards off a small point of rocks.

The mouth of **Ussal Valley** lies 1 mile northward of Ussal Rock, and is a narrow, steep gulch in front of which is a small area of flat land with a low beach; a small, grassy hillock is just inside the gulch. The view up the valley is open for a very short time while passing.

Big White Rock, 100 feet high, is 2 miles northward from Ussal Valley, and 125 yards offshore from the steep cliffs, which are bordered by numerous rocks. This rock is a prominent feature when the higher points of the land are in fog.

Anderson Cliff, 2 miles north of Big White Rock, is a projecting rocky spur, 680 feet high, with one large rock and numerous smaller ones close inshore.

Cluster Cone, 80 feet high, is the whitest and most conical of a small cluster of high rocks 200 yards offshore, 4¾ miles northward of Big White Rock. The largest rock is over 100 feet high.

A small, white rock lies 5 miles northward from Cluster Cone Rock and 4 miles southward from Point Delgada. It is close inshore and just outside the low-water beach.

From a little below the small, white rock to Point Delgada the country is not timbered but is covered with dense, low brush, which presents a uniform dark green appearance.

Point Delgada lies 66 miles northward from Point Arena, and nearly 20 miles southward from Punta Gorda. It is a cliff-faced plateau making out about 1 mile from the general trend of the coast. The seaward face of the plateau is 1 mile long and bordered by numerous rocks.

Shelter Cove (chart 5773) lies under the southern face of Point Delgada, and affords fair shelter in northwesterly weather, but is exposed and dangerous with southerly or westerly winds. There is nearly always a swell running. A wharf has been built in the western part of the cove and has about 15 feet at the end. Some farm produce is shipped and general merchandise received. A wagon road leads to the interior. Coasting vessels stop here irregularly. No supplies are obtainable, but water may be had. A gas and whistling buoy is placed 1½ miles 215° true (S by W ⅜ W mag.) from the end of the wharf. The best anchorage is in 5 fathoms, a little over ¼ mile southeastward from the wharf, with the southern extremity of Point Delgada bearing 290° true (W mag.). Two pinnacle rocks close together, with 15 feet over them, lie a little over ½ mile 154° true (SE mag.) from the point. These are usually well marked by kelp. A rock, with 14 feet over it, lies a little over ¼ mile 143° true (SE by E mag.) from the point. This also is usually well marked by kelp.

To ENTER, pass ¼ mile southward of the gas and whistling buoy and steer 70° true (NE ½ E mag.) for 1 mile, until the end of Point Delgada bears 321° true (NW by W ¼ W mag.). Then change to 349° true (NNW ¾ W mag.), which course leads to the anchorage. If coming from northward, Point Delgada should be given a berth of not less than 1 mile when heading for the buoy.

A submarine ridge, known as the **Tolo Bank,** extends southward from Point Delgada for about 7 miles, and is generally marked by numerous kelp patches. The depths are quite irregular, the least found being 7 fathoms about 3 miles 180° true (S by E ¾ E mag.)

from the point. At the tail of the ridge is 20 fathoms, from which the depths increase rapidly to 30 fathoms.

From Point Delgada the coast extends west-northwestward for 19 miles to Punta Gorda, backed by steep mountains covered with chaparral and trees. About ¾ mile northward from Point Delgada the rocky character of the coast changes to a clean shore, with a sand beach extending northward for 4 miles. **Kaluna Cliff**, nearly 1,500 feet high, overhangs the southern end of the sand beach.

King Peak, 4,090 feet high, the highest of three, is the well-known landfall generally called Three Peaks. It lies 8½ miles northward from Point Delgada, 2½ miles from the coast, and in clear weather is visible seaward for about 75 miles.

About 6 miles northward from Point Delgada is the head of a submarine valley, the 100-fathom curve lying within ½ mile of the beach. This valley extends in a north and south direction, with an average width of 1 mile between the 100-fathom curves for 3½ miles, and then expands funnel-shaped for 3 miles more. Over 400 fathoms are found at its mouth, and 300 fathoms within 4 miles of the beach. The side slopes are abrupt.

Big Flat is a narrow strip of low, flat land about 7 miles westward from Point Delgada. It is 2 miles long and bordered by sand beaches. Several ranch houses and barns are located along the flat. **Shubrick Rock**, low and small, lies 300 yards off the southern end.

Reynolds Rock, 20 feet high, lies 6½ miles westward from Big Flat. It is 480 yards offshore, abreast the precipitous slope of Reynolds Spur, which is about 800 feet high.

Rodgers Break is a sunken rock, with 3 feet over it, nearly ¾ mile offshore, just northward of Reynolds Rock. It lies 4¾ miles 136° true (SE by E ⅝ E mag.) from Gorda Rock and 6¾ miles west-northwestward from Big Flat. It is a pinnacle rock that seldom breaks; the top is occasionally seen in a heavy swell. This is the outermost known danger on this stretch of the coast. It is marked by a whistling buoy.

Another break has been reported about ½ mile northward of Rodgers Break, but not so far from shore.

From Reynolds Rock northwestward to Punta Gorda the shore is bordered by numerous rocks extending about ¼ mile offshore.

The sharp depression in the hills near the coast, caused by the gulch of **Cooskie Creek**, 3½ miles southward of Punta Gorda, is sometimes useful in dark nights to vessels close inshore in making the point from southward.

Punta Gorda is a high, bold, rounding cape, 83½ miles northwestward from Point Arena and 11 miles southward from Cape Mendocino. The seaward face rises to 800 or 900 feet, 400 yards back from the beach, and the point of it is a smaller spur, 140 feet high, almost overhanging the sea. It is bare of trees except in the gulches. For over 1½ miles northward and about 2 miles southward of the point the beach is bordered by numerous rocks extending in some cases 400 yards offshore.

Punta Gorda lighthouse is a gray rectangular structure. The light is group flashing white (flash 1 second, eclipse 3 seconds, flash 1 second, eclipse 10 seconds), 75 feet above the water, and visible 14 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds.

Gorda Rock, 15 feet high, is a conical rock a little over ¾ mile southward from Punta Gorda and ⅝ mile offshore.

Conical Rock, about 20 feet high, lies 300 yards off the point. A small, low rock lies 350 yards westward from it, with foul ground between.

From Punta Gorda to Cape Mendocino the hills back of the coast are lower than those southward; they are bare of trees and bordered by stretches of low, narrow, sandy flats with a narrow, low-water beach. The outlying rocks are not over ⅔ mile offshore until within 1½ miles of Cape Mendocino, where they extend farther and terminate in **Blunts Reef**, 2½ miles broad off the cape. At 3 miles northward of Punta Gorda a narrow submarine valley makes in, with 100 fathoms a little over 1 mile from the beach; and another makes in 4½ miles southward of Cape Mendocino, with 100 fathoms 2 miles from the beach.

A sunken rock is reported to exist about 1½ miles northwestward from Gorda Rock, and ¾ mile offshore. The position is doubtful.

The **Mattole River** enters 2 miles northward of Punta Gorda. The north head is bare and about 360 feet high, and the south head is about the same height, partially covered with oak trees. A prominent sand dune is on the south side at the entrance to the valley.

Mattole Landing is situated at the head of the submarine valley 3 miles northward of Punta Gorda. A wharf is built out a distance of about 200 yards to a landing stage on a flat-topped rock, from which cargo is handled by means of a wire cable. Vessels lie in deep water about 400 feet outside this rock, being secured to mooring buoys.

The landing is exposed, but the depths are ample, and it is reported that the seas never break at the moorings. The wharf usually carries away during the winter.

A rock with 7 feet at low water lies 400 yards west-northwestward from the end of the wharf, and another rock with 10 feet over it lies 200 yards west-southwestward from the end of the wharf. When a vessel is in position at the moorings this latter rock lies about midway between the stern and the southwest mooring buoy.

Tanbark and farm produce from the Mattole Valley are shipped, and general merchandise is received. The traffic is intermittent.

Sea Lion Rock, 12 feet high, is the largest of a cluster of small rocks ½ mile offshore and nearly 4 miles northward from Punta Gorda.

Double Rock, 12 feet high, consists of two small rocks, close together, 800 yards offshore, and ½ mile northward of Sea Lion Rock.

Devils Gate Rock, 20 feet high, lies nearly 2¾ miles southward of Cape Mendocino and ½ mile offshore. It is low and pyramidal, with a smaller rock close under the northwest side. A reef extends 200 yards westward from the rock. Numerous rocks lie inshore.

Steamboat Rock, 46 feet high, lies 1½ miles southward from Cape Mendocino and 600 yards offshore. The upper part is white and the lower black, somewhat resembling a steamer with a low, black hull and white upper works.

Cape Mendocino (chart 5795) is one of the most prominent points on the western coast, lying 94 miles northward from Point Arena and 11 miles northward from Punta Gorda. It is a bold, mountainous headland, the seaward face being steep and rocky and backed by

rolling grass-covered hills. For over 3 miles southward of the cape the beach is bordered by numerous rocks and sunken ledges, extending in some cases over ½ mile offshore.

Cape Mendocino lighthouse, a white pyramidal tower, is situated on one of the western spurs about 400 feet above the sea. The light is flashing white (flash 4.5 seconds, eclipse 25.5 seconds) 422 feet above the water and visible 28 miles.

Sugar Loaf Rock, 331 feet high, lies 250 yards westward from the cape and is connected with it at low water by a narrow neck of rocks and shingle beach. This rock is a prominent feature in making the cape from either northward or southward, but in thick or hazy weather care should be taken to avoid mistaking it for False Cape Rock, which it somewhat resembles, that lies in a similar position off False Cape, 4½ miles northward of Cape Mendocino. False Cape Rock is about 216 feet high and is not so regular in outline as the Sugar Loaf, and from the west or northwest shows two large rocks, 90 and 46 feet high, immediately inside of it, whereas the Sugar Loaf stands solitary and compact.

Blunts Reef is the outermost danger off Cape Mendocino. It consists of two small, black rocks, awash at high tides, about 230 yards apart with 15 fathoms between. The southern and outer rock lies nearly 2¾ miles 283° true (W ⅝ S mag.) from the Sugar Loaf Rock. This is the larger of the two rocks.

Blunts Reef light vessel is moored in 28 fathoms 1⅞ miles southwestward from the outer rock. It has a red hull with "Blunts" on each side and two masts with a red circular grating at each masthead. The lights, shown from each masthead, are fixed white, 50 feet above the water and visible 11 miles. The fog signal is a steam whistle, blast 2 seconds, silent 28 seconds; if whistle is disabled, the same signal will be given on a bell struck by hand. A submarine bell strikes groups of 8 and 3 strokes "83" every 22 seconds.

Vessels sounding their way around the cape have reported irregular rocky bottom with depths of 14 to 18 fathoms in the area from 2 to 4 miles north-northwestward from the light vessel, and a break in a heavy westerly swell has been reported in the same locality. Vessels should pass outside the light vessel.

Reports also indicate the existence of one or more submarine valleys northward of the cape. (See caution on p. 42.)

A rock, with 9 feet over it, lies ½ mile 170° true (SSE ⅝ E mag.) from the outer rock of Blunts Reef. **The Great Break**, with 4¼ fathoms over it, lies ¾ mile 194° true (S ½ E mag.) from the outer rock of Blunts Reef.

Eastward of Blunts Reef and the Great Break are a number of dangerous rocks and sunken ledges, a detailed description of which is unnecessary. Vessels should not attempt the passage between Blunts Reef and the cape under any circumstances. A heavy westerly swell breaks even in 9 and 10 fathoms in this locality.

Cape Mendocino is the turning point for nearly all vessels bound north or south and, in view of the dangers in its vicinity, should be approached with considerable caution in thick weather, owing to the irregularity of the bottom and currents. The meteorological conditions northward of the cape are quite different from those southward. Fog is more prevalent southward and the rainfall is heavier north-

ward. The strong northwesterly winds of summer are less violent southward of the cape, which forms a partial lee for vessels working their way northward. The currents at the light vessel are described on page 31.

COAST FROM CAPE MENDOCINO TO POINT ST. GEORGE.

From Cape Mendocino to Trinidad Head the coast trends nearly north for 40 miles and with the exception of the rocks off False Cape is free from dangers if the beach be given a berth of over ½ mile. The land is generally low with sandy beaches, broken by the mouths of the Eel and Mad Rivers and the entrance to Humboldt Bay, the only marked elevations northward of False Cape being Red Bluff and Table Bluff. From Trinidad Head to Rocky Point, 5½ miles, the coast is rocky with numerous outlying, rocky islets, and sunken ledges; these, however, do not extend over 1 mile offshore. Above Rocky Point the beach is low and sandy, with several lagoons behind it for nearly 11 miles to the southern end of the Gold Bluffs. From this point to Point St. George the coast is rocky, the cliffs being from 100 to 500 feet in height and bordered by numerous rocks. The Klamath River breaks through the cliffs 16 miles southward from Point St. George.

From Cape Mendocino to False Cape, a distance of 4½ miles, the coast is straight and bold and bordered by a broad, low-water beach. Bear River, a small stream, enters through a narrow valley about midway between the two capes.

False Cape is a steep, bold headland, rising to a height of over 600 feet in less than ¼ mile from the beach. It projects but little from the general trend of the coast. It is covered with grass, but the gulches on its sides are wooded. The base of the cape is bordered by a narrow, low-water beach of shingle and sand. For about 1 mile on each side of the cape are numerous rocks and ledges which do not extend over ½ mile from the beach.

False Cape Rock, 216 feet high, lies nearly ½ mile westward from the cape, with two rocky islets, 90 and 46 feet high, between. It is not as regularly shaped nor as high as the Sugar Loaf off Cape Mendocino, and the top is much flatter. A rock, with 12 feet over it, lies a little over ½ mile westward from False Cape Rock.

Northward from False Cape the hills decrease in height, and 4 miles beyond the cape is the beginning of a stretch of sand beach and dunes that extend to Trinidad Head, broken only by Table and Red Bluffs.

Eel River (chart 5819) empties nearly 9½ miles northward from False Cape. This is a stream of considerable size and is occasionally entered by light-draft vessels, but the channel over the bar is continually shifting. The depth on the bar varies largely with the amount of water in the river, depending upon the character of the winter, and has been at times as much as 14 feet, but generally it is about 8 or 9 feet.

Table Bluff, 12¼ miles northward from False Cape and 4½ miles southward of Humboldt Bay entrance, is a prominent feature from seaward. The western face is ½ mile in length, 165 feet high, very steep, and has a narrow sand beach under it.

Table Bluff lighthouse, near the extreme western edge of the bluff, is a white tower on dwelling. The light is flashing white (flash 0.5 second, eclipse 4.5 seconds), 176 feet above the water, and visible 20 miles. The fog signal is an air siren (blast 4 seconds, silent 26 seconds). The fog signal sounds five or six short, sharp blasts and blast of 15 seconds duration to warn the Coast Guard crew when vessels are in distress.

A United States Navy radio station is located at the light station; call letters, NPW.

From Table Bluff to Humboldt Bay entrance the coast consists of a narrow sand spit for 4 miles, behind which lies the southern part of Humboldt Bay.

Humboldt Bay and entrance are described under a separate heading on page 129.

Red Bluff lies abreast the entrance on the eastern shore of Humboldt Bay and is a conspicuous feature from seaward on account of its color and elevation. While only 100 feet high, it is prominent on account of the surrounding lowland, and in a low-lying haze frequently resembles an island.

Northward of the entrance to Humboldt Bay the coast consists of sand dunes partly covered with timber for 11 miles to the mouth of **Mad River,** and for the first 7 miles forms the western shore of Humboldt Bay. Above the bay the land behind the dunes is low and marshy as far as the river.

From the mouth of Mad River the sand dunes, varying in height from 20 to 60 feet, continue for 5½ miles to **Little Trinidad River,** a small shallow stream. The north point at the mouth of the stream is rocky, and from this point the coast consists of rocky cliffs extending to Trinidad Head and farther north.

Little River Rock, 120 feet high, lies ¾ mile northwestward from the mouth of Little Trinidad River and about ¼ mile offshore. Several rocks and foul ground lie between it and the beach, and a rock, 10 feet high, lies about 100 yards northwestward.

From Little River Rock to Trinidad Head the shore is bordered by numerous rocks and sunken ledges, extending ¼ mile offshore.

Trinidad Head lies nearly 39 miles northward from Cape Mendocino, and 17½ miles northward from the entrance to Humboldt Bay. It covers an area 700 yards long and 500 yards wide, and rises to a height of 380 feet. The sides are steep and covered with chaparral. From northward or southward it is generally raised as a dark, round-topped island. Near the northern end it is joined to the mainland by a narrow neck from the southern side of which **Little Head,** a rocky knoll, 125 feet high, projects into the bay.

Trinidad Head lighthouse, near the southwest side of the head, is a white pyramidal tower. The light is group flashing white (three flashes of 0.5 second duration each; eclipses 3, 3, and 12.5 seconds), 196 feet above the water, and visible 20 miles.

A whistling buoy is placed 1¾ miles west-southwestward from the light.

Blank Rock, 100 feet high, lies a little over ¼ mile westward from the head; there is foul ground between it and the head. A smaller rock lies 150 yards northward from Blank Rock. A rock awash and a ledge with 15 feet over it lie 275 yards southeastward from Blank Rock.

Off Trinidad Rock, 80 feet high, lies ⅓ mile northwestward from Blank Rock. It is considerably larger than Blank Rock, with two rocky heads of about the same height. A sunken rock lies 300 yards off its southwestern face, and numerous ledges extend southeastward toward the head.

Pilot Rock, 103 feet high, lies ½ mile southward from Trinidad Head. It is of small extent, conical, and whitish in color, rising abruptly from depths of 8 and 9 fathoms on all sides.

Prisoners Rock, 60 feet high, is the most prominent of the rocks in the cove, and consists of two rocks so close together that they are usually taken for one. From southward they resemble an animal lying down with its head toward the west. It lies 220 yards eastward from the eastern shore of the head. A rock, with 7½ feet over it, lies 150 yards north-northwestward from it.

Flat Rock, low and small, lies 350 yards northeastward from Prisoners Rock; a rock, with 5 feet over it, lies 150 yards southeastward from it.

A rock, with 3¾ fathoms over it, lies nearly ¼ mile 146° true (SE ¾ E mag.) from Prisoners Rock.

Trinidad Harbor (chart 5846) is the small cove lying eastward of Trinidad Head. It affords shelter in northwesterly weather, but is dangerous in westerly or southerly weather. The cove is small and further contracted by several rocks, and as a rule there is always a swell even in northerly weather. The post village of **Trinidad** is on the north shore of the cove, but at present is of little commercial importance. It is connected by rail with Humboldt Bay, and all traffic is by that means. The wharf and mooring buoys are gone.

The best anchorage is in 7 fathoms, muddy bottom, about halfway between Prisoners Rock and Trinidad Head, with Flat Rock bearing 73° true (NE ¾ E mag.) just open southward of Prisoners Rock.

In entering from southward, vessels should not pass eastward of the line with the west tangent of Prisoners Rock on with Little Head to avoid the 3¾-fathom spot southward of Prisoners Rock. Pilot Rock may be passed close-to on either hand. From northward, after passing Cone Rock, 3½ miles northward of the lighthouse, the coast should be given a berth of not less than 1¼ miles, until the lighthouse bears 93° true (ENE ½ E mag.), when the course can be changed to 98° true (E by N mag.). This passes about 250 yards southward of the 15-foot spot and rock awash southward of Blank Rock. The southern face of the head may be kept close aboard.

From Trinidad Head to Rocky Point, a distance of 5½ miles, the coast is rugged and rocky, the cliffs reaching elevations of over 100 feet. Rocks and sunken ledges extend, in some cases, over 1 mile offshore. The mountains back of Trinidad Head are good landmarks for vessels approaching from seaward.

Trinity Mountain, 3,012 feet high and heavily wooded, lies nearly 7 miles northeastward from Rocky Point, and is easily made out. **Mount Hoopah,** 4,050 feet high, lies farther inland, 16 miles eastward from Rocky Point.

Green Rock, 108 feet high and of small extent, lies 1½ miles northward from Trinidad Head and nearly 600 yards offshore. The top is covered with grass. Numerous rocks lie inshore, and a rock awash at high water lies 700 yards 275° true (WSW ¾ W mag.) from it.

A rock, with 3¾ fathoms over it, lies about ½ mile 267° true (WSW mag.) from Green Rock; it seldom breaks, and rises abruptly from 15 fathoms. Two sunken rocks lie ⅗ and ⅘ mile 329° true (NW ½ W mag.) from Green Rock.

White Rock, 130 feet high, lies 1⅞ miles northward from Trinidad Head. It is of small extent and lies 250 yards off a wooded, projecting head of about the same height. Another rocky islet, 150 feet high, lies 1 mile northward from White Rock.

Cone Rock, 40 feet high, lies 3¾ miles northward from Trinidad Head and a little over 1 mile offshore. It is conical in shape and of small extent. A smaller rock, 40 feet high, lies ½ mile eastward.

Turtle Rocks, two rocks 20 and 50 feet high, lie 1½ miles northward from Cone Rock. They are of small extent and lie 1 mile off Rocky Point. Eastward of Turtle Rocks the ground is foul, with two breakers lying 600 and 800 yards from the outer rock, and numerous visible rocks thence to the beach.

A bell buoy is placed ½ mile westward from Turtle Rocks.

Rocky Point, 5½ miles northward from Trinidad Head, is a bold, rocky point with cliffs about 200 feet high, bordered by numerous rocks and ledges extending 200 to 300 yards offshore. It is covered with oak and scrub pine for ½ mile back to the redwood forest; through this oak growth project two rocky pinnacles about 250 feet high.

Northward from Rocky Point the cliffs are succeeded by a low, sandy beach for 4½ miles to the entrance of **Big Lagoon,** which lies immediately behind the sand beach. Above the entrance to Big Lagoon the cliffs recommence and extend 2 miles to **Stone Lagoon.**

Sharp Point, at the northern end of the sand beach in front of Stone Lagoon, lies 7¾ miles northward from Rocky Point. It is a high, projecting point, with a precipitous face southward, and sharp slope northward, where a low sand spit extends for ½ mile to a second rocky head and thence for another ½ mile to the Gold Bluffs. A fresh-water lagoon lies behind each sand beach. Numerous rocks, extending about ¾ mile offshore, border the beach.

The southern point of **Gold Bluffs** lies 9 miles northward from Rocky Point. They extend northward for 9 miles, ranging from 100 to 500 feet high, the first 3 miles being comparatively low and bordered by several outlying rocks. About 4 miles from the southern end the cliffs are broken by two moderately broad valleys. These bluffs are composed of gravel and sand and are not rocky.

Mussel Point is a small, projecting head 11¼ miles northward from Rocky Point.

Redding Rock, 94 feet high and of small extent, lies broad off Mussel Point, nearly 4½ miles offshore. It is dark for about one-third the height and white above with a cleft on the southern face. It rises abruptly from depths of 20 fathoms, and can be approached close-to with safety. It is marked by **Redding Rock light,** a black skeleton tower. The light is flashing white (flash 1 second, eclipse 9 seconds), 116 feet above the water and visible 12 miles.

Northward of Gold Bluffs the coast becomes rocky, irregular, and broken, the bold cliffs being bordered by many rocks.

Split Rock is a slightly projecting head 3½ miles northward from the north end of Gold Bluffs; it is so named on account of the cut in the north face.

High Bluff is a slightly projecting head ¾ mile northward from Split Rock. It is prominent on account of an enormous split or chasm on its northern face; at the southern edge of the cut the bluff is 340 feet high.

White Rock, 107 feet high, lies 600 yards northward from High Bluff and 300 yards offshore; numerous rocks, sunken and visible, lie between it and the beach. Its southern face is very precipitous and its west face is steep, sloping northward.

Flint Rock Head, 135 feet high, is a detached, rocky head connected with the cliffs by a low sand spit. It lies at the southern end of the Klamath River sand beach, 1¾ miles northward from Split Rock. Its southwest face is precipitous. A rock awash lies ¾ mile 315° true (NW by W ¾ W mag.) from Flint Rock Head and about ½ mile offshore.

The **Klamath River** empties 16 miles southward of Point St. George and 30 miles northward of Trinidad Head. It is a large river with an extensive mountainous watershed. The entrance has 6 to 10 feet at low water, but is narrow, leads through rocky ledges, and is subject to change. It should not be attempted without a pilot. One may be obtained at Crescent City.

Requa, a small town on the north shore of the river just inside the mouth, ships lumber, dairy produce, and fish. Two launches maintain an irregular schedule to Eureka.

Mount Toorup, 4,225 feet high, 8 miles eastward of the mouth of Klamath River, is a prominent landfall in this vicinity, and in clear weather is visible about 60 miles seaward.

From the mouth of the Klamath River the coast curves northwestward for 3 miles to the mouth of Wilson Creek. The cliffs are high, irregular, and jagged, and the hills above are covered with grass and chaparral; numerous rocks extend about 300 yards offshore.

A sunken rock, ⅝ mile offshore, lies 1⅜ miles 297° true (W ½ N mag.) from the mouth of the Klamath River.

A rock, 17 feet high, lies 1 mile offshore a little over 2½ miles 318° true (NW by W ½ W mag.) from the mouth of the Klamath River and about 1½ miles southward of Wilson Creek.

False Klamath Rock, 195 feet high and round-topped, is the most prominent rock on this part of the coast. It lies 650 yards westward of the south point of the small cove into which Wilson Creek empties.

Wilson Rock, with but 2½ feet over it, lies ½ mile 270° true (WSW ¼ W mag.) from False Klamath Rock.

A rock awash lies ⅞ mile 324° true (NW by W mag.) from False Klamath Rock. Numerous sunken rocks lie eastward and northeastward of the line from this rock to the rock 17 feet high southward of False Klamath Rock.

From False Klamath Rock the coast for 7 miles northward consists of bold, rocky cliffs, much broken and bordered by numerous sunken and visible rocks. Beyond these, extending about 4 miles to Crescent City, is a broad sand beach backed by flat land under cultivation.

Midway Point lies 4 miles northward from False Klamath Rock. It is bold, rising to an elevation of 820 feet 800 yards from the beach.

Sister Rocks, a cluster of prominent rocks ½ mile westward from Midway Point, consist of three large and several smaller rocks cov-

ering a limited area; the outer one is 92 feet and the inner one 89 feet high.

Crescent City (chart 5895) is located on the north side of a small, rocky, contracted bay about 3 miles southeastward from Point St. George. The anchorage affords fair shelter in northwesterly weather, but is dangerous in westerly or southerly weather; the approaches are bad, and the greatest caution must be observed in making it. A wharf, with about 13 feet at its end, is built out from the western shore, and heavy mooring buoys have been placed for riding to and for warping into position. Communication may be had by coasting steamers at irregular intervals, and by wagon road with the interior. Lumber and some farm produce are shipped; general merchandise is received.

A small, rocky islet, 45 feet high, lies 200 yards southward of the western point of the bay. **Crescent City lighthouse**, situated on the seaward extremity of this islet, is a white tower on dwelling. The light is flashing white (flash 2 seconds, eclipse 13 seconds), 77 feet above the water, and visible 14 miles.

The dangers in the cove and approaches are too numerous for detailed description. From Crescent City lighthouse numerous rocks, above and under water, extend southward ½ mile, and also east-southeastward for nearly ¾ mile to a bell buoy which marks the western side of the entrance. **Round Rock**, lying ⅞ mile 145° true (SE by E mag.) from Crescent City lighthouse, is 45 feet high and has deep water close-to. Eastward of Round Rock are numerous sunken rocks which extend northward to **Whaler Island** (77 feet high, largest in cove); the channel between the westernmost of these rocks and the bell buoy is about 100 yards wide.

A whistling buoy is placed 1½ miles 182° true (S by E ⅝ E mag.) from the lighthouse.

In approaching from southward, keep Crescent City lighthouse bearing northward of 346° true (NW ⅞ N mag.) until up with the whistling buoy, to clear Chase ledge lying ⅞ mile 175° true (SSE ¼ E mag.) from Round Rock. In thick weather the depth should not be shoaled to less than 18 fathoms until the whistling buoy is made. From the whistling buoy steer 32° true (N by E mag.) so as to pass over 100 yards westward of Round Rock, and from the rock steer 26° true (N ½ E mag.) and pass close eastward of the bell buoy. After passing the bell buoy haul gradually westward for the wharf and anchor in about 3½ fathoms.

In approaching from westward, when Round Rock is made it may be steered for on any bearing northward of 88° true (ENE mag.), passing ¾ mile or more southward of Crescent City lighthouse. When up with Round Rock proceed as directed in the preceding paragraph.

From Crescent City lighthouse to Point St. George, 3⅜ miles, the coast is moderately low, but rocky, with numerous rocks above and under water, extending ¾ mile offshore. **Castle Rock**, the largest, is 208 feet high, and lies 2¼ miles 301° true (W ⅞ N mag.) from Crescent City lighthouse and ⅝ mile southward of the southern point of Point St. George. By passing ¾ mile or more southward of Crescent City lighthouse and over ¼ mile southward of the outer visible rocks, all dangers between the lighthouse and Castle Rock will be avoided.

Point St. George is low, with several irregular and rocky hillocks near the beach; the seaward face is about 1 mile long, northwest and southeast, with sand dunes and low land immediately behind it. The tree line is about 5/8 mile inland, with a few trees near the southern end of the point. Numerous prominent rocks fringe the point between Castle Rock and Brown Rock, one of which (**White Rock**) shows an arch from westward. **Brown Rock** is 51 feet high and lies at the end of the reef of visible rocks which extends 1/2 mile west-northwestward from the northwest end of Point St. George; the reef extends 250 yards southwestward from Brown Rock.

St. George Channel, with a width of over 1 mile, is a clear channel between the visible rocks fringing Point St. George and the easternmost rocks of St. George Reef. It is frequently used by coasting steamers in clear weather.

St. George Reef is a group of rocks and sunken ledges, extending 6 1/2 miles northwestward and westward from Point St. George. There are nine visible rocks, the outer one, **Northwest Seal**, being marked by **St. George Reef lighthouse**, a white stone tower on pier. The light is flashing red and white (red flash 2 seconds, eclipse 13 seconds, white flash 2 seconds, eclipse 13 seconds), 146 feet above the water, and visible 18 miles. The fog signal is an air siren (blast 2 seconds, silent 3 seconds, blast 2 seconds, silent 23 seconds).

Star Rock, the southeasternmost rock of the group, is 64 feet high and lies 2 miles 277° true (WSW 3/4 W mag.) from the southern end of Point St. George. Between Star and Northwest Seal rocks are three rocks, **Hump**, **Whale**, and **Southwest Seal**, almost in line, varying in height from 15 to 45 feet. Southward of this line of visible rocks are two sunken ledges, **Mansfield Break** and **Jonathan Rock**. The latter lies 2 1/2 miles 289° true (W 1/8 S mag.) from Star Rock and 3 1/8 miles 155° true (SE mag.) from Northwest Seal Rock. It breaks only in a heavy swell, and then not continuously, and has deep water surrounding it. **Mansfield Break** lies 2 1/4 miles 162° true (SE 1/2 S mag.) from Northwest Seal Rock and nearly 3 1/2 miles 298° true (W 5/8 N mag.) from Star Rock. It is about 100 yards in extent, with 20 fathoms close-to and around it. The **Great Break** lies 1/2 mile 149° true (SE 5/8 E mag.) from Southwest Seal Rock and is about 150 yards in extent. A sunken ledge showing a heavy breaker at low tide lies 125 yards southwestward of Southwest Seal Rock. **Dragon Channel**, which leads northward of Jonathan Rock and between Mansfield Break and The Great Break, is not recommended. **East** and **Long Rocks** lie 2 1/8 and 1 5/8 miles, respectively, 349° true (NNW 7/8 W mag.) from Star Rock. On this line and 1 mile northward from Star Rock is a rock visible at lowest tides; southeastward from this rock nearly 3/8 mile is a rocky patch with but 4 3/4 fathoms in which a rock, with but 5 feet over it, has been reported. **Flat Rock** lies nearly midway between Long and Whale rocks and about 1/2 mile from the former. **Mussel Rock** lies nearly 1/2 mile 284° true (W 5/8 S mag.) from Long Rock; a sunken ledge showing a breaker lies 200 yards 9° true (N by W mag.) from the rock. All the rocks of St. George Reef rise abruptly, and when in its vicinity the lead gives no warning of their presence. In thick weather the greatest caution should be observed and the reef given a good berth.

HUMBOLDT BAY

(chart 5832) is the first important harbor north of San Francisco. The entrance is 21 miles northward of Cape Mendocino lighthouse. A large amount of lumber is shipped to both foreign and domestic ports; considerable quantities of farm and dairy produce, live stock, leather, and fish are also shipped, mostly to San Francisco. General merchandise, fuel oil, and coal are received.

Since the improvements by the Government, the bay can be used as a harbor of refuge in impending bad weather, provided it can be made before the bar becomes impassable.

The bay consists of two shallow basins connected by a narrow channel about 5 miles long: the entrance to the bay being at the junction of this channel with the southern basin.

The **northern basin** is about 3 miles in diameter, with low, marshy shores cut by numerous sloughs. There are two channels, the **Mad River Channel**, leading into **Mad River Slough**, and the **Arcata Channel**, leading to the railroad wharf at **Arcata**. The former has a least depth of 8 feet and is now abandoned; the latter has a depth of 20 feet until within ½ mile of the railroad wharf, where it shoals to a least depth of 14 feet. This channel is marked by beacons. **Indian**, **Woodley**, and **Daby Islands**, low and marshy, lie in the entrance to the northern basin.

The **southern basin** is about 3 miles long and 2 miles wide. There are two channels, one leading toward **Southport**, and the other past Fields Landing to **Hookton**, at the head of **Hookton Slough**. The **Southport Channel** has a least depth of 9 feet, but is little used. The **Hookton Channel** has a controlling depth of 19 feet to Fields Landing, and is marked by beacons and buoys. Beyond that point the channel is not used, and is unmarked.

Eureka, the principal town on the bay, is situated on the eastern shore, about 4 miles northward of the entrance. It handles most of the water-borne traffic of the bay, and is the terminus of a railroad from San Francisco, although a branch of the road continues to Arcata, Samoa, and Trinidad.

The approach to Eureka from the main channel through the bay is through an almost straight natural channel, which has been improved by dredging to a width of 300 feet, and a depth of 18 feet at mean lower low water. Subsequent shoaling has reduced the depths off the town to 16 feet in places. The depths at the wharves vary from 12 to 18 feet.

Arcata is situated on the north shore of the northern basin. A railway from the town leads southward across the flats at the head of Arcata Bay to a wharf near the head of Arcata Channel. Lumber is shipped from this wharf. The channel leading to it is well marked by beacons, some of which are lighted, but the depths are shoal, and vessels approach the wharf only on tide.

Another wharf, from which stone for the jetties is shipped, is situated ⅜ mile eastward of the Arcata wharf.

Samoa, on the western shore opposite Eureka, is the terminus of a railroad from Arcata. Considerable lumber is shipped. The wharf has depths of 14 to 16 feet at low water.

Fairhaven, on the western shore 2 miles southward of Samoa, has a small shipyard devoted to the building of steam schooners. The facilities for repairs are confined to work above water.

Fields Landing, on the eastern shore of the south basin, is reached by Hookton Channel. Lumber is shipped by both water and rail. The depth at the wharf is 12 feet at low water.

Prominent features.—Table Bluff lighthouse, 4 miles southward of the entrance, is the best landmark by night. By day, the smoke from the sawmills on the bay can usually be seen. The old lighthouse and the lookout station near the end of the north spit are good day marks. Humboldt Bay fog-signal station (white frame building; fog signal, blast 3 seconds, silent 17 seconds) also near the end of the north spit, is the guide in thick weather.

Red Bluff, on the eastern shore of the bay abreast the entrance, is a small hill 100 feet high, and noticeable on account of the lower land surrounding it.

The approach to the bay is marked by a gas and whistling buoy (flashing white light) placed 1¼ miles west-northwestward from the end of the south jetty.

The bar is being improved by the Government by the construction of two jetties, 750 yards apart. The south jetty, which is completed, extends west-northwestward a distance of ⅞ mile from the northwest point of the south spit. The north jetty, at present under construction, extends parallel to the other for a distance of 1,000 yards, and when completed will equal it in length.

In February, 1917, the controlling depth on the bar for vessels with local knowledge was 26 feet at mean lower low water. Strangers can not count on finding a greater depth than 22 feet at mean lower low water. The entrance is buoyed, but owing to the shifting character of the shoals the buoys can not be relied upon as leading through the best water. For the same reason, the entrance range should not be trusted without local knowledge.

The channel after crossing the bar is contracted between the jetties to a least width of about 275 yards by a shoal making out from the north jetty. From abreast the outer range beacon the channel curves northward and passes close under the eastern point of the north spit and then continues northward for about 3¼ miles to the entrance to the north basin. Here it divides into three branches, the eastern one, locally called the **Eureka Channel**, passing along the water front of Eureka, the middle one between Indian and Woodley Islands, and the western and largest one between the north spit and Indian Island. The western channel divides into Mad River and Arcata channels immediately northward of Indian Island; the eastern channel runs into **Eureka Slough**.

Anchorage.—The best anchorage is from a point about ¼ mile northward of the red buoy abreast Bucksport wharf to the post light marking the entrance to the channel leading to the water front at Eureka. Vessels in anchoring must keep clear of the cable crossing the channel from a little below the red post light on Brosnon's wharf to the western shore. It is forbidden to anchor in the Eureka Channel longer than 24 hours at a time. If obliged to anchor outside the bar, the best anchorage will be found a little southward and westward of the gas and whistling buoy in about 15 fathoms, sand and clay bottom; anchors as a rule are hard to break out.

Pilots and towboats.—Towboats are available, and may be obtained by making signal to the Coast Guard lookout station on the north spit. The masters of the towboats also act as pilots. Pilotage is compulsory for foreign vessels only.

Harbor regulations are prescribed by the board of harbor commissioners, and are enforced by the harbor master.

Marine hospital.—A relief station of the United States Public Health Service, in charge of a service officer, is located at Eureka.

Quarantine.—Regulations of the United States Public Health Service are enforced. The quarantine station is at Fairhaven.

Storm warnings are displayed by the United States Weather Bureau from the roof of the Federal Building, Eureka, plainly visible from the anchorage, and also at Humboldt Bay Coast Guard station.

The **customhouse** is at Eureka.

Supplies.—Coal, fuel oils, provisions, water, and ship chandlers' stores can be obtained at Eureka.

Repairs.—Minor repairs to machinery and to woodwork above water can be made. There are no dry docks or marine railways.

A **coast guard station** is located inside the north spit, ½ mile northward from the end. A lookout tower is located on the seaward side of the spit, abreast the station.

Communication is by rail to San Francisco, and by regular lines of steamers plying between Columbia River, Coos Bay, Humboldt Bay, and San Francisco. There is also considerable irregular traffic in large launches to various local points north and south. A United States naval radio station is located on Table Bluff. Communication may also be had by telegraph and telephone or by commercial radio at Eureka.

Currents.—The tidal currents follow the general direction of the channels. In the main channel the average velocity at strength is less than 2 knots, and the maximum does not exceed 3 knots. Between the jetties the average velocity at strength is 2.5 knots, with a maximum of between 4 and 5 knots.

DIRECTIONS, HUMBOLDT BAY.

The following directions are good for a draft of 17 feet at high water with a smooth bar and lead to the anchorage. Strangers of a deeper draft, or with any sea on the bar, should take a pilot. It should be borne in mind that the bar is subject to change, so that strangers can not rely on finding the charts correct or the buoys indicating the best water.

From southward.—From a position 1 mile westward of Blunts Reef light vessel, a 30° true (N ⅞ E mag.) course made good for 23½ miles leads to Humboldt outside bar gas and whistling buoy. At night Table Bluff lighthouse should be made shortly after passing Blunts Reef light vessel, and when nearing the entrance the lights in Eureka will be seen. In thick weather, after passing False Cape Rock, all dangers will be cleared by keeping in a depth of over 15 fathoms until up with the gas and whistling buoy, where anchorage should be made until a pilot is obtained.

From northward.—From a position 3 miles westward of Trinidad Head lighthouse a 187° true (S by E ⅛ E mag.) course, made good for 17 miles, leads to the gas and whistling buoy.

On this course Table Bluff lighthouse, 5 miles southward of the gas and whistling buoy, should be made ahead. In thick weather the depths should not be shoaled to less than 20 fathoms between Turtle Rocks and Trinidad Head, and when southward of the head the depths should not be shoaled to less than 15 fathoms until up with the gas and whistling buoy, where a vessel should anchor until a pilot is obtained.

From seaward.—Vessels can stand in boldly until sure of their position when the course should be shaped for the entrance. In clear weather, the high land of Cape Mendocino and Punta Gorda southward and Trinidad Head northward of the entrance are good landmarks. At night the lights are a good guide. In thick weather soundings should be taken frequently, and upon getting depths of 30 fathoms or less great caution must be exercised until sure of the vessel's position.

Sailing vessels during the prevailing northwesterly winds of summer should endeavor to make the land in the vicinity of Trinidad Head, which gives them a fair slant for the entrance, and is an additional precaution against the irregular southerly set of the current. In thick weather soundings should be taken constantly when inside of 50 fathoms. Making the land northward of the entrance avoids the irregular bottom and dangerous currents in the vicinity of Cape Mendocino. The description of the features of the coast are given under the heading "Coast from Cape Mendicino to Point George," page 122.

From the gas and whistling buoy steer 135° true (SE by E ¾ S mag.) to a position 100 yards northward of the outer end of the south jetty. Follow the south jetty at a distance of 100 yards, heading for buoy No. 2, until Humboldt Bay entrance front range beacon is abeam, distant 250 yards. Then haul to 115° true (E ½ S mag.) to pass 100 yards southward of the gas and bell buoy marking the southeasterly end of the shoal extending from the north spit. Passing midway between this buoy and buoy No. 2 A, head for buoy N. 4, course 25° true (N ½ E mag.) and passing the latter close-to on the starboard hand, steer 47° true (NNE ⅜ E mag.) to buoy No. 6. Then steer 31° true (N by E mag.), heading for Brosnon's wharf light, and select anchorage on the edge of the channel as desired.

COAST FROM POINT ST. GEORGE TO CAPE BLANCO.

From Point St. George to Cape Blanco, a distance of about 60 miles, the coast trends in a general northwesterly direction, with a shallow bight, Pelican Bay, immediately northward of Point St. George. The beach is fringed by numerous rocks and sunken ledges, but, with the exception of Rogue River and Orford Reefs, these in general do not extend over 1 mile from shore. The 30-fathom curve follows the general trend of the coast, and in thick weather may be considered as the limit within which it is unsafe to approach it, but in the vicinity of Rogue River and Orford Reefs the depths should not be shoaled to less than 50 fathoms.

For about 10 miles northward of Point St. George sand dunes, with a broad sand beach, extend to the mouth of Smith River. Lake Talawa and Lake Earl, surrounded by low, marshy land, lie behind this stretch of dunes.

A small rock, about 20 feet high, lies 1¾ miles south of the mouth of Smith River and nearly ½ mile offshore.

A cluster of three low rocks lies nearly 1 mile offshore and 1⅛ miles 200° true (S mag.) from Prince Island.

Pyramid Point, a rocky knoll 250 feet high, marks the north point of Smith River.

Prince Island, of small extent and 187 feet high, lies ⅛ mile offshore abreast Pyramid Point. **Hunter Rock**, double-headed and somewhat smaller, but of the same elevation, lies ¼ mile north of Prince Island; several other smaller rocks are in the vicinity.

Between Smith River and Chetko River, a distance of nearly 7 miles, the coast is composed of low, rocky cliffs, bordered by numerous rocks and ledges, sunken and awash, and is backed by a low, narrow table-land. Several prominent, rocky knolls rise from 100 to 200 feet above this table-land. The **Winchuck River**, a small stream with ½ mile of low sand dunes on the south side of its mouth, empties 3 miles northward from Prince Island. The outermost rock awash lies nearly 1½ miles offshore southwestward from the Winchuck River, or 2¾ miles 335° true (NW ⅛ W mag.) from Prince Island.

Cone Rock, nearly 1½ miles northward of Prince Island and over ½ mile offshore, is the most prominent of the visible dangers in this vicinity. It is 70 feet high and of small extent. The remaining dangers are too numerous for description, and this stretch of coast should not be approached closer than 1½ miles.

Chetko Cove (chart 5909), at the mouth of the Chetko River, is 15½ miles northward of Point St. George. It affords an indifferent anchorage, with some protection from northwest winds, but is exposed in southerly weather. There are numerous visible and sunken rocks fringing the shore of the cove and its approaches, necessitating caution in its use. At the middle of the cove is a sand and gravel beach over ½ mile in length at the mouth of the river. From southward the valley of the river is well marked even in hazy weather.

On the north shore of the cove, westward from the mouth of the river, is a sawmill about which has grown the post village of **Brookings**. The three stacks of the sawmill are prominent from southward. Lumber is loaded by means of a wire cable, vessels being moored to buoys in the small cove just eastward of Chetko Point. Communication is by launches, and by stage to the railway in the interior. Supplies in limited quantities only can be obtained.

In approaching Chetko Cove from southward, give the coast a berth of over 1½ miles until Bar Rock, which is the easternmost visible rock in the cove, bears 9° true (N by W mag.), and then stand in on that course, anchoring about ¼ mile southward of Bar Rock, with the southernmost bare rock off Chetko Point (¾ mile westward) bearing 279° true (W by S mag.) in about 7 fathoms. There are several sunken rocks southward and southeastward of Bar Rock, and vessels should not stand eastward of the bearing nor approach Bar Rock closer than ¼ mile. In approaching from northwestward give the coast a berth of over 1 mile until the sawmill is made, and then stand eastward into the cove, giving the outer bare rocks a berth of over ½ mile until Bar Rock bears 9° true (N by W mag.). Anchor as directed above.

From Chetko Point to Cape Ferrelo, 4½ miles, the coast is composed of high broken cliffs bordered by numerous rocky islets and ledges extending in some cases over ½ mile offshore.

Goat Island, 218 feet high, lies 2 miles northward from Chetko Point and 500 yards offshore. There is deep water off its western and southwestern face, but rocks and foul ground extend 200 yards southward from the southeastern point.

Cape Ferrelo is the first prominent headland north of St. George Reef, and, while not projecting seaward to any considerable extent, is noticeable on account of its bold, rugged face. Several rocks and islets lie directly off the cape to a distance of ½ mile.

From Cape Ferrelo to Crook Point the coast is very rugged and rocky, with several large and prominent rocky islets and reefs extending well offshore, forming, in some cases, anchorage for small vessels in northerly weather.

Whales Head is the outer of two rocky islets 134 feet high, 2¼ miles northward from Cape Ferrelo. A rock awash lies 800 yards southward from the highest point of Whales Head.

A rugged cliff from 200 to 300 feet high lies 3¼ miles northward from Cape Ferrelo. The face is about 1 mile in length and behind it rises a treeless, triple-headed hill to heights of 700 to 800 feet.

Leaning Rock, 77 feet high, lies close inshore, 3½ miles northward from Whales Head: it has a perpendicular face on its northwest side and slopes gradually southeastward. Several other rocks are in its vicinity.

Between Whales Head and Crook Point are two prominent, apparently grassy, areas in the forest near the crest of the hills, about 2 miles apart and situated at an elevation of nearly 2,000 feet; the southern one is known as **Rocky Prairie**. These are noticeable when off this section of the coast.

Yellow Rock, 84 feet high, lies 4½ miles northward from Whales Head, and ½ mile offshore.

Mack Arch is a double-headed, rocky islet ¾ mile offshore, 1½ miles southward from Crook Point and 8 miles northward from Cape Ferrelo. The western head is 228 feet high and the eastern a little lower; both are black to near the summits, which are generally white from bird droppings. The arch, about 40 feet high, is under the eastern summit and shows prominently from southward. A rock awash lies 125 yards southward from the eastern point.

Mack Reef extends from Mack Arch to Crook Point, and is a collection of some 30 rocks, visible and sunken, varying in height from awash to 110 feet. From southward these rocks stand out conspicuously when seen against the white sand dunes northward of Crook Point; Mack Arch, on account of its size and height, being the most prominent.

Mack Arch Cove (chart 5923) lies immediately eastward of the reef and affords fair shelter in northwesterly weather in 6 to 7 fathoms, sandy bottom. In entering from southward, pass eastward of Mack Arch, giving it a berth of about 150 yards, but taking care to avoid the rock 125 yards southward of its eastern point. Then bring the 111-foot rock, the highest of the northern part of the reef, to bear 352° true (NNW ⅝ W mag.) and steer for it on that bearing until up to the anchorage abreast the group of rocks ½ mile northward of

Mack Arch. Local steamers drawing less than 12 feet find smoother water by continuing the 352° true (NNW 5/8 W mag.) course through the kelp and anchoring in 4 fathoms with the 111-foot rock bearing 333° true (NW 1/4 W mag.), distant 300 yards. This latter anchorage is contracted and is not recommended.

Crook Point is moderately low, but terminates seaward in a rocky knoll 160 feet high, with a slight depression immediately behind it.

Northward of Crook Point for 2½ miles to the mouth of Pistol River is a low, sandy beach backed by high sand dunes; these are visible for a considerable distance, and with northwesterly winds the flying sand resembles smoke. From the mouth of the river to Cape Sebastian are numerous rocks and rocky islets extending 1/3 mile offshore, reaching in some cases a height of 170 feet.

Cape Sebastian is prominent from either northward or southward. It is the seaward termination of a ridge transverse to the coast, and rises abruptly from seaward to a height of 720 feet, with a depression behind it, and then more gradually to a height of about 2,000 feet. The seaward face is precipitous and broken and has few trees; southward the lower part is grass-covered. A sunken rock, showing a breaker, lies ½ mile offshore, 1 mile 341° true (NW ½ N mag.) from the western extremity of the cape.

Hunter Cove (chart 5923) is a small, contracted anchorage under the southeastern face of Cape Sebastian. It is formed partly by the cape and partly by Hunter Island in the entrance. The island is 1/4 mile in extent, rocky, flat-topped, and about 120 feet high; shoal water extends from it eastward to the beach. The anchorage is only suitable for small vessels in northerly weather and is not recommended.

From Cape Sebastian to the mouth of Rogue River, a distance of 6 miles, the coast is considerably broken and quite rugged, but rather low in the vicinity of the beach, and has but few outlying rocks.

Hunter Creek empties 4 miles northward from Cape Sebastian; it is small and unimportant. Off the mouth are three visible rocks, the outer (middle) one lying nearly ½ mile offshore.

Rogue River (chart 5951) is the first important stream north of San Francisco. Tan bark, wool, and the output of several canneries are shipped, and gasoline, distillate, and general merchandise are received. **Gold Beach**, on the south bank of the river near its mouth, is the principal town, and opposite it, on the north bank, is **Wedderburn**, with a wharf having 5 feet of water at low tide. The bar at the entrance has a depth of 4 to 5 feet at low water, and is crossed only at high tide during the summer months by light-draft vessels with local knowledge. Owing to the shifting character of the bar no directions of value to a stranger can be given. Pilots, without license but with good local knowledge, can be obtained at Gold Beach or Port Orford.

Launches drawing 8 to 12 inches run up the river to **Agness**, a distance of about 30 miles.

Communication is by launch, by stage and by telephone.

The low land of the river valley, and the rocks of Rogue River Reef are prominent from seaward.

The north head of Rogue River reaches an elevation of 700 feet about 1 mile northward of its mouth, and the marked depression in

the coast range made by the valley of the stream is visible from a considerable distance seaward.

Rogue River Reef extends in a general west-northwest direction from the mouth of Rogue River for 4 miles, with a channel ½ mile wide separating it from the beach. This channel has been used occasionally, but it is not safe for a stranger. **Northwest Rocks**, 4 miles 308° true (WNW ½ W mag.) from the entrance to Rogue River, are the outermost rocks of the reef and are about 10 feet in height. **Needle Rock**, 120 feet high, is the most prominent and lies nearly in the middle of the group, 3 miles 302° true (W by N mag.) from the north point of the river. The needle is on the southern side of the rock. **Pyramid** and **Double Rocks** are the most prominent of the remaining visible rocks, and are 50 and 65 feet high, respectively. A rock with 16 feet over it, lies 2 miles 185° true (S by E ⅜ E mag.) from Needle Rock and 2¾ miles 262° true (SW by W ⅜ W mag.) from the mouth of the river, and shows a breaker with an ordinary swell. A rocky patch with 4¾ fathoms over it lies 2½ miles 248° true (SW ⅛ W mag.) from the mouth of the river and 2½ miles 172° true (SSE ½ E mag.) from Needle Rock; this patch generally shows a breaker.

Northward of Rogue River the coast trends nearly north for 10 miles and then sweeps northwestward until reaching Cape Blanco. The mountains are high, irregular, dark, and covered with chaparral. For 5 miles northward from the mouth of the river the beach is bordered by numerous rocks, but beyond that is comparatively clear with the exception of Orford and Blanco Reefs.

A group of sunken and visible rocks, 1 mile long and ½ mile wide, lies 5 miles northward of Rogue River and nearly 2 miles offshore; these rise abruptly from 12 fathoms. **North Rock**, about 10 feet high, is the largest and is nearest the beach.

Sisters Rocks are a group of three rocky islets 10½ miles northward from the mouth of Rogue River. The northern and largest one is about 350 yards in extent and 400 feet high, lying close to a projecting, rocky point 265 feet high. The second one lies 250 yards south of the first and is 150 yards in diameter and 200 feet high. The southern and outermost is about 150 yards long and only 5 feet above water, and lies a little over ⅜ mile southward from the middle rock and nearly ¾ mile offshore. There is fairly smooth water in northwest weather under the lee of the largest islet, and a landing has been built that is used by small schooners. This is known as **Frankfort** and ships a small amount of tan bark to San Francisco. The warehouses and buildings on the cliff behind the largest islet can be seen for some distance in clear weather.

Lookout Rock, 2¼ miles northward of The Sisters, is a prominent, projecting cliff, 550 feet high, with a marked depression behind it. The seaward face is precipitous.

Humbug Mountain, 1,740 feet high, lies 5¼ miles northward from the Sisters and 4 miles southward from Port Orford. It is conical in shape and its seaward face is steep and rugged. It is a prominent feature from seaward.

Bald Mountain (Pilot Knob), 2,954 feet high, lies in the interior about 4 miles eastward from Humbug Mountain. From northward this appears as a double peak, but from southward shows three peaks

of nearly equal height, the eastern one being bare and the other two wooded.

Island Rock, 219 feet high, lies 1¼ miles off the seaward face of Humbug Mountain. It is about 350 yards in extent and flat on top. About 200 yards off its northwest end is a needle rock 115 feet high. These islands are prominent when approaching Port Orford from southward. There is deep water around them and between them and the beach.

Redfish Rocks are a group of islets covering an area of about ½ mile square lying 2 miles northward of Island Rock and nearly 1 mile offshore. They are five in number and range from 60 to 140 feet in height. A sunken rock lies in the center of the cluster.

Port Orford (chart 5952), lies 6½ miles southward of Cape Blanco and 19 miles northward of Rogue River. It affords good shelter in northwesterly weather, but is exposed and dangerous in southerly weather. It is easy of access, and is probably the best northwest lee north of Point Reyes. **The Head,** 300 feet high, the western point of the cove, is rugged and precipitous. It is easily made out from either northward or southward. **Tichenor Rock,** 90 feet high, lies 175 yards off the head. **Battle Rock,** high, narrow, and black, lies in the northern part of the cove close to shore. Rocks and foul ground extend about ⅝ mile southeastward. Port Orford is at present of little commercial importance. Some lumber is shipped and a small amount of general merchandise is received. The wharf, which is situated about the middle of the cove, has 13 feet at its end. Water is piped on the wharf. A small amount of provisions may also be obtained. The best anchorage is in 6 fathoms, hard, sandy bottom, with Battle Rock bearing 21° true (N mag.) distant about ⅓ mile, and the south point of Tichenor Rock bearing 246° true (SW mag.) distant ¾ mile. There is usually some swell making around the point.

Klooqueh Rock, 60 feet high, black and conical, lies ⅓ mile off the northwest face of Port Orford Head. It is prominent, especially when coming from northward inside Orford Reef.

From Port Orford Head to Cape Blanco, 6½ miles, the coast extends in a general northwest direction. Northward of the head it is a narrow sand ridge, rising at one point to 160 feet, covered with grass, fern, and brush and which ends abruptly nearly 3 miles from Port Orford Head at the edge of the Elk River valley. Northward of this are sand dunes to the mouth of Elk River, a small, unimportant stream. Beyond the mouth of Elk River to Cape Blanco the coast consists of vertical cliffs, wooded to the edges and in some places over 150 feet high.

Orford Reef is composed of a group of irregular rocks and sunken ledges, about 2½ miles long by 1½ miles wide, extending in a north and south direction. The northernmost limit of the reef is about 2½ miles southward from Cape Blanco lighthouse, and the southernmost limit lies about 5½ miles westward from the western head of Port Orford. A channel 2 miles wide leads eastward of the reef following the general trend of the coast, but at its northern end where it turns westward is contracted to 1 mile by the reef extending southward and westward from Cape Blanco. This channel is much used in clear weather, but should not be attempted when thick. There is considerable kelp eastward of and inside the reef.

Fox and **Southeast Black Rocks**, a little over 1¼ miles apart, are the two southernmost rocks of Orford Reef. The former is about 10 feet high, and lies 5¾ miles 291° true (W mag.) from Port Orford Head; the latter is 12 feet high and lies 1⅜ miles 93° true (ENE ⅜ E mag.) from Fox Rock, with a heavy break about ¼ mile west-northwestward from it.

Steamboat, West Conical, and Arch (Fin) rocks are the prominent ones in the southern part of Orford Reef, and extend in a general north-northeast direction about ¼ mile apart.

Steamboat Rock is so named on account of its appearance from northward or southward.

West Conical Rock, 112 feet high, is so named on account of its shape, the highest point being on the northwest side.

Arch or **Fin Rock** is 149 feet high with steep sides and a large, square arch visible from southward or southwestward. It is the inshore rock of the three.

Conical White Rock, 81 feet high, is nearly in the middle of Orford Reef, and a little over ¼ mile northward from Arch Rock.

Table Rock, 147 feet high, is the largest of the northern group of rocks. Foul ground extends from it southward and eastward for nearly ⅜ mile, and for ¾ mile northward in the direction of Cape Blanco. The northernmost part of this danger lies 1 mile 92° true (ENE ⅜ E mag.) from Northwest Rock with the eastern edge of Seal Rock in range with Arch Rock; Klooqueh Rock is also in range with Tichenor Rock off Port Orford Head.

Seal Rock, 53 feet high, is large and lies ¼ mile about southeastward from Table Rock. **Long Brown Rock**, 70 feet high, lies nearly ½ mile westward of Table Rock. **Large Brown Rock** lies midway between and a little northward of them. **Square White Rock**, 72 feet high, lies about ½ mile westward from Seal Rock, with Round Rock midway between and a little northward of them. Between these rocks are numerous smaller ones, some sunken and some visible.

Northwest Rock, 20 feet high, the northwesternmost rock of the reef, lies 3 miles 226° true (SSW ¼ W mag.) from Cape Blanco lighthouse.

Orford Reef gas, whistling and submarine bell buoy (flashing white light) is placed 6½ miles 218° true (S by W ½ W mag.) from Cape Blanco lighthouse and is the guide for clearing the reef.

Blanco Reef extends about 1½ miles southwestward from Cape Blanco, and consists of numerous rocks and sunken ledges, some of which are marked by kelp. **Pyramid Rock**, 80 feet high, lies nearly 1 mile 260° true (SW by W ¼ W mag.) from the lighthouse. There are no visible rocks outside of it, but several between it and the cape. A narrow, black rock, 125 yards long, lies ⅝ mile 176° true (SSE ¼ E mag.) from Pyramid Rock. A rock with 13 feet over it lies a little over ¾ mile 201° true (S mag.) from Pyramid Rock, and 1½ miles 234° true (SW by S mag.) from the lighthouse. This is, as far as known, the outermost rock of the reef. A rock, with 18 feet over it, lies ⅞ mile 195° true (S ½ E mag.) from the lighthouse; it is well marked by kelp.

Cape Blanco projects about 1½ miles from the general trend of the coast. It is a small, bare tableland, terminating seaward in a cliff 225 feet high, with lowland behind it. A large, high rock lies close

under the south side of the cape. From seaward the cape is not prominent, but from northward or southward appears like a moderately low, bluff islet.

Cape Blanco lighthouse, a white conical tower, is situated about in the center of the flat part of the cape. The light is group occulting white (eclipse 2 seconds, light 3 seconds, eclipse 2 seconds, light 13 seconds), 245 feet above the water, and visible 22 miles. A United States Navy radio station (call letters NPF) is located near the lighthouse.

A bank with 25 to 60 fathoms of water, and with over 100 fathoms eastward of it, is reported to exist 20 to 25 miles westward from Cape Blanco.

COAST FROM CAPE BLANCO TO COLUMBIA RIVER ENTRANCE.

From Cape Blanco to the Columbia River, 208 miles, the coast is remarkably straight, trending in a general N by W mag. direction. It differs considerably from that southward. The coast mountains are much lower, the difference being more marked by the high mountains inland. The shore consists of high, yellow sand dunes and cliffs, broken by bold, rocky headlands of moderate height and backed by low, pine-covered hills. There are few outlying dangers or islands, the farthest offshore being at Coquille River, Cape Arago, and Tillamook Rock.

From Cape Blanco to Cape Kiwanda, a distance of 147 miles, no detailed surveys have been made, and the shores should be given a berth of at least 2 miles.

Cape Blanco and **Blanco Reef** are described above.

Gull Rock, 118 feet high, lies 1 mile northward from Cape Blanco lighthouse, with sunken rocks surrounding it and between it and the beach. Its seaward face is black and rugged, and the summit of the rock is marked by two knobs, the higher at its southern part.

Castle Rock, 188 feet high, lies 1½ miles northward from Cape Blanco lighthouse, about 300 yards offshore and abreast the mouth of Sixes River. It rises abruptly from the sea and is readily made out from seaward at a distance of 10 miles. Several low rocks and sunken ledges surround it, the farthest outlying rock being about 350 yards southwestward.

Blacklock Point is a precipitous rocky point 2½ miles northward from Cape Blanco. The cliff is about 190 feet high, with a sharp, high point, bordered by rocks, stretching out nearly 300 yards. A narrow, curved line of rocks, some of which are from 80 to 100 feet high, extends west-southwestward from the point for ¾ mile. **Tower Rock,** 126 feet high, is the principal one and lies nearly 700 yards west-southwestward from the point. The **Three Sisters** mark the outer end of the reef; two of them are about 40 feet high and pyramidal in shape.

A sunken rock, having a depth of 10 feet at low water, is reported to exist about 1¼ miles west-northwestward from Blacklock Point. The entire stretch of coast from Cape Blanco to the Coquille River is unsurveyed and should be given a wide berth.

From Blacklock Point the shore continues rocky with cliffs gradually decreasing in height for 1½ miles. Thence for 11 miles is a broad sandy beach backed by sand dunes and long narrow lakes.

The tree line is at an average distance of ¼ mile from the sea. From the end of the sand beach to the mouth of the Coquille River, 3 miles, the shore is again rocky cliffs from 40 to 80 feet high, with a number of outlying rocks reaching ½ mile from shore and sunken dangers extending 1⅝ miles westward from Coquille Point. The land behind this stretch of coast is comparatively flat and wooded, rising to heights of 1,000 feet in 2½ to 3 miles.

Coquille River and Coquille River lighthouse are described under a separate heading on page 148.

From the entrance to Coquille River the sand dunes extend northward for 4 miles and are then succeeded by cliffs.

Five Mile Point, 6 miles northward from the river, is a projecting rocky cliff about 60 feet high, with a cluster of rocks 10 to 40 feet high extending more than ¼ mile offshore.

Northward of Five Mile Point the coast consists of cliffs, 40 to 80 feet high, which 2 miles southward of Cape Arago increase to heights of 100 to 250 feet, heavily wooded, and cut by seven or more deep gulches, locally known as the "Seven Devils," from the rough coast trail leading around and over them. Numerous rocks of varying shapes and sizes border the beach.

South Cove, immediately under the southern point of Cape Arago, is a small, contracted anchorage available in summer for small vessels with local knowledge.

Cape Arago, 29 miles northward from Cape Blanco, is an irregular, jagged point projecting about 1 mile from the general trend of the coast. There are no high mountains immediately behind it and it is conspicuous only when the mountains in the interior are obscured. The seaward face of the cape is 2½ miles long north and south and is a narrow, sparsely wooded tableland 50 feet high with rugged and broken cliffs and outlying rocks of the same height which formerly were part of it. Immediately off the cape are reefs extending northwestward for about 1 mile. A small cove near the northern end, inside the reefs, is sometimes used by very small vessels with local knowledge.

Cape Arago lighthouse, a white frame tower, is situated 2½ miles northward of the cape on a rocky, partially wooded island close inshore. The light is group flashing white (flash 0.4 second, eclipse 3.6 seconds, flash 0.4 second, eclipse 3.6 seconds, flash 0.4 second, eclipse 11.6 seconds) 100 feet above the water and visible 16 miles. The fog signal is an air siren (blast 5 seconds, silent 12 seconds, blast 3 seconds, silent 40 seconds).

Baltimore Rock, with 11 feet over it, lies ⅝ mile 333° true (NW ⅜ W mag.) from the lighthouse and generally shows a breaker. It is the outermost detached rock of a sunken ledge extending northwestward from the lighthouse island and has 7 fathoms of water close around it. It is marked by a bell buoy placed about 200 yards westward from it.

Coos Head, 220 feet high, is the southern point at the entrance to Coos Bay and lies 1¾ miles northeastward from Cape Arago lighthouse. The cliffs are about 100 feet high and terminate in several small rocky points with sand beaches between them.

Coos Bay is described under a separate heading on page 149.

From Coos Bay to Heceta Head, about 48 miles, the coast consists of sand dunes backed by moderately low, wooded hills. In the northern portion the dunes are quite high and conspicuous from contrast with the dark trees with which they are partly covered. Back of these wooded dunes are a number of lakes drained by small creeks through the sand beach. This stretch of coast is broken by several streams, the principal ones being the Umpqua and Siuslaw Rivers, which are described under separate headings.

Umpqua River lighthouse is described on page 153.

Heceta Bank lies 70 miles 350° true (NNW ¾ W mag.) from Cape Blanco, about 30 miles offshore, and covers an irregular area about 30 miles long and 10 miles wide. The least water found so far is 43 fathoms, but the soundings are irregular. Northward and southward of the bank the depths are considerably greater.

Heceta Head lies 28½ miles 7° true (N by W ⅜ W mag.) from Umpqua River lighthouse. The seaward face is 2½ miles long, with nearly vertical cliffs from 100 to 200 feet high. The summit of the head reaches an elevation of 1,000 feet in ½ mile from the cliffs and is covered with grass and a few pines. A sharp, black, conical rock, 180 feet high, marks the extreme western and northern part of the head and is easily made out from either northward or southward.

Heceta Head lighthouse is a white conical tower on a bench cut in the high bluff near the western extremity. The light is flashing white (flash 8 seconds, eclipse 52 seconds), 205 feet above the water, and visible 21 miles. Vessels from northward will not make out the tower or buildings until abreast the station, as they are shut out by the high bluff northward.

Cox Rock, 100 feet high, conical in shape and usually white on top with bird droppings, lies close under the southern part of the head.

From Heceta Head to Cape Perpetua, 9 miles, the coast consists of high, broken, rocky cliffs, with the exception of the first 2 miles, where it is much lower and formed by sloping, sandy cliffs backed by a strip of clear land. The hills behind reach an elevation of over 800 feet in less than ½ mile from the beach and are heavily wooded, showing in many places large areas of burnt timber still standing.

Ten Mile Creek, 5 miles northward of Heceta Head, is marked by a sand beach about ¼ mile long at its mouth.

Cape Perpetua lies 9 miles northward from Heceta Head and consists of two projecting points; the northern one is the bolder and reaches a height of 800 feet a short distance from the beach and 1,000 feet in about ¾ mile. The rocky cliff forming the face of the northern point is reddish in color, with a few rocks, awash at low water, close under its face.

Yachats Creek, navigable only for canoes, breaks through the coast hills immedately northward from Cape Perpetua.

The coast northward of Cape Perpetua for 2½ miles consists of cliffs, 15 to 30 feet high, with a narrow strip of grassy land ¼ to 1 mile wide behind them. Thence for 5½ miles are low bluffs with a broad sand beach in front and comparatively low wooded country behind them to Alsea Bay.

Cannibal Peak, 2,852 feet high, lies about 11 miles northeastward from the mouth of Alsea Bay. It is flat-topped, covered with dead trees, and presents a whitish appearance.

Alsea Bay lies 8 miles northward of Cape Perpetua. The principal shipment is lumber, but a salmon cannery is in operation and some farm and dairy produce are shipped and general merchandise is received. **Lutgens** and **Waldport** are the two principal settlements. Communication northward and southward may be had by stage. The north point is low, broad, and sandy; the south point is an abrupt rounding, sandstone cliff about 100 feet high, covered with trees. The entrance has the usual shifting bar and channel; the depth on the bar is about 6 feet at low water. A buoy is moored about 1 mile westward from the entrance. The bay is formed by the widening of the river immedately inside the entrance to a little over 1 mile. It is full of shoals and sand flats with a narrow, winding channel. No directions of value to a stranger can be given.

From Alsea Bay to Yaquina Bay the coast is nearly straight for 11½ miles. For 1½ miles northward of Alsea Bay the shore is a low sand beach backed by sand dunes and then changes to bluffs, which 2½ miles farther north rise to heights of 70 and 100 feet.

Seal Rocks, abreast the highest part of the bluffs, are low and extend parallel to the coast for 2½ miles at a distance of ½ mile from the beach. The highest rock rises 20 feet above water.

Beyond Seal Rocks the bluffs are low with a broad sand beach until within 1½ miles of Yaquina Bay, where sand dunes begin and continue to its entrance. The land behind is comparatively low and wooded, with areas of burnt timber.

An area of sunken rocks is reported to exist from 2 to 4 miles northwestward from Seal Rocks, and about 1½ miles offshore.

Marys Peak, a prominent mountain 4,097 feet high, lies 24 miles eastward from the entrance to Yaquina Bay. Its sides are wooded, but its summit is covered with grass.

Yaquina Bay is described under a separate heading on page 156.

From Yaquina Bay to Yaquina Head, 3½ miles, the coast consists of broken, yellow cliffs bordered on the southern part by broad, low-water, sand beaches.

Yaquina Head, 32½ miles northward of Heceta Head, is distinguished by two conical hills covered with grass. The outer one is 360 feet high and the inner 407 feet high, with a low saddle, 200 feet high, between them. The extremity of the point, which projects about 1 mile from the general trend of the coast, is broken and rocky, but comparatively low. One mile inland from the point the grass-covered land changes to a dense forest and the hills rise rapidly. Two sunken ledges lie northward from the point, not over ½ mile from the beach.

Yaquina Head lighthouse is a white conical tower situated on the flat bench projecting at the western extremity of the head. The light is fixed white, 162 feet above the water, and visible 19 miles.

From Yaquina Head to Cape Foulweather, 4½ miles, the coast consists of yellow and white sandstone cliffs, low and broken.

A low, flat, black rock, 2⅞ miles northward from Yaquina Head, lies ½ mile offshore.

Otter Rock, 36 feet high, lies 3¼ miles northward from Yaquina Head and ½ mile offshore, and 1⅛ miles northward from it. ⅜ mile off the southern end of Cape Foulweather, lies another rock, larger in extent and 30 feet high. In line between them is a kelp

field with several sunken rocks in it, and ½ mile and 1 mile northward of the latter rock lie sunken rocks marked by breaks. Inside the line between the two large rocks lies a cluster of small rocks.

Cape Foulweather is a prominent headland with a seaward face 6½ miles in length, consisting of rocky cliffs over 60 feet high. It is formed by several grass-covered headlands with densely wooded gulches between them. Near the middle of the cape is a strip of flat land ½ mile long and ¼ mile wide, bare of trees. The highest point of the cape is near the southern part; a grassy patch on the southwest slope is a good landmark. About ⅞ mile southeastward from the extreme western point of the cape is a rocky point, 430 feet high; ⅝ mile eastward of this point the hills rise to a height of 1,100 feet. Dangers extend for nearly 2 miles northward from the northern point of Cape Foulweather and nearly 600 yards offshore.

From Cape Foulweather to the entrance of Siletz Bay, 5½ miles, the coast continues as yellow, broken bluffs, 40 to 100 feet high, bordered by sandy beaches for 3 miles. From the northern point of the bluffs to the entrance to the bay are sand dunes, covered with low brush, on the spit bordering the bay.

Siletz River empties about 15 miles northward from Yaquina Head, the entrance being marked by a buoy moored ¾ mile westward of the bar. The channel changes frequently, but is used by light-draft vessels bound to the cannery. The bay inside the entrance is shoal and formed by a widening of the river. The north point at the entrance is a low bluff with a narrow sand beach; the south point is a low sand spit with sand dunes extending ⅝ mile northward from the yellow, sandy bluffs. No directions that would be of value to a stranger can be given.

From the north point of Siletz Bay the coast extends 7 miles northward to the Salmon River. For 2½ miles of this stretch the yellow sandstone cliffs are from 80 to 100 feet high. At this point they cease altogether for ¼ mile at the outlet of **Devils Lake**, a large body of fresh water, 10 feet above the sea, emptying through a narrow stream. At ½ mile 259° true (SW by W mag.) from the mouth of the stream lies a sunken rock, generally marked by a breaker. From the outlet of the lake for 3 miles northward the bluffs are from 20 to 60 feet high, rising to grassy hills and with a broad low-water beach and ledges of rocks along the low water line.

Immediately southward of Salmon River is a rocky cliff with a seaward face ⅝ mile in length, the summit being 470 feet high; extending southward and eastward from this to the river is a rolling, grassy plateau with but few trees. A rock, 74 feet high, lies 700 yards westward of this cliff, and a sunken rock lies 630 yards from the beach 1 mile southward. Immediately southward of, and in line with Cascade Head, opposite the mouth of the river, lie three rocks, 76, 20, and 50 feet high, respectively.

Cascade Head lies 16¾ miles northward from Cape Foulweather; it is very jagged, heavily wooded, and prominent to vessels close inshore. The face of the cliff is 3 mile long, in places over 700 feet high, and is cut by several deep gorges through which the waters of three creeks are discharged from cascades 60 to 80 feet high. Several rocks lie about ⅛ mile offshore.

Two Arches Rock, 30 feet high, lies 7/8 mile northward from the southern point of Cascade Head, the surface sloping westward. The arches are visible from northward, the inner one being the larger.

From Cascade Head to Cape Kiwanda, 9½ miles, the coast is a low sand beach with a narrow line of marsh behind the southern part. Rolling hillocks, occasionally wooded, rise to an elevation of 500 feet behind the beach.

Nestucca River (chart 6088) empties about 5½ miles northward from Cascade Head. The channel over the bar changes frequently in position and depth, and only vessels of light draft with local knowledge are able to cross. A small amount of canned salmon is shipped. A buoy is moored ½ mile westward from the bar.

The south point at the entrance to the river consists of several low, rolling, grassy hillocks, about 400 to 500 feet high, which at this point approach very closely to the beach. The north point is the southern extremity of the sand spit and dunes that extend to Cape Kiwanda.

Haystack Rock, 327 feet high, lies ½ mile southwestward from Cape Kiwanda and ½ mile offshore; it is a prominent landmark when in this vicinity. It is conical in shape and dark for about half its height, the top in summer being white with bird droppings.

Cape Kiwanda is a low, yellow, rocky point, much broken and eroded, projecting about ½ mile from the general trend of the coast. Behind the cape are bright sand dunes, 500 feet high, which are prominent from seaward.

From Cape Kiwanda the coast extends for 7½ miles in a general northerly direction to Cape Lookout; it is broken about halfway by the entrance to Sand Lake, which is shallow and not navigable. The coast consists of sand beaches and dunes until 1 mile northward of Sand Lake, when it changes to vertical sandstone cliffs 50 to 100 feet high, which continue to Cape Lookout. The hills and country back of the beach as far as the ridge of Cape Lookout have been burned over except in the gulches, and numerous trunks of whitened trees are still standing.

Cape Lookout lies 17½ miles northward from Cascade Head and nearly 40 miles northward from Yaquina Head lighthouse. It projects about 1½ miles at right angles to the coast, a narrow, rocky promontory 425 feet in height at its seaward extremity. The southern face is nearly straight, with precipitous cliffs, in which are numerous caves. The northern face is sloping, covered with a thick growth of timber. The ridge in continuation of the cape is at right angles to the coast and reaches an elevation of 2,500 feet 3¾ miles northeastward from the extremity of the cape. The north side of the cape is clean and bold for the first mile, and then is much broken and marked by caves and several cascades. Fair shelter in northwesterly winds may be had under the south side of the cape, in 6 to 8 fathoms, sandy bottom.

North of Cape Lookout for 2 or 3 miles the land falls to a low, narrow, sandy peninsula, separating Netarts Bay from the ocean. The sand dunes on the peninsula are visible 10 or 12 miles from seaward.

Netarts Bay is a shallow lagoon about 4 miles long, with an average width of 1 mile. The greater portion is bare at low tide except the

channel, close under the north shore, which has from 6 to 7 feet. The post village of Netarts is on the north shore about 1 mile inside the entrance; it is of no commercial importance. Only light-draft vessels with local knowledge can enter, and no directions can be given that would be of value to a stranger.

North of the entrance to Netarts Bay for 1½ miles to the rocks forming the southern part of Cape Meares the coast is a sandy beach, backed by cliffs 50 to 120 feet high. These cliffs are covered by sand dunes varying in height from 150 to 200 feet, which are good landmarks.

Cape Meares is high and rocky, with a seaward face 2 miles in length. The northern portion is the higher, with nearly vertical cliffs 460 feet high. The western point is narrow, covered with fern and brush, and terminates seaward in a cliff about 200 feet high.

Cape Meares lighthouse, on the summit of this cliff, is a white pyramidal tower. The light is fixed white, with a red flash of 2 seconds duration every 60 seconds, 217 feet above the water, and visible 21 miles.

A pillar rock, 75 feet high, lies ⅜ mile northwestward from the point, and a little over ½ mile farther in the same direction is a pyramid rock, 109 feet high, which leans outward.

Bald Mountain, 550 feet high, is an irregular hill close to and eastward of the southern part of the cape.

Three Arch Rocks are the largest of a cluster extending about 350 yards off the southern point of the cape, and range in height from 275 to 304 feet. The largest arch is in the middle and lowest rock, and is about half the height of the rock above water. These rocks are the favorite resort of sea lions, whose barking can be heard a considerable distance with a favorable wind.

From Cape Meares to Kincheloe Point the coast is a low, partly wooded, narrow sand spit, with dunes 40 to 50 feet high; it forms the western shore of Tillamook Bay.

Tillamook Bay is described under a separate heading on page 157.

From Tillamook Bay to the Nehalem River the coast is nearly straight for about 4½ miles. There are several lakes in this stretch separated from the beach by wooded sand dunes. The high hills begin to rise ½ to ¾ mile in from the beach and in 1 mile reach elevations from 1,000 to 1,600 feet all heavily wooded.

Double Headed Rock lies 700 yards offshore and 2 miles northward from the entrance to Tillamook Bay. This prominent feature is in reality two rocks, whose bases are so close together that they generally appear as one. The southern and larger one is 88 feet high and has an arch in it; the other is 75 feet high.

Nehalem River is described under separate heading on page 159.

Northward from the entrance to Nehalem River the coast for 3 miles is low and sandy; it then increases in height and is covered with a dense forest, except in the vicinity of the beach, where there is a narrow line of grassy hillocks, 40 to 100 feet high, which rise gradually to the southern slope of Neah-Kah-Nie Mountain.

Cape Falcon, 17 miles northward from Cape Meares and 10 miles southward from Tillamook Rock, projects about 2 miles from the general trend of the coast. The seaward face is less than ½ mile in

extent, very jagged, with numerous rocks under the cliffs. The southwest point of the cape is composed of nearly vertical cliffs 200 feet high and is partially bare of timber.

Falcon Rock, 50 feet high and small in extent, lies ⅔ mile westward from the southwest point of the cape.

Neah-Kah-Nie Mountain, 2 miles eastward from Cape Falcon, is a prominent landmark. It is double-headed, the western summit being rounded and 1,700 feet high; the eastern summit is lower, serrated, and divided into three peaks of nearly equal height. The entire southeastern slope is bare of timber and covered with grass and fern. The seaward face terminates in rocky, broken cliffs over 500 feet high, with a few rocks lying about 100 feet from the beach.

The coast northward from Cape Falcon consists of high cliffs until 1½ miles southward of Arch Cape, where they change to low bluffs.

Arch Cape is rocky and precipitous, and projects but little from the general trend of the coast, but it is the termination of a mountain ridge rising to 2,775 feet 3 miles eastward. It is bare of timber on the south side for a short distance from the point. A rock, 120 feet high, lies close under the cape, and is connected with it at low water; a smaller rock, 25 feet high, lies about 100 yards outside of this rock. There are several other high rocks in the vicinity of the cape.

Arch Cape Rock, 113 feet high, lies a little over ¾ mile westward from the highest part of the cape and is the outermost bare rock. A rock awash lies about ⅞ mile off the cape and ⅜ mile 225° true (SSW mag.) from Arch Cape Rock; and a rock, bare at lowest tides, lies ½ mile offshore and 1 mile 174° true (SSE ⅝ E mag.) from Arch Cape Rock.

Hug Cape is a small cliff close to the beach 1¾ miles northward from Arch Cape; the cliffs in its vicinity are about 180 feet high.

Midway Cliff, halfway between Cape Falcon and Tillamook Head, is the seaward termination of a ridge extending eastward which reaches a height of 1,000 feet in less than ⅔ mile from the shore. It is heavily wooded and pitches abruptly to the sea, ending in a rocky, broken cliff 100 feet high and ¼ mile long. A rock, 100 feet high, lies close to and abreast of the southern end of the cliff, and another, 76 feet high, lies close to and abreast the northern end. A ledge, showing two rocks bare at half tide, lies 1 mile west-southwestward from the highest part of the cliff.

From Midway Cliff the coast extends north-northwestward for 2⅔ miles to the mouth of Elk Creek, and then turns sharply northwestward for the same distance to the western point of Tillamook Head. The coast is high and wooded, with broken cliffs bordered by numerous rocks except at the mouth of Elk Creek.

Tillamook Head ends in a double point, the points being ½ mile apart. At the southern point the cliffs are 560 feet high, and at the northern point are 1,000 feet high. A pinnacle rock lies at the foot of the cliffs at the northern point, and extending offshore from it for 300 yards is a cluster of rocks, 45 to 150 feet high, the outer one being the lowest. The summit of the head is 1,200 feet high, flat, and densely wooded, with slightly lower land behind it.

Tillamook Rock lies nearly 1¼ miles 268° true (SW by W ¾ W mag.) from the southern point of Tillamook Head. It is nearly 100 feet high, and is marked by a lighthouse and buildings. The western

face leans a little seaward. A rock awash lies ⅓ the distance from the rock to the nearest part of Tillamook Head.

Tillamook Rock lighthouse is a white, square tower on a dwelling. The light is flashing white (flash 1 second, eclipse 4 seconds) 133 feet above the water, and visible 18 miles. The fog signal is an air siren (blast 5 seconds, silent 40 seconds).

North of Tillamook Head the coast is a broad sand beach extending for 14 miles to Point Adams, the south point at the entrance to the Columbia River. Low, sandy ridges, covered with grass, fern, and brush, extend parallel with and back of the beach. **Necanicum Creek**, a small stream, empties at 2½ miles from the southern end of this beach. Several hotels and summer resorts are situated along this stretch, and a sawmill, the smoke from which can generally be seen, is near the southern end.

Saddle Mountain, double-headed and 3,266 feet high, is the landfall for this section of the coast and in approaching the Columbia River. It lies 14 miles 82° true (NE by E ¼ E mag.) from Tillamook Rock lighthouse, and is visible 50 miles offshore.

Cape Disappointment, the north point at the entrance to the Columbia River, is the only headland on the low, sand beach that extends from Tillamook Head to Point Grenville, a distance of over 80 miles. It is a group of rounding hills covering an area 2½ miles long and 1 mile wide, divided by a narrow valley extending north-northwest and south-southeastward. The seaward faces of these hills are precipitous cliffs with jagged, rocky points and small strips of sand beach. The extreme southeastern point is marked by a lighthouse. **McKenzie Head**, ¾ mile northwestward from the lighthouse, is 190 feet high and nearly round; it is covered with grass and fern, but bare of trees. **North Head**, the extreme western point of the cape, is 270 feet high, with a very jagged, precipitous cliff backed by a narrow, grassy strip, the higher ground behind it being covered with trees.

North Head lighthouse, a white conical tower, is on the west point of North Head. The light is group occulting white (eclipse 2 seconds, light 6 seconds, eclipse 2 seconds, light 20 seconds) 194 feet above the water, and visible 20 miles.

Near the light is a United States Weather Bureau storm-warning display station, with telegraph and telephone to Astoria and Portland, and equipped with international code signals for reporting vessels and receiving messages.

A United States Navy radio station (call NPE) is also located near the lighthouse.

From southward or northward Cape Disappointment is generally made as two small, round-topped islands. From westward it is not prominent, but any haze or smoke inside the cape brings it out clearly.

The Columbia River and approaches are described under a separate heading on page 160.

Columbia River light vessel is located on the Main Channel range for entering Columbia River, and is 8¼ miles 210° true (S ⅝ W mag.) from North Head lighthouse. It has a red hull with "Columbia" on each side, and two masts, with red circular grating at each masthead. The lights, shown from each masthead, are fixed white,

50 feet above the water, and visible 11 miles. The fog signal is a steam whistle, blast 2 seconds, silent 18 seconds. The submarine bell strikes "88" every 32 seconds.

COQUILLE RIVER,

(chart 5971), empties about 18 miles northward from Cape Blanco. The principal shipments consist of lumber, railroad ties, farm produce, and the output of several canneries. General merchandise, machinery, and farming implements are received. The river is in the collection district of southern Oregon; the port of entry is at Marshfield, on Coos Bay.

The south point at the mouth of the river is 60 feet high, with several outlying rocks, of which the highest is 65 feet. Broken, rocky bottom, showing breakers in any swell, extend a distance of a little over 1 mile beyond the outermost visible rock; the outermost danger being Coquille Rock, which breaks only in very heavy weather, lying 1⅝ miles west-northwestward from Coquille Point. All other known offshore dangers are south of a line between Coquille Rock and Coquille Point.

A whistling buoy, placed 2 miles 293° true (W ⅛ N mag.) from the lighthouse, is the guide for clearing the above dangers.

The north bank of the river, at the entrance, is a long, low, narrow spit of shifting sand dunes.

Coquille River lighthouse, at the southern extremity of the north spit, is a gray conical tower attached to a dwelling. The light is occulting white (light 28 seconds, eclipse 2 seconds) 47 feet above the water, and visible 12 miles. The fog signal is a reed horn (blast 5 seconds, silent 25 seconds).

The river is under improvement by the Government. The channel at the entrance is confined between jetties, which extend out to a depth of 12 feet. The outer third of the north jetty is submerged.

The bar is narrow; on the range for entering, the 30-foot curve is 400 yards outside the ends of the jetties. In 1916, the least depth on the range across the bar was 14 feet. Between the jetties, however, the channel shoaled in places to 9 feet at mean lower low water, which was the controlling depth to Bandon.

A number of outcropping rocky ledges, with depths of 3 to 5 feet at mean lower low water, lie in the southern part of the channel between the jetties. Of these rocks, the two most dangerous are marked by buoys.

Above Bandon, the improvements consist of the removal of snags and sunken logs, and of dredging a channel, 140 feet wide through the shoal ½ mile northward of Bandon, thence 100 feet wide through the other shoals to Coquille, a total distance of 24½ miles from the mouth; to be 10 feet in depth at mean lower low water from the mouth to Riverton, a distance of 16 miles, and 9 feet from Riverton to Coquille. The present controlling depths, due to subsequent shoaling, are 9 feet to Prosper, 4½ miles above the mouth, 8 feet to Riverton, and 6 feet to Coquille.

Local interests have undertaken the improvement of the river from Coquille to Myrtle Point, a distance of 12 miles. The present controlling depth in this section is about 4 feet.

Bandon, on the south bank at the mouth of the river, is the principal port. Lumber, railroad ties, farm produce, and occasionally coal are shipped; general merchandise, machinery, and agricultural implements are received. The depths at the wharves vary from 12 to 17 feet.

Prosper, 4½ miles above the mouth, ships considerable quantities of lumber. Vessels go direct to the wharf, which has 17 to 19 feet at low water.

Riverton, 16 miles above the mouth, has coal mines which supply the various towns along the river. Some coal was formerly shipped.

Coquille, 24½ miles above the mouth, is the distributing center for the various agricultural communities of the river valley. It has railway connection with the interior.

Pilots and towboats.—There are no regularly licensed pilots, but a towboat at Bandon, owned by the municipality, is available for towing or piloting vessels in and out.

Supplies.—Coal, fuel oils, water, provisions, and a limited amount of ship chandlers' stores may be obtained at Bandon.

Repairs.—Ship carpenters may be had, and small machine work can be handled at the mills.

A **coast guard station** is located near the western end of the waterfront at Bandon. The lookout station is at Coquille Point.

Communication is by steamers from Bandon, of which there are from two to four a week. From various points on the river, the railway at Coquille may be reached by launch or stage. There are telegraph and telephone connections.

To Enter.—At high water and with a smooth bar, vessels drawing less than 11 feet should have no difficulty in reaching the wharves at Bandon. From a position 100 yards northward of the whistling buoy, steer 120° true (E ¾ S mag.) to a position 500 yards outside of the ends of the jetties, at which point the vessel should be on the lighted range for entering. This range does not show well in daytime, but vessels will be on it when the street on which the beacons are placed, and which shows from seaward as a gap between the buildings at the foot of the bluff and those along the waterfront, shows midway between the ends of the jetties. Follow the range, course 111° true (E mag.) until buoy No. 4 is abeam, distant 25 yards. Then haul northward to pass 25 yards off the end of the dike, and follow the waterfront at a distance of 50 yards to the desired berth.

Strangers of a greater draft than the above should take a pilot, as local knowledge is necessary for following the best water. It must be remembered that the bar and the channel between the jetties are subject to changes, so that too great reliance must not be placed on the chart.

When the bar is rough, strangers, irrespective of draft, should not attempt to enter without a pilot, as local knowledge of the undertow is necessary to avoid being carried upon the ends of the jetties.

COOS BAY

(chart 5984) is about 13 miles in length by 1 mile in width, with a tidal area of about 15 square miles. The entrance lies 33 miles northward from Cape Blanco and 1½ miles northward from Cape Arago lighthouse.

The commercial importance of the bay has increased materially in recent years. Large quantities of lumber are shipped, and there is also a considerable traffic in farm and dairy produce, fish, and coal. General merchandise and agricultural and mill machinery are received.

Since its improvement by the Government the bay can be used as a harbor of refuge, and may be entered in any save exceptionally heavy weather.

The entrance is near the southern part of the bay. It has been improved by the Government by the construction of a jetty 9,520 feet long, extending westward from the end of the north spit, and by dredging on the bar. By these means the channel across the bar had been deepened in June, 1916, to a least depth, on the entrance range, of 31 feet at mean lower low water.

The outer 1,500 feet of the jetty has subsided, being now entirely submerged at low tide. On this account caution is necessary in entering in order to avoid the end of the jetty on the one hand and the dangerous shoals off the south entrance point on the other. Vessels should make certain of being on the range before standing close in.

From the entrance, the bay extends northward for 6½ miles, with an average width of ¾ mile, and then bends southeastward for 3¾ miles, terminating in a shallow basin 1½ miles in width, surrounded by marsh land and intersected by several sloughs.

A channel 300 feet wide and 25 feet deep at mean lower low water, and with turning basins 500 feet wide opposite Marshfield and North Bend, has been dredged through the bay from the deep water inside the entrance to the mouth of Isthmus Slough. Subsequent shoaling has reduced these depths to about 20 feet. The channel is well marked by buoys, lighted beacons, and ranges.

A submerged jetty extends 700 yards southwestward from Fossil Point; northwestward from the point, rocky patches, with depths of 15 to 18 feet, contract the channel to a width of 100 yards between the 18-foot curves.

Westward of North Point the bay is crossed by a railway trestle. The section of this trestle which crosses the main channel of the bay is a swinging drawbridge, with a clear opening of 200 feet on either side of the draw span central pier. The dredged channel leads through the south draw. The draw span is kept open at all times except when closed for the passage of trains. During foggy weather, a fog bell installed in the center of the draw span strikes every 10 seconds. At any time during foggy weather when the draw span is closed a siren is sounded, which can be heard a distance of 1 mile. When the bridge is again opened the siren is stopped, indicating that the way is clear for the passage of vessels.

The western shore of the bay as far as the bend is formed by a sand spit, covered with sand dunes, partly wooded and reaching in some places a height of 100 feet. On the eastern shore and above the bend are low, rolling hills, covered with timber.

South Slough, shoal and navigable by small boats only, extends 4 miles southward from its junction with the bay near the entrance.

Haynes Slough and **North Slough** join the bay through a common entrance on the north side of the bay at the bend. These are navi-

gated by small boats and launches engaged in marketing the produce of several farms situated on the sloughs.

The **Coos River** empties through two channels into the bay at its head. The north channel (unmarked) follows the eastern side of the bay and empties abreast of North Bend. The Marshfield Channel (marked by beacons) crosses the flats and empties abreast the town of Marshfield. The river is navigated for 14 miles by light-draft steamers engaged in towing logs and carrying farm and dairy produce. The river has been improved by the Government, and a draft of 5 feet can be taken to the head of navigation at high water.

Three sloughs empty into Coos Bay between Coos River and Marshfield. **Coalbank Slough** is unused and has bridges across it near the mouth. **Isthmus Slough** has been improved by dredging to a depth of 25 feet to a point above **Bay City**. Most of the lumber from the bay is shipped from sawmills on this slough. **Catching Slough** is navigable for several miles by light-draft vessels and is used mainly for logging operations.

Empire is situated on the eastern shore of the bay 4 miles above the entrance. At present the place is of little commercial importance. There is a large sawmill here, but it is not in operation. A cannery is in operation during the fishing season. The depth at the wharves is from 9 to 14 feet.

North Bend, 4½ miles above Empire, is located on the eastern side of North Point. It is a prosperous town with sawmills, factories, and a small shipyard. The depth at the wharves is about 22 feet.

Marshfield, on the western shore near the head of the bay, is the principal town. It is the port of entry for the collection district of southern Oregon, a deputy collector being stationed there. It is the distributing center for a considerable section of country devoted to lumbering, coal mining, dairying, and agriculture. A commercial radio station is located here.

There are ample wharfage facilities with depths of 20 to 25 feet.

Marshfield and North Bend now form practically one continuous settlement, extending along the shore from North Point to the mouth of Coalbank Slough.

Prominent features.—Coos Head, Umpqua River lighthouse, and Cape Arago lighthouse are good guides in making the entrance to the bay; the sand dunes northward toward the Umpqua River are also a noticeable feature.

Guano Rock lies on the south side of the entrance channel, about 250 yards northwestward from Coos Head. This rock now shows only at extreme low water, the top having broken off. It is marked by a buoy placed in 23 feet of water, 100 yards northwestward from the rock.

Anchorage may be had at almost any point inside the bay, dependent upon the draft. Outside the entrance vessels with local knowledge have ridden out southeast gales by anchoring close under Cape Arago in 5 to 6 fathoms, but this is dangerous if the wind shifts to southwest.

Pilots and towboats.—There are no regularly licensed pilots and no towboats. Pilots with local knowledge can be obtained, however, by making signal to the Coast Guard station.

Harbor regulations.—None are prescribed.

Marine hospital.—A relief station of the Public Health Service, in charge of a service officer, is located at Marshfield.

Quarantine.—Regulations of the Public Health Service are enforced by the service officer at Marshfield.

Storm warnings are displayed by the Weather Bureau at the Coast Guard station, at North Bend and at Marshfield.

The **customhouse** is at Marshfield.

Supplies.—Fuel oils, coal, water, provisions, and ship chandlers' stores can be obtained at Marshfield and North Bend.

Repairs to both hulls and machinery may be made. There is a shipyard at North Bend with a railway capable of hauling out a vessel 150 feet long and 10 feet draft. There are also excellent machine shops at the sawmills on Isthmus Slough.

A **Coast Guard station** is located on the south point at the entrance, ¼ mile eastward of Coos Head.

Communication is by rail to the interior, and by regular lines of steamers plying between Columbia River, Coos Bay, Humboldt Bay, and San Francisco. There is also considerable local traffic in smaller vessels to various local points north and south. Communication may be had by telegraph and telephone.

Currents.—The following statement concerning the currents at the entrance has been furnished by the master of the Government bar dredge:

The time of slack water varies with the height of tide. The ebb runs from 1 to 1½ hours after low water, and the flood from ½ to ¾ hour after high water. During long runouts I have found an ebb tide of 5 knots at Guano Rock, and up to 7 knots at the bell buoy, same buoy being run under at times in winter months. Flood tide—maximum velocity, 3½ knots.

From the bell buoy to the outer end of the north jetty the ebb generally sets west (mag.), with a strong tendency toward the south spit. From midway between the end of the jetty and the black buoy, and well out across the bar, the ebb invariably sets strong to south, from 1 to 3 knots. At times I find it necessary while dredging on W ½ N course to haul up to northwest to overcome it.

Entering in rough or heavy weather this should be especially guarded against. With the run of the sea and the set a ship is more likely to be set upon the south spit than upon the jetty.

The present ranges are good guides when visible. The current never sets north at the whistling or channel buoys except under a continued spell of strong southerly winds.

DIRECTIONS, COOS BAY.

From northward or southward the course should be shaped for the whistling buoy. From seaward Cape Blanco and Cape Arago are the prominent features, and at night their lights furnish an excellent means for determining a vessel's position, after which a course can be laid for the whistling buoy.

Approaching from any direction in thick weather, great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3.4 knots have been observed at the light vessels between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. For detailed information regarding the conditions which may be encountered and the precautions to be observed see the statement on coastwise navigation beginning on page 31.

Under the above conditions particular care is necessary in this locality, as the approaches are unsurveyed. The depths should not be shoaled to less than 50 fathoms until the fog signal on Cape Arago has been made.

Strangers should not attempt to cross the bar unless the entrance range can be seen, and not then unless the bar is smooth enough so that a speed can be maintained sufficient to have the vessel under full control at all times. The fact that the outer end of the jetty is submerged should be borne in mind.

Vessels of 20 feet or less draft, having crossed the bar shortly before high water, should have little difficulty in reaching the wharves at North Bend or Marshfield, as the dredged channels are well marked by ranges, lighted beacons, and buoys. The chart is the guide, and no other directions are necessary.

UMPQUA RIVER

(chart 6003) has its entrance 20 miles northward from Cape Arago lighthouse. Considerable lumber, the output of several salmon canneries, and farm and dairy produce are shipped; general merchandise is received. The port of entry is at Coos Bay.

The south point at the entrance to the river is marked by sand dunes, partly covered with trees and reaching elevations of 300 feet. About 1 mile below the entrance, is a bright bare spot in the dunes, that shows prominently among the trees.

Umpqua River lighthouse is situated on the south entrance point. The light shows 2 white and 1 red flash every 15 seconds (each flash 2 seconds and each eclipse 3 seconds duration), is 165 feet above the water, and visible 19 miles. Trees surround the lighthouse and only the lantern shows over their tops.

The north point at the entrance consists of shifting sand dunes, extending northward for 3 miles. These are bare as a rule, and on the river side reach elevations of 100 to 124 feet.

The entrance is at present under improvement, by local interests, by the construction of a jetty from the north entrance point. The bar is subject to change; in 1916, it had a controlling depth of 11 feet at mean lower low water. With a heavy westerly swell the bar is impassable.

Inside the entrance the river has a controlling depth at mean lower low water of 11 feet to Gardiner, 7½ miles above the entrance, and 9 feet to the canneries at Reedsport, 9½ miles above the entrance. At high tide the river is navigable by vessels of 6 feet draft to Scottsburg, 23 miles above the entrance. The channel across the bar is marked by range lights and buoys, which, however, because of the shifting nature of the bar, can not always be relied upon as indicating the best water. The channel to Gardiner is also marked by lights and buoys, and vessels which can cross the bar should have no difficulty in reaching Gardiner.

The channel to Reedsport passes westward of the low marshy islands in mid-river abreast Gardiner and is unmarked. Just above the mouth of **Schofield Creek** this channel is crossed by a railway drawbridge with openings of 150 feet clear width on either side of the central pier. The signal for opening the draw is one long blast of the

whistle, followed quickly by one short and one long blast. During foggy weather, an answering signal of one long blast from the whistle on the bridge will indicate that the draw is open for the passage of boats, and a succession of short blasts will indicate that there will be some delay in opening the draw.

A channel from Gardiner to Reedsport, which is commonly used by launches carrying freight and passengers from the railway station to Gardiner, follows the eastern shore to the cannery ½ mile above Gardiner, then leads through the flats and around the north and west sides of Bone Island. A post light marks the crossover.

Winchester Bay is a small open cove on the east bank just inside the entrance to the river.

Ork Reef, a patch of rocks and sand awash at half tide, lies nearly in mid-channel abreast the northern point of Winchester Bay. Depths of 3 to 5 feet extend 350 yards southwestward from the reef.

A rock, bare at low tide, lies 400 yards southwestward from the south point of Winchester Bay and 200 yards offshore.

Gardiner, the principal town on the river, is situated on the north bank, 7½ miles inside the entrance. It has a large sawmill and a salmon cannery. The sawmill wharf has a depth of 15 feet at low water.

Reedsport is a station on the railway near the south bank of the river. A creamery and salmon cannery are located on the south bank just above the drawbridge.

A **Coast Guard station** is located on the north bank of the river, 1 mile inside the entrance.

Pilots and towboats.—A towboat belonging to the lumber company at Gardiner is available for towing or piloting vessels in and out. This towboat usually sounds the bar before attempting to pilot a vessel across. Strangers are advised not to attempt to enter without its assistance. Vessels desiring to secure the tug should signal the Coast Guard station.

Supplies.—Water, provisions, and a limited amount of ship chandler's stores can be had at Gardiner.

Repairs.—Minor repairs to hulls or machinery can be made. Carpenters are available, and there is a machine shop at the lumber mill. There are no facilities for docking vessels.

Communication is by rail to the interior, or to Coos Bay and thence by steamer. The vessels calling here for lumber do not carry passengers. There is communication by telegraph and telephone.

Directions.—No directions that would be of value to a stranger can be given.

SIUSLAW RIVER

(chart 6023) enters the ocean 42 miles northward of Cape Arago lighthouse, and 7½ miles southward from Heceta Head lighthouse. The principal shipments consist of lumber, canned fish, and dairy produce, in the order named. The river is in the Oregon collection district; the port of entry is at Newport, on Yaquina Bay.

The south entrance point is a narrow spit of high, shifting sand dunes. The north point consists of a low, flat sand beach, backed by rocky, wooded cliffs of 50 to 100 feet elevation.

Cannery Hill, 145 feet high and wooded, is situated on the eastern shore just inside the entrance, and is prominent from seaward.

The entrance has been improved by the Government by the construction of jetties. These confine the channel which, prior to their construction, was subject to extensive changes in position. The approach is marked by a whistling buoy.

The **bar** is narrow, but the depths are subject to change. In June, 1916, the effective depth off the entrance was 11 feet at mean lower low water. Information regarding the condition of the bar channel can usually be obtained at San Francisco from the masters or agents of local vessels.

The usual draft of vessels entering the river is about 10 feet. Such vessels at high water can ascend to the lumber mill below Mapleton, 18 miles above the entrance. The controlling depth to Mapleton was reported to be 7 feet at mean lower low water in June, 1916, with a tidal range of 3 feet at the head of navigation. The channel, however, is narrow and crooked, and the aids to navigation are few. Strangers desiring to enter should take a pilot.

Florence is a small town on the north bank of the river, 4 miles inside the entrance. It has a sawmill, with a depth of 20 feet, at the wharf.

Glenada, on the south bank of the river opposite Florence, is a small settlement of no commercial importance.

Acme, on the north bank 2 miles above Florence, has lumber and shingle mills, with ample depths at the wharves for any vessels which can enter the river.

About 1 mile above Acme, the river is crossed by a railway **drawbridge**, with a clear opening of 100 feet on either side of the central draw span. The signal for opening is one long blast of the whistle, followed quickly by one short and one long blast. During foggy weather, an answering signal of one long blast from the bridge indicates that the draw is open for the passage of boats, and a succession of short blasts indicates that there will be some delay in opening the draw.

Pilots and towboats.—There is a towboat at Florence, which can be obtained for piloting or towing vessels in or out. At present, however, there are no adequate facilities for obtaining the services of this tug.

Supplies.—Water, fuel oils, and a small amount of provisions are obtainable.

Repairs.—Minor repairs only can be made. Carpenters are available and small machine work can be handled at the mills.

A **Coast Guard station** is at present under construction on the east bank, ½ mile south of Cannery Hill, and will be completed during the summer of 1917. The site of the lookout station has not yet been selected.

Communication is by irregular coasting steamer and by rail to the interior. There are telegraph and telephone connections.

Directions.—No directions that would be of value to a stranger can be given. With a smooth bar, vessels drawing 10 to 12 feet may enter at high water and follow the chart to Florence. If desiring to proceed above that point, a pilot should be employed.

YAQUINA BAY

(chart 6058) has its entrance 3½ miles southward of Yaquina Head lighthouse. It is a tidal estuary, the bay proper being only the widening of the Yaquina River just inside the entrance.

The north point at the entrance is a rounding, sandy bluff, 120 feet high; the old lighthouse tower, situated at the extremity and the hotels and cottages northward of it, are prominent as daymarks. The south point is a low sand beach backed by sand dunes rising to 150 feet.

The entrance has been improved by the Government. Jetties have been built out from the north and south points, and several rocks in the channel crossing the bar have been removed to depths of 11 to 12 feet at mean lower low water. The outer end of the south jetty is marked by a fixed red post light.

The **bar** is lumpy and uneven. The bottom is hard, and the depths are subject to comparatively slight changes. In June, 1916, the effective depth on the bar was 11 feet at mean lower low water. On the lighted entrance range, however, the effective depth was only 9 feet.

During the summer months, when the swell is roughly parallel to the coast, the bar is comparatively smooth, being partially sheltered by Yaquina Head. In winter, however, the heavy westerly swell renders it generally too rough to be crossed with safety.

Yaquina Reef, a ridge of hard sand and rock, with depths of 7 to 12 feet, lies ½ mile off the entrance, extending parallel to the shores, a distance of 1½ miles.

South Reef is a southerly continuation of Yaquina Reef, the two being separated by a deep-water channel. A black buoy marking the southern end of Yaquina Reef is the guide for this channel.

Yaquina Head lighthouse and a whistling buoy, placed 2 miles southwestward of the north entrance point, are the guides for making the entrance.

The river has been improved to Toledo, 11 miles above the entrance, by dredging wherever necessary to produce a channel 150 feet wide and 10 feet deep at mean lower low water. This channel is well marked by aids, a number of which are lighted, so that at ordinary high water vessels up to 14 feet draft can reach Toledo. At high tide the river is navigable for vessels drawing 6 feet to Elk City, 7 miles above Toledo.

Newport, just inside the north entrance point, is the principal town on the river. It is a port of entry. Newport is of importance principally as a summer resort, although there is some halibut fishing, the catch being shipped by rail.

Yaquina, about 3½ miles above the entrance, is a small settlement, the terminus of a railroad extending into the interior. Otherwise, it is of no commercial importance.

Toledo, 11 miles above the entrance, ships some lumber by both water and rail. The wharves have 10 to 12 feet at low water.

Anchorage.—No regulations are prescribed. Vessels choose anchorage in the channel at points suited to the draft.

Pilots and towboats.—Pilotage is not compulsory, and there are no licensed pilots or towboats available. Vessels desiring a pilot can

obtain the services of men with good local knowledge by making signal to the Coast Guard lookout station on the north point.

A **Coast Guard station** is located at Newport. The lookout station is the old lighthouse on the top of the hill near the end of the north entrance point.

A **customs officer** is stationed at Newport.

Supplies.—Fresh water, gasoline, distillate, and provisions can be obtained.

Repairs.—There are no facilities for making repairs.

Communication is by rail to the interior, and by irregular coasting steamers to Astoria. There is also communication by telegraph and telephone.

Directions.—No directions that would be of value to a stranger can be given. Strangers desiring to enter or to ascend the river, should employ a man with local knowledge. At the entrance, the buoys can not be relied upon as indicating the best water, and in the river the depths are subject to frequent change.

TILLAMOOK BAY

(chart 6112) has its entrance about 42 miles southward from the Columbia River, 22½ miles southward from Tillamook Rock lighthouse, and 5 miles northward from Cape Meares lighthouse. The bay is about 6 miles long and 3 miles wide, with a tidal area of about 13 square miles, the greater part of which, at low tide, presents a succession of sand and mud flats traversed by three principal channels which, although of fair depth near the entrance, gradually shoal toward the head of the bay.

The country tributary to the bay is devoted chiefly to farming and dairying; the shipments consist of these farm and dairy products, lumber, and fish. General merchandise is received.

Kincheloe Point, the south point at the entrance, is low and sandy. The north point at the entrance is the southern termination of a high, wooded ridge lying between the bay and the Nehalem River. **Green Hill**, at the entrance opposite Kincheloe Point, is a spur from this ridge, terminating in a bluff, rounding point; it is bare of trees, but is covered with ferns and grass, and is a prominent feature in recognizing the entrance. A number of rocks lie close inshore northwestward of the point.

The Sow and Pigs, a ledge of small extent and bare at half tide, lies in the entrance, ⅜ mile eastward from the end of Kincheloe Point and 400 yards off the north shore. This ledge is dangerous when entering with a flood tide, as the current sets toward it.

The entrance is under improvement by the Government. A jetty 5,700 feet long is being built out on the north side of the channel across the bar. It is expected that this jetty will be completed early in 1917. In June, 1916, the channel across the bar had a width of 300 feet, and a controlling depth of 16 feet at mean lower low water. Inside the bar, the controlling depth in the entrance channel was 12 feet.

Inside the entrance the bay is traversed by three principal channels, the **Bay City Channel**, the Main Channel, and the **South Channel**. Of the three, the Main Channel is the only one of any present commercial importance.

Hoquarten Slough, a continuation of the Main Channel, is a narrow, crooked waterway leading from the head of the bay to the town of Tillamook. It has ample depths for any vessels which can pass through the channels in the bay, but it is so crooked that vessels over 125 feet long have difficulty in rounding the bends.

The **Main Channel** has been improved by dredging a cut, 200 feet wide, and 16 feet deep at mean lower low water, from the deep water inside the entrance to abreast the town of Bay City. From the head of this cut, a channel 100 feet wide and 16 feet deep at mean lower low water has been dredged to the wharf at Bay City. A post light (fixed red) placed on the south side of the Bay City cut marks the junction of these two channels.

Above the limits of this dredged area, the Main Channel and Hoquarten Slough have been improved as far as Tillamook by the construction of dikes, the removal of snags, and by dredging in places, resulting in a channel having, in 1916, a least width of 60 feet, and a least depth of 4 feet at mean lower low water. Vessels drawing 9 feet (if not over 125 feet long) can reach Tillamook at mean high tide.

During freshets snags are carried into the upper portion of the bay, where they form a menace to navigation.

Tillamook, on Hoquarten Slough, is the principal town on the bay. It is the distributing center for a rich farming and dairying section and has communication by rail and water to Portland.

Bay City, about midway of the eastern shore of the bay, has a cannery and sawmill. A channel dredged to 16 feet leads to the wharf.

Hobsonville, a small settlement on the point 1½ miles northwestward of Bay City, has a sawmill, but is of no present commercial importance.

Garibaldi, on the north shore ½ mile inside the entrance, is a summer resort. There is a wharf built out to 5 feet. From Garibaldi northward the beach is thickly lined with summer hotels and cottages.

Pilots and towboats.—There are no regular pilots. The nearest available towboat is at Wheeler on the Nehalem River.

A **Coast Guard station** is located on the north shore at the entrance, ½ mile northwestward from Green Hill.

Supplies.—Gasoline, distillate, water, provisions, and a limited amount of ship chandlers' stores can be obtained at Tillamook.

Repairs.—Facilities are limited to carpentry work and minor repairs to launch engines.

Communication is by rail to Portland, and by irregular coasting steamers to the Columbia River or San Francisco. There are telegraph and telephone facilities.

Currents.—In the entrance the average central surface velocity of the flood or ebb stream at strength is 3.7 knots.

Directions.—No directions that would be of value to a stranger can be given. The bar is subject to change, and inside the entrance the aids to navigation are few, and local knowledge is necessary for following the best water in the channels.

NEHALEM RIVER

(chart 6122) is a small stream which empties 19½ miles northward of Cape Lookout and 17 miles southward of Tillamook Rock lighthouse. The tidal reach extends to a point about 10 miles from the entrance, above which the river is a mountain stream full of riffles and obstructed by bowlders.

The river constitutes a natural outlet for an extensive area of heavily timbered country. Lumbering and fishing are the principal industries; sawmills and canneries are located at various points on the lower river.

Nehalem Beach, the north point at the entrance, is a narrow sand spit, bare of trees, and with sand dunes of moderate elevation over the northern part. The south side of the entrance is a low, broad sand beach, backed by wooded country rising to elevations of 400 feet.

Brighton Beach is a small settlement on the eastern shore, 1 mile inside the entrance. It has a sawmill, with wharf built out to 10 feet.

Wheeler Heights and **Wheeler** form one practically continuous town on the south bank of the river, 2¾ miles above Brighton Beach. There is a salmon cannery and a large sawmill, with 6 to 8 feet at the wharf.

Nehalem is a small settlement on the western shore of the river, 1½ miles above Wheeler. It has a cannery with 6 feet at the wharf.

The entrance is being improved by the Government, by the construction of jetties. The south jetty, 4,800 feet long, has been completed, extending in a curve from a point on the eastern shore ½ mile below Brighton Beach. The construction of the north jetty has but recently been begun. As a result of this jetty construction, the entrance channel, which was formerly subject to extensive shifting, has been fixed in position, and the depths in the channel across the bar have been increased to a least depth of 12 feet in June, 1916. Inside the entrance the controlling depths at mean lower low water are 10 feet to Brighton Beach, 8 feet to Wheeler, and 5 feet to Nehalem.

A dangerous sunken rock lies on the eastern side of the channel, 350 yards southward from the inshore end of the south jetty. It is marked by a red buoy.

Anchorage.—No regulations are prescribed. Vessels choose anchorage in the channel at points suited to the draft.

Pilots and towboats.—Pilotage is not compulsory, and there are no licensed pilots available. A towboat belonging to the lumber company at Wheeler can be obtained for piloting or towing vessels in and out.

Supplies.—Water and a limited amount of provisions can be obtained.

Repairs.—Carpenters are available, and the lumber mills can handle minor repairs to machinery.

Communication is by rail to Portland. There is no traffic by water at present. There are telegraph and telephone facilities.

Directions.—No directions that would be of value to a stranger can be given. The bar should not be attempted in heavy weather.

Vessels of 10 feet draft entering near high water can follow the chart to the wharf at Brighton Beach. Beyond that point local knowledge is necessary.

COLUMBIA RIVER

(charts 6151, 6152, 6153, 6154, and 6146) enters the ocean in latitude 46° 15′ north and, with its tributaries, drains a large and productive territory. The lower portion of the river forms the boundary between the States of Oregon and Washington. Below the Cascades, the river flows through a canyon averaging 5 miles in width between the high cliffs on each side; of this width the river occupies about 1 mile, the rest being marsh, low islands, and lowland. Near the mouth the river becomes wider, and in some places is 5 miles across.

This river and its tributaries are navigable by deep-draft ocean steamers to Portland and Vancouver, 98 and 92 miles, respectively, above the mouth, and by light-draft river steamers to **Priest Rapids**, Wash., and **Lewiston**, Idaho, 345 and 406 miles, respectively, above the mouth.

The commerce, both foreign and domestic, is extensive. The exports are principally lumber, grain, flour, fruit, fish, and general merchandise; the imports are coal, fuel oil, cement, manufactures, and general merchandise. There are numerous settlements and landings, but Astoria, on the south bank, 10 miles inside the entrance, and Portland, on the Willamette River, 9 miles from its junction with the Columbia, are the principal shipping points.

Cape Disappointment is described on page 147.

Baker Bay is a shoal, open bight eastward of Cape Disappointment, formed by the cape and the recession of the land northward. Sand Island, low and flat, lies in front of the bay; a channel dredged to a width of 200 feet and a depth of 10 feet at mean lower low water lies eastward and northward of the island, and leads to **Ilwaco**, a small town on the railway extending northward to Willapa Bay. The remainder of the bay is full of shoals and fish traps, and at low tide is not navigable, even for light-draft river steamers.

Point Adams, the south point at the entrance, is a low sandy point covered with fir and undergrowth to the edge of the sand beach and low dunes. The point usually shows well from seaward, particularly if it is hazy inside. Clatsop Spit is a low sand beach extending from Point Adams, a distance of 2½ miles toward Cape Disappointment. It was formerly subject to extensive shifting, but the construction of the south jetty has fixed it in position.

Flavel, on the northeast side of Point Adams, is the terminus of a line of large steamers plying between the Columbia River and San Francisco. It has railway connection with the interior. The wharf, which has depths of over 30 feet at low tide, is marked by a light (fixed white) at its outer end.

Youngs Bay, on the south side of the river, about 10 miles inside the entrance, is shoal, and receives the waters of **Youngs River** and **Lewis and Clark River**. Traffic is confined to light-draft steamers navigating Youngs River. The portion of the bay southeastward from Smith Point is under improvement intended to provide additional frontage for the city of Astoria. Two shipyards devoted to the building of steam schooners are located here. In 1916 they had

one marine railway with a lifting capacity of 1,200 tons dead weight, but a drydock was under construction, 650 by 100 feet, and with a depth of 30 feet over sills.

Youngs Bay is crossed by a railway and a highway bridge. The railway bridge has 130 feet width of openings; the signal for opening is one long blast of the whistle, followed quickly by one short blast. The highway bridge has 120 feet width of openings; the signal for opening is one long blast followed quickly by two short blasts.

Astoria, on the south bank of the river about 12 miles inside the entrance, extends from Youngs Bay to Tongue Point. It is the principal city on the lower portion of the river, and is of great and increasing commercial importance. It has connection with the interior by both rail and river steamers, and ships large quantities of grain, lumber, and general merchandise to both foreign and domestic ports. There are ample wharfage facilities, both municipal and private, with depths of 20 to 40 feet. A commercial radio station is located here.

Harbor regulations are prescribed by the Port of Astoria Commission and enforced by the harbor master. The following are the principal provisions:

That no vessels shall be allowed to anchor for a longer period of time than 1 hour within the following described district in the Columbia River off the mainland of the city of Astoria, Oregon, to wit:

On the west by a line drawn due north from the foot of Melbourne Avenue in the city of Astoria, Oregon, to the north limits of the present ship's channel on the south side of the Columbia River, on the east by a line drawn from the mainland due south of black can buoy No. 3; thence due north to black can buoy No. 3, thence in a westerly direction to gas buoy No. 2, thence due north to the north limits of the present ship's channel on the south side of the Columbia River; on the north by the north limits of the main ship's channel on the south side of the Columbia River.

That all vessels of 50 tons or over be, and they are hereby, prohibited from running at a greater rate of speed than 6 miles per hour within the limits of the waters of the port of Astoria, described in the preceding paragraph.

That all unnecessary whistling by vessels within the waters of the port of Astoria be, and the same is hereby, prohibited.

If any vessel be sunk or stranded within the waters of the port of Astoria, or if any obstruction be found to impede navigation within said port, the owner of the vessel or property by which such obstruction is caused shall immediately notify the harbor master of the position of such obstruction, and shall exhibit on or near such vessel or obstruction such flags, masts or lights, as the harbor master may direct: Two red lights at night and two red flags by day, with bells sounded in case of fog.

Passenger carrying vessels of 100 tons or upward lying along side a vessel berthed at a wharf, shall from sunset until sunrise be provided with such lights as may be necessary to intelligently denote its position, and such vessels shall be provided continuously with such appliances in the way of gangways and man ropes as may, in the opinion of the harbor master, or in fact, be necessary for the convenience and safety of persons passing to and from such vessels, and every gangway fixed for the purpose of giving the crew or passengers, or other persons access to the ship after dark, shall be well lighted as long as such gangway is in communication with the shore, and during such times a watch shall be continuously set upon said gangway.

It shall be unlawful for any person to throw, place or leave any dead animal or putrifying matter in any of the waters of the port of Astoria.

It shall be unlawful for any person to place or deposit any rubbish, refuse matters, or articles of any offensive character likely to create a nuisance upon any wharf or dock, within the limits of the port of Astoria.

It shall be unlawful for any person or persons, firm or corporation to dump or deposit, or throw or cause to be dumped, deposited or thrown into the waters of the port of Astoria, any sawdust, slabs, gravel, loose earth, rock, stone, or any débris which may tend to obstruct the flow or navigation of the waters of the port of Astoria, or to dump or cause to be deposited or dumped, any of the aforesaid articles in any point within the corporate limits of the port of Astoria, where the same will be carried away, and into the waters of said port.

Detailed information regarding anchorages, pilots, towboats, etc., are given under separate headings following:

Megler, on the north shore opposite Astoria, is the terminus of a railway which follows the beach northward to Willapa Bay. It is connected by ferry with Astoria and by steamer with Portland.

Between Astoria and Portland there are numerous landings and settlements, dependent on the fisheries, or acting as shipping points for the lumbering or agricultural areas behind them; they are ports of call for the regular river steamers. Ocean-going vessels do not, as a rule, stop between Astoria and Portland, except occasionally for lumber cargoes at **Rainier, Kalama, St. Helens, Linnton,** or **St. Johns,** 58, 65, 74, 91 and 93 miles, respectively, above the mouth.

Cowlitz River enters the Columbia about 58 miles above the entrance. As a result of improvements by the Government, it has a low-water depth of 4 feet to **Ostrander,** about 8 miles above the mouth, and 2 feet to **Toledo,** the head of navigation, 33 miles above the mouth. Considerable amounts of lumber and farm and dairy products are shipped.

Lewis River, which enters the Columbia 75 miles above the mouth, has also been improved by the Government. A draft of about 3 feet can be carried to **La Center** on the east fork, and to **Woodland** on the north fork, 6½ and 7 miles, respectively, above the mouth. The commerce consists of farm and dairy produce, building materials, and general merchandise.

Willamette River, which empties into the Columbia about 87 miles above the mouth, is the largest tributary of the Columbia below the Cascades. It has been extensively improved by the Government and by local interests, and a draft of 30 feet can be carried from the mouth to Portland, 9 miles; 5 feet, Portland to **Oregon City,** 11½ miles, and 2 feet, Oregon City to **Corvallis,** 94 miles.

Portland, on the west bank of the Willamette River, about 9 miles from its mouth, is a large and prosperous city having an extensive commerce, both foreign and domestic. It is on the line of several railway systems and a port of call for numerous steamship lines. There are ample wharfage facilities, both publicly and privately owned, with depths ranging from 25 to 60 feet.

Improvements of the harbor and the regulations of traffic are in charge of the Port of Portland Commission. Improvements consist of the maintenance of a 30-foot channel from Portland to the mouth of the Williamette River, and the construction and operation of municipal wharves and warehouses, a drydock, and a fleet of towboats.

Harbor regulations are enforced by a harbor master. The following are the most important items of the regulations in force in 1917.

SECTION 1. That for the better protection of persons passing to and from ships and wharves in the city of Portland, it shall be the duty of every owner, lessee, or proprietor of every dock or wharf, to close, and keep closed when not in

actual use, by sufficient gates, barricades, or hatches, all slips or runways used as passageway between the dock or wharf and a ship, and to keep every dock and wharf sufficiently lighted at night when a vessel is made fast thereto.

SEC. 2. Vessels arriving within the corporate limits of the city of Portland, if obliged to anchor, shall be anchored below the Albina Ferry, and on the west side of the main ship channel; such vessels shall be moored with bower anchor forward and another bower anchor ready to drop, and a stream anchor out astern, to prevent the vessel from swinging across the main ship channel and obstructing the same, and shall have a boat swung out ready for instant use at all times. Vessels moving from the docks or wharves to anchor in the river while waiting for cargo, and shall be moored under the same conditions as other vessels, so as to leave a clear channel for vessels coming up or going down the river. Pilots and masters of towboats bringing vessels to anchorage in the harbor of the city of Portland shall see that the vessel in their charge is moored so as to comply with these regulations. Vessels must not be anchored or moored in the fairway channel within the city limits, neither must they moor or anchor within 400 feet of any bridge or ferry line.

SEC. 3. Vessels moving from one dock or wharf to another or from one place to another, when necessary to pass through the draw of any bridge or cross the line of any ferryboat, or when moving from a dock or wharf on one side of the Willamette River to a dock or wharf on the opposite side of said river, shall, in order to prevent the obstruction of travel, have the service of a tug, provided this section shall not apply to vessels when propelled by their own engines.

SEC. 4. A vessel anchored or moored in the harbor or lying at the dock must at all times have at least one officer and three seamen on board capable of taking proper care of the vessel. If it becomes necessary, in order to facilitate navigation or the commerce of the port or for the protection of other vessels or property, a vessel may be removed by order of the harbor master at the expense of the owner, and the owner and vessel shall be liable for all damages and costs that shall arise thereby.

SEC. 5. If any vessel be sunk or stranded within the port, or if any obstruction be found to impede navigation within said port, the owner of the vessel or property by which said obstruction is caused shall immediately notify the harbor master of the position of such obstruction, and shall exhibit on or near such vessel or obstruction such flags, masts, or lights as the harbor master may direct—two red lights at night and two red flags by day, with bell sounded in case of fog.

SEC. 6. The master or person having the charge or command of any vessel coming to or lying alongside any wharf or vessel berthed at a wharf shall, both before and during such time as such vessel is moored or stationed at such wharf, or vessel berthed at a wharf, have the anchors stowed, the jib boom in, the lower yards topped and braced sharp up, and all other projections stowed within the rail of the said vessel.

SEC. 7. In order to facilitate the removal of vessels from their berths at any wharf or place of mooring, or for other reasons, the harbor master may direct the master or person in charge of any vessel to slack away hawsers, cables, or other fastenings of any ship, or to have her yards topped or braced fore and aft, and her martingale and jib boom to be rigged in. The master or person in charge of any vessel shall forthwith comply with such directions given by the harbor master.

SEC. 8. Every vessel lying alongside a wharf, or vessel lying alongside a vessel berthed at a wharf shall, from sunset until sunrise, be provided with proper lights, and shall be provided continuously with such appliances in the way of gangways and manropes as may, in the opinion of the harbor master, or in fact, be necessary for the convenience and safety of persons passing to and from such vessels, and every gangway fixed for the purpose of giving the crew or other persons access to the ship after dark shall be brightly illuminated by the best available means as long as such gangway is in communication with the shore, and a watch shall be continually set upon said gangway.

SEC. 9. Every vessel lying at a wharf shall have such a safety net suspended from a stage or other appliance that may be rigged for the purpose of facilitating ingress and egress to said vessel as will prevent persons falling into the water in the event of their slipping off the said stage or other appliance that may be rigged for the aforesaid purpose.

SEC. 10. Every hawser or rope by which a vessel is made fast to the wharf or shore shall be defended by at least one metal disk of such size and pattern as has been approved by the harbor master, and every such metal disk shall,

if not affixed to the hawser or rope to the satisfaction of the harbor master, be removed to a position on said hawser or rope pointed out by him, and the ship fended off a distance of 6 feet.

SEC. 11. All openings in the ship's side shall be closed at sundown, gangways raised clear of the dock, and all cargo skids shall be unrigged at sundown, except during such time as they are actually in use, when they shall be brightly illuminated. Ballast logs when used by ships are to be properly fastened by chains or wire cables in such manner that they can not float through their fastenings if disturbed by the displacement of water caused by passing steamers.

SEC. 12. Combustible matter, such as pitch, tar, resin, or oil, shall not be heated on board any vessel lying at anchor in the port, and all combustible matter shall be heated in a boat astern at a proper distance from such vessel: *Provided*, That combustible matter shall not be heated while such vessel is alongside a wharf.

SEC. 13. Oil, spirit, or inflammable liquid shall not be pumped or discharged from any vessel or tank into the waters of the port.

SEC. 14. It shall be unlawful for goods or cargo to be placed on any street or roadway near or at the approach to any wharf or dock without the permission of the harbor master having first been obtained.

SEC. 15. When loading into or discharging from any vessel, coal, ballast, ashes, or any material whatsoever, a good and sufficient tarpaulin shall be so stretched and spread as to effectually prevent any lading or material from falling into the waters of the port.

SEC. 17. All stray boats, timber, or other articles found within the port shall be immediately delivered up to the harbor master, in whose custody they shall remain until claimed by the proper owners, * * *.

SEC. 18. It shall be unlawful for any person to throw, place, or leave any dead animal or putrefying matter into or on any part of the port.

SEC. 19. It shall be unlawful for any person to place or deposit any rubbish, refuse matter, or articles of any offensive character, likely to create a nuisance upon any wharf. * * * except at the places and in the manner pointed out by the harbor master.

SEC. 21. It shall be unlawful to fasten vessels or floating timber to either of the bridges or to any support thereof.

SEC. 22. It shall be unlawful for any person or persons to bathe from any wharf or in any part of the port which is open to public view.

SEC. 23. It shall be unlawful for any person or persons, firm or corporation, to dump or deposit or throw, or cause to be dumped, deposited or thrown into the Willamette River, within the limits of the city of Portland, any sawdust, slabs, gravel, loose earth or other débris which may tend to obstruct the channel of said river, * * *.

SEC. 24. It shall be unlawful to run or propel a steamboat on the Willamette River within the corporate limits at a greater speed than 8 miles an hour.

SEC. 25. The harbor master shall have the right to call on the chief of police to aid him in the execution of his duties and he shall have full power to arrest any person or persons who obstruct or resist or refuse to obey his legal orders and requirements, and bring him or them before the proper court, or courts having jurisdiction in the case, for punishment.

SEC. 26. The harbor master is hereby authorized to enter upon and inspect any vessel to ascertain the kind and quality of merchandise or cargo thereon or her condition in any respect, or the condition of her crew, and no person shall hinder or molest the harbor master, or refuse to allow him to enter upon any vessel for any purpose specified in this section.

SEC. 28. It shall be unlawful for any steamship, vessel, or other water craft to enter the city limits while having on board any blasting powder, gunpowder, dynamite, or other explosive compounds used for blasting purposes. * * *.

SEC. 29. No person shall discharge blasting powder, gunpowder, dynamite, or other explosive substances from any vessel or steamship except from ships' sides or tackles, and before the vessel shall have been hauled up to the wharf. No water craft shall be permitted to remain at the wharf longer than six hours after receiving gunpowder, blasting powder, or explosive substances on board. All gunpowder, blasting powder, dynamite, or other explosive substances deposited on the wharf for shipment shall be immediately passed on board the vessel which is to receive the same.

SEC. 30. Any person or persons, firm or corporation, violating any section of this ordinance or part thereof, or fail to comply with any of its provisions, shall,

upon conviction thereof in the municipal court of said city, be fined not less than $10 nor more than $200, or by imprisonment in the city jail for not less than 5 days nor more than 90 days, or by both such fine and imprisonment.

In addition to the above detailed regulations and tariffs for the use of the municipal wharves and dry docks are published by the commission and can be obtained upon request.

The Willamette River in the vicinity of Portland is crossed by six **drawbridges**, as follows:

(1) Railway bridge above St. Johns; openings 230 feet wide; signal for opening, one long blast of whistle followed quickly by one short and one long blast.

(2) Broadway Bridge; opening 250 feet wide; signal, one long, one short, and one long blast.

(3) Railroad bridge, Gilsan Street; opening 205 feet; signal, one long and one short blast.

(4) Burnside Street Bridge; openings 157 feet; signal, one long and two short blasts.

(5) Morrison Street Bridge; openings 157 feet; one long and three short blasts.

(6) Madison Street Bridge; openings 200 feet; one long and four short blasts.

Detailed information regarding anchorages, pilots, towboats, etc., is given under separate headings following.

Vancouver is situated on the north bank of the Columbia, 92 miles above the mouth. The commerce is local and consists of general merchandise, agricultural products, and logs. No lumber has been shipped since the destruction of the sawmills in 1907. A channel 150 feet wide and 20 feet deep at extreme low water leads through the shoals below the town and constitutes the controlling depth to the wharves. The river at Vancouver is crossed by a railway drawbridge with 100 feet width of openings. The signal for opening the bridge is one long and one short blast of the whistle.

Extensive improvements have been made throughout the **lower reaches of the Columbia River,** under a project to secure a depth of 40 feet at mean lower low water on the bar and a channel 300 feet wide and 26 feet deep at mean lower low water for a distance of 24 miles above the mouth, thence 300 feet wide and 30 feet deep at mean lower low water to Portland.

The entrance has been improved, under this project, by the construction of north and south jetties and by dredging. In June, 1916, the least depth on the main channel entrance range was 37 feet at mean lower low water and the depths over the entire bar were generally in excess of 30 feet. The improvement has made it possible for the largest vessels operating on the Pacific coast to enter and leave at all normal stages of tide and in any weather except during the most severe storms. Bar-bound vessels, once so common, are now on account of improved conditions rarely to be seen.

Above the entrance the project is to be attained partly by the construction of stone and pile dikes and revetments, but chiefly by dredging on the various bars. The project depth has been obtained at various times, but on account of excessive shoaling during the annual freshets it has been impossible to maintain the depth on all bars. In 1916 the controlling depth to Portland was 26 feet at mean

lower low water. In the Willamette River the project depth of 30 feet is at present being maintained. Under normal conditions of shoaling and redredging a draft of 28 feet is considered practicable from February to September and 25 feet for the balance of the year.

Freshets occur annually, the high-water stage being reached about June. The heights above normal generally range from about 20 feet at Portland to 4 feet at Astoria. These freshets cause shoaling in the dredged cuts through the various bars, but redredging is begun as soon as the waters have partly subsided, and normal conditions are restored shortly after the end of the flood season.

Aids to navigation.—The entrance and the main ship channel to Portland are well marked by ranges, beacons, and buoys. A number of the beacons are usually carried away when the ice goes out of the river and their absence may make navigation difficult in the early spring.

Prominent features.—The jetty extending seaward from Point Adams is prominent from southward; it shows well when entering by the main channel.

Scarboro Hill is on the north bank of the river inside the entrance, 5¾ miles eastward from Cape Disappointment. It is a long, gradually rising ridge, reaching a height of about 1,000 feet, covered with grass and fern, and prominent because it is the only grass-covered hill visible on the north bank of the river. In recent years many scattered trees have grown up on it, and the slopes eastward to Point Ellice have been largely denuded of their dark timber. A number of conspicuous light-colored buildings, belonging to the military post of **Fort Columbia** are seen near the base of the hill, and alongshore to the westward lies the town of **Chinook**, with a church which is conspicuous from seaward.

Point Ellice, on the north bank of the river, is the termination of a spur from the mountain ridge back of Scarboro Hill; it is about 4 miles northeastward from Point Adams. The point is rounding and rocky, but not high. Two hillocks lie behind the point; one is 240 feet high and the one behind it is much higher.

Smith Point, on the south bank, at the junction of Youngs Bay and the river, is the western termination of a high, wooded ridge; it is the first prominent point on the south bank eastward of Point Adams. The ridge culminates in **Coxcomb Hill**, 647 feet high, behind Astoria.

Tongue Point, on the south bank, about 4 miles northeastward from Smith Point, is a bold, rocky peninsula 300 feet high covered with trees and connected with the south bank by a low, narrow neck. It projects into the river for ¾ mile; a buoy depot of the Lighthouse Establishment is situated on the western side of the peninsula, near its inner end.

Mount St. Helens, nearly 10,000 feet high, cone-shaped and snow-capped, lies about 75 miles eastward of the entrance to the river. On a clear day it is visible when looking up the valley from seaward.

Saddle Mountain is described on page 147.

Anchorage.—There are no prescribed anchorage limits. Regulations governing anchorage off the water fronts of Portland and Astoria are given under separate headings preceding. Anchorage is forbidden in the area included between two lines, ¼ mile on each side of a line from the wharf at Fort Stevens, near Point Adams, to the

wharf at Fort Columbia, at the base of Scarboro Hill. Vessels waiting for a berth at the Astoria wharves usually anchor below Smith Point. At Portland vessels generally anchor between the southern part of the Oregon-Washington Railway & Navigation Co.'s docks and the first bridge, leaving a fairway for passing vessels.

Towboats, some privately owned, and others belonging to the Port of Portland, will usually be found cruising off the entrance. The following are the rates charged for towage by the Port of Portland tugs. Charges by privately owned tugs are subject to prior agreement, but conform closely to the rates here given.

(1) Round trip, sea to Portland and return, for sail vessels, except lumber vessels plying between domestic ports:

Vessels of—	Rate.
500 to 700 tons net register	$500
701 to 1,000 tons net register	550
1,001 to 1,200 tons net register	600
1,201 to 1,500 tons net register	650
1,501 to 1,800 tons net register	700
1,801 to 2,000 tons net register	750
2,001 to 2,500 tons net register	800
2,501 to 3,000 tons net register	850
3,001 to 3,500 tons net register	900
3,501 to 4,000 tons net register	950

Hawser charge, $10 each way.

Vessels towed from sea to Astoria and return only, are charged 70 per cent of the round-trip rate to Portland, as named above.

Oil barges, loaded, towed from sea to Astoria only, will be charged 52½ per cent of the round-trip rate to Portland as named above.

Vessels entering the Columbia River in ballast and departing without cargo and vessels entering for fuel or supplies for use of the vessel so entering, will be towed from sea to Astoria and return for 25 per cent of the rate charged from sea to Portland and return.

(2) Round trip, sea to Portland or intermediate points and return, on lumber vessels when plying between domestic ports (per 1,000 feet of lumber):

	Cents.
To Astoria or Knappton	25
To Skamokawa, Westport, Stella, or Mayger	40
To Prescott, Rainier, Goble, Kalama, St. Helens, or Columbia City	45
To Portland, St. Johns, or Linnton	50

Charges are computed on the actual amount of lumber carried outward bound, subject to a minimum charge based on 300,000 feet of lumber.

No hawser charge is made.

Pilots.—Pilotage across Columbia River Bar, or on Columbia or Willamette Rivers is not compulsory, but pilots are always available for either the bar or the rivers. Bar pilots will be found on a pilot schooner. All but the largest vessels usually cross the bar without a pilot, but strangers usually take one for the river channels.

The Oregon statutes allow the following compensation for bar pilotage, either inward or outward: Two dollars and fifty cents per foot draft and 2 cents per registered ton. For river pilotage between Astoria and Portland the law permits a charge of $2 per foot draft and 2 cents per registered ton.

The actual rates charged in 1916 were $1.50 per foot draft and 1 cent per net registered ton for the bar pilotage and $1 per foot draft and 1 cent per net registered ton for the river pilotage between Astoria and Portland.

The bar pilotage ground extends from the uppermost dock or wharf at the port of Astoria or Knappton to the open sea at least 10 miles beyond the outermost buoy, and the river pilotage ground extends from the lowermost dock or wharf at the port of Astoria to the head of navigation on the Columbia or Willamette Rivers and their tributaries.

When a vessel outward bound takes a pilot, and is thereafter prevented from going to sea on account of stress of weather and the pilot remains thereon at the request of the master, such pilot is entitled to compensation therefor at the rate of $5 per day.

Quarantine.—National regulations are enforced by the Public Health Service. The quarantine officer is stationed at Astoria. Vessels subject to quarantine are boarded below Smith Point and do not proceed above the point until so boarded. There is a fully equipped quarantine station on the north bank of the river 2½ miles northeastward from Point Ellice.

Marine hospital.—Relief stations of the Public Health Service, in charge of service officers, are located at Astoria and Portland.

Customhouse.—The river is in the Oregon collection district, of which Portland is the headquarters. The port of entry for the river is at Astoria.

Supplies of all kinds and in any quantities can be obtained at Portland and Astoria.

Repairs of all kinds can be made at Astoria or Portland. The facilities for repairs at the shipyards on Youngs Bay have been described above. At Portland there are a number of shipyards of various capacities, the maximum facilities for docking being found at the Port of Portland's dry dock, which has the following dimensions:

Length	feet	468
Width between wings	do	82
Depth of water over keel blocks	do	25
Lifting capacity, dead weight	tons	10,000
Length of vessels which can be lifted	feet	500

A machine shop is operated in connection with this dry dock, which is available for use by all contractors.

Storm warnings are displayed by the Weather Bureau at the Point Adams Coast Guard station and at Astoria.

Reporting station.—Vessels are reported to Astoria and Portland from a reporting station at North Head.

A Coast Guard station is located on the eastern side of Point Adams.

Communication between Astoria and Portland and intermediate points may be had by rail and river steamers, and with points north and south by rail and ocean-going steamers. Several transcontinental railroads pass through Portland, and lines of steamers operating across the Pacific or through the Panama Canal call at Portland and Astoria. There is also communication by telegraph, telephone, and wireless.

Currents.—The currents at the Columbia River light vessel are described on page 31.

In the entrance the currents are variable and at times reach a velocity of over 5 knots with an ebb tide; with a flood tide they seldom exceed a velocity of 2 knots.

The velocity due to the tide alone is 2.5 knots at strength of either flood or ebb, but this tidal current is always modified, both as to velocity and time of slack water, by the river discharge. Normally, the strength of the flood current occurs 2.1 hours before the time of high water at Astoria, and the strength of ebb 2.5 hours before the time of low water. On days when the river discharge is such that the velocity of the flood stream becomes 1.6 knots and the ebb stream 3.4 knots the flood or high-water slack precedes high water by 5 minutes and the ebb or low-water slack follows low water by 1.8 hours. These differences between the times of slack current and the times of high or low water will decrease as the river discharge diminishes and increase as the discharge increases.

Above Astoria the current averages 1 to 2 knots except during the freshet period when it is considerably increased, although not enough to seriously affect navigation.

Ice forms occasionally in the river. It is usually not heavy enough to affect navigation, although there may be a short period when the ice goes out in the spring when navigation may be rendered difficult.

DIRECTIONS, COLUMBIA RIVER.

From seaward, in clear weather, the landmarks are prominent, and the lights at the entrance, at Willapa Bay, 25 miles northward, and on Tillamook Rock, 20 miles southward, are distinguishing marks for determining a vessel's position north or south of the entrance and the subsequent shaping of the course.

Approaching from any direction **in thick weather**, great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3.4 knots have been observed at the light vessels between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of those amounts have been reported. For detailed information regarding the conditions which may be encountered and the precautions to be observed see the statement on coastwise navigation beginning on page 31. Under such conditions vessels should keep outside the 30-fathom curve until the light vessel has been made. Care should be taken not to mistake the low sand beach north of Cape Disappointment for that southward of Point Adams; nearly all the vessels which have gone ashore while endeavoring to make the entrance have been wrecked north of the mouth of the river.

Sailing vessels should endeavor to make the land to windward of the entrance; in the summer months, in the latitude of Cape Disappointment, and in winter well southward of the cape; and when compelled to heave to while waiting for favorable conditions for entering, particularly during the heavy weather of the winter season, should make ample allowance for current. Vessels have been known to heave to on making Columbia River light vessel and 24 hours later find themselves off Grays Harbor.

In clear weather vessels should have no difficulty in entering the river, as the aids to navigation are numerous. The chart is the guide, and no detailed directions are necessary. In thick weather, however,

when the aids can not be seen, strangers should not attempt to enter without a pilot.

Local vessels entering in thick weather and with a flood tide as a rule do not attempt to pass beyond Desdemona Sands lighthouse, because of the difficulty, under such circumstances, of avoiding vessels anchored in the narrow channel above the light.

Because of the frequent changes in the position of certain portions of the dredged channel, no directions for the river can be given which would be of permanent value. These channels throughout, however, are well marked by ranges, beacons, and buoys, and by following the chart vessels of less than 23-feet draft should have little difficulty in reaching Portland, provided the trip can be made in daylight. Darkness greatly increases the difficulty of navigation, not only because the unlighted aids can not then be seen, but more particularly because the lighted aids are in some cases difficult to distinguish from the numerous other lights surrounding them. Strangers should not attempt to run the river at night.

COAST FROM COLUMBIA RIVER ENTRANCE TO JUAN DE FUCA STRAIT.

From Cape Disappointment the coast extends northward for 22 miles to Willapa Bay as a low, sandy beach, with sandy ridges about 20 feet high parallel with the shore. Back of the beach the country is heavily wooded. Numerous summer resorts and cottages are situated along the beach, and a railway follows it for a distance of 12 miles above North Head.

Klipsan Beach Coast Guard station is situated on the beach 10 miles northward from North Head.

Leadbetter Point, the southern point at the entrance to Willapa Bay, is low and sandy with no distinctive feature to mark its extremity nearer than the limit of the trees 2¾ miles southward.

Cape Shoalwater, the northern point at the entrance, is low and sandy, the northern portion covered with trees.

Willapa Bay lighthouse is a white conical tower on dwelling, situated about 1 mile northward of the extremity of the point, clear of the trees, on the southern point of a sand ridge about 50 feet high. The light is fixed white, with a white flash of 0.4 second duration every 20 seconds, 81 feet above the water, and visible 14 miles.

A **Coast Guard station** is situated just inside Cape Shoalwater.

Willapa Bay is described under a separate heading on page 178.

From Cape Shoalwater to Point Chehalis, the southern point at the entrance to Grays Harbor, the coast extends for 12 miles as a low sand beach backed by a heavy growth of timber.

Point Chehalis is low and sandy, and for 1½ miles southward from the extremity is bare of trees. A jetty projects seaward from the end of the point.

Grays Harbor lighthouse is situated on the seaward side of Point Chehalis. The light is alternate flashing red and white every 10 seconds (red flash 0.2 second, eclipse 4.8 seconds, white flash 0.2 second, eclipse 4.8 seconds) 123 feet above the water, and visible 17 miles. The fog signal is a steam siren (blast 5 seconds, silent 5 seconds, blast 5 seconds, silent 75 seconds).

Grays Harbor Coast Guard station is situated just south of the lighthouse.

Point Brown, the northern point at the entrance to Grays Harbor, is 2½ miles northward from Point Chehalis; it is low, rounding, and sandy, with shoals extending southward and westward, forming with those extending westward from Point Chehalis the bar at the entrance. It is wooded to within ½ mile of the extremity, near which is a lone tree, easily made from seaward and serving as a leading mark for crossing the bar. A jetty extends southwestward from the point.

Grays Harbor is described under a separate heading on page 181.

From Point Brown the coast extends northward for 22 miles to Point Grenville as a low, sandy beach, broken occasionally by small streams and in some places by bluffs. A few small settlements connected by stage roads or trails are scattered along this stretch.

Copalis Head, 12 miles northward from Point Brown, is a bright yellow bluff, about 2 miles long and 140 to 200 feet high; it is 1¾ miles northward from Copalis River. Two small rocks, the larger 96 feet high, lie 500 yards off the head and a rock awash lies nearly 700 yards westward from them.

Two small bluffs mark the mouth of Jo Creek, 3½ miles northward from Copalis Head.

Moclips River enters 6 miles northward of Copalis Head. The south point at the mouth is bare and sandy; on the north bank is a bright yellowish bluff 50 feet high. **Moclips**, a watering place near the mouth of this river, is connected by a branch of the Northern Pacific Railroad with Hoquiam on Grays Harbor. The hotel and other buildings are prominent from seaward.

Point Grenville is a broken, rocky promontory with nearly vertical, whitish cliffs over 100 feet high. Numerous rocks extend for some distance off the point. **Grenville Arch**, 82 feet high, is the outer and more prominent of two rocks lying westward from the point. It is over ½ mile 237° true (SW by S mag.) from the inner extremity of the point; the arch lies east and west. A rock, awash at high water, lies 400 yards 316° true (WNW mag.) from Grenville Arch. The western rock off the western end of the point is 200 yards off the cliff and 92 feet high; there are a number of rocks inside of it, but none outside. Two rocks over 90 feet high lie 400 yards southward from the southern extremity of the point.

A poor anchorage in northwesterly weather may be had under Point Grenville by vessels of moderate draft, but the depths compel anchoring at such a distance from the beach that little shelter is afforded. The anchorage is in 4 fathoms, sandy bottom, with the inner extremity of the cape bearing 338° true (NW mag.) and Grenville Arch bearing 293° true (W mag.).

From Point Grenville to Cape Elizabeth, 3½ miles, the coast consists of dark cliffs, 80 to 100 feet high, covered with trees.

Quinault River breaks through the cliffs 1 mile southward from Cape Elizabeth.

Sonora Reef extends south-southeastward from Cape Elizabeth for over 2 miles, its southern end lying 1⅛ miles offshore. The reef lies out of the usual course of vessels.

Cape Elizabeth projects about 1 mile from the general trend of the coast and when seen from seaward appears as a bright yellow, rocky cliff reaching in places a height of 200 feet. There are no high or

large rocks off the cape. A little less than 1 mile south-southeastward and south-southwestward, respectively, lie two rocks awash at low water, and inside of these, less than ½ mile from the extremity of the cape, are some small visible rocks and breaks. The houses of the **Quinault Indian Reservation** are situated at the eastern end of the cliffs.

From Cape Elizabeth to the Hoh River, a distance of 24 miles, the coast is nearly straight with low shores and rocky cliffs heavily wooded to the edges. Numerous rocks lie offshore but out of the usual track of vessels.

Flat Rock, low and black, lies 1⅝ miles 322° true (NW by W ½ W mag.) from Cape Elizabeth, and ⅞ mile offshore. A sunken rock which breaks in ordinary weather lies 400 yards southward from it.

A small low rock lies halfway between Flat Rock and Cape Elizabeth, with a smaller one inside halfway to the beach.

Pratts Cliff, 3 miles northward from Cape Elizabeth, is a sharp point with cliffs 100 feet high.

Split Rock, 85 feet high, lies 3½ miles 330° true (NW ¾ W mag.) from Cape Elizabeth and 1 mile offshore abreast the north end of Pratts Cliff; it is split in two, the division showing when seen from west to northwest. A small, low, black rock lies ½ mile southward from it, and another, somewhat larger, lies ⅜ mile 170° true (SE by S mag.) from Split Rock.

Willoughby Rock, 123 feet high, lies ⅜ mile 57° true (NE by N mag.) from Split Rock; it is nearly round with an abrupt seaward face. A cluster of rocks lies between Willoughby and Split Rocks and a little southward of them; one is black and conical, with a rock awash 200 yards southwestward from it.

Sea Lion Rock, 15 feet high, small and black, lies 3 miles 324° true (NW by W ¼ W mag.) from Split Rock and 2¾ miles offshore.

From Pratts Cliff to Raft River, 3½ miles, the coast consists of broken cliffs over 100 feet high, bordered by rocks extending over ½ mile offshore. Midway between them are three rocky heads projecting beyond, and almost detached from the cliffs, and like them, covered with trees to the edges.

Arch Island lies in the entrance to Raft River and at low water is connected with the south point of the river; it is over 100 feet high and 300 yards long. A vertical pillar, 114 feet high, stands 150 yards north-northwestward from the rocks and a cluster of rocks lies close-to under its southeastern point.

From Raft River to Queets River, 4½ miles, the coast consists of cliffs about 80 feet high, broken occasionally by small streams.

Queets River is the largest stream between Grays Harbor and Cape Flattery. The south point is a low, sandy spit about ⅛ mile long, projecting from an abrupt cliff, 80 feet high, and densely wooded. The north point is 1⅓ miles long, low and sandy, with some trees at the mouth of the river, and a narrow lagoon between it and the bluff.

From Queets River to Abbey Islet, abreast Destruction Island, 11½ miles, the coast is rather low and is broken by cliffs about 50 feet high with broad, low-water beaches; a group of low, flat rocks lies 6 miles northward from the river close inshore.

Destruction Island, 90 feet high, lies 20 miles northward from Cape Elizabeth and 3 miles offshore. It is flat-topped and covered with

brush, with a few clumps of trees. It is ½ mile long and at its southern part 300 yards wide. From the northern end rocks and ledges extend about 1 mile from the cliff. These are bordered by a line of kelp on the inshore side.

Destruction Island lighthouse is a white conical tower situated on the southwest part of the island. The light is flashing white (flash 4.5 seconds, eclipse 5.5 seconds), 147 feet above the water, and visible 18 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds.

An indifferent anchorage, affording shelter from northwest winds, may be had off the southeast face of the island in 12 fathoms, sandy bottom, with the lighthouse bearing between west (mag.) and west-northwest (mag.). Vessels must leave if the wind hauls westward or southward.

Abbey Islet, over 100 feet high and covered with trees, lies 200 yards off the cliffs, 3½ miles 48° true (NNE mag.) from Destruction Island. A number of rocks lie near it to the southward, the most distant of which is **South Rock**, 46 feet high, which lies 1 mile southward and ½ mile from shore.

From abreast Abbey Islet to Hoh Head, 4 miles, the coast trends in a general northwesterly direction, forming a shallow bight; the cliffs are 80 to 100 feet high, with numerous rocks and ledges extending in some cases nearly 1 mile offshore.

Hoh River empties 2 miles eastward from Hoh Head. There is a broad sand beach at its mouth, and there are no cliffs for ½ mile, which is noticeable for a considerable distance offshore and marks the mouth of the river. In smooth weather it can be entered by canoes, but the channel shifts. An Indian village is located on the south bank at its mouth.

Hoh Head, 200 feet high, is a bright yellow cliff, covered with a dense forest. It projects a little over ½ mile from the general trend of the coast. Sunken rocks extend 1 mile 215° true (S by W mag.) from the head and between it and North Rock, while a large cluster lies off the south cliff of the head.

North Rock, 100 feet high, black with nearly vertical sides, lies a little over 1 mile southward from Hoh Head.

Middle Rock, 40 feet high, black with vertical sides, lies ¾ mile off the mouth of the Hoh River and 1 mile eastward from North Rock. A rock awash lies ⅔ mile from Middle Rock on a line between it and Destruction Island. Numerous low, flat rocks lie between it and the shore.

Perkins Reef, a long, bold, and jagged islet, lies 1⅛ miles westward from the head. Between it and the shore is a small, visible rock with two sunken rocks near it.

From Hoh Head to Toleak Point, 5 miles, the coast forms two shallow bights, the southern being the longer. The cliffs are from 100 to 120 feet high and are broken by two small streams, one 2 miles northward from Hoh Head and the other 1 mile southward from Toleak Point. Several rocky islets, 25 to 115 feet high, lie in some cases 1½ miles offshore, and numerous rocks and sunken ledges extending over 2 miles offshore border this stretch of the coast. A detailed description is impracticable and only the prominent ones will be described.

Alexander Island, 121 feet high, lies 2 miles northward from Hoh Head and 1 mile offshore. It is ¼ mile long and ⅛ mile wide, bare, flat-topped with steep sides, and in general appearance is similar to Destruction Island. It is prominent in hazy or smoky weather. A sunken rock lies 1¾ miles 282° true (W by S mag.) from Alexander Island and is the outermost known danger in this vicinity. A cluster of three **sunken rocks** lies nearly ½ mile southward from the island. A **rock**, awash at low water, lies 1⅛ miles 274° true (WSW ¼ W mag.) from the island, and a small, bare rock, 25 feet high, lies halfway between them. Between the rock awash and the beach are two small rocks 44 and 74 feet high.

Toleak Point is a narrow point terminating in a small knob with an abrupt seaward face. A high, wooded islet lies 400 yards westward from the point, and is connected with it by an extensive, bare reef.

Rounded Islet, a round, grassy rock, 129 feet high, with steep sides, lies ½ mile seaward from the point; a low, black rock lies ⅔ mile southward from it, or 1 mile south-southwestward from Toleak Point.

From Toleak Point to Teahwhit Head, 3½ miles, the coast is irregular and much broken with numerous outlying rocks and sunken ledges extending in some cases 1 mile offshore.

The **Giants Graveyard** is an irregular group of rocks, some of which are wooded, varying in height from 88 to 212 feet. They lie 1½ miles northward from Toleak Point, and extend ½ mile offshore, the farthest outlying danger being ¾ mile from the beach.

Teahwhit Head is an irregular, jagged, double point, 100 feet high, and heavily wooded behind the dead trees at the edge of the cliff.

From Teahwhit Head to the Quillayute River the coast extends for 1½ miles in high, rocky cliffs, changing to a low sand beach 1 mile southward of the mouth of the river.

Huntington Rock, 135 feet high, is the outermost of a group of islands and rocks ½ mile off the cliffs and 1 mile westward of Teahwhit Head; it is flat-topped and bare with vertical sides. One of the inner islets is 192 feet high and another 223 feet high, the latter being wooded. One sunken and five low, black rocks extend northward for ¼ mile from Huntington Rock.

Quillayute Needle, 83 feet high, a little over ¼ mile southeastward from Huntington Rock, is 35 feet in diameter and nearly vertical; it is the southeasternmost of a line of rocks from Huntington Rock, one of which is 47 feet high and another 73 feet high.

James Island, 125 feet high, lies 15 miles northwestward from Destruction Island and marks the mouth of the Quillayute River; it is bold, wooded, and connected with the beach at low water. Three smaller, wooded islands lie immediately northward of it. These islands are prominent, as the beach north and south of them is low, bare, and sandy, and the valley of the Quillayute River, heavily wooded and low, is behind them. An indifferent anchorage affording some shelter from northwest winds may be had close under and southward of James Island, in 5 to 6 fathoms, sandy bottom, about 600 yards from the beach. Any swell makes it unsafe.

The Indian village of **Lapush** is situated abreast James Island at the southern end of the sand beach extending from the Quillayute River. A road runs hence to East Clallam in Juan de Fuca Strait.

Quillayute River enters at the northern end of the sand beach, expanding into a large lagoon inside the entrance. The bar at its entrance is navigable only by canoes.

From the Quillayute River to Cape Johnson the coast extends northward for 3 miles with steep, wooded bluffs and a narrow beach.

Cake Rock, 116 feet high, lies 2 miles 315° true (WNW ¼ W mag.) from James Island and 1½ miles offshore. It is about 200 yards long by 100 yards wide, with steep sides and a flat, grassy top in the middle of which is a small round mound about 20 feet high. Halfway between Cake Rock and the beach is a jagged rock 131 feet high. A large, low, black rock lies 1⅛ miles 351° true (NW by N mag.) from Cake Island about 1 mile offshore. Two other low rocks lie ¼ mile inside of it.

Cape Johnson is small and not particularly prominent. It projects less than ½ mile from the general trend of the coast, terminating in a rocky, vertical cliff about 100 feet high with a mass of rocks at its base. Several high rocks extend ½ mile west-northwestward from the cape, the highest being 103 and 127 feet.

Three high, rocky pillars lie from ½ to 1 mile south-southeastward from the cape and reach elevations of 117, 207, and 125 feet.

From Cape Johnson to Cape Alava the coast extends in a general north-northwest direction for 12½ miles. The cliffs are not continuous and show bright in but few places, the slopes being densely timbered. Back from the coast the country rises gradually for 10 or 15 miles to the flanking, wooded, snow-capped mountains of the Olympus Range.

Jagged Islet, 68 feet high, lies nearly 2¾ miles 307° true (WNW ⅞ W mag.) from Cape Johnson. It is large, bare, black, and irregular in outline; a low, black rock lies 200 yards northward.

Carroll Islet, 200 feet high, lies 3 miles 322° true (NW by W ½ W mag.) from Cape Johnson and ¾ mile 11° true (N by W ¼ W mag.) from Jagged Islet. It is about ⅛ mile in diameter, with vertical, whitish sides and wooded on top. A pillar rock, 126 feet high, lies 200 yards westward. A small, low, black rock lies 200 yards off the southeastern side. Carroll Islet and the pillar rock are quite prominent, especially when in sunlight.

Bald Islets are two high, bare rocks inside of Jagged and Carroll Islets about ¾ mile offshore. The outer and larger one is 247 feet high, with steep sides; the smaller one is 175 feet high. They are 200 yards apart and between them are two pinnacle rocks close together.

A cluster of small, low, black rocks lies ⅔ mile south-southeastward from the larger islets. Five small, black rocks lie between the larger islet and the beach, and several low, black rocks lie about 1 mile northwestward.

Hand Rock, 27 feet high, lies 1½ miles 7° true (N by W ½ W mag.) from Carroll Islet and 1½ miles offshore; it is so named from its shape. A large rock, 46 feet high, lies halfway between it and the beach, and several low rocks inside the latter.

White Rock, 162 feet high, lies 7¾ miles 358° true (NNW ⅜ W mag.) from Carroll Islet, 2 miles 179° true (SSE ¼ E mag.) from Cape Alava, and ¾ mile offshore. It is 100 yards in extent, with nearly vertical sides and a rounded top.

A group of large, low, black rocks lies ¾ mile south-southeastward from White Rock and ¾ mile offshore; a small black rock lies in the same direction, distant 1½ miles.

Cape Alava lies 13½ miles southward from Cape Flattery, and nearly the same distance northward from Cape Johnson. The seaward face is about 1 mile in extent, with a steep, rocky islet 118 feet high and with trees on top off its northwestern end: the shore is bordered by numerous rocks and sunken ledges. The Ozette Indian village is situated here.

Flattery Rocks and **Umatilla Reef** are a group of rocks and islets extending westward from Cape Alava for a little over 2¼ miles. **Ozette Island**, 240 feet high, lies 1 mile southward from the cape; it is ½ mile long, with a width of ⅜ mile. It is flat-topped and wooded, with steep sides; off the south and southeast sides are low, black rocks at a distance of ⅓ mile. **Bodelteh Islets** (Flattery Rocks) are two wooded islets with high, bold, seaward faces. The outer one, 250 feet high, lies 1⅓ miles westward from Cape Alava; the inner one, 220 feet high, is 100 yards inshore from the outer islet. A high, bare rock lies close under the southwest face of the outer islet; a rock 173 feet high with one tree on top, and about 50 yards in extent, with two smaller rocks outside of it, lies 200 yards westward of the outer islet.

Umatilla Reef extends 200 yards east and west, with a width of 75 yards. It lies 1 mile westward of the outer Bodelteh Islet, and consists of several small, low, black rocks, and a number of breakers; a break is reported 1.1 miles 38° true (N by E ¼ E mag.) from this reef. Umatilla Reef is difficult to make out, especially in thick weather, and is the greatest danger on the northern coast.

Umatilla Reef light vessel is moored in 25 fathoms about 2½ miles southwest from the reef. It has a red hull with "Umatilla" on each side and two masts with a white circular gallery at each masthead. The lights, shown from each masthead, are fixed white, 39 feet above the water and visible 11 miles. The fog signal is a steam whistle (blast 3 seconds, silent 27 seconds) and if this whistle is disabled a bell is struck by hand. A submarine bell strikes groups of 6 and 7 strokes "67" every 24 seconds. In very heavy weather the light vessel is sometimes obliged to leave her station.

From Cape Alava the coast extends northward for 8 miles in two shallow bights and then bends eastward, forming Mukkaw Bay, 3 miles wide, from the northern point of which it trends northwestward for 3 miles to Cape Flattery. The coast is irregular, with alternate stretches of wooded bluffs and rough, rocky cliffs, 100 to 200 feet high. The country immediately back of the beach is not high, but densely wooded.

Point of Arches lies 5 miles northward from Cape Alava, and is the northern point of cliffs extending 1½ miles southward. Numerous rocks and ledges border the cliffs, and extend in some cases ¾ mile offshore.

Father and Son, two rocks connected by a low reef, lie ⅝ mile offshore abreast the southern end of the cliffs; the outer rock is 163 feet high and the inner one 66 feet. A rock 40 feet high lies 1 mile 1° true (NNW mag.) from Father and Son and ½ mile offshore, with several rocks between it and the beach.

Spike (Sail) Rock, 42 feet high, sharp and bare, lies 7/8 mile westward from Point of Arches. It is the outermost of a chain of rocks extending from the point, the three largest ranging in height from 152 to 170 feet; there are three arches in these rocks. A rock awash lies 3/8 mile 245° true (SW 3/8 S mag.) from Spike Rock; it is inside the usual course of vessels.

Portage Head, 7 2/3 miles northward from the outer Flattery Rock, has a seaward face about 1 mile in length of bold, rocky, irregular cliffs over 100 feet high. A reef extends from the point toward Cape Flattery for 1 1/2 miles, showing several low, black rocks awash at low water and one small rock 44 feet high.

Mukkaw Bay is a shallow bight included between Portage Head and Waatch Point, a distance of 3 miles. It affords indifferent shelter in northerly and easterly weather with a smooth sea, but is little used. The shores are low and sandy. The southern half of the bay is shoal, with reefs and rocks extending 1 1/2 miles from Portage Head. The **Sooes Indian village** is situated at the southern end of the sand beach. The Sooes River enters about the middle of the bight. **Waatch Slough** enters in the northern part of the bight immediately eastward of Waatch Point. It is a tidal slough, and the valley through which it runs extends 2 1/4 miles to Neah Bay on Juan de Fuca Strait. This low depression is one of the features for recognizing Cape Flattery. The **Waatch Indian village** is situated at the mouth of the slough.

Waatch Point, 3 miles southeastward from Cape Flattery, is the southeastern extremity of the cliffs extending to the cape. This stretch is bordered by numerous rocks and ledges. Four rocky masses, extending 3/8 mile offshore, range in height from 44 to 88 feet.

Fucas Pillar stands 1/4 mile 181° true (SSE mag.) from the western point of Cape Flattery. It is a rocky column, 140 feet high and 60 feet in diameter, leaning slightly northwestward; it is 150 yards off the face of the cliffs and is more prominent from northward than from southward.

Cape Flattery is a bold, rocky head, with cliffs 120 feet high, rising to an elevation of 1,500 feet 1 mile back from the beach. Numerous rocks and reefs border the cliffs eastward and southward of the cape. From southward it is usually raised as an island, on account of the low land in the vicinity of Waatch Slough.

Tatoosh Island lies 3/8 mile northwestward from Cape Flattery. The main island is about 1/4 mile in diameter, with three smaller ones and several reefs awash close-to on its northwestern face. It is 108 feet high, flat-topped, and bare; a reef, the outer rock of which is usually awash, extends 1/4 mile westward. The passage between the island and the cape is dangerous, and should not be attempted.

Cape Flattery lighthouse is a white conical tower on a gray dwelling, situated on the western end of Tatoosh Island. The light is group occulting white (eclipse 2 seconds, light 4 seconds, eclipse 2 seconds, light 4 seconds, eclipse 2 seconds, light 16 seconds), with a red sector covering Duncan and Duntze Rocks, 165 feet above the water, and visible 19 miles. The fog signal is an air diaphone, (blast 5 seconds, silent 15 seconds, blast 3 seconds, silent 37 seconds).

A Navy radio station (call NPD), is located on the island, and storm warnings are displayed by the Weather Bureau. There is telegraphic communication, and vessels can be reported or send messages. A rocky patch, having a least depth of 7 fathoms, and on which the sea breaks occasionally in a westerly swell, lies 1⅜ miles 231° true (SSW ¼ W mag.) from Cape Flattery lighthouse.

Duncan Rock, small, low, and black, lies 1 mile 347° true (NW ⅝ N mag.) from the lighthouse. A ledge, with 4 fathoms over it, lies ⅜ mile 131° true (ESE ½ E mag.) from Duncan Rock, and a sunken rock between them 250 yards off on the same bearing. Another sunken rock lies 250 yards from Duncan Rock in the direction toward the lighthouse. These dangers contract the passage between Duncan Rock and Tatoosh Island to less than ½ mile.

Duntze Rock, with 3¼ fathoms over it, lies ¼ mile 346° true (NW ½ N mag.) from Duncan Rock and almost in line with it and the lighthouse.

WILLAPA BAY

(chart 6185) has its entrance about 22 miles northward from Cape Disappointment. The entrance is in the northern part of the bay, which consists of two arms; the southern, 16 miles, and the eastern, 10 miles long. Both arms are filled with extensive shoals, large areas of which bare at low water. The southern arm is separated from the ocean by a strip of low sand and sand dunes, averaging 1½ miles in width and covered with trees until within 2¾ miles of **Leadbetter Point**, the northern extremity, and the southern point of the entrance to the bay. Numerous cottages and summer resorts are situated along the seaward face of the narrow peninsula. The shores of the bay elsewhere are composed of low, rolling hills 100 to 200 feet high, covered with a dense growth of timber.

Willapa Bay, with its various tributaries, furnishes an outlet to an extensive area of valuable timber. Lumber and lumber products are the principal exports; fish and sea foods are also shipped. The imports consist of general merchandise, mill machinery, and farming implements. The port of entry is at South Bend, on the Willapa River.

The bar at the entrance to the bay lies about 3 miles outside of the line joining the lighthouse and Leadbetter Point. It is short and, as a rule, has but one breaker. The depth on the bar varies from season to season, ranging from 20 to 27 feet, with a usual depth of about 23 feet at mean lower low water. Vessels of 20 feet draft can cross in safety, at high tide, at any time except occasionally during the heavy westerly weather of the winter season.

Long Island, 5½ miles long northwest and southeast and of irregular width, wooded and rising to over 200 feet in elevation, lies in the southern arm of the bay near the head and nearly fills it.

Nasal River and several small streams enter from the eastern shore of the south arm, and are navigated by small logging steamers.

Willapa River enters at the head of the eastern arm, and at high tide is navigable by vessels drawing 12 feet to Willapa, 11 miles above the mouth. The river channel from deep water in the bay to the town of Raymond, a distance of 12 miles, has been improved by the Government by dredging a channel 200 feet wide and 18 feet

deep at mean lower low water, which depth has since been maintained.

North River enters the eastern arm of the bay 3 miles westward from the mouth of Willapa River; it is navigated by small logging steamers. It has been improved by the removal of snags and log jams.

South Bend, the principal town, is situated on the south bank of Willapa River, 3 miles above the mouth. The town is mainly dependent on the lumber, oyster, and fish industries. It has several large sawmills and shingle mills, and two canneries. The depths at the wharves vary from 15 to 30 feet, depending on the locality.

Raymond is a town on the south bank of the Willapa River at the junction of the south fork, 3 miles above South Bend. It has sawmills and shingle mills, and under normal conditions, ships large quantities of lumber. The depths at the wharves range from 15 to 25 feet.

Tokeland, on **Toke Point**, about 2 miles eastward from Cape Shoalwater, is a summer resort and in summer only, the terminus of a stage line connecting with points northward along the coast as far as Westport, on Grays Harbor. The wharf at Toke Point has 10 feet at low tide.

Bay Center is a small village on Goose Point on the eastern shore of the south arm near its entrance; oyster culture is the main industry.

Nahcotta, about 9 miles southward from Leadbetter Point, on the western shore of the south arm, is a station at the terminus of the railroad communicating with the Columbia River.

Channels.—The shoals extending northward from Leadbetter Point are encroaching upon the entrance channel. The best water is now on the north side of the channel, as indicated by the buoys. The channel leading into North Cove, formerly used as an anchorage by towboats, has shoaled at the mouth to a depth of 3 feet and is no longer used.

The channel leading to Nahcotta has sufficient depth for any vessel that can cross the bar. Its northern portion, however, is unmarked and care is necessary to avoid the shoals on either side. This portion of the channel is unused; only light-draft vessels with local knowledge call at Nahcotta at present and these follow the aids to the eastward of the long mid-channel shoal until abreast of buoy No. 2 A and then cross the shoal, heading for buoy No. 2. The least depth on the course between the buoys is about 8 feet at mean lower low water.

The channel leading to Bay Center is subject to change and caution should be used in attempting to follow the aids.

Aids to navigation.—Willapa Bay lighthouse is described on page 170. Willapa Bay Outside Bar gas and whistling buoy (flashing white light) is situated 6¾ miles south-southwestward from the lighthouse and about 2 miles outside the bar. The channel across the bar and through the entrance is well marked by buoys; and ranges, beacons (lighted and unlighted), and buoys mark the channel through the eastern arm of the bay and the Willapa River to South Bend and Raymond.

Prominent features.—Willapa Bay lighthouse on Cape Shoalwater, the northern point at the entrance, is the most prominent feature in the approaches.

Anchorage may be had at almost any point inside the bay; the holding ground is good.

Pilots and towboats.—There are no towboats and no regular pilots. Towboats, when needed, are secured from Grays Harbor.

Quarantine is established when considered necessary, the anchorage limits being defined at the time and is under the regulations of the National Government.

A **Coast Guard station** is located in North Cove, 1 mile eastward of the lighthouse.

Harbor regulations.—None are prescribed.

Supplies.—Provisions and water may be obtained. A limited amount of coal is usually on hand, but any amount can be had at short notice. Some ship chandler's stores can be had.

Repairs.—Repairs to wooden vessels may be made, and also minor repairs to machinery and boilers. Vessels are sometimes beached for cleaning.

Communication may be had by coasting steamers, and by boats, stage, and rail. A small passenger steamer makes a daily trip with mail from South Bend to Nahcotta and return, stopping at Bay Center and Tokeland en route. There are also telegraph and telephone facilities.

Currents.—In the entrance the average velocity of the flood or ebb stream is 2.6 knots at strength. Currents of 4 to 6 knots occur at times, the velocity being greatest on the ebb, particularly with a southerly wind.

In the channel opposite South Bend, Willapa River, the current turns ½ hour after the times of the tide at Astoria. The average velocity of the flood stream at strength is 1.2 knots and that of the ebb stream 1.4 knots.

DIRECTIONS, WILLAPA BAY.

From northward or southward the course should be shaped to make the gas and whistling buoy. From seaward, in clear weather, the lighthouses at the entrance, at Grays Harbor, 14 miles northward, and at North Head, 22 miles southward, are distinguishing marks for fixing a vessel's position and the subsequent shaping of the course.

Approaching from any direction in thick weather great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3.4 knots have been observed at the light vessels between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. For detailed information regarding the conditions which may be encountered, and the precautions to be observed, see the statement on coastwise navigation beginning on page 31.

Under such conditions vessels should not shoal the water to less than 20 fathoms until the gas and whistling buoy off the entrance has been made.

Strangers should not attempt to navigate the bay in thick weather. At any time, however, when the aids to navigation can be seen ves-

sels of 16 feet or less draft should have little difficulty in reaching the wharves at South Bend or Raymond, as the channel throughout is well marked by ranges, beacons, and buoys. Vessels of a deeper draft should secure the services of a man with local knowledge.

GRAYS HARBOR

(chart 6195) has its entrance 40 miles northward from Cape Disappointment and about 93 miles southward from Cape Flattery. The bay and its tributaries furnish an outlet to an extensive area of valuable timber. A large amount of lumber is shipped to domestic and foreign ports, and general merchandise and mill machinery are received. The port of entry is at Aberdeen.

The bay at the entrance is about 2 miles in width, but shoals extending southward from Point Brown contract the navigable channel to a width of ⅜ mile. From the entrance the bay extends eastward for 15 miles to the mouth of the Chehalis River. The bay throughout is filled by shoals and flats, mostly bare at low water, and cut by numerous channels.

Point Brown and Point Chehalis, the north and south points at the entrance, are described on pages 170 and 171.

North Bay, on the north shore immediately eastward of Point Brown, is a shallow bight about 4 miles long at the entrance and 4 miles wide; it is filled with shoals and flats, bare at low water. The **Humtulips River** enters in the north part of the bight, and several narrow channels wind through the flats to the main channel of the bay.

South Bay, on the south shore immediately eastward of Point Chehalis, is 2 miles long and 2 miles wide; it is full of shoals, bare at low water, with a narrow channel leading through them to the mouth of the **Elk River**, which empties at the head of the bay.

Chehalis River enters at the eastern end of Grays Harbor; it is navigable by light-draft steamers to **Elma**, 30 miles above the mouth, and the upper portion of the river for a distance of approximately 45 miles above Elma is used for floating saw logs.

Hoquiam River empties into Grays Harbor 2 miles westward of the mouth of the Chehalis. The river is practically a tidal slough 11 miles long.

Westport is a village on Point Chehalis in South Bay just inside the entrance to Grays Harbor; it is a summer resort principally, and during the season the terminus of the stage line between Willapa Bay and Grays Harbor, but otherwise is of little commercial importance. A wharf ⅓ mile long extends to deep water in the channel.

Bay City, on the eastern shore of South Bay, has a whaling station and fertilizer factory, with wharf built out to 10 feet. It is the terminus of a railway which follows the south shore of the bay from South Aberdeen.

Ocosta, on the eastern shore of South Bay, 2 miles northward of Bay City, is a small settlement on the line of the railroad. It can not be reached by water and is of no commercial importance.

Markham, on the south shore of the bay 2 miles northeastward of Ocosta, has two shingle mills, whose product is shipped by rail.

Logs are towed to the mill by way of the channel south of Whitcomb Flats.

Hoquiam, on the north shore of the bay at the mouth of Hoquiam River, 12½ miles from the entrance to the harbor, is the terminus of a spur of the Northern Pacific Railroad. There are large lumber and shingle mills, and wharves with from 12 to 25 feet alongside, according to locality.

Aberdeen, on the north shore at the mouth of Chehalis River, is the largest town on the bay. There are several lumber and shingle mills on both sides of the river and several shipyards. The depth alongside the wharves varies from 12 to 30 feet, according to locality. A deputy collector of customs is stationed here.

Cosmopolis, about 2 miles above Aberdeen on the south bank of Chehalis River, has several lumber and shingle mills. It is the head of navigation for ocean-going vessels.

Montesano, on the north bank 14 miles above Aberdeen, also has sawmills; lumber is carried on barges to Cosmopolis or Aberdeen for loading.

The entrance to Grays Harbor has been improved by the construction of jetties and by dredging. By these means the depths on the bar have been considerably increased; in January, 1917, the buoyed channel across the bar had a least depth of 21 feet at mean lower low water and there was a depth of 20 feet on the lighted entrance range. The bar is subject to shifting; it is surveyed twice annually, and the aids are shifted to lead through the best water, but too great reliance should not be placed on them.

It is only in exceptionally rough weather that the bar can not be crossed. Vessels inside usually wait for a blow to pass; but if outside, tugboats and steam schooners drawing 12 to 16 feet enter on the high water, irrespective of weather.

The main channel through the bay to Aberdeen, and the Chehalis River from Aberdeen to Cosmopolis have been improved by the construction of dikes, the removal of snags, and by dredging where necessary to produce a channel 200 feet wide and 18 feet deep at mean lower low water. These are the present controlling depths of the channel. The river between Cosmopolis and Montesano has also been improved, resulting in a channel 150 feet wide and with a controlling depth of 6 feet at mean lower low water.

Hoquiam River has been improved for a distance of 2 miles above the entrance by dredging a channel 100 feet wide and 18 feet deep at mean lower low water. The project depth is at present (1916) available except at the upper end, where a rocky ledge obstructs the channel.

Prominent features.—The country about Grays Harbor is flat and featureless, with few conspicuous objects.

Saddle Hill, about 400 feet high, 8 miles northward of the entrance and 2 miles inshore, is the most conspicuous feature.

Grays Harbor lighthouse shows prominently on a closer approach to the entrance. A lone tree on the southern extremity of Point Brown is used as a leading mark for crossing the bar. In clear weather **Brackenridge Bluff**, on the north shore of the bay 6 miles inside the entrance, is quite prominent; it is a reddish cliff about 1 mile long.

rising in two places to a height of 80 feet. From seaward it is visible only through the entrance.

Neither of the jetties is conspicuous; the crest of the north jetty is at about the level of the ordinary high waters, while the south jetty is at present submerged throughout its entire length at extreme low water.

Anchorage may be had anywhere in the channels inside the bay. The best anchorage is southward of Sand Island, in depths of 35 to 40 feet. Here the holding ground is good, and there is more room than elsewhere in the harbor. Outward bound vessels waiting opportunity to cross the bar frequently anchor in the channel abreast Westport.

Pilots and towboats.—There are no regular pilots. The masters of the towboats, who are licensed for the bar, act as pilots when necessary. For piloting steamers over 800 tons to or from Hoquiam or Aberdeen over the bar or from within the bar to the open sea the rate is $5 per foot draft and 2 cents per ton gross register each way.

Steam vessels over 700 tons and under 800 tons, in and out	$100
Steam vessels over 500 tons and under 700 tons, in and out	75

Towboats are available at all times and may be obtained by making signal off the entrance, which is reported from a lookout station on Point Chehalis. Towage rates on vessels up to 800 tons are 50 cents per gross registered ton, which includes towage in and out over the bar and docking at one dock within the harbor.

Marine hospital.—A relief station of the Public Health Service, in charge of a service office, is located at Hoquiam.

Quarantine.—Regulations of the Public Health Service are enforced. Vessels subject to quarantine inspection are boarded abreast of Hoquiam and do not proceed above that point until so boarded. The anchorage limits are defined when necessary.

Storm warnings are displayed by the Weather Bureau at Aberdeen.

A **Coast Guard station** is situated at Grays Harbor lighthouse.

Drawbridges.—The navigable tributaries to Grays Harbor are crossed by a number of drawbridges. The following table gives their location, clear width of opening, and the whistle signal prescribed for use by the vessel desiring their opening:

Location.	Width of opening.	Signal for opening (blasts of whistle).
	Feet.	
South Bay	100	1 long and 2 short.
Johns River	54	Do.
Hoquiam River (mouth)	125	1 long and 1 short.
Hoquiam River (Eighth Street Hoquiam)	129	1 long and 2 short.
Hoquiam River (near forks)	105	1 long and 3 short.
Wishkah River (railroad bridge)	125	2 long and 1 short.
Wishkah River (Heron Street)	125	2 long and 2 short.
Wishkah River (Second Street)	100	2 long and 3 short.
Chehalis River (railroad bridge)	125	1 long, 1 short, and 1 long.
Chehalis River (Wests Bridge)	130	1 long and 2 short.
Chehalis River (railroad bridge)	125	1 long and 3 short.
Chehalis River (railroad bridge at Montesano)	100	1 long and 2 short.
Chehalis River (highway bridge at Montesano)	100	Do.

The following are the regulations governing the operation of the above bridges:

SECTION 1.—When at any time during the day or night a vessel, unable to pass under the closed draw span of any of the above bridges, approaches it from a distance of over 1,000 feet, the person in command of such vessel shall cause to be sounded, when said vessel shall be at a distance of not less than 1,000 feet, the prescribed signal, and shall repeat this signal until it is understood at the bridge.

SEC. 2.—When such vessel is about to leave a landing 1,000 feet or less from the drawbridge, with the intention of passing through the draw, the person in command shall cause the prescribed signal to be sounded at such interval before leaving the landing that the draw may be opened in time for the vessel to pass.

SEC. 3.—Wagons, vehicles, and trains shall not be stopped on said drawbridges or on a draw span for the purpose of delaying the operations of drawbridge, nor shall water craft or vessels be so manipulated as to hinder or delay the operations of a draw span, but all passage upon, through, or under said drawbridge shall be prompt, to prevent delay to either land or water communication.

SEC. 4.—Whenever possible vessels with tows shall not so approach a bridge as to attempt to pass the draw in succession without interval. They must endeavor to so arrange their approach as to cause no delay in closing the draw promptly for the relief of land traffic.

SEC. 5.—The following signals are prescribed for vessels wishing to have the draws opened: * * *

The above bridges shall also be opened for the passage of vessels or water craft of any description propelled by other than steam power, upon like signals given by whistle or trumpet, or upon verbal request of the person or persons in charge of same.

SEC. 6.—In case the draw span can not be immediately operated when the prescribed signal is given, a red flag or ball by day and a red light by night shall be displayed; or, on bridges where a suitable whistle has been installed, five short blasts shall be immediately given and repeated until the approaching vessel answers.

Supplies.—Fuel oils, water, provisions, and ship chandlers' stores can be obtained. A limited amount of coal is kept on hand and any amount can be obtained on short notice, but the facilities for handling it are poor.

Repairs.—There are a number of shipyards devoted to the building of steam schooners, where repairs can be made. There is a marine railway capable of lifting vessels 210 feet long, 11 feet draft, and 1,500 tons dead weight.

Communication is by rail to the interior, and to Moclips, on the coast 20 miles northward of the entrance.

Communication with points north and south may be had by irregular coasting steamers. Steamers make the round trip daily between Aberdeen, Hoquiam, Westport, and Bay City, and up the Chehalis River to Cosmopolis and Montesano. There are telegraph, telephone, and wireless facilities.

Currents.—In the entrance the average central surface velocity of the flood or ebb stream at strength is 3 knots, and velocities of 5 knots have been observed. In the channels through the bay the velocities seldom exceed 2½ knots.

DIRECTIONS, GRAYS HARBOR.

From northward or southward the course should be shaped to make the entrance buoy. From seaward, in clear weather, Saddle Hill, 8 miles northward of the entrance, and the lighthouse on Point Chehalis will be seen.

Approaching from any direction in thick weather great caution is essential. The currents are variable and uncertain. Velocities of 3 to 3.4 knots have been observed at the light vessels between Blunts Reef and Swiftsure Bank, and velocities considerably in excess of these amounts have been reported. For detailed information regarding the conditions which may be encountered and the precautions to be observed, see the statement on coastwise navigation, beginning on page 31.

Under such conditions vessels should not shoal the depths to less than 20 fathoms unless sure of the position.

Strangers should not attempt to cross the bar when it is breaking, but if desiring to enter should take a pilot.

At any time when the aids can be seen vessels of 16 feet or less draft, having crossed the bar, should have no difficulty in reaching the wharves at Hoquiam or Aberdeen, as the channel, although narrow, is well marked. The channels should not be attempted in thick weather.

JUAN DE FUCA STRAIT AND TRIBUTARIES.

The entrance to this important body of water lies between the parallels of 48° 23′ N. and 48° 36′ N., on the meridian of 124° 45′ W. Juan de Fuca Strait is the connecting channel between the ocean and the inland passages extending southward to Puget Sound and northward to the inland waters of British Columbia and southeast Alaska.

The commerce of this region is extensive, both foreign and domestic. Vast quantities of lumber and fish, together with grain, coal, and general merchandise are exported, while the manufacturing and shipbuilding industries are important. Several transcontinental railroads have their western terminals on Puget Sound and Georgia Strait, and there are several lines of steamers, foreign and domestic, operating across the Pacific or through the Panama Canal, in addition to the coasting and local steamers and sailing vessels.

The navigation of these waters is simple in clear weather; the aids to navigation are numerous, and the chart is a good guide; but in thick weather, owing to the irregularity of the current, strangers need a pilot.

Pilots.—The masters of towboats are licensed pilots, and are the only ones cruising at the entrance to Juan de Fuca Strait. Pilots can be obtained at Port Townsend, Seattle, and Tacoma. There is no statute fixing the rates of pilotage on Puget Sound waters. It is reported that the charge for pilotage from Port Townsend to Seattle and return ranges from $100 to $150, and from Port Townsend to Tacoma and return, from $125 to $175, subject to prior agreement. The following are extracts from the State laws regarding pilotage:

SECTION 1.—That no person shall pilot on Puget Sound waters unless he shall hold a pilot's license from the United States Government for Puget Sound waters and that he shall not pilot a vessel of any greater tonnage than his license provides and must have had at least one year's experience as pilot over sea or coasting vessels of at least 1,500 gross tons.

SEC. 2.—Each vessel, its tackle, apparel and furniture, and the master and the owner thereof, are jointly and severally liable for the compensation of any pilot employed for such vessel; and such pilot shall have a lien upon such vessel, her tackle, apparel and furniture, for such compensation.

SEC. 3.—Nothing in this act shall be construed to compel any vessel to employ a pilot; but no pilot shall be employed by any such vessel for the waters aforesaid except one licensed under the provisions of this act. The master of any vessel subject to the provisions of this act who knowingly employs any person to act as pilot in such waters who is not so licensed shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $200 and not more than $500, and shall be imprisoned in the county jail of the county wherein he is so convicted until said fine, and the costs of prosecution, are paid.

SEC. 4.—Any person who has not been licensed as provided in this act, or whose license is then suspended or has been revoked, who shall offer or undertake to pilot, or shall pilot, any vessel subject to the provisions of this act, upon any of the waters of Puget Sound, its bays, harbors or inlets, shall be guilty of a misdemeanor, and shall upon conviction thereof be punished by a fine of not less than $200, and not more than $500, and shall be imprisoned in the county jail of the county wherein he is so convicted until said fine, and the costs of his prosecution, are paid.

SEC. 5.—That vessels regularly in the coasting trade between ports of the United States or between such ports and ports in Alaska, whether such vessels touch at a British Columbia port or not, and pilots of such vessels while engaged thereon, are exempt from the provision of this act.

Pilots for the waters of British Columbia can be obtained in Royal Roads, and can also be found at the entrances to the principal ports.

Towboats will generally be found cruising at the entrance to Juan de Fuca Strait or in Neah Bay and can be obtained by making signal to the lighthouse on Tatoosh Island.

Towage rates for the Strait of Fuca and adjacent waters are published by the Puget Sound Towboat Owners' Association, Seattle, from whom they may be obtained upon request.

Quarantine.—National regulations are enforced by an officer of the Public Health Service stationed at Port Townsend.

A **marine hospital** conducted by the Public Health Service is located at Port Townsend.

Descriptions of the various sections of this region are given under separate headings, following.

THE ENTRANCE.

In clear weather no difficulty will be experienced in approaching the entrance of the strait from any direction, as the land on both sides is high, and Cape Flattery, the southern point at the entrance, is readily distinguished, particularly from southward, on account of the low land between Mukkaw and Neah Bays. Cape Beale, the eastern point at the entrance to Barkley Sound, on the Vancouver Island shore about 20 miles westward of the entrance to the strait, is marked by a lighthouse and fog signal. Pachena lighthouse, Carmanah lighthouse, Cape Flattery lighthouse, Umatilla Reef light vessel, and Swiftsure Bank light vessel mark the approaches, and have fog signals. In thick weather the soundings also will assist in estimating approximately the distance from shore.

Soundings.—The soundings in the approaches to Juan de Fuca Strait are very irregular, especially outside the 50-fathom curve. The outer limit of the 100-fathom curve is about 35 miles south-southwestward from Cape Flattery and Cape Beale. Westward of Barkley Sound it is at an average distance of 25 miles offshore until westward of Clayoquot Sound. Southward of Umatilla Reef light

vessel it is at an average distance of 20 miles from the light vessel and from Destruction Island; but there is a deep submarine valley making into the strait in a general north-northeast direction with depths of over 100 fathoms and an average width of 4 miles between the 100-fathom curves. On the east side of this valley the 100-fathom curve lies 20 miles southwestward of Destruction Island and Umatilla Reef light vessel, its average direction being northwest (magnetic). It then runs northeastward toward the light vessel for about 12 miles and then northward for about 20 miles. It then turns north-northeastward and passes close outside of Duntze Rock, and then sharply eastward into the strait for about 30 miles. The 100-fathom curve on the west side of the valley is too irregular for description and the chart must be consulted for details.

From the west side of the opening of this deep valley, which is 40 miles 233° true (SSW ½ W mag.) from Cape Flattery light, the 100-fathom curve runs northwestward for 20 miles, then turns west-northwestward for 45 miles and more, lying 50 miles west-southwestward from Cape Beale.

In thick weather, therefore, if the 100-fathom curve is followed for 20 miles or more in a northwest direction, and is found to change to the eastward, a vessel is probably in the valley about 15 to 20 miles southwestward from Umatilla Reef light vessel; but if the direction of the curve changes to the westward she may be on the outside of the bank about 40 miles west-southwestward from Cape Flattery light.

The 50-fathom curve is less complicated southward of the strait. From about 25 miles southward of Cape Flattery it runs in a general N by W ½ W mag. direction and passes 3 miles westward of Umatilla Reef light vessel. It then curves gradually northward toward Cape Flattery and passes close to Duntze Rock. Vessels from southward following this curve in thick weather ought to hear the fog signals both at Umatilla Reef light vessel and at Cape Flattery, and thereby verify their position.

Swiftsure Bank, about 3½ miles in extent within the 30-fathom curve, lies off the mouth of Juan de Fuca Strait northwestward of the submarine valley making into it. The least depth found upon it is 20 fathoms. It is marked by Swiftsure Bank light vessel, which lies 13 miles 310° true (WNW ¾ W mag.) from Cape Flattery light and 10½ miles 244° true (SW ½ S mag.) from Carmanah light. The light vessel has a yellow hull with "Swiftsure" on the sides and two masts with a white oval grating at each masthead. The mainmast shows a fixed white light, 50 feet above the water and visible 11 miles, and the foremast a fixed red light, 50 feet above the water and visible 8 miles.

The fog signal is a steam whistle sounding a group of two blasts every 30 seconds (blast 2 seconds, silent 2 seconds, blast 2 seconds, silent 24 seconds). A bell is struck by hand if the whistle is disabled. A submarine bell sounds groups of 9 and 3 strokes "93" every 26 seconds.

Fog.—The fogs are generally heavier near the entrance, decreasing in density and frequency up the strait. Near the entrance the fog sometimes stands like a wall, and vessels entering the strait run out of it into clear, bright weather even before passing Tatoosh Island.

These fogs frequently extend a long distance seaward, and when combined with the smoke from forest fires become exceptionally dense. The wind gradually works the fog into the strait, and it will follow the northern shore past Port San Juan to the Sombrio River; occasionally it will reach as far as Sooke Inlet and at times to Race Rocks. As a rule, however, the fog follows farther into the strait along the southern shore, at times reaching Port Townsend; frequently the northern shore is clear when the southern is enveloped in fog (see fog signal Race Rocks lighthouse, p. 193).

Wind and rain.—In summer the prevailing northwesterly winds draw into the strait, increasing toward evening, and at times blowing a 10-knot breeze before midnight; this occurs, however, only when the winds are strong outside. In light winds sailing vessels may be a week from Cape Flattery to Admiralty Inlet, or vice versa.

In winter southeasterly winds draw out of the strait, causing a confused cross sea off the entrance, the heavy southwesterly swell meeting that coming out. Under these conditions outward-bound vessels, especially sail, make Neah or Clallam bays and await more favorable weather. The weather off the entrance in winter is as a rule exceptionally severe and wrecks are of frequent occurrence; the heavy, broken seas are probably due to the shoaling off the entrance, the irregularity and velocity of the currents, and the conflict between the wind drawing out of the strait and that along the outer coast.

The rainfall in the vicinity of the entrance is considerable, even during the summer months; the heaviest rains occur during December, January, February, and March.

Currents.—The currents along the coast and at Swiftsure Bank lightvessel are described on page 30. Off the entrance of Juan de Fuca Strait the current is augmented by the current from the strait. On the flood tide there is a set into all the sounds on the Vancouver Island shore, and this combined with the prevailing northwest current and light southerly winds, with possibly some swell from the same direction, make the coast in the vicinity and westward of Carmanah lighthouse dangerous, especially for sailing vessels.

The **flood current** sets northward along the outer coasts of Washington and Vancouver Island at a rate ranging from 1 to 1½ knots, the velocity being increased in southerly weather and diminished in northerly weather. Entering Juan de Fuca Strait it sets with considerable velocity over Duncan and Duntze Rocks, but instead of running in the direction of the channel there is a continual set toward the Vancouver Island shore, which is experienced as far as Race Rocks. The flood current has also more velocity on the northern shore of the strait than on the southern.

The **ebb current** is felt most along the southern shore of the strait, and between New Dungeness lighthouse and Port Crescent there is a decided set southward and westward, especially during spring tides. With the wind and swell against the tide a short, choppy sea is raised near the entrance to the strait.

From Cape Flattery to Race Rocks the tidal currents have a velocity of 2 to 4 knots, varying with the range of tide and influenced by strong winds; eastward of Race Rocks in the wider portion of the strait the velocity is considerably less. At Race Rocks and Discovery

Island the velocity is 3 to 6 knots, and the currents continue to run 1 to 2½ hours after high and low water. Along the Vancouver Island shore the currents turn 1½ to 2½ hours earlier than on the Washington shore of the strait, and advantage is frequently taken of this by vessels having an adverse current in the strait.

Tide rips occur off the prominent points and in the vicinity of the banks. They are particularly heavy off Cape Flattery, Race Rocks, Point Dungeness, and Point Wilson, at times becoming dangerous to small vessels.

Aids to navigation.—Swiftsure Bank light vessel is described on page 187; Umatilla Reef light vessel on page 176; and Cape Flattery lighthouse on page 177.

Cape Beale lighthouse is situated on the Vancouver Island shore about 20 miles westward of the entrance to the strait. The light is revolving white (1 revolution every 30 seconds) with a red sector from 114° to 182°, 178 feet above the water, and visible 19 miles. The fog signal is an air diaphone (blast 4 seconds, silent 90 seconds).

Pachena lighthouse is on the Vancouver Island shore, 6 miles east-southeastward from Cape Beale. The light is group flashing white (flash 0.4 second, eclipse 1.2 seconds, flash 0.4 second, eclipse 5.5 seconds) 200 feet above the water, and visible 20 miles. The fog signal is an air diaphone (blast 3 seconds, silent 4 seconds, blast 3 seconds, silent 86 seconds). A radio station (call VAD) is situated at the lighthouse.

Carmanah lighthouse is situated on the Vancouver Island shore, 15 miles eastward of Pachena lighthouse. The light is flashing white (3 seconds), 173 feet above the water, and visible 19 miles. The fog signal is an air diaphone, sounding a group of 3 blasts every 60 seconds (each blast 2 seconds duration, silent interval 50 seconds).

Rescue stations.—Depots, with provisions and other necessities for shipwrecked mariners, have been established at Cape Beale and Carmanah lighthouses. Notice boards have been erected at intervals between Cape Beale and Port San Juan, giving information for the use of shipwrecked mariners respecting the direction and distance of the nearest lighthouse and also of the nearest Indian village where assistance can be obtained.

DIRECTIONS, APPROACHING AND ENTERING.

A general description of the conditions which may be encountered and of the precautions which should be observed, including directions for approaching from southward, is given in the statement on coastwise navigation, beginning on page 31.

From seaward vessels should pick up the 100-fathom curve and be guided by the soundings. The relation between the 100 and the 50 fathom curves is the best indication for fixing the position, and vessels should not get inside the latter depth until a fix has been obtained. From seaward the mountain peaks in the interior can sometimes be seen when the coast is obscured by fog.

On this portion of the coast the tendency toward a northerly set inshore is much more pronounced than farther south. The great majority of the strandings which have occurred have been on the Vancouver Island shore, and allowance should be made accordingly.

Sailing vessels approaching the strait should keep well off the mainland coast southward of Cape Flattery unless working to windward against a fine northerly wind, which is frequently found during the summer, in which case the coast may be approached to within 3 miles. At other times there is no inducement to hug the coast, on which a long rolling swell frequently sets, and this swell, meeting the southeasterly gales of winter, causes a confused sea. The cape and its off-lying dangers should be given a berth of at least 3 miles, as the tidal stream sometimes sets with great velocity toward Duncan and Duntze Rocks.

It is equally necessary, when entering or leaving the strait, to avoid the coast of Vancouver Island between Port San Juan and Bonilla Point when there is any appearance of bad weather.

Sailing vessels making the strait during the winter months, especially during November and December, and experiencing the easterly and southeasterly winds prevalent at that season, should endeavor to hold a position southward or southwestward from Cape Flattery and should on no account open the entrance of the strait until an opportunity offers of getting well inside. It is also important to remember that, though it may be blowing strongly from the southward or south-southwestward outside, on rounding Cape Flattery an easterly wind may be found blowing out of the strait, and a vessel would then find the Vancouver Island coast a dangerous lee shore.

Coming from the westward with a heavy westerly or northwesterly gale and thick weather vessels uncertain of their position should lie-to at not less than 30 miles from the entrance or on the edge of the bank of soundings. These gales seldom last more than 12 hours, and if they veer toward the southwest the weather will clear and vessels may bear up for the strait.

DIRECTIONS, JUAN DE FUCA STRAIT.

Follow the directions for the outside coast on page 42 and pass 3 miles northwestward of Cape Flattery lighthouse, then steer 103° true (E by N mag.) for 49 miles to a position 2 miles southward of Race Rocks lighthouse. From here steer 100° true (ENE ¾ E mag.) for 32 miles with Admiralty Head lighthouse ahead, passing 2 miles northward of New Dungeness lighthouse and to a position 1⅝ miles northward of Point Wilson lighthouse. Then follow the directions for Pugete Sound on page 204.

JUAN DE FUCA STRAIT, NORTH SHORE.

Juan de Fuca Strait, separating Washington from Vancouver Island, extends eastward for about 50 miles to Race Rocks, with an average width of over 10 miles. Eastward of Race Rocks it extends east-northeastward for 30 miles, with an average width of over 18 miles, connecting northward with Georgia Strait through the channels of Washington Sound, and connecting southward through Admiralty Inlet, which enters in its southeastern part with Puget Sound. The depths, as a rule, are bold to within a short distance of the shore, with but few outlying dangers, most of which are in the eastern part. The shores on both sides are heavily wooded, ris-

ing rapidly to elevations of considerable height, and except in a few places are bold and rugged.

The north shore should be avoided, as it is the lee shore for most gales, and, with the exception of Esquimalt Harbor, there are no anchorages for strangers that afford shelter from all winds.

Cape Beale and Pachena Point, about 5 miles apart, form the western extreme of the northwestern shore of the strait, Pachena Point being about 25 miles northwestward from Cape Flattery. This coast is a very dangerous one, and should be given a wide berth except during fine weather and offshore winds. Shelter sheds, with food, etc., are established along this coast.

Cape Beale is a bold, rocky point, 120 feet high, or 300 feet to the tops of the trees; a reef, with rocks above and below water, extends about ¾ mile southwestward from it. Cape Beale lighthouse (see page 189) is a signal station and is connected with Victoria by telegraph. It is also a rescue station; a depot for provisions and necessities for shipwrecked mariners being maintained there.

Pachena Bay lies between Cape Beale and Pachena Point; it is about 2 miles long and ½ mile wide, with depths of 5 to 6 fathoms. There is usually a heavy swell entering the bay and vessels should not attempt to anchor. At the head of the bay, on the western side, is a small stream into which boats can go and find shelter in rough weather.

A **life-saving station** in connection with one maintained at Banfield Creek, Barclay Sound, is located on the eastern side of Pachena Bay. This station has a motor lifeboat, and in the winter months a crew is maintained.

Seabird Islet, off the entrance to Pachena Bay, is about 10 feet high, bare, and of small extent. Two rocks lie off the islet; one ½ mile 132° true (ESE ½ E mag.) and the other ½ mile 219° true (S by W ¼ W mag.) from it, the latter being awash at high water. There is no safe passage between Seabird Islet and the shores northeastward, and the islet should not be approached closer than 1½ miles.

Pachena Point lies about 5 miles eastward of Cape Beale and has depths of 15 fathoms fairly close in. The coast eastward, as far as Bonilla Point, is apparently of the same character excepting the rocks eastward of Nitinat Lake, but the charts show but few soundings.

The lighthouse on Pachena Point is described on page 189.

From Pachena Point the coast trends southeastward for 11 miles to Nitinat Lake, with **Shelter Bight** and **Clanewah**, a bight with a good beach, between them.

Tsusiat, 6½ miles eastward of Pachena Point, is a conspicuous waterfall which may be seen at a considerable distance, even in hazy weather, and may be used to help fix a vessel's position, as it is the only waterfall on this part of the coast.

A **rescue shed** is maintained at this point on the coast, connected by telephone to Victoria and Banfield Creek.

Behind Tsusiat the mountains rise to a height of 2,000 feet.

Nitinat Lake, 12 miles long and about ½ mile wide, enters the strait about 4 miles eastward of Tsusiat. The depths at the entrance vary from 1 to 2 fathoms, and in bad weather the sea breaks entirely across it.

Clo-oose, in the small cove eastward of the entrance to Nitinat Lake, is a small village and mission. The village is connected with the Government telegraph line to Victoria, and by telephone with Carmanah lighthouse. Shelter and assistance can be obtained here.

A reef, ¾ mile long northwest and southeast, with a rock 4 feet high in its center, lies off this cove. It is marked by a submarine bell buoy placed ¾ mile southwestward of the rock.

Carmanah lighthouse, 5½ miles eastward of the entrance to Nitinat Lake, is described on page 189.

Bonilla Point, about 2 miles east-southeastward from Carmanah lighthouse, slopes gradually to the sea from hills 100 to 2,000 feet in height. A conspicuous house is situated about ½ mile eastward of the point. A reef extends ½ mile off the point; the shores should be given a berth of at least 1½ miles.

From Bonilla Point the coast trends in an easterly direction for 9 miles to Owen Point. It is nearly straight, rocky and bluff, with high mountains rising immediately behind it, all heavily wooded. Vessels are apt to lose much of their wind close to the shore.

Seven Mile Creek empties 1½ miles eastward of Bonilla Point. A shelter station is maintained here, with telephone connections to Victoria and to Banfield Creek.

Port San Juan is the first anchorage on the north shore within the entrance to the Strait of Juan de Fuca. The port is conspicuous from seaward, appearing as a deep gap between two mountain ranges.

The entrance, between Owen Point and San Juan Point, is 1½ miles wide, and lies 13 miles 48° true (NNE mag.) from Cape Flattery lighthouse. It is marked by a gas and whistling buoy (occulting white light) which is situated in mid-channel and may be passed close-to on either side.

Owen Island, about 200 yards off Owen Point, is a low flat rock, awash at high water.

On the western side of the port, rocks and broken ground extend for 1 mile within **Owen Point** and nearly 400 yards offshore; one rock, awash, lies 1,000 yards 72° true (NE ⅛ E mag.) from Owen Island, and 550 yards offshore.

Observatory Rocks, off San Juan Point, are high pinnacles with two or three trees growing on them, and some smaller off-lying rocks, the outermost of which lies 300 yards from shore. About 800 yards northward of these rocks, and 300 yards from shore, is another reef, partly out of water.

Snuggery Cove, on the eastern shore of Port San Juan, about 2 miles inside the entrance, has a substantial wharf, with a depth of 15 feet alongside, protected by a breakwater 900 feet long. At the head of the cove is a hotel, store, post office, and telephone station.

Anchorage.—The port is open to southwest winds, and a heavy sea rolls in when a moderate gale is blowing from that direction; and though it is possible that a vessel with good ground tackle would ride out a gale if anchored in the most sheltered part, it is by no means recommended to remain with any indication of such weather, but to weigh immediately, and if outward bound, seek shelter in Neah Bay, nearly abreast and 10 miles distant from Port San Juan.

There are depths of from 6 to 9 fathoms all over Port San Juan, the bottom fine muddy sand; when within ¾ mile of the head it shoals to 4 fathoms, and here, in heavy gales, the sea breaks; a flat

extends 600 yards from the head. In the outer part of the port there is generally a swell. Good anchorage will be found about 1⅓ miles from the head, in 6 to 8 fathoms.

From Port San Juan the coast trends eastward for 23½ miles to Sheringham Point. This stretch of coast presents no prominent features; the country is thickly wooded and the land rises to a considerable elevation.

From Port San Juan to Race Rocks fish traps are reported to extend, in places, from 1 to 2 miles offshore.

Sheringham Point is marked by a lighthouse having a white tower and red lantern. The light is group flashing white (flash ½ second, eclipse 1¼ seconds, flash ½ second, eclipse 1¼ seconds, flash ½ second, eclipse 3½ seconds), 72 feet above the water, and visible 14 miles.

From Sheringham Point the coast continues in an easterly direction for 16½ miles to Race Rocks, and consists of a number of bays or inlets including **Sooke Bay, Sooke Inlet** and **Becher Bay,** none of which are of more than local importance.

Race Rocks, a cluster of low, bare islets or rocks, the outermost lying about 1 mile southeastward of Bentinck Island, occupy a space of about ½ mile in extent. With the exception of **Great Race,** which is about 300 yards in extent and 28 feet high, they are small, a few feet above water or awash at low water. For a distance of about ½ mile southeastward of the group the bottom is foul and during bad weather heavy, dangerous overfalls and races occur. In light winds sailing vessels should give this group a good berth, especially when to the eastward of them, as the ebb sets in their direction.

Race Rocks lighthouse is a circular tower painted in alternate black and white horizontal bands. The light is flashing white (10 seconds) 118 feet above the water, and visible 18 miles. The fog signal is an air diaphone (blast 3 seconds, silent 47 seconds). Four short blasts from the lighthouse in answer to the fog signal of a vessel in the strait will indicate that the northern portion of the strait is clear of fog.

Rosedale Rock, with a least depth of 5 feet, lies ⅜ mile southeastward from Race Rocks lighthouse; rocky, uneven bottom, with depths of 5 to 8 fathoms, extends ½ mile eastward of the rock. A buoy is moored in 10 fathoms, 250 yards eastward from the rock, which should be given a berth of not less than 1 mile to avoid the tide rips and currents in its vicinity which set toward it and the reefs near it with great velocity.

Eastward of Race Rocks, Juan de Fuca Strait expands to a width of about 16 miles, and extends for 30 miles east-northeastward to the entrances to Admiralty Inlet on the south, and Rosario Strait on the north. Washington Sound, comprising the numerous channels and islands northward of its eastern end, is described on page 243.

Victoria, British Columbia, is at the southeast end of Vancouver Island, 10 miles northward of Race Rocks.

Hein Bank, the shoalest point of which, 14 feet, lies 8¼ miles 283° true (W by S mag.) from Smith Island lighthouse and 10¼ miles 14° true (N ¾ W mag.) from New Dungeness lighthouse, is about 2 miles long north and south within the 10-fathom curve and ¾ mile wide. The shoalest part of the bank is covered with thick kelp in

summer. On the north, east, and west sides of the bank the water deepens quickly; at its south end the bank is continued for over 2 miles within the 20-fathom curve with a width of 1 mile. It is marked by a horizontally striped gas and bell buoy placed close northward of the shoalest point of the bank.

Smith Island lies 5 miles westward from Whidbey Island and 6½ miles from Point Partridge. It is irregular in shape and about ½ mile in extent. At its eastern end it is low, but rises abruptly to an elevation of 55 feet at its western end, terminating in a white perpendicular cliff of sand and gravel. The lighthouse is situated near the western end. The light is flashing white (flash 2 seconds, eclipse 13 seconds). **Minor Islet**, marked by a light (fixed red), small, low, and rocky, lies 1 mile northeastward from the island, and at lowest tides is connected with it by a gravel and bowlder spit. A field of kelp extends 1½ miles westward of Smith Island, with a width of 1 mile and depths of 4¼ to 5 fathoms. A sunken rock, bare at lowest tides, is reported ⅜ mile 269° true (SW by W ¾ W mag.) from the lighthouse.

Partridge Bank, within the 10-fathom curve, is 3 miles long, 1½ miles in width, and the eastern extremity reaches within 1½ miles of Point Partridge. The northern and eastern sides fall off abruptly to 20 and 30 fathoms. The shoalest spot lies on the northern side of the bank midway between the eastern and western ends. It has a depth of only 14 feet at mean lower low water, and is 3¼ miles from the nearest shore of Whidbey Island and 3¾ miles south-southeastward from Smith Island lighthouse. It is marked by a black buoy placed on the southeast side of thick kelp, in 24 feet. Depths of 4 and 5 fathoms extends 1 mile west-northwestward of the 14-foot patch. A considerable part of the bank is covered with kelp, which is usually drawn under by currents. The kelp generally extends to the 7-fathom curve, except toward the eastern end, where the shoal narrows and no kelp exists beyond a depth of 4 fathoms.

JUAN DE FUCA STRAIT, SOUTH SHORE.

Cape Flattery, the south point at the entrance, is described on page 177.

From Cape Flattery the coast trends east-northeastward for 4 miles to Koitlah Point, the west point at the entrance to Neah Bay. The shores are rugged, and the country is heavily timbered.

Neah Bay is described under a separate heading following.

From Neah Bay to Clallam Bay, a distance of 13 miles, the coast extends eastward in a nearly straight line. The shores are rugged and the country is high and heavily wooded.

Seal Rock and **Sail Rock** lie 660 and 560 yards offshore, respectively, about 1¾ miles eastward from Baaddah Point light. Seal Rock, the western one, is 100 feet high, broad in an east and west direction, with flat top sloping eastward; it is light in color. Sail Rock, ¼ mile eastward from it is not so high, sharp pointed, with a low base to westward. Both are prominent landmarks. A line of sunken rocks extends from Seal Rock to the point 1¼ miles 130° true (ESE ¾ E mag.) from it. There are patches of kelp between Seal Rock and the shore and along the line of sunken rocks. Kelp and

some sunken rocks extend over 400 yards off a point 5 miles eastward from Seal Rock.

Clallam Bay, about 15 miles eastward from Neah Bay, is a broad, open bight about 2 miles long and less than 1 mile wide. It affords anchorage in 9 to 10 fathoms, sandy bottom, and is used to some extent in southerly or thick weather.

Slip Point, the eastern point of the bight, is high, wooded, and has a light-colored streak, like a landslip, down its face which is visible a long distance off. A reef extends about ¼ mile westward from the point. Slip Point lighthouse, a white tower on dwelling, is located on a low narrow shelf on the western extremity of the point. The light is fixed white, 72 feet above the water, and visible 14 miles. The fog signal is an air diaphone (blast 3 seconds, silent 27 seconds).

East and **West Clallam** are two small settlements situated on the eastern and western ends of the bight. There are post offices in both places and East Clallam has a telegraph office. A limited amount of provisions may be obtained in either place and communication may be had with Puget Sound ports by steamer and telegraph. At East Clallam is a wharf built out to 15 feet and at West Clallam is also a wharf with 10 feet at the end. Farm produce is shipped and general merchandise is received.

From East Clallam the mail is carried over a county road to Lapush village at the mouth of Quillayute River on the outside coast.

Storm-warning displays of the United States Weather Bureau are made from a staff at East Clallam and can be seen by vessels in the strait.

No directions are necessary for entering other than to give Slip Point a berth of over ¼ mile to avoid the reef projecting westward from it, and which is marked by a bell buoy. Stormbound vessels generally anchor abreast the rocky point near the middle of the long semicircular beach. It is claimed that this is a better anchorage than Neah Bay in heavy southwest weather.

From Slip Point the coast trends eastward for 6½ miles to Pillar Point and then east-northeastward a farther distance of 15½ miles to Crescent Bay.

The **Fuca** coal mine is located about 3 miles eastward from Slip Point on the high, rocky, wooded shore. A wharf supporting a small coal bunker is built on the rocks. The locality is exposed to all winds drawing into or out of the strait.

Pillar Point is a bold point, 675 feet high, wooded to the summit, and with a dark, pillar-shaped rock over 100 feet high lying close under its eastern face. The rock shows prominently from westward.

Pysht River empties into the bight 1 mile south of Pillar Point. The water shoals rather suddenly off the mouth of the river, but good anchorage may be had ¾ mile southeasterly from Pillar Point in from 9 to 12 fathoms, sticky bottom, with good shelter from the heavy westerly swell, but with no shelter from the brisk easterly and northeasterly winds which prevail in winter. **Pysht**, a village and post office, is located near the mouth of the river. Logs and fish are shipped. Freight and passengers are landed by boat.

Twin Rivers (Twin post office), is a small settlement 7 miles eastward from Pillar Point. In front of it, between East and West Twin Rivers, is a small cove protected by shoal spits on either side of it

upon which the sea breaks in rough weather. There is reported to be 6 fathoms between the spits and 4 fathoms at the anchorage inside. A flagstaff near the beach in line with the north gable of a white schoolhouse farther back, bearing about 176° true (SSE ⅝ E mag.), is the leading-in range to the anchorage. Logging is carried on there, and tugs have been in there after rafts.

Gettysburg Landing, at the mouth of Lyre River, is 11½ miles eastward from Pillar Point. Logging is the main industry and freight and passengers are landed by boat. Low Point, the eastern point of Lyre River, is marked by a fixed white post light 25 feet high and visible 6 miles. Shoal water makes out a considerable distance from Low Point and vessels should not approach it closer than ¾ mile. There are many bowlders bare at low tide westward of the point.

Port Crescent, 15 miles eastward from Pillar Point, is a small semicircular bight 1 mile in diameter. The eastern part is shoal, but a wharf has been built from the western shore with 12 feet at its end. This is not a good landing in northerly weather. The anchorage is of limited extent and suitable only for small vessels. Logs, shingles, and a small amount of farm produce are shipped. **Port Crescent** is a post office and settlement at the head of the bight. A limited amount of provisions may be obtained. Communication with Puget Sound ports may be had by steamer and telegraph. The western head of the bay is marked by a fixed red post light, 40 feet high and visible 4 miles.

Crescent Reef, with 8 feet over it, lies ⅜ mile northward of the western point at the entrance. It extends ⅜ mile in an east and west direction, with a narrow channel between it and the point. The channel is used by the small coasting steamers with local knowledge, but is not recommended for strangers. It is reported to have 10 fathoms in it. The reef is marked by a bell buoy placed about 50 yards northward from the shoalest part. A reef extends about 400 yards northwestward from **Tongue Point**, the eastern point at the entrance.

To ENTER, bring the hotel near the inner end of the wharf, just open westward of the outer end, and stand in on that range: this clears Crescent Reef and the reef extending westward from Tongue Point.

Observatory Point lies 3 miles eastward from Tongue Point. Between them is a ridge with lower land behind it, making it appear as an island when raised from westward or eastward. The summit of the tree-covered ridge is about 1,200 feet high. On its north face is a conspicuous landslide, and the hill is known as **Striped Peak**. Observatory Point has a rock off it about 50 feet high with a single tree on top. It is almost connected with the point at low tide.

Fresh Water Bay, about 5 miles eastward from Port Crescent, is a broad, open bight affording anchorage in 6 to 10 fathoms. It is little used, on account of the lack of shelter and its proximity to Port Angeles. Shingles are shipped at times in small coasting craft from a mill about 1½ miles inland.

Angeles Point, on the east side of Fresh Water Bay, is low, sandy, and covered with alders.

Port Angeles is described under a separate heading following.

From Port Angeles the shores trend east-northeastward for 5 miles to Green Point, and thence northeastward for 8 miles to the end of Dungeness Spit.

New Dungeness Bay lies 12 miles eastward of Port Angeles. It affords shelter in westerly winds, but is open eastward, and in northerly weather the protection afforded is only fair. It is a dangerous place in winter gales, especially from the southeast. It is formed by a sand spit extending northeastward 3½ miles, and forming, in addition to New Dungeness Bay, a small lagoon at the head of the harbor which can be entered by light-draft vessels with local knowledge.

New Dungeness lighthouse, a conical tower on a dwelling, upper part black, lower part white, is situated on the end of the spit, and is the prominent feature in the approaches. The light is group occulting white (eclipse 2 seconds, light 2 seconds, eclipse 2 seconds, light 2 seconds, eclipse 2 seconds, light 20 seconds), 96 feet above the water, and visible 16 miles. The fog signal is an air siren (blast 6 seconds, silent 12 seconds, blast 3 seconds, silent 39 seconds).

From the end of the spit a shoal extends northward for ¾ mile from the lighthouse. This is marked by a buoy, and vessels should not pass between the buoy and the lighthouse. The best anchorage is in 5 to 9 fathoms, sticky bottom, on line between the end of the long wharf and the lighthouse.

New Dungeness is a small settlement on the south shore of the bay. Shingles and farm produce are the principal shipments, and general merchandise is received. A wharf about 4,000 feet long and 75 feet wide at its outer end, where there is a small warehouse, has been built out to a depth of 12 feet. A limited amount of provisions may be obtained. Communication may be had with Puget Sound ports by steamer and telegraph.

No directions are considered necessary further than to caution vessels not to pass between the lighthouse and the buoy marking the extremity of the shoal making off from the spit. A shoal makes out nearly 1 mile from the southern shore, and the spit forming the western side of the bay should be given a berth of over ⅜ mile.

Washington Harbor is a landlocked bay, 3¾ miles long in a northwest and southeast direction, with an average width of 1 mile. A sand spit extends from the eastern shore at the northern point nearly across to the western shore, leaving a narrow, winding channel, through which 11 feet can be taken at low water with local knowledge. Once inside, there is good anchorage anywhere in 6 to 20 fathoms, muddy bottom. The harbor is but little used. A creamery with conspicuous white buildings is located on the west side of the entrance to the harbor abreast the sand spit. It has a wharf in front, about 100 feet along the face, with 18 feet of water. Vessels load shingles and produce.

Port Discovery lies 5 miles eastward from Washington Harbor; it is winding and about 8 miles long, with an average width of 1¼ miles. From the entrance it extends southward for 1½ miles, and then bends southeastward for 2½ miles, from which point it sweeps in a gentle curve southward and then southwestward to the head, terminating in flats that bare at low water for ¾ mile. There are no outlying dangers, and the depths in mid-channel range from 30 fathoms at the entrance to 10 and 12 fathoms 1½ miles from the head, where

good anchorage may be had in 8 to 10 fathoms, muddy bottom. The flats rise abruptly from depths of 3 and 4 fathoms, and at high water care should be taken to avoid anchoring too close to them. This harbor is but little used, as it is out of the usual lines of travel.

Protection Island, 1¾ miles northward from Clallam Point, the western point at the entrance, is the prominent feature in approaching. It is 1½ miles long in a northeast and southwest direction, with an average width of ½ mile, and 200 feet high and sparsely wooded; its north shore consists of bare, light bluffs. Its eastern end and southern shore are clear. From **Kanem Point,** its southwestern extremity, a shoal extends southwestward for over ¼ mile, and depths of less than 5 fathoms are found ½ mile westward of the point. This shoal is marked by a buoy placed in 5½ fathoms about ½ mile west-southwestward from the end of the point. **Dallas Bank** extends northward from Protection Island, the 10-fathom curve lying at a distance of 2½ miles from the northern point. From the 10-fathom curve the bank drops off abruptly to depths of over 20 fathoms. A wharf is built out from the east side of Kanem Point to 17 feet, from which farm produce is shipped occasionally in small coasting vessels.

The National Quarantine Station is located at Clallam Point, the western point at the entrance to Port Discovery. The largest vessels can moor at the wharf in front of it; the anchorage for detained vessels is about 2 miles southward of Clallam Point in 12 fathoms, mud bottom.

No directions are considered necessary for entering, and a mid-channel course is clear to the anchorage. Entrance may be made either eastward or westward of Protection Island.

From Port Discovery the shores trend northeastward for 6 miles to Point Wilson, the western point at the entrance to Admiralty Inlet, and consist of high, bare, clay bluffs, sparsely wooded on top, reaching a height of 400 feet near **Middle Point,** and breaking down abruptly a little westward of Point Wilson.

A shoal with 10 feet over it lies ⅝ mile northwestward from Middle Point; it is marked by a red buoy. A sunken rock has been found southward and eastward of the shoal, and vessels are cautioned not to pass between the buoy and the point.

NEAH BAY

(chart 6265), about 5 miles eastward of Cape Flattery, is used extensively by vessels in southerly and westerly weather when too severe to venture outside. Its proximity to the entrance to the strait and ease of access at all times makes this anchorage very valuable; there is usually some swell, especially in northerly or westerly weather, when it is rather uncomfortable. The anchorage area is about 1 mile by ½ mile with depth varying from 4 to 6 fathoms, sandy bottom. **Waaddah Island,** about ½ mile long by 250 yards in width, forms the northeastern side of the bay; it lies ¼ mile northward from Baaddah Point and is high and wooded, with a reef and foul ground extending ¼ mile from its southwestern side. A gas and whistling buoy (flashing white light) is placed in 20 fathoms, ½ mile west-northwestward from the northwest end of the island, as a guide to the main entrance.

The western shore of the bay from Koitlah Point to the village is high, precipitous, and bordered by craggy outcropping rocks. A

reef, bare at low tide, and marked by kelp, extends in places a distance of ¼ mile from the beach. From the village the character of the shore changes to a low sand beach, which continues to Baaddah Point.

Between Waaddah Island and the mainland southeastward is a channel, having a depth of 20 feet or more, and a clear width of 300 yards between the 3-fathom curves. This channel is the one commonly used by local vessels making the bay from eastward.

Baaddah Point, the southeastern entrance point of this channel, is rocky and grass covered for some distance back from the shores. The buildings of the Weather Bureau station, and **Neah Bay light** (flashing red, 3 seconds) are the prominent features on the point.

A reef, bare at low tide, extends 500 yards northwestward from Dtokoah Point, the point 500 yards eastward from Baaddah Point. The end of the reef is marked by a black buoy.

Neah Bay is a post village situated on the south shore of the bay; there is a cannery with wharf built out to 17 feet.

Pilots and towboats.—The bay is frequently used as an anchorage for towboats waiting for a tow, and which may be obtained by making signal to Cape Flattery lighthouse. The masters of the tugs are the only pilots available.

Storm warnings are displayed by the Weather Bureau from a tower on Baaddah Point.

A **Coast Guard station** is situated on the shore of the bay ⅜ mile southwestward from Baaddah Point.

Supplies.—Fresh water, fuel oils, and a limited amount of provisions and ship chandlers' stores can be obtained.

Communication is by steamer to Seattle and intermediate points.

Directions.—From westward, give Koitlah Point a berth of ½ mile and steer 155° true (SE ½ E mag.) heading for a white house standing alone on the beach about ½ mile eastward from the wharf. Select anchorage as desired.

Vessels desiring to enter by the channel southeastward of Waaddah Island may pass 100 yards northwestward of the black buoy marking the reef northwestward from Dtokoah Point and steer 244° true (SW ½ S mag.) heading for the buildings on the outer end of the wharf. This course leads through mid-channel.

PORT ANGELES

(chart 6303), is 56 miles eastward of Cape Flattery and 26 miles westward from Point Wilson; the entrance is 11 miles southeastward from Race Rocks lighthouse. It is included between **Ediz Hook**, a low, narrow, bare, sand spit 3 miles long, and the southern shore, and is 2½ miles long with a width of 1¼ miles at the entrance, decreasing to half that width at the head. The harbor is easy of access by the largest vessels and is frequently used by them when weather bound and awaiting orders or a tug.

The harbor is protected from all but easterly winds, which are rare and have no serious effect. During southeast gales in winter the wind is not, as a rule, felt in Port Angeles, but some swell rolls in there. The depths are greatest on the north shore and decrease from 30 fathoms to about 15 fathoms in the middle of the harbor; sticky bottom; from the middle the depths decrease regularly to the

southern shore, where the 3-fathom curve in some places in the eastern part is nearly ¼ mile from the beach. The best anchorage is in 7 to 12 fathoms, sticky bottom, off the wharves.

Ediz Hook lighthouse, a white frame tower on dwelling, is the prominent feature in approaching. The light is group flashing white (flash 0.2 second, eclipse 2.3 seconds, flash 0.2 second, eclipse 2.3 seconds, flash 0.2 second, eclipse 4.8 seconds), 47 feet above the water, and visible 12 miles. The fog signal is an air siren (blast 5 seconds, silent 40 seconds).

Port Angeles, a town of some importance, is situated on the southern shore, and is a port of entry, a deputy collector being stationed there. Shingles, lumber, farm produce, fertilizer, and some salmon are shipped, and general merchandise received. Morse Wharf, at the foot of Laurel Street, has a depth of 21 feet at its outer end; the city wharf, at the foot of Oak Street, has 20 feet. The remaining wharves are not much used. There are several new wharves near the head of the bay, built out from a sawmill, a cannery, and a fertilizer plant. The cannery wharf has conspicuous white buildings upon it.

A red electric light, raised 12 feet above the wharf, is maintained by the dock company at the northwest corner of Morse Wharf.

National quarantine regulations govern the port, and there is a national quarantine officer.

Supplies.—A limited supply of provisions and ship chandler's stores may be obtained. Water can be had at Morse Wharf. Coal is not kept on hand, as a rule, but can be obtained at short notice from other ports.

Communication may be had by rail with Port Townsend and with Puget Sound and British Columbia ports by steamer and telegraph. There is also cable communication with Victoria, B. C., and northern ports.

Storm-warning displays of the United States Weather Bureau are shown from a high staff on Laurel Street, and are plainly visible to vessels in the harbor and strait.

Harbor regulations are enforced by a harbor master. The following are the principal provisions:

It shall be unlawful for the master of any tugboat or any person having charge of any raft or boom of logs or part of any raft or boom of logs, to allow the same to be or lie at anchor or be tied or fastened in any manner to any piles, wharves, buildings, or any such structures in the waters of the Port Angeles Bay within the corporate limits of the city of Port Angeles.

No master of a vessel or any other person whomsoever shall deposit, discharge, or throw into the waters of Port Angeles Bay within the corporate limits of the city of Port Angeles, any ballast whatsoever or any material whatsoever that will sink, except in pursuance of a written permit authorizing the same, signed by the harbor master of the city of Port Angeles.

Directions.—No directions are necessary. Vessels may round Ediz Hook at a distance of over 200 yards and proceed to the wharves or select anchorage as desired.

PUGET SOUND

(charts 6450 and 6460) extends about 53 miles in a general southerly direction from Point Wilson and then turns southwestward for about 30 miles, expanding into numerous inlets and passages, the majority

of which are navigable by deep-draft vessels, although seldom used by them. The northern portion of the sound, from Point Wilson to Point No Point, is known as Admiralty Inlet. The eastern shore of the sound is comparatively straight, the principal indentations being Possession Sound, Elliot Bay, the Port of Seattle, and Commencement Bay, the port of Tacoma. On the western shore the principal inlets are Port Townsend, Hood Canal, Port Orchard, the site of the naval station, Port Blakely, and Eagle Harbor, on Bainbridge Island abreast of Elliot Bay, and Quartermaster Harbor, between Vashon and Maury Islands, immediately northward from the entrance to Commencement Bay. Case and Carr inlets, near the head of the sound, each extend in a general northerly and westerly direction for about 10 miles, but at present are of little commercial importance. Budd Inlet, the southernmost inlet, is the approach to Olympia, the capital of the State of Washington. It is used mainly by light-draft vessels which run to the small settlements on the inlets in the vicinity.

The navigation of Puget Sound is easy in clear weather and the chart is an excellent guide. The outlying dangers are few and marked by aids, and generally a mid-channel course can be followed with safety. Few deep-draft vessels pass beyond Tacoma, the communication with points beyond being maintained by local steamers from either Tacoma or Seattle. The currents follow the general direction of the channels, and have considerable velocity: see also Currents, following. In thick weather vessels with local knowledge depend upon the echo from the whistle in navigating these waters; but owing to the uncertainty of the currents and the great depths which render the lead useless in many places, strangers are advised to take a pilot.

The principal cities and towns are Seattle, Tacoma, Everett, Bellingham, Anacortes, and Olympia; there are numerous small settlements which are at present of little commercial importance.

The large tides of Puget Sound are very complex and variable, and the use of the tide tables for the Pacific coast, which give the daily time and height of every high and low water for the principal ports, is advised.

CURRENTS, PUGET SOUND.

Daily predictions of the times of slack water in Admiralty Inlet and factors for obtaining the times of slack water for other points in Puget Sound are given in the annual tide tables.

In Admiralty Inlet and Puget Sound the tidal currents are not subject to such great inequalities as the tides, and there are two flood currents and two ebb currents every lunar day. The greatest velocities, 2 to 5 knots, occur from Point Wilson to Point No Point. In the more open waters of the sound southward of Point No Point the velocities are much less.

From **Point Wilson** to **West Point** slack water occurs in mid sound about ¾ hour after high or low water at Seattle. Near Point Wilson and Marrowstone Point, and also elsewhere in places in the inlet and sound near the shores, slack water occurs ½ to 1 hour earlier than in mid sound.

In the winter when southerly winds prevail, there is generally a northerly surface drift which increases the ebb current and decreases

the flood current. This effect is about ½ knot between Nodule and Bush Points and ⅛ knot between West and Skiff Points.

Possession Sound.—The tidal currents in the southern entrance of Possession Sound have a velocity of ¼ to 1 knot at strength, and slack water occurs about 2 hours after high or low water at Seattle.

Hood Canal.—In the middle of Hood Canal, between Oak Head and Point Misery, the tidal currents have a velocity of ¼ to 1¼ knots at strength, and slack water occurs at the time of high or low water at Seattle.

Agate Passage.—The tidal currents have a velocity of 2 to 6 knots at strength, and slack water occurs ¼ hour after high or low water at Seattle.

Richs Passage.—Continuous hourly observations for about one month at a principal station, located in midchannel about midway between Point Glover and Point White, and similar observations for shorter periods at various other points in the passage indicate the following:

At the principal station the strongest currents which have been observed are 4 knots on the flood and 4.8 knots on the ebb. The average maximum velocity of the flood current is 2.4 knots and of the ebb 3 knots.

The strength of the flood at the principal station occurs 7.5 hours after the time of low water at Astoria, and the strength of the ebb 8.3 hours after the time of high water at Astoria.

High-water slack at the principal station occurs 34 minutes after the time of high water at Seattle and low-water slack 42 minutes after the time of low water at Seattle. The average duration of the high-water slack, or of the period when the current velocity does not exceed one-fourth knot, is 26 minutes; that of the low-water slack is 19 minutes. For strong currents these periods will be decreased, and for weak currents they will be increased.

In the channel between Pleasant Beach and Point Glover the average velocity of the flood at strength is about 1.5 knots and of the ebb about 2.3 knots. High-water slack occurs about 27 minutes earlier and low-water slack about 20 minutes later than at the principal station.

North-northwestward of Orchard Rocks the average velocity of the flood stream is about 0.5 knot and of the ebb about 2 knots.

A few observations taken northward of Blake Island indicate that the high-water slack occurs about 50 minutes earlier and the low-water slack about 1 hour later than at the principal station.

From points north of Blake Island to the western end of the passage the flood and ebb streams attain their maximum velocity at one and the same time, which is that already given for the principal station.

The flood stream through the passage is of a simple and regular character. The stream lines are nearly uniform in tread from shore to shore, except off the bight just northwestward of Middle Point and in the large cove on the north shore opposite Point Glover, where eddies occur. These eddies, however, are both of limited extent, neither extending outward to the usual steamer track. This regularity tends to increase the actual or available cross section of the flood stream and consequently to diminish its strength.

The funnel-shaped configuration of the passage is not favorable to the production of regular stream-line motion on the ebb current, and extensive eddies and countercurrents occur.

Between Middle Point and Point Glover an extensive eddy extends from shore almost to midchannel and will frequently be encountered by vessels on the track between the Orchard Rocks and Point Glover buoys.

An eddy fills the cove on the north shore opposite Point Glover, but does not extend outward to the steamer track.

An eddy occurs about one-fifth mile south-southwestward of Point White and a little north of midchannel at the western entrance to the passage.

A weak countercurrent occurs inshore along the southeastern side of Point White.

These eddies and countercurrents on the ebb greatly diminish the effective cross section of the passage, and so increase the velocities in the channel. They also increase the duration of the ebb stream and diminish that of the flood, this inequality being much more pronounced in the eastern portion of the passage than in the western.

Current table, Puget Sound.

Locality of current station.	Time of current at strength.				Factor.	Velocity at strength.			Greatest velocity observed.	Mean direction of—	
	Flood.		Ebb.				Tropic tides.				
	After low water at Astoria.		After high water at Astoria.			Mean.	Greatest.	Least.		Flood.	Ebb.
	1		2		3	4	5	6	7	8	9
	h.	*m.*	*h.*	*m.*		*Knots.*	*Knots.*	*Knots.*	*Knots.*	*° True.*	*° True.*
0.5 mile 43° true from Point Wilson	5	50	6	43	0.85	2.7	3.9	1.0	4.0	136	314
0.9 mile 98° true from Point Hudson	5	40	6	00	.23	.7	1.1	.3	1.5	140	278
1.6 miles 37° true from Marrowstone Point	8	40	7	55	.93	3.0	4.3	1.1	3.2	153	345
0.4 mile 75° true from Marrowstone Point	7	50	6	30	1.10	3.5	5.1	1.3	3.9	142	333
1.9 miles 138° true from Admiralty Head light	6	28	5	50	.76	2.4	3.5	.9	3.6	114	295
Midway between Nodule and Bush Points	7	35	7	39	.58	1.9	2.7	.7	4.8	180	.....
Possession Sound, southern entrance	8	49	9	20	.15	.5	.7	.2	1.1	19	211
Hood Canal, 0.9 mile northward of Point Misery	7	15	6	45	.17	.5	.8	.2	1.2	.....	75
Dabop Bay, entrance	6	42	7	55	.17	.5	.8	.2	1.2	54	204
Agate Passage	6	22	6	44	1.09	3.5	5.1	1.3	6.0	217	35
Midway between West Point and Skiff Point	7	30	8	03	.09	.3	.4	.2	1.3	189	9
Elliott Bay, entrance	.....		.....		.11	.4	.5	.1	.5	.....	.....
1.1 miles 104° true from Orchard Point	7	13	8	18	.16	.5	.7	.2	.....	302	65
Richs Passage, western end	7	28	8	16	.86	2.7	3.6	.9	4.8	238	54
Colvos Passage, north entrance	8	27	8	13	.24	.8	1.1	.3	1.6	201	32

NOTE.—To find the velocity at strength of a flood current at any station, take the predicted height of the low water at Astoria for that tide from the tide tables and subtract it from the constant 4.6 (if the height at Astoria has the minus sign, add it to the constant 4.6); the remainder multiplied by the factor in column No. 3 in the preceding table will give the velocity of the flood current at strength for that tide.

To find the velocity at strength of an ebb current at any station, take the predicted height of the high water at Astoria for that tide from the tide tables and from it subtract the constant 4.6; the remainder multiplied by the factor in column No. 3 in the preceding table will give the velocity of the ebb current at strength for that tide.

DIRECTIONS, PUGET SOUND, POINT WILSON TO TACOMA.

These directions are available for vessels of any draft. The navigation of these waters is perfectly simple in clear weather with the use of the chart, as the channels are broad, open, and free from outlying dangers. In thick weather the use of whistle echoes is common by those with local knowledge, and in certain localities the lead is of use. Local navigators, familiar with the peculiarities of the currents, depend largely on the speed of their vessels, the usual times on certain courses, and the conditions of the tides, and as a rule have but few mishaps even in the thick, smoky atmosphere that at times, when exceptionally dense, has been known to suspend navigation almost completely. This intimate knowledge of the localities, only obtained by long experience under varying conditions, it is impossible to impart. Each steamer has its own track, dependent on size, speed, and current conditions. With a favorable current a mid-channel course is usually steered to obtain the full advantage; with an adverse current the courses are usually closer inshore, where the currents have less velocity and advantage may be taken of favorable eddies.

The courses given are the usual ones followed by vessels, but a mid-channel track should be followed when it is desired to make the most of a favorable current.

Strangers when overtaken by fog in these waters are advised to anchor if practicable or to employ a pilot who may be obtained in Port Townsend. Available anchorages will be pointed out under the descriptions of the various localities. All sailing vessels, except small coasting schooners, are towed in these waters.

Follow the directions, Juan de Fuca Strait, page 190, to a position 1⅝ miles northward of Point Wilson lighthouse; then steer 143° true (SE by E ½ E mag.) for 4¾ miles to Marrowstone Point light abeam, distant ½ mile, then 154° true (SE ½ E mag.) for 9¾ miles, passing ½ mile off Bush Point light to Double Bluff abeam, distant 1 mile, and then steer 136° true (ESE ⅛ E mag.) for 3¼ miles to Point-No-Point lighthouse abeam, distant ¾ mile. From this point, a 158° true (SE ⅛ E mag.) course for 6¼ miles will lead to Apple Cove Point abeam, distant 1¼ miles, and then a 179° true (SSE ¼ E mag.) course for 9⅝ miles will lead to West Point lighthouse abeam, distant ½ mile. From this position vessele, if **entering Seattle Harbor**, can steer for Duwamish Head for 2½ miles and then enter the harbor in mid-channel.

If **bound to Tacoma or beyond** continue the 179° true (SSE ¼ E mag.) course for 5 miles beyond West Point lighthouse to Alki Point lighthouse abeam, distant ⅞ mile. Then steer 164° true (SE ⅜ S mag.) for 11½ miles, passing ¼ mile off Pully Point light and to a position with Robinson Point lighthouse abeam, distant ⅜ mile. Round it at this distance and steer 218° true (S by W ¼ W mag.) for 5⅝ miles to Point Brown light abeam, distant ⅜ mile. Round Point Brown at this distance, and steer southward or southeastward to the mooring buoys or wharves at Tacoma. If bound above Tacoma, follow the directions on page 235.

POINT WILSON TO RESTORATION POINT.

EASTERN SHORE.

Admiralty Head, with the light on its summit, is the southeastern end of a succession of light, bare bluffs, which extend well northward of Point Partridge. At Point Partridge, 5½ miles northwestward from Admiralty Head, the bluffs are highest—about 300 feet. **Admiralty Head light** is fixed white, on a white, cylindrical tower. At night many lights from the military post of Fort Casey are seen in the vicinity of the light.

Admiralty Bay, eastward of Admiralty Head, is used only occasionally as an anchorage, as it is exposed to southwesters, and has hard bottom and strong currents.

Bush Point is marked by a post light (fixed white) at the end of a low spit.

Mutiny Bay, northwestward of Double Bluff, affords temporary anchorage near the center in 10 to 20 fathoms, which may be used if overtaken by fog.

Double Bluff consists of bare, white cliffs, 300 to 400 feet high on its eastern face but much lower on its southwest face. Shoals extend nearly 600 yards westward from Double Bluff and are usually marked by kelp. There is a buoy at their outer end.

Useless Bay, on the eastern side of Double Bluff, is open to the southwest. The shores are in part bluff and in part low, with a fringe of marsh nearly around the bay. Deer Lagoon, a large shallow sheet of water, extends inland from the head of the bay.

Scatchet Head and **Possession Point**, at the southern end of Whidbey Island, are both prominent, especially from southward, the white bluffs being visible for a considerable distance. Shoals extend ½ mile offshore immediately westward of Scatchet Head and over ¼ mile offshore from the head to Possession Point; those off Possession Point are marked by a buoy.

Possession Sound and tributaries are described under a separate heading following.

The Great Northern Railway runs along the shore on the east side of Puget Sound from Shilshole Bay to the Snohomish River in Possession Sound. It carries all the mail and most of the passenger traffic between Seattle, Everett, and intermediate towns and villages, but there are also landing wharves at these places and considerable traffic by water.

Point Edwards is a high wooded point on the east side of Puget Sound 8½ miles east-southeastward from Point No Point. It is a turning point for the steamers running from Seattle northward into Posession Sound and adjoining waters.

Edmonds is a manufacturing town 1 mile northward from Point Edwards. There is a wharf built out to 12 feet at low water.

Meadowdale is a post village 4 miles northward from Point Edwards and has a short landing wharf.

Point Wells is a low sandy point projecting 450 yards from the high land 1¼ miles southward from Point Edwards. It is distinguished by prominent oil tanks and the wharf and warehouses at the foot of the bank.

Richmond Beach (Richmond post office) is a village ½ mile southward of Point Wells. There is a shingle mill with short wharf in front of it and ½ mile farther southward is a wharf for loading gravel.

Meadow Point, nearly opposite Point Monroe, is a low, grassy point, with a marshy lagoon within, and higher ground behind it.

West Point is low but rises abruptly to an elevation of over 300 feet ⅜ mile from its extremity, which is marked by a lighthouse and fog signal on a white square tower. The light is alternating flashing red and white every 20 seconds, and the fog signal is a reed horn (blast 5 seconds, silent 25 seconds). The edge of the shoal extending southwestward from the point is marked by a black buoy. Submarine telegraph cables are laid out close to the north side of the point.

Elliot Bay and Seattle Harbor are described under a separate heading on page 218.

WESTERN SHORE.

Point Wilson is low, but rises rapidly to the high bluffs extending eastward from Port Discovery. Its eastern end is marked by **Point Wilson lighthouse**, an octagonal tower on fog signal building. The light is fixed white, with red flash of 2 seconds' duration every 20 seconds. The fog signal is a siren (blast 4 seconds, silent 26 seconds), and is reported to be difficult to hear in certain directions close by it.

Shoals extend ½ mile northward of Point Wilson to the 5-fathom curve, over irregular bottom; these are generally indicated by kelp. A reported dangerous sunken rock lies ½ mile offshore about ¾ mile westward from Point Wilson. The eastern edge of the shoals rises rather abruptly from deep water. A buoy is placed off the foul ground in 7 fathoms ¾ mile 312° true (WNW ⅜ W mag.) from Point Wilson lighthouse. Heavy tide rips extend northward of these shoals, being especially heavy with a westerly wind and ebb current. In approaching Point Wilson in thick or foggy weather the lead should be kept going, especially if the fog signal is not heard.

Port Townsend is described under a separate heading following.

Marrowstone Point, the eastern point at the entrance to Port Townsend, is low at its extremity but rises abruptly to a bluff about 120 feet high. The eastern extremity of the point is marked by a light and fog signal on a small square structure. The light is group flashing white, and the fog signal is an acetylene gun, one report every 30 seconds. There are landing wharves built out on both sides of Marrowstone Point about ½ mile from the light, and submarine telegraph cables are laid northwestward and southeastward from both of them.

Foulweather Bluff is bold and wooded and over 200 feet high; its northern face is a bare bluff and the bottom deepens gradually northward of the head. The 20-fathom curve lies about ¾ mile, and depths of less than 6 fathoms are nearly ½ mile northward of the head. There are several bowlders exposed at low tide within 100 yards northward of the highest part of the bluff, and sunken bowlders are reported as reaching 200 yards eastward from the end, and in line with the face of the bluff. If overtaken by fog, temporary anchorage may be had ½ mile northward of Foulweather Bluff, in not less than 10 fathoms.

Port Ludlow and Hood Canal are described under separate headings following.

Point No Point, on the west shore of the sound 3½ miles eastward from Foulweather Bluff, is a low sand spit marked with a lighthouse and fog signal station. The light, shown from a white square tower, is group flashing white (three flashes every 10 seconds), and the fog signal is a reed horn (blast 3 seconds, silent 3 seconds, blast 3 seconds, silent 21 seconds). There is a post office located here for settlers in the vicinity. The low, rounding point 1 mile westward from Point No Point is locally known as Norwegian Point, and has some houses upon it. On the rising ground ¼ mile southward from Norwegian Point is a small settlement known as Hansville.

Apple Cove Point is a low sand spit projecting 220 yards from the high, wooded land 6 miles southward of Point No Point. It has some houses upon it. It is steep-to at the point but a shoal makes out nearly ½ mile southeastward from it. A landing wharf for a summer resort called **Sand Point** is built in the bight 1 mile westward from the point.

Apple Tree Cove is the open bight on the west side of the sound 1½ miles southward of Apple Cove Point. It affords anchorage in 5 to 10 fathoms inside the line of the points, with some shelter from winds drawing in or out of the sound, but not from northward and southeast. The post village of **Kingston** is on the north side of the cove, and has a wharf built out to 10 feet.

Port Madison (chart 6443) is on the western shore of Puget Sound, 12 miles southward of Point No Point. It is included between the northern end of Bainbridge Island and Point Jefferson, and is 2½ miles in length with an average width of 2 miles. The depths range from over 80 fathoms at the entrance to 20 fathoms less than ½ mile from the beach, but the port affords anchorage closer inshore in 15 to 16 fathoms, sticky bottom. In the southwestern part it connects with Port Orchard through Agate Passage.

The north shore is formed by broken, white bluffs with low beaches between and bordered by sand and shingle beaches, bare at low water in some cases for a distance of nearly ¼ mile. The bluffs on the western shore are moderately low; the buildings of the Indian reservation near the entrance to Agate Passage are prominent. There is a wharf built out to 14 feet, and **Suquamish** post office is located there. The southern shore is composed of broken bluffs except where it is indented by the narrow arm extending southward about 1 mile, on which is situated the town of Port Madison. **Point Monroe**, the southern point at the entrance, is a low, narrow, sand spit, curving westward and southward and marked by a light.

The entrance to the inlet leading to the town of Port Madison is about ¾ mile westward of the light. The town has become a summer resort for a large number of Seattle residents. The channel in entering is narrow with a least depth of 9 feet, and local knowledge is necessary to keep in the best water. There is a wharf built out from the east shore about 400 yards inside the entrance, but the landing wharf for steamers is now just outside the narrow entrance, and has 10 feet at the end. The old mill wharf is in ruins. There is a shingle mill further up the inlet.

A sunken bowlder with 5 feet over it at low tide is reported to lie ⅝ mile 286° true (W ⅝ S mag.) from Point Monroe light, or 400 yards northwestward from the east point of the inlet to Port Madison harbor.

Murdens Cove is an open bight, 1¾ miles across, on the west side of the sound 3 miles southward of Point Monroe. It has a flat ⅜ mile broad at the head which bares at low tide, and outside of it the depth increases rapidly to 15 fathoms on the line of the points. **Skiff Point,** on the north side, has low, yellow bluffs to the southward. **Yemoalt Point**, on the south, is a low, grassy sand spit 150 yards broad, rising gradually to the general level of the high land. **Manitou Beach** is a settlement on the north side of Murdens Cove, and has a wharf built out to 8 feet. The post office is named **Rolling Bay** and has a landing wharf with 9 feet on the north side of Skiff Point. On the south side of the cove is a wharf with 6 feet at the end, and ¼ mile westward from Yemoalt Point is another wharf with 8 feet.

Eagle Harbor is described under a separate heading on page 223.

Blakely Harbor (charts 6444 or 6445) is a small inlet situated on the eastern shore of Bainbridge Island, near its southern end. It is about 1 mile in length and at the entrance nearly ½ mile wide, narrowing to the head. The depths range from 18 fathoms at the entrance to 3½ fathoms near the head. The usual anchorage is near the entrance in 9 to 16 fathoms, sticky bottom, slightly favoring the southern shore.

Blakely, at the head of the harbor, is a large mill port and exports a considerable amount of lumber. There are ample wharfage facilities, with depths for deep-draft vessels. Provisions, water, and tugs can be obtained. Communication with Seattle is had by means of a steamer making regular trips, and by telephone.

Blakely Rock is prominent in approaching; it lies ¾ mile northward of Restoration Point and at high water shows about 15 feet at its highest point. It is 400 yards in extent, with shoal water, well marked by kelp, extending over 250 yards northward.

Directions are not needed for entering Blakeley Harbor. Blakeley Rock may be passed on either side, but if passing northward of it, should be given a berth of not less than ¼ mile.

Restoration Point is flat and about 10 feet above high water for 300 yards, beyond which it rises abruptly to a wooded knoll about 100 feet high, on which a number of large residences are prominent.

Decatur Reef, partly bare at low water, extends 300 yards eastward from Restoration Point. The end of the reef is marked by a buoy placed in 8 fathoms, 450 yards eastward of the point.

Port Townsend

(chart 6405) lies immediately southward of Point Wilson, and has its entrance between Point Hudson and Marrowstone Point. It extends in a general south-southwest direction for 2½ miles, with an average width of 1½ miles, and then turns southeastward for 3 miles, with a reduced width, to its head. Inside Point Hudson the depths range from 15 to 8 fathoms to Port Hadlock, at the head of the bay. It is an excellent harbor with good anchorage throughout and easily entered.

Point Hudson, on the western shore, about 1¾ miles southeastward from Point Wilson, is low and sandy. Its extremity is marked by an unwatched occulting white light (light 3 seconds, eclipse 2 seconds). On the high land back of Point Hudson is a wireless telegraph station, and in the depression between the hill and the summit

of Point Wilson are the buildings of a military post, in front of which is a wharf for landing supplies. Northward of Point Hudson shoals make out for nearly ¼ mile, the outer limits being marked by a buoy.

Marrowstone Point, the eastern point at the entrance, is described on page 206.

Midchannel Bank extends northwestward from Marrowstone Point about 2 miles toward Point Wilson, with depths varying from 5¾ to 10 fathoms.

Kilisut Harbor is a narrow inlet extending 4 miles in a southeasterly direction with an average width of ½ mile; the entrance is 2½ miles westward of Marrowstone Point. The channel entering is winding, with a depth of about 11 feet; inside good anchorage is afforded in 4 to 5 fathoms. At the southern end it connects at high water with Oak Bay, a small cove opening into Admiralty Inlet. This inlet is little used and local knowledge is necessary to enter.

Port Townsend, the principal town, is situated on the western shore immediately southward and westward of Point Hudson. It is a port of entry for Puget Sound. The depths at the wharves are ample.

Fort Townsend, on the western shore about 3 miles southward of Port Townsend, is an abandoned military post; the buildings are visible from the anchorage.

Irondale, on the western shore about 1 mile from the head of the bay, exports some pig iron when in operation: the furnaces are prominent and there is a wharf extending to deep water.

Port Hadlock, at the head of the harbor, formerly exported considerable lumber. The sawmill has burned, but the wharves remain.

Oak Bay is connected with the head of **Port Townsend** by a channel dredged 75 feet wide and 15 feet deep, with jetties at the south end. It is marked by a lighted range and a light on the south jetty at the Oak Bay entrance. The channel is subject to considerable shoaling.

Anchorage.—The usual anchorage is 1 to 1½ miles southward of Point Hudson in 8 to 10 fathoms, muddy bottom. In southerly gales, better anchorage is afforded in the bight northward of Port Townsend, in 8 to 10 fathoms, muddy bottom, as the cliffs afford some protection.

Prohibited anchorage.—Vessels are requested not to anchor on a line running 63° true (NE ½ N mag.) from Point Wilson lighthouse nor in the area ⅖ mile southeastward of that line.

Do not anchor on a line running 128° true (ESE ¾ E mag.) from Point Wilson lighthouse nor within ⅖ mile southwestward of that line.

Do not anchor on a line running 7° true (N by W ½ W mag.) from Marrowstone Point light nor ⅖ mile westward of that line.

Quarantine.—There is a national quarantine office, and vessels bound to ports in Washington are boarded here. The national quarantine station is at Port Discovery, 7 miles southwestward from Point Wilson.

Harbor regulations are enforced by a harbor master. The following is a summary of the principal provisions:

1. It is forbidden to dump ashes, or any material which will sink, from any wharf or vessel alongside a wharf.

2. Vessels desiring to discharge ballast must first obtain a written permit from the harbor master.

3. Vessels carrying explosives are forbidden to dock without first obtaining a written permit from the harbor master.

Fees for the above permits range from $1 to $3.

Supplies.—Provisions and ship chandlers' stores can be obtained Water may be had at the wharves. A limited amount of coal is on hand, but any amount can be supplied at short notice.

Repairs.—Minor repairs to vessels and machinery can be made.

Hospitals.—A marine hospital of the United States Public Health Service is situated at Port Townsend.

Communication with ports on the Sound, British Columbia, and Alaska, and with points on the outside coast, may be had by regular lines of steamers. There are also telegraph and telephone facilities.

Storm warnings are displayed by the Weather Bureau from a staff on the customhouse and are plainly visible from the harbor.

Port Ludlow.

The entrance to this harbor, on the western shore of Admiralty Inlet, lies 9 miles southward of Marrowstone Point and on the west side at the entrance to Hood Canal. From the entrance, which is broad, the bay extends in a general southerly direction 2½ miles, terminating in a basin ½ mile in diameter. The basin affords good anchorage in 7 to 8 fathoms, soft bottom; the shores are fairly steep.

Tala Point, the eastern point at the entrance and the dividing point between the harbor and Hood Canal, is bluff and wooded and about 250 feet high. **Colvos Rocks**, three in number, lie 1¼ miles 338° true (NW mag.) from Tala Point and about ¼ mile offshore; the western one is 25 feet high, of small extent, with deep water around it. From the other two a bank with 8 to 27 feet extends to Tala Point. The passage between the rocks and Tala Point is marked by a red buoy placed in 22 feet about ½ mile southeastward from Colvos Rocks, and a black buoy placed in 16 feet ⅜ mile northward from Tala Point. There is a least depth of 3½ fathoms midway between the buoys, with deeper water near the northern buoy.

Snake Rock lies ⅜ mile 229° true (SSW ¼ W mag.) from the western Colvos Rock and 300 yards offshore; it is 150 yards in extent and shows slightly above high water.

Klas Rock lies ⅝ mile 358° true (NNW ⅜ W mag.) from the western Colvos Rock and ¼ mile from the western shore abreast the narrow entrance to a small lagoon; it is of small extent and portions of it show a few feet at high water. It is marked by kelp and surrounded by deep water, with 16 fathoms between it and the shore.

Channels.—The deepest channel in entering lies eastward of Klas Rock and between Snake Rock and the western Colvos Rock; the width between the 5-fathom curves is 600 yards, with depths of 11 to 16 fathoms in mid-channel. The channel between Colvos Rocks and Tala Point is marked by buoys, and its depth ranges from 21 to 27 feet.

Port Ludlow, on the north side of the basin, has a large sawmill and exports considerable lumber. There is ample wharfage room, with depths of 26 feet. Two steamers maintain a daily schedule with

Seattle, by which means supplies of all kinds can be obtained on short notice. Towboats can be obtained by telephoning to Seattle.

DIRECTIONS, PORT LUDLOW.—From northward the course should be shaped to pass ¼ mile eastward of Klas Rock. Round the western Colvos Rock at a distance of 200 yards, and pass midway between it and Snake Rock. Then steer 182° true (SSE mag.) giving the western shore a berth of about ¼ mile. Then haul southward and westward into the port, favoring the point on which the mill is located when rounding into the basin, and anchor as desired.

Caution is necessary when entering by the buoyed channel between Tala Point and Colvos Rocks. The best water will be found by favoring the red buoy, but this buoy has at times been fouled by log rafts and dragged onto the shoal northwestward, and vessels rounding the buoy closely have stranded on the tail of the shoal.

HOOD CANAL.

The entrance to this inlet is on the western shore between Foulweather Bluff and Tala Point, about 10 miles southward from Marrowstone Point. It extends in a general southerly direction for 44 miles and then bends sharply northeastward for 11 miles, terminating in flats bare at low water. The shores are high, bold, and wooded, rising to a much greater height, particularly on the western shore, than in other parts of the sound. The water is deep as a rule, except at the heads of the bays and at the mouths of the streams. The chart is a sufficient guide for the purpose of navigation. No vessels except small steamers carrying mail, passengers, and supplies, and tugboats towing rafts, navigate Hood Canal at present above Port Gamble. Numerous small farming settlements, with post offices and landings, have sprung up along the shores in recent years, and have daily or triweekly communication with Seattle and other Puget Sound ports by steamer.

Port Gamble (chart 6412) is a small inlet on the eastern shore of the canal, 5 miles from the entrance. It is 2 miles in length, with an average width of ½ mile and a contracted entrance. The channel in entering is narrow and leads for ½ mile over a bar just outside the entrance, the least depth over which is 3½ fathoms. The outer end of the channel is marked by a lighted beacon. Good anchorage is afforded in 4 to 9 fathoms, muddy bottom. Port Gamble, on the western shore at the entrance, is a mill port that ships considerable lumber. Provisions can be obtained and water is piped on the wharf.

TO ENTER Port Gamble caution is necessary, as the channel is narrow and slightly curved, and on its eastern side shoals abruptly. The western side of the channel should be favored in entering.

From a position ¼ mile northwestward of the light at the entrance, shape a course to pass 100 yards westward of the light, and when abreast of it steer 173° true (SSE ¾ E mag.), heading in midchannel between the mill wharf and the end of the low flat point opposite. When the outer end of the northern wharf is abeam, change to 188° true (S by E ½ E mag.), to pass 50 yards off the mill wharf, and continue to the desired anchorage.

Bangor is a post village on the east side of Hood Canal 11½ miles southward from Hood Head. It has a landing wharf on the north

side of King Spit built out to 18 feet. A road leads from Bangor to Poulsbo, in Port Orchard.

Seabeck is a settlement and summer resort at the head of Seabeck Bay, a small cove on the eastern shore, 21 miles from the entrance to the canal. There is 7 feet at the wharf. A road runs to Silverdale, on Dyes Inlet.

Dabop Bay, the entrance to which is on the western shore, abreast Seabeck, is the largest inlet in the canal and divided from it by the Toandos Peninsula, the southernmost point of which is Oak Head. The bay extends 9 miles in a northerly direction, with a small inlet, Quilcene Bay, on the western shore. The western shore is particularly steep and bold, reaching an elevation of over 2,600 feet in less than 2 miles.

Quilcene is a post village at the mouth of Big River, on the west side and near the head of Quilcene Bay. It is the terminus of a railway from Port Townsend and supplies a mining country in the interior. The wharf is dry at low tide.

Brinnon is a post village on the south side of Dusewallips River, 3½ miles westward of Oak Head. It has a landing wharf built to 16 feet.

Coyle is a post village at Fishermans Harbor, on the east side of Oak Head, with a landing wharf from the west side of the cove.

Dewatto post village at Dewatto Bay, on the east side of the canal 15 miles from Seabeck, has a short landing wharf accessible at high water only.

Hoodsport, a post village on the west side of the canal 18½ miles from Seabeck, has a landing wharf with 14 feet at low tide. A stage road runs hence 9 miles to Lake Cushman, a resort much frequented in summer.

Potlach, an important post village on the west side of the canal 2 miles southward from Hoodsport and opposite the great bend, has a substantial wharf with 25 feet at low water along the face of it. There is also a long trestle carrying a logging railway where logs are rolled into the water. This railway is said to be 25 miles long and rises by switchbacks into the high back country. This is the outlet for numerous logging camps in the interior.

Union, a post office on the southern shore of the bend where the canal turns northeastward, has a wharf with 20 feet alongside. Water is piped to the wharf. This is at present the last regular steamboat landing on the canal, but there are many logging camps farther up toward the head.

Annas Bay lies immediately westward of Union and is a broad, open bight, the eastern half being a flat, bare at low water. This flat extends about ¼ mile into the canal immediately westward of Union and is formed by the Skokomish River, which empties at the head of the bay.

There are several other small settlements on the canal, none of which is at present of commercial importance.

Foulweather Bluff, the eastern point at the entrance to the canal, is one of the most prominent cliffs in Puget Sound. The northern face is ½ mile broad and consists of vertical, sandy, clay bluffs 225 feet high, covered with fir and dense undergrowth. Eastward it slopes to a bluff 40 feet high, but on the canal side the point is steep.

Hood Head, on the west side 3 miles south of the entrance to Hood Canal, is 160 feet high, steep and wooded, and generally appears as an island. It is a detached knoll connected by a low, narrow strip of sandy beach with the western shore. It is a prominent feature in entering the canal.

Sisters are two rocks 3/8 mile from the northern entrance point to **Squamish Harbor,** a small, open bight on the western shore abreast the entrance to Port Gamble. They are a little over 200 yards apart, of small extent, and cover at about half tide. A rock with 7 feet over it is reported to lie about 3/8 mile west-southwestward of the southern Sister and 3/8 mile offshore. Another rock with 15 feet over it is reported to lie 1 mile westward of the southern Sister and about 1/4 mile offshore.

Cases Shoal, partly bare at low water, lies 5/8 mile from and parallel with the western shore of Squamish Harbor. It is 1 mile long and its northern end is 1/2 mile from the northern shore of the harbor.

Communication.—The different settlements are reached by a steamer making regular trips from Seattle.

The **tidal currents** have a maximum velocity of about 1 1/4 miles; off **Point Hannon,** the eastern point of Hood Head, swirls are formed, heaviest during spring tides, but not dangerous to navigation.

Sailing directions are not considered necessary. The dangers are few and close inshore, and a mid-channel course is clear until reaching the point where the canal turns, when the north shore should be favored to clear the flats extending from the eastern part of Annas Bay. The chart is a good guide.

Possession Sound and Tributaries.

These comprise the waters eastward of Whidbey Island, the principal ones being Possession Sound, Port Susan, Saratoga Passage, and Skagit Bay. These bodies of water connect at the southern end with Puget Sound through Possession Sound, and at the northern end with the northeastern part of Juan de Fuca Strait through Deception Pass. Swinomish Slough leads northward from Skagit Bay and connects with Padilla Bay in the southern part of Washington Sound.

Camano Island lies between Port Susan and Saratoga Passage; it is irregular in shape and 14 miles in length, the southern portion consisting of a long, narrow tongue terminating in **Camano Head,** 300 feet high. At its northern end it is separated from the mainland by sloughs, dry at low water.

There is considerable traffic in these waters, confined, as a rule, to small local steamers that take advantage of the shelter afforded in making their trips between Washington Sound ports and points on Puget Sound. There are several towns and settlements, but the majority are of little commercial importance. The principal exports consist of lumber, fish, and some farm produce; general merchandise is imported. The principal points have rail and telegraph communication in addition to steamers.

Possession Sound enters at the southern point of Whidbey Island and extends in a general northerly direction for 10 miles to its junction with Saratoga Passage and Port Susan. From the entrance it

extends for 3½ miles with an average width of 2 miles, and then expands to an irregular basin about 6 miles in diameter. The eastern part of this basin is filled with extensive flats, a large portion of which are bare at low water, and rise abruptly from deep water. These flats are intersected by several shifting channels, forming the mouth of the Snohomish River. These channels are under improvement by the Government and are used by light-draft river steamers that navigate the deeper waters of the river. The water is generally deep and the only anchorage afforded is off the town of Everett, close inshore, in about 10 to 15 fathoms.

Point Elliot, on the east side of Possession Sound, 4 miles 48° true (NNE ¼ E mag.) from Possession Point, is a low spit projecting over 200 yards from the high land. It is prominently marked by Muckilteo lighthouse and fog-signal station; light flashing white, 5 seconds; fog signal, reed horn (blast 4 seconds, silent 16 seconds).

Glendale post village, with a short landing wharf in 10 feet, is on the west side of the sound, 2¼ miles northward from Possession Point.

Muckilteo is a small town eastward of Point Elliot; it has a large sawmill and several shingle mills, and wharf facilities for the largest vessels. Lumber is exported.

Everett (chart 6448), on the eastern shore of the sound, 4 miles northeastward of Point Elliot, is a city of about 30,000 people. Lumber, paper, and flour are the principal exports. Extensive improvements have been made for increasing the wharf facilities and for improving the harbor. There are a number of docks with ample depths for all vessels calling at the port.

Coal, fuel oils, water, provisions, and a limited amount of ship chandlers' stores can be obtained. There are good machine shops, but no dry-docks or marine railways.

Communication is by rail and steamer and by telephone and telegraph.

Storm warnings are displayed by the Weather Bureau.

Gedney Island, in the western part of the basin, is 1½ miles long in an east and west direction by an average width of ½ mile. The island is high, wooded, and prominent. From its eastern point a shoal extends eastward, the 5-fathom curve being at a distance of ¾ mile; foul ground extends ¼ mile from the south side of the eastern half of the island.

Clinton, on Randalls Point, 2 miles southwestward of Gedney Island, is a post village with landing wharf in 9 feet of water.

Langley, on the eastern shore of Whidbey Island, 2 miles southwestward of Camano Head, is a post village and farming community with a wharf built out to 11 feet.

Saratoga, 3 miles northwestward of Langley, has 18 feet at the wharf. Vessels approaching the wharf from southeastward must keep well offshore to avoid the flats, which make off from the shores to considerably beyond the end of the wharf.

Tulalip Bay is a small cove at the junction of Possession Sound and Port Susan, on which are situated the buildings of the Indian reservation. The bay is shoal and the channel leading to the wharf is marked by a buoy. It is of little commercial importance.

Port Susan, on the eastern side of Camano Island, has a total length of 11 miles in a northwest and southeast direction and a width of 1 mile at its entrance; it expands to a width of 5 miles at its head, terminating in flats, bare at low water, that extend over 3 miles. There are no important settlements. There is deep water throughout until nearing the head, where anchorage may be had off the extreme western edge of the flats in about 10 fathoms. Care should be used in approaching and anchoring as the flats rise abruptly from deep water. A channel, dry at low tide, has been dredged over the flats to the southern mouth of the Stillaguamish River; this is buoyed and used by light-draft vessels at high water. The entrance to the south pass is marked by a light.

Saratoga Passage, on the western side of Camano Island, is 18 miles long in a northwest and southeast direction. At its entrance between Sandy Point and Camano Head it is 1¼ miles in width, widening to its upper end, where it expands into a basin 4¼ miles in diameter, connecting eastward with Skagit Bay. The depths decrease uniformly from 100 fathoms at the entrance to 17 and 18 fathoms at the head. There are few outlying dangers and a mid-channel course is clear to the head.

Sandy Point, the southern point at the entrance, is a low spit, rising rapidly to an elevation of 100 feet, with bluffs on each side; the end of the point is marked by a post light.

Holmes Harbor, the entrance to which is on the southern shore 8 miles above Sandy Point, extends in a southerly direction for 5 miles, with an average width of 1¼ miles. The depths range from 30 and 40 fathoms at the entrance to 17 and 18 fathoms at the head, where anchorage may be had in muddy bottom. **Rocky Point**, the eastern point at the entrance, is low, but rises rapidly to a hill 500 feet high. **Hackney Island**, low and of small extent, lies ¼ mile northwestward from the point, with which it is connected at low water. From the island a shoal, bare at extreme low water, extends ¼ mile northwestward.

In entering, round Rocky Point at a distance of ¾ mile and follow a mid-channel course to the head. The harbor is but little used.

Camano post village, with a short landing wharf, is on the east side of Saratoga Passage, 1 mile westward from Point Lowell.

Penn Cove enters the western shore of the basin at the head of Saratoga Passage and extends southwestward for 3½ miles, with an average width of 1 mile. The head of the cove is 1½ miles eastward from Point Partridge, the western extremity of Whidbey Island. There are several small settlements—**Coveland** at the head, **San de Fuca** on the north shore, and **Coupeville** on the south shore; these are of little commercial importance. The cove affords good anchorage in 8 to 14 fathoms inside the entrance. **Watsak Point**, the southern point at the entrance, is shoal, a narrow sunken spit extending northward for ½ mile, with depths of about 6 feet. The spit is marked by a black buoy placed in 24 feet about 100 yards northward of the end.

No directions for entering are considered necessary. After rounding the buoy a mid-channel course can be followed with safety.

Oak Harbor, on the northern shore, is a small, irregular cove 1½ miles long and ¾ mile wide. The cove is shallow, with a narrow,

winding channel leading to the wharf at Oak Harbor, a small settlement at the head. About 10 feet can be taken to the wharf. **Maylors Spit** extends northwestward from the eastern shore and is marked by two lights, one at the southern and one at the northern end. **Forbes Point**, the eastern point at the entrance, is foul, with a rock, bare at low water, ½ mile southwestward from the point. This is marked by a red buoy placed in 4 fathoms, 150 feet south-southeastward from the rock. The channel leading to the wharf is marked by buoys, but should not be attempted by strangers.

Crescent Harbor, immediately eastward of Oak Harbor, is a semicircular bight 2 miles in diameter. The entrance is between Forbes Point and **Point Polnell**, the latter low, with a shoal extending westward for ¾ mile. Shoals extend ½ mile eastward from Forbes Point. With these exceptions the harbor is clear and affords good anchorage in 10 to 11 fathoms, muddy bottom, but is exposed southward.

No directions are necessary; in entering pass midway between Forbes Point and Point Polnell, which clears the shoals extending from these points.

Skagit Bay, the entrance to which is between Point Polnell and **Point Demock**, the northwestern point of Camano Island, is 12 miles long in a west-northwest and east-southeast direction. The greater portion of it is filled with flats, bare at low water, and intersected by numerous channels through which the Skagit River discharges. Along the shore of Whidbey Island, between it and the edge of the flats, is a narrow channel varying in width from ¼ to ½ mile; the shore of the island is also shoal for a distance of 100 to 200 yards offshore. This channel is 6½ miles long from its southern end to **Hope Island**, beyond which it expands into a small basin connecting westward through Deception Pass with Juan de Fuca Strait, and northeastward with Similk Bay. The tidal currents have considerable velocity. The depths vary from 7 to 23 fathoms.

The channel leading into **Skagit River** follows the north shore of Camano Island for 3 miles beyond Utsalady, then crosses the flats, where it is buoyed and marked by two lights; this channel has been improved by the Government, and at low tide a draft of 3 feet can be carried into the river.

From the northernmost point of Camano Island another channel, also buoyed, leads eastward across the flats and connects through **West Pass** and **South Pass**, with the head of Port Susan. This channel is used only by small launches with local knowledge.

Swinomish Slough connects the waters of Skagit Bay with those of Padilla Bay, 5 miles northward. The slough and its southern approach have been improved by the Government by dredging and by the construction of dikes. From deep water in Skagit Bay the dredged channel leads northeastward along the north side of Goat Island and around the western end of McGlinn Island, and is marked by a number of lights, including one at the western end of each of the jetties. This channel is good for a draft of about 3 feet at low tide.

Laconner, near the southern end of Swinomish Slough, is the center of a rich agricultural district. It has wharves with depths of 4 to 6 feet. A limited amount of provisions can be obtained. A freight boat makes three trips a week to Seattle; passenger traffic is by stage to the railroad in the interior.

Northward of Laconner traffic in the slough is confined to small launches with local knowledge. Strangers should not attempt to pass through, as the channel through the flats at the head of Padilla Bay is intricate and unmarked.

Hope Island, in Skagit Bay, 2 miles northwestward of the entrance to Swinomish Slough, is marked by a white light on its southwestern end.

Ala Spit, abreast the western end of Hope Island, is low, with a sunken spit extending 350 yards offshore in the direction of the point. A wharf and bunker for loading gravel is built about ¼ mile southward of Ala Spit.

Good anchorage may be had northward of Hope Island, and vessels at times make use of the anchorage while waiting for slack water in Deception Pass.

Deception Pass connects the northern end of Skagit Bay with the southern end of Rosario Strait. It is 2 miles in length; near its western end the channel is obstructed by an island, nearly in the middle of the passage, contracting the navigable channel, which is south of the island, to about 200 yards. **Deception Island** lies ⅜ mile northwestward from the southern point at the western entrance; foul ground exists between the point and the island and vessels should not attempt to pass between them. The north point at the western entrance is marked by a fixed white light. A fixed red light is established on the small island near the center of the bight on the south side of the pass 1 mile southwestward from Hoypus Point.

Deception Pass is commonly used by local vessels from Seattle bound for Anacortes, Bellingham, and points in the San Juan Islands. Some of these vessels plan to make the pass at the time of slack water; the higher powered passenger vessels run it at all stages of the tide. It is also frequently used by tows of logs from the northward, bound to Everett or Seattle, which take this route to avoid the rough weather they are liable to encounter in passing to the westward of Whidbey Island.

The **currents in Deception Pass** attain a velocity of from 5 to 7 knots at strength, at which times strong eddies will be encountered along the shores. The low-water slack occurs about 20 minutes before the time of low water at Port Townsend. The time of high-water slack is more uncertain; it occurs approximately 7¼ hours before and 5 hours after the time of the lower low water at Port Townsend. The period of slack water is of short duration, usually not over 10 minutes, after which the current immediately begins to run swiftly.

Directions, Possession Sound and Tributaries.

The chart is a sufficient guide for the navigation of these waters and may be followed with safety. A mid-channel course may be followed, and with the exceptions previously noted the shore can be approached with safety to within ¼ mile. In entering Possession Sound from northward, the southern end of Whidbey Island from Indian Point to Possession Point should not be approached closer than 1 mile to avoid the shoals extending from the island. Vessels bound through Skagit Bay should keep the Whidbey Island shore aboard, distant 400 to 600 yards, from the north end of Saratoga Pas-

sage until approaching the flats off Dugala Bay. Then steer about 329° true (NW by W mag.), passing 700 yards westward of Laconner South Jetty light, and hold the course until the southwestern ends of Hope and Skagit Islands are in range. Then steer a little to the westward of Hope Island, passing nearer to the island than to Ala Spit, and continue in mid-channel to the entrance to Deception Pass. In following the above track through Skagit Bay, vessels will be assisted, during the fishing season, by the presence of fish traps on the flats eastward of the channel, as these traps usually extend to the edge of the fairway.

Strangers should not attempt to run **Deception Pass** at any time except slack water. Pass northward of the small island 1 mile southwestward of Hoypus Point and southward of the island in the middle of the narrow part of the pass, taking care to keep in mid-channel at all times to avoid the eddies which may be encountered along either shore. Favor the light on the north entrance point to avoid the shoal extending eastward from Deception Island, and pass in mid-channel between Deception Island and the northwest point of Reservation Bay.

Elliott Bay (Seattle Harbor)

(chart 6445) is on the eastern shore of the sound about 35 miles southward from Marrowstone Point; the entrance is between West Point and Alki Point, about 5 miles southward. The bay proper, included between Smith Cove and Duwamish Head, has a width of nearly 2 miles and extends east-southeastward for nearly the same distance to the flats at the head. The bay is deep and free from dangers throughout.

Duwamish Head, 300 feet high, 1¾ miles northward from Alki Point, is bluff and steep on its northern face. At its base is a large, light-colored pleasure resort built on piles. A shoal extends 600 yards northwestward from the head, the outer extremity being marked by a gas and bell buoy.

Seattle, the largest and most important city on the sound, covers practically the entire shore of the bay. It has spread northward to include Ballard, eastward to Lake Washington, southward around the head of Elliott Bay, and westward to embrace West Seattle and the east shore of the sound to and beyond Alki Point. Its commerce, both foreign and domestic, is extensive, and it is the terminus of or connects with several transcontinental railroads. It is the terminus of several lines of steamers operating across the Pacific or through the Panama Canal, and connects with points north and south by rail and water. Its railroad and shipping facilities give it a large proportion of the Alaska commerce. Coal, lumber, grain, fish, machinery, and general merchandise are largely exported. The wharves are extensive, with sufficient depth for any draft. Vessels usually go direct to the wharves, but mooring buoys have been placed for those waiting dock room or opportunity to coal at the bunkers.

West Seattle, on the south shore of the bay, now included in Seattle, has wharves, flour mill, grain elevators, coal bunkers, and a shipyard. Deep-draft vessels can lie at the wharves. It connects with Seattle by rail and ferry.

Smith Cove, on the north shore about 3 miles eastward from West Point, is a small indentation bare at low water which has been extensively improved by the construction of docks and by dredging, and is now practically a continuation of the Seattle water front. There are wharves, coal bunkers, and grain elevators with modern facilities for loading and discharging. The deepest draft vessels can lie at the wharves.

The **Duwamish River** empties into the head of Elliott Bay. The flats at the mouth of the river have been improved by local interests by dredging two basins, each 1,000 feet wide, and with a present controlling depth of 32 feet, known as the **east** and **west waterways,** the dredged material being deposited between the two waterways to form a reclaimed area known as **Harbor Island.** Terminals, shipyards, and industrial plants are located on these waterways. The depths at the wharves are ample for deep-draft vessels. The Duwamish River now empties through a dredged channel into the west waterway, and at its mouth is crossed by two drawbridges, which are described under a separate heading following.

Lake Washington and **Lake Union** are at present being connected with the waters of Puget Sound by the construction of the **Lake Washington Canal.** This project contemplates a channel, at least 75 feet wide and 25 feet deep, to be dredged from deep water in the sound through **Shilshole Bay,** a shallow open bight immediately northward of West Point, to locks built in the narrow gorge between Shilshole and **Salmon Bays,** and thence to and connecting the waters of the two lakes.

The locks consists of one large and one small chamber, placed side by side. The large lock is 80 feet wide, 825 feet long between upper and lower miter sills, and has an intermediate gate dividing it into two sections, 450 feet and 375 feet long, respectively. The depth of water on the upper miter sill is 36 feet at low water in the upper pool and on the intermediate and lower miter sills is 25 feet at extreme low tide in Puget Sound, which will afford 36 feet at low water in the upper pool and mid-tide stages in Puget Sound.

The small lock, which lies south and alongside of the large lock, is 30 feet wide and 150 feet long between miter sills. The depth of water on the upper sill is 16 feet at low water in the upper pool and on the lower sill is 12 feet at extreme low tide in Puget Sound, which will afford 16 feet at low water in the upper pool and at mean low water in Puget Sound.

From the locks a canal 100 feet wide and 36 feet deep has been dredged through Salmon Bay and the connecting channel to Lake Union, and from Lake Union a canal 100 feet wide and 30 feet deep is being dredged to Lake Washington.

It is expected that the project will be completed during 1917.

The canal is crossed by a number of drawbridges, of which the details are given under a separate heading following.

Harbor regulations are enforced by a port warden, with an office at Pier 1. Dockage and wharfage charges are made and vary with the size of vessel and the class of cargo. The port warden maintains a radio station (call letters KPE) with a range of approximately 100 miles for the purpose of furnishing information concerning the harbor regulations, securing wharfage for incoming vessels, etc.

Masters are invited to take advantage of this service, for which no charge is made. The station is open every day except Sundays and holidays between 8 a. m. and 12 m. and between 1 p. m. and 5 p. m.

The following are extracts from the harbor regulations:

SEC. 3. No compulsory pilotage or harbor dues shall be charged any vessel navigating any of the above-described waters, either for arriving at or departing from the Seattle Harbor.

SEC. 4. The master of every vessel entering the harbor between the hours of 8 o'clock a. m. and 5 o'clock p. m. of any day, except Sundays and holidays, shall report to the port warden before 5 o'clock p. m. of such day, and if entering the harbor between 5 o'clock p. m. of any day and 8 o'clock a. m. of the next day shall report to the port warden at 8 o'clock a. m. of such next day, and if entering the harbor day or night upon any Sunday or legal holiday shall report to the port warden at 8 o'clock a. m. on the next legal day, stating name of vessel, master, tonnage, amount and nature of cargo, and such other information as may be required by the port warden; provided, that these provisions shall not apply to vessels carrying cargoes or part cargoes of explosives, nor to coastwise vessels nor to those plying between Puget Sound ports.

SEC. 7. All waters herein specified, subject to reservations for anchorage, shall be known as "fairway" and shall not be obstructed in any manner whereby navigation may be endangered or impeded and shall include, subject to such reservations, the following-described waters:

All of Elliott Bay, lying easterly of a straight line drawn from Alki Point to West Point;

All of the east and west waterways;

All of the Duwamish River;

All of the Duwamish waterway project;

All of Salmon Bay;

All of Lake Washington Canal outside that portion which shall be under the supervision and control of the United States Government;

All of Lake Washington, Lake Union, and Green Lake lying or being within the corporate limits of the city of Seattle or within the jurisdiction and control of the city;

All that portion of Shilshole Bay lying easterly and southerly of a line from West Point to the intersection of the northerly boundary of the city of Seattle with the outer harbor line.

All navigable waters in the projection of public streets lying on the landward side of the outer harbor line shall be fairway. It shall be unlawful for the master or other person in charge of any vessel to anchor, tie, or make fast such vessel in any such fairway for a longer period of time than reasonably sufficient to load or unload the same, except that the port warden may, in his discretion, grant any permit for the use of any such fairway for a longer period of time whenever in his judgment such use will not interfere with the use of the fairway by any other vessel, but only upon the payment of the anchorage charges herein provided for.

SEC. 8. In aid of commerce and navigation anchorage for vessels is authorized in the following described waters:

Elliott Bay anchorage.—Beginning at the northeast corner of Harbor Island; thence northerly and in a straight line to a point intersecting a line drawn along the north side of King Street; thence west on said line to a point intersecting the east line of the west waterway; thence along said east line to the northwest corner of Harbor Island; also, beginning at a point of intersection of the outer harbor line with a straight line drawn along the west line of the west waterway; thence north to a point intersecting a straight line drawn along the north side of Washington Street; thence in a westerly direction to the junction of the outer harbor line and the east side of the West Seattle ferry dock.

Smith Cove anchorage.—Beginning at a point at the junction of the outer harbor line and a line drawn along the north side of Denny way; thence westerly on said line for a distance of approximately 2,000 feet; thence in a northwesterly direction paralleling the outer harbor line to a point intersecting a straight line drawn along the east side of the Great Northern dock.

Salmon Bay anchorage.—Beginning at a point at the junction of the outer harbor line and a straight line drawn along the south side of Sheridan Street; thence in a southeasterly direction in a straight line to a point at the intersection of the outer harbor line and the Great Northern bridge.

Lake Union anchorage.—Whenever deemed advisable by the port warden he may grant a written permit to the master or owner of any vessel for the anchorage or mooring of said vessel outside of the outer harbor line, or in any unused slip, or in any street end, on Lake Union, at such locations as he shall determine will not interfere with or impede navigation.

Lake Washington anchorage.—Whenever deemed advisable by the port warden he may grant a written permit to the master or owner of any vessel for the anchorage or mooring of said vessel outside of the outer harbor line, or in any unused slip, or in any street end, on Lake Washington, at such locations as he shall determine will not interfere with or impede navigation.

SEC. 9. It shall be unlawful for any master or person having charge of any vessel to anchor or make the same fast in the waters of the fairway or anchorage without first obtaining a permit therefor from the port warden and paying anchorage as follows: 1 to 15 tons, 3 cents per day; 15 to 50 tons, 5 cents per day; 50 to 100 tons, 10 cents per day; 101 to 200 tons, 20 cents per day; 201 to 300 tons, 30 cents per day; 301 to 400 tons, 40 cents per day; 401 to 500 tons, 50 cents per day; 501 to 600 tons, 60 cents per day; 601 to 700 tons, 70 cents per day; 701 to 800 tons, 80 cents per day; 801 to 900 tons, 90 cents per day; over, $1 per day.

Anchorage at city buoys.—Every vessel attached to any city buoy shall pay as follows: Vessels under 500 tons, each day or part thereof, $1; vessels over 500 tons, each day or part thereof, $2.

SEC. 10. It shall be unlawful for any vessel in fog, mist, falling snow, or heavy rain storms, whether by day or night, to travel in excess of 6 nautical miles per hour on any of the waters of Seattle Harbor. It shall be unlawful for any vessel in clear weather to travel in excess of 8 nautical miles per hour within 2,000 feet of the outer harbor line on any of such waters.

SEC. 24. Every vessel or obstruction, except vessels containing cargoes or part cargoes of explosives, while lying at any pier or other structure in Seattle Harbor between the hours of sunset and sunrise, shall display at least one white light at the outer end of the vessel or obstruction, which white light or lights shall show clearly from seaward and be so constructed and of such character as to be visible at least 1 mile in clear weather.

SEC. 33. No master, or other person in charge of any vessel or obstruction, shall attach the same to any city buoy until he shall have obtained permission so to do from the port warden: *Provided*, That during the night or in bad weather such vessel or obstruction may be attached to any vacant city buoy, but the master, owner, or person in charge thereof shall notify the port warden not later than 8 o'clock a. m. of the next legal day of such act, stating the name and character of such vessel or obstruction and the probable length of time it is desired to remain at said buoy. Should more than one vessel or obstruction apply for the use of any particular buoy, the port warden shall be the sole judge as to which shall occupy the same, and his decision shall be final and conclusive.

SEC. 42. All city floats now or hereafter established may be used by launches and other power boats for dockage purposes, other than the handling of freight, free of charge for a lying time not to exceed 5 consecutive hours at any one time. After such time the port warden shall collect the sum of 25 cents for every day, or fraction thereof, as a dockage charge. Whenever any person in charge of any boat shall use any city float for such a length of time as shall be to the detriment of other persons desiring to use such floats, the port warden is empowered to charge a weekly dockage fee of not less than $5 for every week or fraction thereof.

The port warden shall from time to time designate the city floats over which freight or merchandise may be handled. Every launch or power boat on arrival at any city float shall report to the port warden, stating the name of boat, home port, name of owner, and lying time desired. Every launch or power boat lying at any city float shall at all times have not less than one person on board authorized and competent to attend lines and fenders, and failure to keep such person on board or to tend lines and fenders shall deprive such launch or boat from the further use of any city float.

Anchorage may be had within the limits defined in the above regulations, but the swinging room is limited, and vessels seldom anchor, preferring to go to one of the mooring buoys maintained by the city. During heavy northerly weather, which is rare but occasionally

occurs during the winter months, the anchorage is uncomfortable, and vessels at the wharves may have to haul out into the stream.

Wharves.—There is an extensive system of wharves, both municipal and private, some of which are equipped with the most modern facilities for handling cargo. The port of Seattle has constructed and operates a number of wharves specially equipped for handling the various commodities—grain, lumber, fish, fruit, etc., which form the principal items in the commerce of the port.

Drawbridges.—The Lake Washington Canal and the Duwamish River at its mouth are crossed by a number of drawbridges, of which the following table gives the location, clear width of opening, and the whistle signal prescribed for use by the vesel desiring their opening:

Location.	Width of opening.	Signal for opening (blasts of whistle).
Lake Washington Canal:	*Feet.*	
Great Northern Ry. at Thirty-sixth Avenue NW.	150	1 long and 1 short.
City bridge at Fifteenth Avenue NW.	150	Do.
City bridge at Fourteenth Avenue NW. (temporary).	80	
Northern Pacific Ry. at Eighth Avenue NW.	150	1 long and 2 short.
City bridge at Fremont Avenue.	150	1 long and 1 short.
Traction bridge at Sixth Avenue NE. (temporary).	80	1 long and 2 short.
City bridge at Sixth Avenue NE. (temporary).	80	Do.
City bridge at Tenth Avenue NE.	175	Not yet prescribed.
Duwamish River:		
City bridge at Spokane Avenue.	80	1 long and 1 short.
Railroad bridge near Spokane Avenue.	80	Do.

The following regulations for the operation of these bridges are common to all those listed above:

SECTION 1. When at any time during the day or night a vessel, unable to pass under the closed draw span of any of the above bridges, approaches it from a distance of over 1,000 feet, the person in command of such vessel shall cause to be sounded, when said vessel shall be at a distance of not less than 1,000 feet, the prescribed signal, and shall repeat this signal until it is understood at the bridge.

SEC. 2. When such vessel is about to leave a landing 1,000 feet or less from the drawbridge, with the intention of passing through the draw, the person in command shall cause the prescribed signal to be sounded at such interval before leaving the landing that the draw may be opened in time for the vessel to pass.

The above bridges shall also be opened for the passage of vessels or water craft of any description propelled by other than steam power, upon like signals given by whistle or trumpet, or upon verbal request of the person or persons in charge of same.

SEC. 4. All vessels when passing any bridge shall be moved as expeditiously as is consistent with established rules governing speed.

SEC. 5. All vessels, crafts, or rafts, not self-propelled, * * *, for which the opening of any bridge may be necessary, shall, while passing such bridge, be towed by a suitable self-propelled boat.

SEC. 6. In case the draw span can not be immediately operated when the prescribed signal is given, a red flag or ball by day, and a red light by night, shall be displayed, or on bridges where a suitable whistle has been installed, five short blasts shall be immediately given, and repeated until approaching vessel answers.

The following additional regulations have been prescribed for the Duwamish River bridges:

SEC. 6. Upon hearing the signal hereinbefore prescribed, the engineers, or operators of drawbridges shall promptly open the draws, except between the hours of 6.30 a. m. and 7 a. m., 7.15 a. m. and 7.45 a. m., and 8.05 a. m. and 8.30 a. m., 5.15 p. m. and 5.45 p. m., and 6 p. m. and 6.30 p. m.: *Provided*, That the draws shall be promptly opened for passage of seagoing vessels of 250 tons or over upon the prescribed signal at any hour of the day or night: *And provided further*, That when any vessel shall arrive at either bridge within 5 minutes before 6.30 a. m., 7.15 a. m., 8.05 a. m., 5.15 p. m., or 6 p. m., it shall be passed promptly through both bridges in the direction in which it is moving and shall not be stopped between bridges.

Pilotage is not compulsory. Reliable licensed pilots can be obtained for the sound or for the inside water to Alaska. (See "Pilotage, Juan de Fuca Strait and tributaries.")

Towboats can be had, and are in general use by sailing vessels.

Supplies of all kinds and in any quantity can be obtained.

Repairs of all kinds to hulls and machinery can be made; there are numerous shipbuilding plants with dry docks or marine railways of various capacities. The largest dry dock availble (exclusive of the dry docks at the Bremerton Navy Yard, which are available for private use when not required by the Government) is 468 feet long, 110 feet inside width, 31 feet depth over keel blocks; lifting capacity, 12,000 tons.

Marine hospitals.—There is a relief station of the Public Health Service in charge of a service officer. The nearest marine hospital is at Port Townsend.

Storm warnings are displayed by the Weather Bureau from the roof of the Hoge Building, Second Avenue and Cherry Street, and are plainly visible from the harbor.

A commercial **radio station** is located at Seattle.

A **Coast and Geodetic Survey suboffice** is located in the Burke Building, Second Avenue and Marion Street. Files of charts, coast pilots, and other publications are maintained for the use of mariners, who are invited to avail themselves of the facilities afforded.

Customhouse.—Seattle is the headquarters of the Washington collection district. The customhouse is at Third Avenue and Union Street.

Currents.—As a rule, the tidal currents in the harbor have little velocity. At times, however, with an ebb tide, an appreciable current will be found setting northwestward along the water front.

EAGLE HARBOR

(chart 6445) is situated on the eastern shore of Bainbridge Island, 5 miles southward of Point Monroe and opposite Elliott Bay. It is about 1 mile long with a width of ½ mile and affords excellent anchorage in 5 to 6 fathoms, muddy bottom. It narrows at the head to 300 yards and winds westward for ¾ mile over flats bare at low tide.

A shipbuilding plant is located on the north side ¾ mile from the entrance. It has ways capable of handling vessels of 4,000 tons displacement. The steel cradle is 378 feet long and can take a draft of 17 feet forward and 21 feet aft. There are ample wharf facilities.

Winslow post village is on the north side of Eagle Harbor and has a landing wharf near the head. **Eagle Harbor** post office is on the south side of the bay. **Creosote** has an extensive creosoting plant, with wharves capable of accommodating vessels of large size, built out inside the south point of the entrance. There is an extensive trade to foreign and domestic ports in prepared piles and paving blocks.

From the bluff on the east side of the southern entrance point a wharf for loading gravel is built out to 18 feet, and from the low spit on the west side of Wing Point a landing wharf projects to the channel.

Communication can be had with Seattle daily by steamers and by telephone.

Wing Point, on the north side of the entrance, is a narrow, bluff point, 30 feet high, covered with trees to the edge.

Wing Point Reef extends southeastward for ½ mile from Wing Point, and is generally marked by kelp. The extremity of the reef is marked by a red nun buoy.

Tyee Shoal, ⅝ mile southeastward of Wing Point, with a least depth of 10 feet and less than 4 fathoms over it, is marked by a horizontally striped buoy.

A spit, bare at low water, extends 300 yards northward from the southern point at the entrance, and is marked by a black buoy placed in 40 feet off its northeast edge. The spit also extends nearly 500 yards northwestward from the point, with depths of 2 feet and less, and marked by a black buoy placed in 24 feet off the end of the spit.

The entrance is deep, but is only 200 yards wide between Wing Point Reef and the sunken spit on the west side of the channel, and caution is necessary in entering. The channel is marked by range lights.

Blakely Rock is prominent in approaching; it lies ¾ mile northward of Restoration Point and at high water shows about 15 feet at its highest point. It is 400 yards in extent, with shoal water, well marked by kelp, extending over 250 yards northward.

To ENTER, give Wing Point and buoy a berth of over ½ mile and pass midway between Blakely Rock and Tyee Shoal buoy. Bring Restoration Point astern, bearing 162° true (SE ¼ S mag.) and steer 342° true (NW ¼ N mag.) with black can buoy No. 1 a little on the port bow. The range beacons are rather faint and close together but should be made out ahead when Restoration Point is astern bearing 162° true (SE ¼ S mag.). Pass about 75 yards eastward of black buoy No. 1 and steer 299° true (W ⅜ N mag.) to clear the northwest end of the spit on the south side, and when past the buoy marking it haul southwestward into the harbor, following the northern side at a distance of 350 yards, and anchor as desired.

RESTORATION POINT TO POINT DEFIANCE.

The waters of this portion of the sound, which extend from Restoration Point a distance of 15 miles in a general south-southeasterly direction, are divided into two parts by Vashon and Maury Islands.

Vashon Island is 11 miles long in a north and south direction, with an average width of about 3 miles.

Maury Island, which is really a part of Vashon Island, the two being connected by a narrow neck of land bare at high water, lies off

the eastern side of Vashon Island, and is 5 miles long, with an average width of 1 mile.

On these islands the land is of moderate elevation, rolling, and in places rugged, and the country throughout is heavily wooded except for the numerous small clearings where farming is in progress. The shores on all sides have numerous settlements, with wharves built out to accommodate the local traffic to Seattle or Tacoma. These are mentioned in detail under the description of the waters following.

Colvos Passage, separating Vashon Island from the mainland westward, is described on page 230.

From Restoration Point, the main body of the sound extends southeastward for 12½ miles to Robinson Point, then bends southwestward and westward a farther distance of 9 miles to Point Defiance. The waters throughout are deep and free from dangers, which in no case extend as much as ½ mile from shore.

Eastern Shore.

Alki Point is low with a small knoll about 100 feet high immediately behind it; eastward of the knoll low land extends for nearly ⅜ mile before rising to the high land extending southward from Duwamish Head.

Alki Point lighthouse is situated on the extremity of the point. The light is group flashing white (5 flashes every 10 seconds). The fog signal is a reed horn (blast 3 seconds, silent 6 seconds, blast 3 seconds, silent 18 seconds).

From Alki Point to Point Williams, 3 miles, the shores are thickly settled. This stretch is accessible to electric railways from Seattle, and passenger steamers do not call regularly. A sawmill, 2 miles from Alki Point, has a wharf for loading lumber.

Fauntleroy Cove lies between **Point Williams** and **Brace Point**, 1 mile apart. A wharf is built out from the head of the cove to 8 feet of water.

A wharf for loading sand and gravel is built out ⅜ mile southeastward from Brace Point.

Seahurst Park is a landing for passenger steamers 3 miles southeastward from Brace Point. The wharf has 12 feet of water.

Point Pully is a sharp, low spit, projecting 300 yards from the high point eastward, which in 1 mile rises to 430 feet elevation. On the low part of the point is a grassy knoll 30 feet high, with three or more trees upon it, from which it derives its local name, **Three-tree Point**. There is a wharf on the north side of the point with 21 feet at the end. Point Pully is marked by an occulting white post light (light 3 seconds, eclipse 3 seconds).

Des Moines is a small town 4 miles southeastward from Point Pully. It has a wharf built out to 21 feet, and is the terminus of a ferry to the town of Portage on Vashon Island. In addition to the daily steamers, a stage connects with the electric railway in the interior.

Zenith, ¾ mile south-southeastward of Des Moines, has a wharf built out to 11 feet.

Redondo is a post office and settlement 6½ miles southeastward from Point Pully, and has a landing wharf in 11 feet of water.

Lakota Wharf, with 22 feet, is situated 2 miles southwestward from Redondo.

Dash Point, 1 mile northward from Point Brown, has a town site with graded streets and a few houses on its north side and a wharf built out to 20 feet.

Point Brown, the north point at the entrance to Commencement Bay, is marked by an unwatched flashing white light (3 seconds) with a bell-fog signal sounding 1 stroke every 20 seconds. In the bight just northward of the point is **Caledonia**, a small settlement with 15 feet of water at the wharf.

Commencement Bay and the City of Tacoma are described under a separate heading following.

Western Shore.

From Restoration Point the shore of **Bainbridge Island** trends southwestward for 2 miles to **Beans Point**, the north point at the entrance to Richs Passage. Between the points the shores are thickly settled with summer cottages which are served by **South Beach wharf**, built out to 12 feet, 1¼ miles southwestward from Restoration Point.

Bainbridge Reef, with depths of 4 fathoms at the outer end and deeper water inside, extends ⅜ mile southward from the shores between South Beach wharf and Beans Point, and constitutes the principal danger in the approach to Richs Passage. Its outer end is marked by a red buoy.

Richs Passage is described on page 229.

From **Orchard Point**, the south point at the entrance to Richs Passage, the shores trend southward and then eastward, forming, with the south shore of Bainbridge Island, a bay, semicircular in form and about 3½ miles in diameter.

Manchester, **Colby**, **South Colby**, **Harper**, and **Southworth** are small towns on the shores of this bay, between Orchard Point and **Point Southworth**, at the entrance to Colvos Passage. Each of these towns has one or more wharves built out to deep water to accommodate the traffic, which is entirely local.

Blake Island, about 1 mile in extent, 160 feet high and covered with trees, lies in the southeastern part of this bay, off the northern entrance to Colvos Passage. A shoal makes out from the entire north shore of the island, attaining a maximum distance of ¼ mile from shore.

Yukon Harbor, 2 miles southwestward from Blake Island, affords anchorage in 6 to 10 fathoms, with protection from southerly winds.

Point Vashon, the northwest point of Vashon Island, is 280 feet high, steep, and wooded. **Dolphin Landing**, ½ mile eastward of the point, has a wharf built out to 9 feet.

Aquarium, on the eastern shore of Vashon Island, ½ mile southward of Dolphin Point, is a post office and landing. The wharf has 20 feet of water.

Glen Acres and **Dilworth**, on the north and south shores of **Point Beals**, each has 14 feet of water at the wharves.

Vashon is a town with a landing wharf in 16 feet of water under the bluff 1 mile southward of Point Beals. It lies directly across the sound from Point Pully. There is a sawmill at the landing and a

brick kiln around the point to the southward of it. The town and post office is on the high land 1½ miles from the wharf.

Ellisport, with wharf in 16 feet of water, is a post village just southward of Point Heyer.

Portage is a post village and hotel on the north side of the low isthmus which connects Vashon and Maury Islands. It is connected by ferry with Des Moines on the mainland shore eastward.

Fernheath and **Maury,** with 13 and 16 feet at the wharves, are landings on the north shore of Maury Island, 1¼ and ¾ miles, respectively, westward from Robinson Point.

Robinson Point, the eastern extremity of Maury Island, is a low spit projecting 140 yards from the wooded high land. It is the turning point in the East Passage and is marked by a lighthouse with a group flashing white light (3 flashes every 10 seconds) and a reed horn fog signal (blast 4 seconds, silent 16 seconds).

There are no landings on the southeast shore of Maury Island, but two bunkers from which sand and gravel are shipped, are situated 1½ and 2½ miles, respectively, southwestward from Robinson Point.

Quartermaster Harbor is described under a separate heading following.

Gig Harbor is an inlet 1 mile long by ¼ mile wide, on the west side of the southern entrance to Colvos Passage abreast Point Defiance. A low sand spit 220 yards long projecting southwestward from the east point leaves a passage less than 100 yards in width with a narrow 10-foot channel in the middle; the currents in this channel have considerable velocity. Inside the entrance the basin has from 4 to 6 fathoms in it. The surrounding land, partially cleared of timber, slopes gently toward the shores, and is dotted with houses, and there are many more in the interior. There are 4 landing wharves in the harbor, including one at which fuel oils can be obtained, and a small plant devoted to the building of fishing launches. Gig Harbor post office is on the west shore near the head, and mail is distributed thence to settlements in Whollochet Bay, Hale Passage, and Carr Inlet. Communication is had with Tacoma by telephone and by steamers making several trips daily.

Port Orchard

(charts 6443 and 6444) is an extensive body of water lying westward of Bainbridge Island. Its general length is about 15 miles with an average width of over ¾ mile. At its northern end it connects with Port Madison through Agate Passage. A narrow inlet, **Liberty (Dogfish) Bay,** makes into the western shore about 4 miles at the southern end of Agate Passage. At the southern end of Bainbridge Island Port Orchard connects with Puget Sound through Richs Passage. About 2 miles south-southwestward of Richs Passage, on the western shore of the port, is the entrance to **Port Washington Narrows,** a narrow passage 3 miles long, connecting with **Dyes Inlet,** a body of water 3 miles long and averaging 1 mile wide. **Sinclair Inlet,** 3½ miles long and averaging 1 mile in width, makes in southwestward beyond the mouth of Port Washington Narrows, and is the principal inlet in Port Orchard.

The depths in the main body of Port Orchard range from 6 to 25 fathoms with but few dangers, and these as a rule close inshore. The shores are moderately low and wooded.

The country around Port Orchard is being rapidly settled and many towns and post villages, each with one or more landing wharves for shipment of farm produce, have sprung up in recent years. These are being constantly added to; the principal ones in existence at present (1916) are mentioned below. All are in daily communication by steamer with Seattle, and many of them by telegraph and telephone.

Fort Ward is a military post on the north shore of Richs Passage, just inside **Beans Point**. There is a wharf built out to 18 feet. A rocky patch, with 11 feet over it, dangerous to vessels approaching the wharf from southward, lies 150 yards 170° true (SE by S mag.) from the southeastern end of the wharf.

Pleasant Beach is a summer resort and landing with wharf built out to 12 feet, on the north shore of Richs Passage, 1 mile northwestward of Fort Ward.

Puget Sound Navy Yard, from which Port Orchard derives its main importance, is situated on the north side of Sinclair Inlet on the west side of the entrance to Port Washington Narrows.

Dock.—The Government dry dock at the naval station is 820 feet long, and has a width of 145 feet; there is a depth of 35 feet on the blocks. Mooring buoys have been placed off the entrance to the dock.

Bremerton is a town on the east side of the navy yard, and Charleston is on the west side. Both have landing wharves and post offices. There is communication with Seattle by several boats daily.

Port Orchard is a post office on the south side of Sinclair Inlet, opposite the navy yard, and has two landing wharves.

Manette is on **Point Herron**, the east side of the entrance to Port Washington Narrows. It has a landing wharf built out to 15 feet on the west side of the point.

A wharf for loading fuel oils is built out to deep water at **Point Turner**, on the western side of the southern entrance to the narrows.

Sheridan, a village and post office, has a landing wharf on the northeast side of Port Washington Narrows, 2 miles above Point Herron.

Tracyton is a post village on the east side of Dyes Inlet near the northern end of the narrows. It has a landing wharf with 12 feet.

Fairview, on the point 1¼ miles northwestward of Tracyton, has a wharf built out to 11 feet.

Silverdale, on the west side at the head of Dyes Inlet, is a post village with two landing wharves built out to 14 feet. A road runs from Silverdale to Seabeck and other settlements on Hood Canal.

Chico, a post village on the west side of Dyes Inlet, has a float landing with 15 feet at low tide.

Enetai, on the west side of Port Orchard 1½ miles northward from Point Herron, is a resort with a landing wharf built out to 12 feet.

Gibson is a small settlement on the eastern shore of Port Orchard, 1 mile northwestward from Point White. It has a wharf in 11 feet of water.

Crystal Springs and **Fletchers Bay** are post villages, with wharves built out to deep water, on the eastern shore of Port Orchard, ¾ and 2½ miles, respectively, north-northwestward of Gibson.

Illahee and Gilbertson are small settlements with landing wharves on the western shore opposite Crystal Springs and Fletchers Bay.

Brownsville, a post office with a sawmill, has a landing wharf on the north side of Burke Bay on the west side of Port Orchard, 5 miles southward from Agate Passage entrance.

Manzanita, a post office with wharf in 6 feet of water, is on the west side of Bainbridge Island in a small cove 3 miles southward from the Agate Passage north entrance.

Seabold, a post office on Bainbridge Island, about 1 mile northward from Manzanita, has two wharves with 12 feet at low tide.

A naval torpedo station is located on the west side of the entrance to Liberty Bay. The dock has 18 feet at the end. There are two large wireless towers and several buildings on the reservation.

Keyport, a post office on the south side of the passage leading to Liberty Bay, has a wharf with 12 feet of water.

Lamola Landing, on the east side of Liberty Bay, has a wharf out to 10 feet.

Pearson, a post office on the south side of Liberty Bay, has a landing wharf with 8 feet, built out from the end of a low point.

Scandia Landing, only ¼ mile westward from Pearson, has a wharf out to 7 feet. Produce from Hood Canal is shipped here.

Poulsbo, a town on the east side at the head of Liberty Bay, has several wharves with from 8 to 12 feet at low water, and is the center of an extensive fishing industry. A saltery, two sawmills, and a shingle mill are located here. Provisions may be had and all kinds of fuel oils at an oil dock. A road connects Poulsbo with Bangor and other settlements on Hood Canal. There is a large area of farming country around Poulsbo and toward Hood Canal, and a considerable amount of produce and lumber is shipped.

Suquamish is a post village in the Indian Reservation on the north shore at the entrance to Agate Passage. There is a wharf built out to 14 feet.

Channels.—Agate Passage, the northern entrance, connects with Port Madison; it is narrow, the tidal currents have considerable velocity, and it is obstructed by a shoal in the middle at the north end with depths of 6 to 7 feet, and there are other depths of 14 to 18 feet almost in mid-channel. It has been examined by means of a wire drag, and the dangers are shown on the chart. Its use is confined to local vessels.

Richs Passage, at the southern end of Bainbridge Island, is the principal entrance to Port Orchard, and the one in general use. The approach to the passage is between Restoration Point and Blake Island, and is deep and free from dangers except for Bainbridge Reef, described on page 226.

The passage is about 3 miles long, with a rather sharp bend near its western end, and varies in width from ¾ mile at its eastern end to a little more than ¼ mile at the western. It has been examined by means of the wire drag and the dangers are shown on the chart. **Orchard Rocks,** 500 by 350 yards in extent, lie on the northern side of the channel just inside the eastern entrance. A small area near the center of the reef is bare at low tide; the highest point covers at about half tide and is marked by a white beacon. The rocks are marked by a gas buoy (flashing white, 3 seconds) placed in 7½ fathoms

450 yards southward from the beacon. The bend near the western end is also marked by a gas buoy (flashing white, 3 seconds) and **Waterman Point**, at the western entrance, by a flashing white light (5 seconds).

The tidal currents in Richs Passage are described on page 202.

Directions, Port Orchard.

Strangers should not attempt to navigate Port Orchard, and particularly Richs Passage, in thick weather, on account of the strong tidal currents. In clear weather, however, the navigation of these waters presents no difficulty. Enter between Restoration Point and Blake Island, giving either shore a berth of not less than ½ mile, and steer so as to pass 300 yards southward of Bainbridge Reef buoy. From a mid-channel position between that buoy and Orchard Point, steer 310° true (WNW ½ W mag.) heading for Middle Point, to pass 200 yards southward of Orchard Rocks gas buoy. When the buoy is abeam, steer 338° true (NW mag.) to pass 200 yards northward of Point Glover gas buoy, and continue in mid-channel through the passage to Waterman Point light. From this point a 225° true (S by W ⅞ W mag.) course for 2¼ miles leads to a position 300 yards southeastward of the buoy marking the shoals off Point Herron. Then steer 247° true (SW ⅛ S mag.) for 1½ miles to the anchorage off the navy yard.

Colvos Passage,

on the western side of Vashon Island, is about 11 miles in length in a general north and south direction, with an average width of 1 mile. It is nearly straight and free from outlying dangers. The northern entrance is about 4½ miles southward from Alki Point and the southern entrance is about 4 miles westward from Point Brown and abreast Point Defiance. The currents, especially the ebb, have greater velocity than in the eastern passage, and advantage is at times taken of this by vessels bound from Tacoma to Seattle, although the distance is a little greater. The passage is used principally by local passenger steamers and by tugs from up-sound points with logs for the sawmills. A mid-channel course can be followed with safety.

Point Southworth, on the western side of the northern entrance, is high and wooded.

There are three landing wharves on the western shore of Colvos Passage, as follows:

Fragoria, with wharf built out to 7 feet, is situated 3 miles southward from Point Southworth.

Olalla is a post village at the mouth of a narrow inlet 5½ miles southward from Point Southworth. The inlet is shoal, and is bridged across at the entrance. The landing wharf, built out to 14 feet, is on the south side of the inlet. A sawmill is located here.

Maplewood, 1½ miles southward of Olalla, has 12 feet at the wharf.

The eastern shore of Colvos Passage has the following landings:

Biloxi wharf, with 15 feet at the end, is situated ½ mile southward of Point Vashon and affords landing for a number of summer cottages. Another private wharf is situated ⅜ mile southward from it.

Cedarhurst, a group of summer cottages in **Fern Cove,** has a wharf built out to 14 feet.

Colvos is a small village on Peter Point, 2¼ miles southward from Point Vashon. There are two wharves, one on either side of the point, with 19 feet of water at the ends.

Cove is a post village with 15 feet at the wharf built out from the point 1½ miles southward from Peter Point.

Lisabeula is a post office and farming community 6½ miles southward from Point Vashon. The wharf has 12 feet at the end.

Cross Landing is a small settlement on Point Sandford, 7 miles southward from Point Vashon. The wharf has 19 feet.

Luseata Beach and **Spring Beach,** each with a wharf built out to deep water, are two groups of summer cottages, 1¾ and 2¾ miles, respectively, southward from Point Sandford.

QUARTERMASTER HARBOR.

This harbor is situated between Maury and Vashon Islands, opposite Commencement Bay, the entrance being 4 miles northwestward from Tacoma. The shores are low and wooded, and at the head of the harbor is a narrow isthmus connecting Vashon and Maury Islands, almost covered at extreme high tide. The harbor is irregular in shape, with a total length of 5 miles and an average width of ½ mile. It affords an excellent anchorage about 2 miles inside the entrance in 5 to 10 fathoms, muddy bottom.

A shoal just inside the entrance extends 300 yards from the eastern shore, and is marked at its outer end by a red buoy placed in 8 fathoms. For a distance of 1 mile above the buoy shoal spots extend 400 yards from the western shore, with depths of 9 to 17 feet.

The harbor is easy of access and a mid-channel course may be followed with safety.

There are many settlements along the shores of the harbor, all having landing wharves, where steamers from Tacoma call several times daily. Under the high bluffs on the west side from Neill Point northward are the following summer resorts: **Monte Vista, Harbor Heights, Indian Point,** and **Magnolia Beach,** and on the east side about 1 mile from the entrance is **Manzanita Landing.**

Burton is a college town on the peninsula projecting eastward from the west side 3½ miles from the entrance. Vashon College and several schools are located here. A landing wharf 760 feet long, is built out southward from the narrow part of the peninsula to 12 feet at low tide.

Dockton, in the bight on the east side 2½ miles from the entrance, is commercially the most important community in the harbor. There are two small shipbuilding plants located here; one devoted entirely to the building of fishing vessels, and with no facilities for repairs, and the other having a marine railway capable of taking vessels 140 feet long and 10 feet draft. There is a blacksmith shop but no machine shop, repairs to machinery being made in Tacoma. There are two wharves, with 12 feet at low tide. There is also a shingle mill and codfish curing plant. Communication is had with Tacoma by telephone and by steamers several times daily.

Newport, with a float landing in 6 feet of water, is on the west shore on the north side of the Burton peninsula, and is another landing for that town.

Quartermaster is a town site on the north shore at the head of the harbor. There are a few houses on it and a landing wharf built out to 8 feet of water.

Kingsbury Landing is on the east side of the harbor about 1½ miles northward of Dockton. The wharf is built out to 3 feet at low tide.

COMMENCEMENT BAY (TACOMA HARBOR)

(chart 6451) has its entrance 18 miles southward from Alki Point and 56 miles from Point Wilson. The bay is 2½ miles in length, with an average width of nearly 2 miles. The waters are deep throughout, ranging in depth from 90 fathoms at the entrance to 25 and 30 fathoms at the head, where they shoal abruptly to mud flats, bare at low water. The bay is easy of access and free from dangers.

Tacoma, the second city in size and importance on the sound, is situated on the southern and southwestern shores of the bay. It has an extensive commerce, both foreign and domestic, exporting large amounts of flour, cotton, wheat, machinery, lumber, and general merchandise; it also has part of the Alaska trade.

From the flats at the head of the bay the city water front extends northwestward along the western shore to within 1½ miles of Point Defiance. Here are numerous industrial plants, with wharves to accommodate deep-draft vessels.

The southwestern half of the flats at the head of the bay has been improved by dredging four basins, and by the construction of wharves, warehouses, railway terminals, and various industrial plants.

The southernmost of these basins is known as the city waterway. It is 1,000 yards long from the entrance to a vertical lift bridge, is 200 yards wide, and has depths of 25 to 40 feet. Above the bridge the depths are shoaler, ranging from 14 to 20 feet. The northeastern point at the entrance to the waterway is marked by a light and fog signal.

This waterway is devoted principally to the traffic of the various local sound boats, all of which passes over the municipal dock on the west side of the basin. The Northern Pacific and the Great Northern Railways also have terminals on this waterway.

The bridge across the city waterway has a vertical lift span, with 200 feet clear width of opening. The following regulations govern its operation:

(1) At all times during the day and night, except as hereinafter provided in paragraph 2, the draw of the above-named bridge shall be opened for the passage of vessels upon signal consisting of four long and two short blasts of a horn or steam whistle, to be given by the vessel desiring to pass; *Provided,* That for the passage of foreign vessels and "Vessels of the United States" as defined in section 4311, Revised Statutes, the draw shall be opened immediately after the aforesaid signal is given, and for the passage of all other vessels which can not pass the closed bridge, the draw shall be opened as soon as practicable after such signal, but no vessel of the latter class shall be delayed for a longer period than 15 minutes. (2) Between the hours of 6.30 a. m. and 7.30 a. m., and between the hours of 5.30 p. m. and 6.30 p. m., the draw need not be opened: *Provided,* That during such periods the draw shall

be promptly opened if necessary to prevent disaster to shipping: *And provided further*, That it shall also be opened during such periods if necessary to meet the requirements of navigation as conditioned by the tides, due notice of the latter contingency to be given to the bridge tender on the preceding day by each vessel desiring to have the draw opened during these periods. (3) In case the draw can not be immediately opened when the signal is given, a red flag or ball by day or a red light at night shall be conspicuously displayed.

North of the city waterway is the middle waterway. This is 1,200 yards long, 300 feet wide, and has depths of 29 to 35 feet. It affords a terminal for the Oregon-Washington Railway. Large lumber mills are also located here.

North of the middle waterway is the Puyallup waterway, through which the Puyallup River discharges. An attempt has been made to dredge here a basin similar to those already described, but excessive shoaling has thus far defeated the project.

The fourth and northernmost basin is the Milwaukee waterway. This is 1,200 yards long, 300 feet wide, and 35 feet deep, and affords a terminal for the Chicago, Milwaukee & Puget Sound Railway.

Anchorage.—The depths as a rule are too great for convenient anchorage, but vessels occasionally anchor under the northern shore about 1 mile eastward of Point Brown. A number of mooring buoys have been placed off the water front and are in charge of the harbor master.

Regulations governing anchorage in the bay and the use of mooring buoys are given in the section following.

Harbor regulations are enforced by a harbor master with office in the municipal dock. The following are extracts from the regulations:

SEC. 3. The master of every vessel entering the harbor between the hours of 9 o'clock a. m. and 4 o'clock p. m. of any day, except Sundays and holidays, shall report to the harbor master before 4 o'clock p. m. of said day, and if entering the harbor between 4 o'clock p. m. of any day and 9 o'clock a. m. of the next day, shall report to the harbor master at 9 o'clock a. m. of the next legal day, and if entering the harbor day or night upon any Sunday or legal holiday, shall report to the harbor master at 9 o'clock a. m. on the next legal day, stating name of vessel, master, tonnage, amount and nature of cargo, and such other statistical information as may be required by the harbor master pertaining to vessel and cargo; provided, that these provisions shall not apply to vessels carrying cargoes or part cargoes of explosives, nor those plying between Puget Sound ports.

SEC. 5. In aid of commerce and navigation, anchorage for vessels is authorized in the following described water: Any part of Commencement Bay outside the outer harbor line, which is not used by vessels arriving at or departing from any dock.

SEC. 6. Anchorage at city buoys: Every vessel attached to any city buoy shall pay as follows: Vessels under 500 tons, each day or part thereof, $1; vessels over 500 tons, each day or part thereof, $2.

SEC. 7. It shall be unlawful for any vessel in fog, mist, falling snow, or heavy rainstorms, whether by day or night, to travel in excess of 6 nautical miles per hour on any of the waters of Tacoma Harbor. It shall be unlawful for any vessel in clear weather to travel in excess of 8 nautical miles per hour within 500 feet of the outer harbor line on any of such waters.

SEC. 24. No master or other person in charge of any vessel or obstruction, shall attach the same to any city buoy until he shall have obtained permission so to do from the harbor master: *Provided*, That during the night or in bad weather such vessel or obstruction may be attached to any vacant city buoy, but the master, owner, or person in charge thereof shall notify the harbor master not later than 9 o'clock a. m. of the next legal day of such act, stating the name and character of such vessel or obstruction and the probable length of time it is desired to remain at said buoy.

SEC. 40. No ballast, iron, rock, sand, gravel, or earth shall be deposited in Tacoma Harbor except at such places and under such conditions as may be

prescribed by the harbor master and after written permit granted by him, or at such places as may be designated by ordinance.

Pilots and towboats for the waters of the sound, or the inside passage to Alaska, can be obtained.

Supplies.—Coal, fuel oils, provisions, and shipchandlers' stores can be had in any quantity.

Repairs.—In 1916 there were no facilities for repairs.

Storm warnings are displayed by the Weather Bureau on the bluff above the city waterway, where they are plainly visible from the harbor.

Hospital.—There is a relief station of the Public Health Service, in charge of a service officer.

The **tidal currents** in the harbor have little velocity.

POINT DEFIANCE TO OLYMPIA.

Southward of Point Defiance the sound is composed of a number of inlets, passages, and islands, rising in commercial importance, outside of the lumbering interests, by reason of numerous settlers and agricultural communities which have been established along the shores in recent years. These waters are navigated by small steamers with local knowledge with headquarters at either Seattle, Tacoma, or Olympia, occasional small sailing vessels, and by tugs engaged in towing logs to the sawmills. The depths are generally great and there are but few dangers. The shores are well wooded and moderately low. Olympia, at the head of Budd Inlet, is the principal and largest town, but there are a number of smaller settlements. The chart is an excellent guide and may be followed with safety in daytime. Strangers bound through these waters at night are advised to take a pilot.

From Point Defiance the sound extends in a general southerly direction for about 15 miles to the flats at the mouth of the Nisqually River, the first 5 miles being known as the **Narrows**. These are about ¾ mile in width, and at spring tides the currents reach a velocity of 5 to 6 knots.

Toliva Shoal lies nearly in mid-channel, 8 miles southward from Point Defiance. It consists of two rocks with 14 feet over them, and is marked by a red and black horizontally striped buoy placed between the rocks. The shoal may be passed on either side, giving the buoy a berth of over 300 yards.

Ketron Island, about 1 mile long, narrow, and about 80 feet high, lies in the southern part of the channel, 11 miles southward from Point Defiance. The island is wooded, and the shores are bluff except at the northern end. Cormorant Passage, ½ mile wide, separates the island from the mainland southward. The passage is clear, but is little used.

Nisqually Reach curves around and southward of Anderson Island. The southern shore is formed by the Nisqually River flats which at low water are bare for nearly 1 mile. The edge of the flats is very bold. The reach may be said to extend from Ketron Island to the southern end of Drayton Passage, about 6 miles, the narrowest part, ¾ mile wide, being at the southern point of Anderson Island.

From Nisqually Reach the sound extends northwestward for 3 miles, where it branches into a number of inlets, which are described under separate headings following.

Directions, Point Defiance to Olympia.

From Tacoma to Point Defiance vessels usually give the shore a berth of ¼ to ½ mile, and if meeting the ebb current from the narrows, round Point Defiance close aboard, or if going with the flood stand out and take a mid-channel course. From Robinson Point vessels steer about 232° true (SSW ½ W mag.), giving Point Piner and Neill Point a berth of about ¼ mile, and then head for Point Defiance. Vessels from northward through Colvos Passage can hold a mid-channel course.

From Point Defiance vessels can hold a mid-channel course for 7¾ miles until up with Toliva Shoal, which may be passed on either side, giving the buoy a berth of over 300 yards. Then steer about 249° true (SW mag.) from Toliva Shoal buoy and follow the south shore of McNeil Island at a distance of ¼ mile. Eagle Island may be passed on either side. The passage northward of the island is the broader, and a mid-channel course through it should be held until Drayton Passage is well open so as to avoid the shoal westward of Eagle Island. A mid-channel course through Drayton Passage clears all dangers. Round Devils Head at a distance of ¼ mile and steer about 305° true (W by N mag.), so as to pass ¼ mile north of Johnson Point light.

Or, if bound through Nisqually Reach, a general mid-channel course should be steered from Toliva Shoal buoy, keeping the southern point of Anderson Island aboard at a distance of ¼ to ½ mile to clear Nisqually Flats and then steering a general mid-channel course until up with Johnson Point.

Round Johnson Point at a distance of ¼ mile and, passing northward and westward of Itsami Shoal buoy, keep in mid-channel through Dana Passage, giving the southern shore a berth of not less than ¼ mile until up with Dofflemyer Point, when follow the directions for Budd Inlet, page 242.

Eastern Shore.

From Point Defiance the shores consist of high, bold bluffs until near Day Island Anchorage. A railway, emerging from a tunnel 1¾ miles southeastward of Point Defiance, follows the beach to the Nisqually River.

Day Island Anchorage is situated 4½ miles southward from Point Defiance. Near the middle of the bight a wharf, locally known as Titlow's wharf, is built out to 13 feet, and from it a ferry service is maintained to Fox Island and Whollochet Bay. Southward of this wharf a large lumber mill, with a wharf in 18 feet of water, was being built in 1916.

Care is necessary in approaching the wharves in this anchorage, as a considerable eddy will be encountered. Good anchorage for small craft can be had in 7 to 8 fathoms about ¼ mile northward of the point of Day Island.

Three miles southward from Day Island anchorage the shores consist of bright, bare bluffs, which are prominent from southward. A number of bunkers for loading sand and gravel are located here.

Steilacoom is a small town 9 miles southward from Point Defiance. The town is of little commercial importance; a limited amount of provisions can be obtained. It has rail and telegraph facilities and a wharf built out to 28 feet, from which a ferry service is maintained to points on McNeil and Anderson islands. The State asylum for the insane is situated near here. Indifferent anchorage may be had along the waterfront close inshore, but it is not recommended, as the holding ground is poor and the currents have considerable velocity. Off Steilacoom are tide rips that, with an adverse wind, are dangerous to small boats.

A wharf of the **Du Pont powder works**, built out from the mouth of Signalilchew Creek, 13 miles southward from Point Defiance, has 28 feet of water. The plant of the powder works is situated a short distance inland and can not be seen from passing vessels.

Nisqually Flats, bare at low tide, begin just westward of the powder wharf, and extend west-southwestward for 3 miles, the western portion extending about ⅝ mile offshore from **Nisqually Head**. The edge of the flats is steep-to.

Puget is a post village situated on the bluffs 4 miles northwestward from Nisqually Head.

Johnson Point, 90 feet high, marks the western end of the main body of Puget Sound. A white post light is situated on the sand spit in which the point terminates.

Henderson Inlet, immediately westward of Johnson Point, extends 4½ miles southward, its southern half being occupied by shoals and flats. The average width is about ½ mile, and good anchorage is afforded inside the entrance in 5 to 6 fathoms, muddy bottom. A spit makes out about ¼ mile northward from the western point at the entrance.

Itsami Shoal, with 5 feet over it, lies 1 mile 250° true (SW mag.) from Johnson Point light and ½ mile northward from the western point at the entrance to Henderson Inlet. It is surrounded by kelp and marked by a red and black horizontally striped buoy placed in 4 fathoms, northward of the kelp and about 200 yards from the rock. This is a danger in entering Henderson Inlet or Dana Passage, and vessels should pass northward of the buoy.

Dana Passage, between the southern end of Hartstene Island and the mainland, is about 2 miles long and nearly ½ mile wide in its narrowest part. It connects at its western end with Budd and Eld Inlets, and northward with Peale and Squaxin Passages leading to Totten and Hammersley Inlets. With the exception of Itsami Shoal, near its eastern end, the passage is clear and a mid-channel course may be followed with safety.

Budd Inlet (Olympia Harbor) is described under a separate heading following.

Eld Inlet, immediately westward of Budd Inlet, resembles the latter in character and is of little commercial importance. It is somewhat narrower than Budd Inlet, and extends about 6 miles in a general southwesterly direction with two slight bends. It affords good anchorage anywhere inside the entrance in 4 to 7 fathoms, soft bottom.

A mid-channel course is clear to the flats at its head. In entering, Point Cooper, the eastern point at the entrance, should be given a berth of not less than ¼ mile. Logs are towed from here to Olympia, Tacoma, or Seattle. The only landing in the inlet is situated on the western shore, 1¼ miles inside Point Cooper, and is locally known as **Mud Bay**. Here a wharf is built out to 6 feet.

Peale Passage, between Hartstene and Squaxin Islands, extends in a general northwesterly direction about 4½ miles from Dana Passage, connecting at its northern end with Pickering Passage. The depths are comparatively shoal, but with local knowledge a draft of 10 feet can be taken through at low water. Strangers should not attempt the passage.

Squaxin Passage, southward of Squaxin and Hope Islands, is about 1 mile in length and extends in a general westerly direction. It leads to the entrance of Totten and Hammersley Inlets. The northern shore is foul, and at its western end a rock with 15 feet over it lies nearly in mid-channel. The passage is narrow and, although the chart is good, strangers should proceed with caution. The south shore should be favored throughout, and at the western end the northern point of Steamboat Island should be favored to avoid the mid-channel rock. The tidal currents have considerable velocity. The passage between Hope and Squaxin Islands is foul and should not be attempted.

Totten Inlet extends southwestward from the western end of Squaxin Passage. It is about 8 miles long and varies in width from ¼ to over 1¾ miles. The depths range from 4 to 14 fathoms, with extensive shoals and flats, some bare at low water. **Skookum Inlet** is a small, shoal inlet on the western shore with a narrow entrance. The oyster industry in Totten Inlet is quite extensive and the main commercial interest. There is good anchorage anywhere inside from the entrance to the mouth of Skookum Inlet, above which the inlet is shoal; in entering favor the western shore to avoid the spit extending from Steamboat Island.

Hammersley Inlet enters the western shore of the sound 1 mile north of the western end of Squaxin Passage. It is 6 miles in length, expanding at its head into Oakland Bay, which is 3½ miles long in a northeast and southwest direction and from ¼ to ½ mile wide. The inlet averages ¼ mile in width and is much obstructed by shoals, particularly at its mouth, where there is an extensive bar. It is navigated by light-draft vessels only, and by tugboats with log rafts, and local knowledge is required. The tidal currents have considerable velocity.

Arcadia post office is located on the south point of the entrance, which is marked by a light.

Church Point is on the north side of the inlet 3½ miles from the entrance and is marked by a light. In the bend ½ mile eastward from Church Point is a sawmill, and 1 mile westward from Church Point, on the north side of the inlet, is **Hoballa** post office.

Shelton is a town at the mouth of **Shelton Creek**, on the west side of the inlet, at the hollow of the great bend northward. Extensive logging interests are centered here; oystering is also an important industry. Communication may be had with Olympia by rail and by steamer twice daily; also by telegraph and telephone. Logging railways reach various other points in the interior.

Two wharves, at one of which fuel oils can be obtained, are built out eastward from the bluff on the north side of the flats to a depth of about 6 feet. In addition to these wharves, two long railway trestles extend eastward across the flats and are used for dumping logs.

Fresh water and fuel oils can be obtained at the wharves and provisions at the town.

Western Shore.

From Point Defiance to the head of the sound the western shore is broken by a number of inlets and passages which afford communication to many small settlements devoted to lumbering or agriculture.

Hale Passage, between Fox Island and the mainland, enters on the western shore 5 miles southward from Point Defiance. It is 4 miles in length and varies in width from 1 mile at its eastern end to less than ⅜ mile at its western end, where it connects with Carr Inlet. The tidal currents have considerable velocity.

Sylvan, a post village on the south side of Hale Passage, on the east side of the bight in Fox Island southward of Grave Island, has a landing wharf in 6 feet of water. A church, schoolhouse, and store are located here, and the village has telephone connection with Tacoma.

There are fruit farms all along the north shore of Hale Passage, also on Fox Island. **Warren** is a village of about 25 houses on the north shore of the passage abreast the northwest end of Fox Island. It has a float landing. **Arletta,** also on the north side in the bight abreast the western mouth of Hale Passage, has a wharf built out to 6 feet.

Whollochet Bay is a small inlet about 2 miles long and ¼ mile wide extending northward from Hale Passage about 1 mile inside the eastern entrance. The upper part of the bay is narrow and shoal. It affords an anchorage about ½ mile inside in mid-channel in 11 to 12 fathoms, sticky bottom. **Bergs Landing,** with 10 feet at the wharf, is located on the east point at the entrance, and there are farm houses on both sides of the bay. **Whollochet** landing wharf is built out to 6 feet of water from the east shore of the bay near the head.

Carr Inlet is described under a separate heading following.

Balch Passage, between **McNeil** and **Anderson Islands,** is the channel most used by vessels bound to Olympia; it is 2 miles long with an average width of ⅝ mile, and connects at its western end with Drayton Passage.

The **Federal penitentiary,** on the southeastern side of McNeil Island, is prominent when approaching; it has a wharf built out to 12 feet. **Bee post office,** on the south shore of McNeil Island, 1 mile westward of the penitentiary wharf, has a wharf in 11 feet of water.

Eagle Island, small, low, and wooded, lies near the middle of Balch Passage, ⅛ mile from Anderson Island, and is marked on its southern end by a fixed white post light. On the shore of Anderson Island southward from Eagle Island is **Johnsons Landing,** with 8 feet at the wharf.

Eagle Island Shoal, with 5 feet over it, lies 300 yards westward from Eagle Island.

Oro Bay, in the southeastern part of Anderson Island, is an irregular bight, the greater part of which is shoal; it affords an indifferent anchorage in about 10 fathoms, but is affected by the currents and affords no protection in northerly weather. **Vega** is a post village on the south shore of the bay.

Drayton Passage, westward of Anderson Island, is about 3 miles long in a north and south direction and about 1 mile wide, connecting with Pitt and Balch passages at its north end and at its southern end with the western part of Nisqually Reach. With the exception of a spit extending ¼ mile from the western shore 1 mile northward of the southern entrance, the waters are deep and free from hidden dangers. **Filuce Bay**, on the western shore at the junction of Pitt Passage, is 1½ miles long and irregular in shape. Its widest part, ⅜ mile, is at the entrance. Good anchorage in 7 to 8 fathoms, muddy bottom, is afforded ¼ mile inside the entrance. There are numerous houses around the shores of this bay, and **Longbranch** post village, with wharf built out to 9 feet, is in the small cove ⅝ mile from and opposite the entrance.

Amsterdam Bay, on the eastern shore of Drayton Passage ¾ mile northward of Point Treble, is shoal. The village of **Amsterdam** is situated on its north shore, and is served by two float landings at the mouth of the bay.

Pitt Passage, westward of McNeil Island, connects Drayton Passage and Carr Inlet. It is badly obstructed about midway of its length by Pitt Island and its surrounding rocks and shoals, and is used only by small craft with local knowledge. **Wyckoff Shoal**, partly bare at low tide, extends ¾ mile westward from the northwestern end of McNeil Island. **Meridian**, a post village having a sawmill with wharf built out to 4 feet, is situated on the eastern shore of the passage, ⅜ mile inside the southern entrance.

Devils Head, the western point at the southern entrance to Drayton Passage, is 280 feet high and heavily wooded. From this point the shore, broken by two small shallow bights of no importance, extends northwestward for 5 miles and then bends northward, forming the eastern shore of Case Inlet, which is described under a separate heading following.

CARR INLET

enters the western shore 8 miles southward of Point Defiance. From the entrance between Fox and McNeil Islands it extends about 6 miles west-northwestward and then trends northward for 8 miles, terminating in flats at the head. Good anchorage is afforded at and near the head in 6 to 15 fathoms, soft bottom, and in several small coves on its southern and eastern shores. From the entrance a mid-channel course may be followed with safety.

Gertrude post village is on the south side of Carr Inlet, in the bight on the north side of McNeil Island southward of Gertrudis Island. It has a landing in 7 feet of water. The bay is locally known as **Still Harbor**. A sawmill and box factory are located here.

De Lano is a summer resort on the south side of Carr Inlet in the bight westward of South Head. It has a landing wharf 800 feet long built out to 7 feet.

Lake Bay, in Mayo Cove, south side of Carr Inlet, is a post village with a landing wharf 350 feet long, dry at low tide. A sawmill, run by water power from a lake in the interior, is located at the head of the cove, and a fertilizer factory on the west side near the entrance.

Home Landing is on the west side of **Von Geldern Cove,** which is locally known as Joes Bay. The wharf has 7 feet at low water at the end. A farming and manufacturing colony occupies the shore of the cove.

Glencove post village is on the west side of Carr Inlet in **Glen Cove,** 5 miles north-northwestward from South Head. It has a wharf which dries at low tide. A road leads across to Vaughns Bay in Case Inlet.

Elgin post village is in **Huge Creek** on the west side of Carr Inlet. A wharf, accessible at high tide only, is built out from the point on the north side. Considerable quantities of logs are towed from the creek.

Wauna is a post village at the head of Carr Inlet, where the spit inclosing Burley Lagoon joins the mainland. There are about a dozen houses, with store, schoolhouse, and hotel on the townsite. It has telephone connection with Tacoma; a county road leads hence along the spit and across the entrance to the lagoon over a drawbridge to Rosedale and Gig Harbor. The landing wharf dries at low tide. **Burley** is a post village at the head of the lagoon. On the east side of Carr Inlet, opposite Wauna, is **Blake's** logging camp with wharf at the end of a railway said to be 10 miles long.

Rosedale post village is on the bay on the east side of Carr Inlet eastward of Raft Island. There are two landing wharves built out to 7 feet. Farm produce is shipped.

CASE INLET

extends northwestward for 4 miles and then trends northward for 10 miles more, terminating in flats at the head, which is but 2 miles from the head of Hood Canal. Its average width is 1½ miles, narrowing at the head. The depths are irregular, varying from 10 to 30 fathoms, but there are no outlying dangers. For 7 miles the western shore is formed by Hartstene Island. **Herron Island,** steep and bluff on its western face, lies near the eastern shore 4 miles from the entrance; the channel eastward of the island is not recommended as at the northern end it has a sharp turn and is obstructed by shoals making off from the island and from the eastern shore. At the northern end of Hartstene Island is the entrance to Pickering Passage. Good anchorage may be had anywhere northward of Hartstene Island, in 6 to 15 fathoms, muddy bottom, and a mid-channel course through the inlet is clear of all dangers to within 2 miles of the land, where the flats begin.

Point Wilson, on the west side at the southern entrance to the inlet, has a float landing which serves a small farming community.

Ballow is a post village with float landing situated on the western shore of the inlet, 2¼ miles northwestward from Point Wilson. **McMicken Island** lies ½ mile northward from the village and is connected with the shores by a flat bare at low tide.

Herron, with wharf built out to 2 feet, is a post village on the eastern shore, ½ mile northward from Herron Island.

Pickering Passage enters the western shore of Case Inlet, 2 miles northwestward from Herron Island. The passage extends in a general southerly direction for 8 miles, connecting at its southern end with Peale Passage and Totten Inlet. The width varies from ¼ to ½ mile, the shores are generally low and wooded, and the depths vary from 6 to 15 fathoms. Except for the shoals extending eastward from the mouth of Hammersley Inlet, the passage is free from outlying dangers and a mid-channel course can be followed with safety. **Hartstene,** in **Geralds Cove,** on the north shore of **Hartstene Island,** and **Grant,** on the western shore of the passage at the bend, are post villages and the only settlements on the passage.

Stretch Island lies near the western shore of Case Inlet, just northward of the entrance to Pickering Passage. The northern part of the island is partly cleared of trees and laid out in orchards. **Eckert Landing** is a small settlement on the north shore of the island. It has a float landing in 8 feet of water.

Detroit is a post village on the western shore of the inlet in the bay between Stretch and Reach Islands. It has a float landing.

The small bay on the east side of the inlet, 2½ miles northward of Herron Island is known as **Dutchers Cove.**

Vaughn post village, with a wharf in 1 foot of water, is on the north side of Vaughns Bay, around the shores of which are numerous houses and orchards. A county road leads hence to Glencove, on Carr Inlet, and northward around the head of Case Inlet, and a logging railroad leads into the interior. The bay has deep water in the entrance and an area with depths of 2 to 3½ fathoms in the southern part, but the remainder of the bay is shoal and is not accessible at low tide.

Rocky Bay is the local name for the shoal bay northward of Vaughns Bay. It has many settlers about it. A float landing in 10 feet of water is established northward of the point dividing the two bays and used at low tide when Vaughns Bay can not be entered.

Allyn is a post village of about 20 houses on the west side of Case Inlet near the head ½ mile northward of Sherwood Creek. It has a landing wharf with about 1 foot of water at low tide. Oyster culture is the principal industry in which many settlers here and around the head of the inlet are engaged, in addition to fruit raising.

Victor is a small village directly across (east) from Allyn. It has a wharf built out to 6 feet, from which oysters and poultry are shipped.

Eberhardt Cove is the local name of the small cove on the west side of Case Inlet 1¼ miles southward of Sherwood Creek. It is the terminus of a logging railway, 10 miles long, to Lake Mason.

Budd Inlet (Olympia Harbor)

(chart 6462) is 26 miles from Tacoma. It is 6 miles in length with an average width of 1 mile, extending southward from Dana Passage and terminating in flats bare at low water. The entrance is 4½

miles southwestward from **Johnson Point light**, between **Cooper Point** and **Dofflemyer Point**, the latter being marked by a fixed white post light. The depths range from 4½ to 6 fathoms, and good anchorage may be had anywhere inside the entrance in muddy bottom. The shores are comparatively low and wooded, and the depths shoal less abruptly on the eastern than on the western side of the inlet. The southern half of the bay is obstructed by flats and shoals that bare for ¾ mile at low water, through which channels have been dredged to the Olympia waterfront, and a shoal with 5 to 12 feet over it extends 700 yards from the eastern shore between Olympia Shoal and the entrance to the dredged channel.

Olympia Shoal lies ⅜ mile off the western shore and ¾ mile northward of **Butler Cove**, a small bight on the western shore, 4 miles southward of Point Cooper. It bares at extreme low water and is marked by a red buoy placed in 5½ fathoms about 200 yards northward from the shoal.

The harbor has been improved by the Government by dredging an east channel, 250 feet wide and 12 feet deep at mean lower low water, from deep water through the flats at the head of the inlet to Olympia, with a turning basin 500 feet wide off the city water front. A second (west) channel 12 feet deep and 200 feet wide has been dredged from deep water in the inlet along the western shore to a junction with the east channel turning basin. Subsequent shoaling has reduced the depths in these two channels to 10 feet at mean lower low water. Additional dredging along the city water front has secured a controlling depth of 20 feet at mean lower low water in that locality.

The eastern dredged channel is marked by two fixed red post lights placed on the eastern edge of the cut, one at either end.

Olympia, the capital of the State of Washington, is situated at the head of the harbor. It has some commerce, mainly lumber and oysters. There are three wharves fronting on the dredged basin, providing ample room to accommodate all present traffic. The sawmills are situated along the southwestern shore of the harbor. Their wharves are at present inaccessible; vessels anchor in the harbor, the lumber being towed out to them on lighters.

Supplies.—Water, provisions, and a limited amount of ship chandlers' stores can be obtained. Fuel oils can be had at an oil dock.

Repairs.—There are no facilities for repairs.

Towboats may be had and pilots for the local waters adjacent.

Communication may be had with points on the sound by rail and steamer; there are also telephone and telegraph facilities.

Directions.—No detailed directions are necessary. A mid-channel course through Budd Inlet clears all dangers until up with the light at the entrance to the dredged channel. At night the range formed by the two lights marking the dredged cut clears Olympia Shoal, but if held southward of that point leads across the edge of the shoal which extends ½ mile from the eastern shore. In daytime, from the entrance to the dredged cut, the southern of the two lights marking the cut can not readily be seen. Vessels may pass 50 yards westward of the light at the entrance to the cut and steer 174° true (SSE ¾ E mag.), heading for a prominent square red brick building on the hillside ahead, until the inner light is made.

WASHINGTON SOUND.

This body of water (chart 6380) embraces the passages and bays northward of the eastern end of Juan de Fuca Strait. These passages are used extensively by vessels bound to British Columbia and Alaska ports and by local steamers. The commerce is extensive, the shipments consisting of farm products, fish, lumber, fruit, and lime, while general merchandise is received. The tidal currents have considerable velocity. There are several important towns connected by rail and steamer with points on Puget Sound and the interior. The principal passage is **Haro Strait**, the one most commonly used by vessels, the majority of which make Victoria a port of call for passengers and freight; it is also the widest and best equipped with aids to navigation. **Rosario Strait**, the eastern passage, is used mostly by vessels running between Blaine, in Drayton Harbor, the settlements in the islands, Bellingham Bay, and Puget Sound ports. The traffic in the islands is confined almost exclusively to local vessels.

The directions following are intended for use only in clear weather; in thick weather or at night strangers should take a pilot. Sailing vessels should not attempt the passages against the current unless the wind is fair and fresh; with the current a vessel will go through with little difficulty by keeping off the shore and giving the dangers a good berth.

The **tidal currents** have great velocity in places, causing heavy tide rips that are dangerous for boats. Owing to the variable direction and velocity of the currents, compass courses are of little value and where followed allowance must be made for the set of the currents.

Vessels bound from sea or from Victoria, British Columbia, to ports in British Columbia or Alaska should use Haro Strait, as it is the widest of the passages and well marked by aids. Vessels from Puget Sound ports bound northward may use Haro Strait, San Juan Channel, or Rosario Strait, as is found convenient. Vessels bound to East and West Sounds should use either Rosario Strait and Thatcher or Obstruction passes, or San Juan and Upright channels. Wasp, North, and Pole passages should not be attempted by strangers. Vessels bound northward through Georgia Strait should follow the directions in United States Coast Pilot, Pacific Coast, Alaska, Part I.

HARO STRAIT

(chart 6380), the western passage, has its southern entrance between Discovery Island (Canadian) and the southern point of San Juan Island. From the entrance it extends northwestward for 16 miles to Turn Point, the western end of Stuart Island, marked by a light and fog signal, and then bends sharply northeastward for 11½ miles to its junction with Georgia Strait between East Point, the eastern end of Saturna Island (Canadian), and Patos Island, both of which are marked by lights. The width varies from 2 to 6 miles, and the depths are generally great with but few dangers.

No difficulty will be experienced in navigating the strait in clear weather; in thick weather strangers should have a pilot.

Tidal currents.—In Haro Strait the flood current sets northward through the strait and the ebb in the opposite direction. At its

northern entrance the flood sets eastward on both sides of Sucia Islands, and eastward across Alden Bank. The velocity of the current in the strait is 2 to 5 knots, increasing to between 3 and 6 knots at Discovery Island, between Stuart Island and Gooch Island. at East Point, and between Patos Island and Sucia Islands. The current has moderate velocity between Sucia Islands and Orcas Island. At its southern entrance the currents continue to run about 1½ to 2½ hours (latter for large tides) after high and low water by the shore. To find the approximate time of slack water at East Point, add 24 minutes to the time of low water, and 26 minutes to the time of high water at Seattle; the time of slack water for small tides is more uncertain than for the large tides. Heavy tide rips occur on Middle Bank and northward of it and around Discovery Island. Tide rips also occur between Henry Island and Turn Point on the ebb, and around Turn Point. Heavy dangerous tide rips occur between East Point and Patos Island and for 2 miles northward in Georgia Strait.

San Juan Island, the largest of the group, is about 13 miles long, with a greatest width of 6 miles. It is rugged and partly wooded, with numerous elevations ranging from 400 to 1,000 feet in height. The shores as a rule are free from outlying dangers. The western side forms a part of the eastern limit of Haro Strait; there is a light on its western side at Lime Kiln. The northern end of the island is indented by several small bays which, with the exception of Roche Harbor, are shoal and of no commercial importance.

Kelp Reefs extend about 2 miles 126° true (E by S mag.) from Darcy Island, on the western side of the channel, and consist of a number of rocks and ledges, some of which bare at low water. The eastern edge of the reefs is marked by a light.

Henry Island lies immediately westward of the northern point of San Juan Island and is separated from it by a narrow passage that at its northern end expands into a small basin forming Roche Harbor. The passage is obstructed by rocks and shoals and is used only by small, light-draft vessels with local knowledge.

Kellet Bluff, at the southern end of Henry Island, is steep and rocky, and prominent from either southward or northward.

Roche Harbor (chart 6381) has its main entrance on the eastern side of the north end of Henry Island, between it and Pearl Island; it is landlocked and about ½ mile in extent, with depths of 5 to 8 fathoms. A large amount of lime is made, and in addition to the kilns there is a barrel factory. This is a port of entry, and a deputy collector of customs is stationed here. Regular communication is had by mail steamers, and there is a radio station, call letters KRW. A small amount of provisions can be obtained. Water can be had at the wharves. The depth at the outer end of the main wharf is about 13 feet.

Danger Shoal, the principal danger in approaching from westward, lies ⅞ mile 10° true (N by W ¼ W mag.) from Morse Island; it has 5 feet over it and is marked by kelp at slack water. A rock, marked by kelp, with 10 feet over it, lies ⅛ mile northwestward from Barren Island; a black buoy is placed in 6 fathoms about 150 feet northwestward from the rock. Another rock, marked by kelp, with 4 feet over it, lies 350 yards eastward of the one marked by the buoy.

Morse Island, small, 30 feet high, with two trees, sometimes called Ship Island from its resemblance to a vessel with two masts, lies ¼ mile west-northwestward from the north end of Henry Island and is the western point in the approaches to the harbor.

The entrance to the harbor is about 350 yards wide in its narrowest part and is obstructed by spits with 16 to 17 feet over them extending into the channel from the shores on either side.

To enter from westward, pass ¼ to ½ mile northward of Morse Island on an 115° true (E mag.) course until the middle of the entrance bears 199° true (S ½ E mag.). Stand in on this course, keeping the entrance points of Nelson Bay, at the head of the harbor, just open so as to see across the low neck of land at its head. Steer nothing eastward of mid-channel in rounding the southwest point of Pearl Island. Anchor in 5 to 7 fathoms, soft bottom.

From eastward, steer so as to pass ⅛ mile northward of Roche Harbor buoy, marking the sunken rock off Barren Island, and when up with the buoy head for Morse Island until the middle of the entrance bears 199° true (S ½ E mag.). Then proceed as directed above.

Spieden Island lies about ¾ mile northward of San Juan Island and is separated from it by Spieden Channel. The island is 2½ miles long in an east and west direction with an extreme width of ½ mile. The eastern end is low and grassy; a few trees are on the south side of the island, but the northern face is well wooded. **Sentinel Island,** steep, wooded, and of small extent, lies 300 yards off its southern shore near the western end. **Sentinel Rock,** low and bare, lies 400 yards westward from Sentinel Island; a sunken rock, marked by kelp, with 3 feet over it, lies about midway between them. **Center Reef,** marked by kelp and bare at low water, lies nearly ⅜ mile 210° true (S ½ W mag.) from Sentinel Rock.

Stuart Island, westward of Spieden Island, is wooded, with two rather prominent hills 650 feet high near the middle. Turn Point, the western end, is marked by a light and fog signal. **Reid Harbor,** at the southeast end, affords good anchorage in 4 to 4½ fathoms, soft bottom. It is 1½ miles long and ¼ mile wide, landlocked and free from dangers. Enter in mid-channel and anchor anywhere in the middle of the wider portion of the harbor. **Prevost Harbor,** on the north shore, 1½ miles eastward of Turn Point, affords good shelter and anchorage. The post village of **Prevost,** with 5 feet at the wharf, is situated on the western shore. **James Island** lies between the two points of the bight, with reefs and shoals extending eastward to the shore of the bight. Enter in mid-channel westward of James Island and anchor in 6 to 7 fathoms, muddy bottom, in the middle of the wider portion just inside the entrance, keeping clear of a rock about 200 yards off its south shore that bares about 8 feet at low water. Vessels should not pass eastward of James Island.

Johns Island lies immediately eastward of Stuart Island, separated from it by a narrow channel known as **Johns Pass,** which should not be attempted by strangers. A number of small islands and rocks lie southward and eastward of the eastern point and between it and Spieden Island.

Directions, Haro Strait.

In crossing from Admiralty Inlet to the entrance of Haro Strait the tidal currents setting to and from Rosario Strait and San Juan Channel with an estimated velocity of 2 to 3 knots should be kept in mind. Between Henry Island and Turn Point, and around Turn Point, there are heavy tide rips on the ebb; and particularly heavy and dangerous tide rips occur on the ebb between East Point and Patos Island and for 2 miles northward in Georgia Strait. The flood from Rosario Strait, which is felt as soon as the passage between Orcas and Sucia Islands is open, is apt to set a vessel toward East Point. The ebb in this vicinity sets to the eastward even before the Strait of Georgia is well open.

Having come from Admiralty Inlet, pass ½ mile off Point Wilson lighthouse and steer 320° true (NW by W ¾ W mag.) for 27½ miles, passing 1⅜ miles southwestward of Partridge Bank buoy and 1⅝ miles northeastward of Hein Bank gas and bell buoy, to a position with Lime Kiln light abeam, distant 1½ miles. Then steer 345° true (NW ⅜ N mag.) for 11½ miles, passing 1½ miles eastward of Kelp Reefs light and ⅝ mile westward of Kellett Bluff to a position ¾ mile westward of Turn Point lighthouse.

Pass ½ mile northward of Turn Point lighthouse and steer 63° true (NE ⅝ N mag.) for 9¼ miles, heading for Patos Islands lighthouse until Saturna Island lighthouse is abeam, distant 1 mile, then steer 39° true (N by E ¼ E mag.) for 2½ miles, until Patos Islands lighthouse is abeam, distant 1⅛ miles, and then shape the course up Georgia Strait as desired.

San Juan and President Channels.

San Juan Channel (chart 6380) separates San Juan Island from the islands eastward. It is 13 miles in length from its southern end to its junction with President Channel at the northern end. The depths as a rule are great and there are few outlying dangers, except at the southern entrance; the width varies from ½ to 3 miles.

Cattle Point, the southeastern point of San Juan Island and the western point at the entrance, is marked by a fixed white light. **Salmon Bank** is an extensive shoal lying southward of Cattle Point, with depths ranging from 9 to 18 feet; it is marked by kelp. It is about 1¼ miles long by ½ mile wide; the southern end lying 1½ miles 205° true (S mag.) from Cattle Point light is marked by a black buoy.

Goose Island, small and low, lies about ½ mile northward of Cattle Point and close to the western shore of the channel.

Several islands and rocks extend from the southwestern part of Lopez Island, the largest being **Long Island. Whale Rocks**, two dark rocks about 4 or 5 feet above high water and about 200 yards apart, lie ½ mile westward from the western end of Long Island; a sunken rock marked by kelp lies about 400 yards southward of them, and a reef, with 18 feet over it, lies 600 yards southward of them.

Richardson is a post village on the southern shore of Lopez Island, on the north shore of the cove northward of Iceberg Point; a wharf has been built out over the rocks to about 12 feet. There is a fishing

station located here. Richardson has daily communication by mail steamer with other points on the islands and with Port Townsend and Bellingham Bay. Water can be had at the wharf. Anchorage with good shelter can be had in the cove about 1 mile eastward of the wharf in 5 to 6 fathoms, soft bottom. **Iceberg Point** is marked by a flashing white light (3 seconds). No directions are necessary; passing ¼ mile eastward of the islands westward and southward of Richardson clears all dangers.

Immediately northward from the southern entrance to San Juan Channel the shore of San Juan Island forms a broad, open bight known as **Griffin Bay**, about 3 miles long and 1¾ miles wide. There are numerous rocks and shoals in this bight and the shore should not be approached closer than ½ mile.

North Bay is a small bight in the northern part of the bay on which is located the village of **Argyle**. There is a small wharf, dry at low water. The cove affords fair anchorage in 7 to 10 fathoms, with **Dinner Island**, near the southern shore, bearing about 182° true (SSE mag.), distant 800 yards. In the approaches to the cove are two dangers. **Argyle Shoal**, with 10 feet over it and marked by kelp, lies ¾ mile 92° true (ENE mag.) from the eastern point of Dinner Island, and a shoal with 6 feet over it and marked by kelp lies ½ mile 143° true (SE by E ½ E mag.) from the eastern point of Dinner Island. Rocks and shoals, some of which bare at low water, extend southeastward and southward from Dinner Island for about 400 yards; the passage between Dinner Island and the shore should not be attempted.

Fisherman Bay is a small, shoal cove on the western shore of Lopez Island and is entered by a narrow winding channel. Good anchorage, with shelter from all winds, for small, light-draft vessels with local knowledge, may be had in 10 to 12 feet, soft bottom. The tidal currents have considerable velocity. **Lopez** is a small settlement situated at the entrance; a wharf is built out about 750 feet with 10 feet at its outer end. Farm produce is shipped.

About 2 miles northward of Lopez is the southern entrance to **Upright Channel**, between Shaw and Lopez Islands, leading to East and Lopez Sounds.

At **Turn Island** San Juan Channel turns westward for about 9 miles, connecting at its northern end with Haro Strait and President Channel. With but few exceptions the channel is free from dangers, with deep water.

Turn Rock, ¼ mile eastward from Turn Island, is a ledge bare at half tide; it is marked by a flashing white light (3 seconds), and should be given a berth of not less than 100 yards.

Reid Rock lies in mid-channel 1¼ miles westward from Turn Rock spindle. There is a depth of 13 feet over it, rising abruptly from deep water. It is marked by a red and black horizontally striped buoy placed in 28 feet on the eastern side of the rock.

Friday Harbor, on the eastern shore of San Juan Island, 1 mile westward from Turn Rock, is a small cove about 1 mile long and nearly as wide. **Brown Island**, wooded and about ½ mile long, occupies the center of the bight; shoals extend 200 yards from its eastern end and southern shore. A shoal, with 15 feet over it, lies 300 yards westward from the western end of the island, nearly in mid-channel.

Friday Harbor, on the western shore of the cove, is a county seat, and the most important town in the San Juan Islands. It is the center of a prosperous agricultural district and the headquarters for the fishing fleet operating through the western part of Washington Sound. Produce, lumber, and fish are shipped, a sawmill, cannery, and creamery being located here. There are a number of docks built out to deep water, at which water and fuel oils can be obtained. There are also good general stores. Communication may be had by daily boat to various points throughout the islands and on the mainland.

Anchorage may be had off the wharves in 6 to 7 fathoms. Entrance may be made either side of Brown Island. Entering eastward of the island, favor the eastern point at the entrance to the cove to avoid the shoal extending eastward from the island. Entering westward of the island, favor the western shore to avoid the shoal nearly in mid-channel off the western end of the island.

Hicks Bay, on the south side of Shaw Island, has a wharf and warehouse at its head. Produce is shipped in scows and motor boats.

Parks Harbor, immediately northward of Point George, on Shaw Island, 2 miles northward of Turn Rock, is ½ mile long and ¼ mile wide. It affords good anchorage for small vessels in 6 to 8 fathoms, soft bottom. The harbor is clear, but a flat extends 300 yards from its head.

Between **Neck Point**, the western end of Shaw Island, and **Steep Point**, the southwestern point of Orcas Island, about 1½ miles, are a number of islands, rocks, and sunken ledges. Between them are several narrow channels, but the ones in general use are **North** and **Pole Passes**, close under the Orcas Island shore. These connect eastward with **West Sound**, in Orcas Island, and with **Harney Channel**, between Shaw and Orcas Islands. The currents have considerable velocity and the channels are navigated only by small vessels with local knowledge.

Yellow Island, the westernmost of the Wasp Islands, is small, grassy, and nearly bare of trees. The western and southern ends of the island are foul, a shoal extending 300 yards, with a rock, bare at low water and marked by kelp, at its end. The island should be given a berth of not less than ½ mile.

Jones Island, wooded and about ¾ mile in extent, lies ⅜ mile westward from the southwest point of Orcas Island. **Spring Passage**, separating the two islands, is clear, with the exception of a shoal projecting 250 yards eastward from Jones Island, ¼ mile from the eastern point.

Flattop Island, prominent in the northern approaches to San Juan Channel, lies 1¼ miles northeastward from the eastern end of Spieden Island. It is about 130 feet high, flat on top, and sparsely covered with underbrush and trees. Gull Rock, 30 feet high, of small extent and bare, lies ¼ mile westward of the island.

Waldron Island, steep and rocky on the eastern side but flat with sandy beaches on the west side, lies 1¼ miles westward from Orcas Island. It is irregular in shape, 3 miles in length, with an extreme width of 2 miles. The highest point, 580 feet, is near **Point Disney**, its southern end. On the north and east sides of the island is a high, yellow sand bluff, terminating abruptly in **Point Hammond**.

Cowlitz Bay, on the southern shore, is a broad, open bight affording anchorage in fair weather. The western point of the bay is shoal, depths of 3¾ and 4 fathoms being found over ½ mile southward of Sandy Point. **Mouatt Reef**, with 9 feet over it and marked by kelp, lies ½ mile inside the eastern point at the entrance and 600 yards offshore. The post village of **Waldron**, with a wharf built out to about 5 feet, is situated on the shore northeastward of Mouatt Reef.

Bare Island, small, grassy, and bare of trees, ½ mile northwestward, and **Skipjack Island**, wooded, 1¼ miles westward of Point Hammond, should be avoided on account of the velocity of the currents in their vicinity. A small, bare rock lies off the eastern end of Skipjack Island, and another lies about midway between it and Bare Island. A rock with 1 foot over it lies ½ mile northeastward from Point Hammond and is usually marked by kelp.

White Rock, 35 feet high, lies halfway between Flattop and Waldron islands. Rocks, bare at low water and marked by kelp, extend nearly 600 yards northwestward.

Danger Rock, with 2 feet over it and marked by kelp, lies 600 yards southeastward from White Rock.

The northern and western sides of Orcas Island are particularly steep and thickly wooded. **Mount Constitution**, 2,300 feet high, in the eastern part of the island, **Turtle Back Range**, 1,497 feet high, and **Orcas Knob**, 1,050 feet high, conical and bare on the summit, in the western part of the island, are prominent and easily recognized from northward and southward.

President Channel, separating Waldron and Orcas islands, is about 5 miles in length, with a least width of 1¼ miles. The depths are generally great and the passage is free from dangers. The tidal currents have a velocity of 2 to 5 knots and off the north point of Waldron Island and between Waldron and Patos islands there are heavy swirls and tide rips, especially with an adverse wind. The rips are generally heaviest with the ebb current. Rips and swirls are also heavy off Limestone Point and the eastern end of Spieden Island.

On the shore westward of Orcas Knob is a limekiln with wharf built out to 6 feet.

Point Doughty, the northwest point of Orcas Island, is bare, and terminates in a small knob at its outer end. **Freeman Island** is a small islet in the broad open bight southward of Point Doughty. Foul ground, marked by kelp, extends about 350 yards westward from the southern point of this bight, about 1¼ miles southward of Point Doughty.

A reef, consisting of two rocky patches bare at low water, lies ¾ mile off the north shore of Orcas Island 2¼ miles northeastward of Point Doughty. Kelp covers the reef and the area between it and the shore.

West Bank (Plumper Reef), within the 10-fathom curve, is 1 mile long in a general east and west direction, with an average width of ¼ mile. The shoalest point, 10 feet, lies 2½ miles 3° true (NNW mag.) from Point Doughty and nearly 1 mile 261° true (SW by W mag.) from the western end of the southernmost of the Sucia Islands. Depths of 3½ fathoms are found ½ mile eastward of the shoalest point.

Patos Island, 4½ miles north-northwestward of Point Doughty, marks the turning point for vessels bound from northward for President Channel or Haro Strait. The island is about 70 feet high, and bare at its western end. **Alden Point,** the western end of the island, is marked by a flashing white light (flash 1 second, eclipse 4 seconds), and by a reed horn fog signal (blast 4 seconds, silent 16 seconds).

The **tidal currents** are particularly heavy and dangerous between Patos Island and East Point and for 2 miles northward in Georgia Strait.

Sucia Islands consist of one large and several small islands 1½ miles southeastward of Patos Island. The large island, 160 feet high and heavily wooded, is horseshoe-shaped, inclosing **Echo Bay,** which in northwesterly weather affords good anchorage for small craft in 4 to 5 fathoms near the head.

Clements Reef, ½ mile northward of Sucia Island, is the northwest extremity of a reef 1¼ miles long ¼ to ½ mile offshore. It is marked by a red buoy.

Matia Island, 120 feet high and wooded, lies 1½ miles eastward of Sucia Islands. **Puffin Island,** with a reef extending ⅛ mile eastward from it, lies eastward of Matia Island, from which it is separated by a narrow channel having a depth of 6 fathoms.

Minor Passages, San Juan Islands.

North Pass, close under Steep Point, the southwestern point of Orcas Island, is about ¼ mile in width between the point and Reef Island, the northwesternmost of the cluster lying between Shaw and Orcas Islands. It is free from outlying dangers, but a rock with 11 feet over it lies ¼ mile 81° true (NE by E mag.) from the northern point of Reef Island. The passage is used principally by small vessels with local knowledge.

Deer Harbor, at the eastern end of North Pass, extends northward into Orcas Island for about ¾ mile. It affords good anchorage in 6 to 7 fathoms ¼ mile from the head. **Fawn Island,** wooded and of small extent, lies near the entrance and about 200 yards from the western shore. The eastern point at the entrance is marked by Pole Pass light (fixed red). Deerharbor is a small settlement and post office on the eastern shore near the head. There is a small wharf extending to deep water. Farm produce is shipped. A sunken bowlder lies 100 yards north-northwestward from the wharf. It has about 4 feet over it at low tide, and is dangerous to steamers in leaving. A mid-channel course leads clear through North Pass and to the anchorage northward of Fawn Island. The eastern shore of the harbor should not be approached closer than 300 yards, on account of shoals which in places extend over 200 yards offshore. Steamers coming from the westward to Deer Harbor run through the passage westward of Fawn Island, and in leaving, eastward bound, use the passage eastward of it.

Pole Pass, between Crane and Orcas Islands, is very narrow, the width between the 18-foot curves being about 75 yards. Eastward of Crane Island it connects with **Wasp Passage,** coming from westward along the shore of Shaw Island. Neither of these passages should be attempted without a pilot, and then only with a quick-

working vessel. The north shore of Crane Island is foul, shoals extending in places over 250 yards from shore. A sunken rock with 5 feet over it lies 250 yards off the northern shore 3/8 mile 287° true (W 3/4 S mag.) from Pole Pass light.

Bell Island, wooded and of small extent, lies 1/4 mile eastward of Crane Island. Vessels using Pole Pass keep the north shore of this island close aboard to avoid the reefs and shoals extending from the western point at the entrance to West Sound. A rock, bare at extreme low water, lies 300 yards eastward of Bell Island; it is marked by a black buoy placed in 34 feet close-to and eastward of the rock. Another rock with 6 feet over it lies 400 yards 71° true (NE 1/4 E mag.) from the north point of Bell Island, and only 250 yards southeastward from the sharp point on the north shore. Some of the steamers go northward of this rock when entering or leaving West Sound.

West Sound, in the western part of Orcas Island on the southern shore, extends northwestward for 2 3/4 miles with an average width of 3/4 mile. The depths range from over 20 fathoms at the entrance to 7 and 8 fathoms at the head. **Double Island**, two small islands connected at low water, lies close to the western shore near the entrance. **Victim Island** lies close to the western shore about 1/4 mile northward from Double Island. **Westsound** is a settlement and post office in a cove on the eastern shore of the inlet 2 miles above the entrance. A wharf has been built out to about 12 feet of water. Another wharf is built from a sawmill in the direction of Sheep Island to the eastward of the landing wharf. A cannery is located here, and lumber and produce are shipped. **Sheep Island**, low, is in the southern part of the cove and is connected with the beach at low water; a shoal projects about 150 yards westward from the island.

Harbor Rock, with 4 feet over it, lies in mid-channel 3/4 mile from the head of West Sound; the rock is of small extent and is surrounded by depths of 4 to 10 fathoms.

Anchorage may be had anywhere in the sound northward of Double Island in 7 to 12 fathoms, soft bottom.

Harney Channel, between the north shore of Shaw Island and Orcas Island, leads from the entrance of West Sound to the entrances of East and Lopez Sounds. At its eastern end it is joined by Upright Channel leading from San Juan Channel between Shaw and Lopez Islands. Harney Channel is 2 1/4 miles long with an average width of 1/2 mile; the depths range from 10 to 25 fathoms. There are no outlying dangers, and a mid-channel course is clear. **Orcas**, a small settlement and post office, is situated on the northern shore in a cove at the western end. A wharf with water piped to the end has been built out to about 12 feet. A rock with 15 feet over it lies about 125 yards southward of the wharf; there is deep water between the rock and the beach.

Blind Bay is a small cove on the southern shore of Harney Channel; the bay is shoal and there are several reefs. A small islet lies in the entrance, and a reef, bare at low water, extends 200 yards from the western point of the cove.

Shaw is a post village at the eastern entrance point of the bay. It has a cannery, with wharf built out to 12 feet.

Upright Channel is 3 miles long with an average width of ¾ mile. **Canoe Island** near the southern entrance contracts the passage to a width of 600 yards. A rock, bare at lowest tides, lies 300 yards southward from the southern point of Canoe Island. A sunken rock marked by kelp lies 300 yards eastward from the southern point of Shaw Island. The depths in the channel range from 20 to 35 fathoms and, excepting the rocks mentioned above, it is free from dangers. Anchorage for small vessels may be had in the cove westward of Canoe Island in 6 to 7 fathoms, soft bottom.

East Sound, on the south shore of Orcas Island, extends northwestward for 6 miles. It varies in width from 2 miles at the entrance to less than ½ mile, the narrowest part being about halfway up the inlet. The depths vary from 15 fathoms at the entrance to 9 and 10 fathoms less than ¼ mile from the head. There are no outlying dangers and a mid-channel course is clear to the head; the shores may be approached to within ¼ mile with safety. **Shag Rock**, marked by a spindle, lies 300 yards offshore about ⅝ mile eastward from the western point at the entrance. The rock shows at high water, but the ledge extends about 150 feet northward. Anchorage may be had anywhere in the inlet in 15 to 17 fathoms, soft bottom, and at the head in 10 to 12 fathoms. **Eastsound** is a summer resort and post office in the western one of the two small coves at the head of the sound; there are two wharves extending to about 10 feet. Fruit is shipped and general merchandise and feed received. **Rosario** is a post office in the small cove on the east side 3 miles from the entrance. There is a landing wharf with water piped to it built out to 12 feet. There are several buildings in the cove and a large private residence on the point to the westward, all lighted by electric lights at night. **Olga** post office and settlement, with a large hotel and summer resort, and wharf built out to 20 feet, is on the west side of **Buck Bay**, the small cove on the east shore just within the entrance.

Obstruction Passes, immediately eastward of the entrance to East Sound, connect with Rosario Strait. **Obstruction Island** is marked on its eastern and southern ends by lights. The north pass is about 350 yards wide in its narrowest part, and in this vicinity near mid-channel a submerged rock, covered by kelp, has been reported. Because of this danger, the passage should be avoided.

The south pass, generally known as **Peavine Pass**, is the straighter and shorter of the two. It is a little over 200 yards wide at its narrowest part, with a least depth of 6¼ fathoms on a mid-channel course, which can be followed with safety. **Lydia Shoal**, with 3¾ fathoms over it, lies 1 mile 81° true (NE by E mag.) from the light on the eastern end of Obstruction Island. This is a danger in entering or leaving the northern passage. In entering the southern pass from Rosario Strait a cluster of rocks, bare at high water and marked by a spindle, will be seen about ¼ mile from the Blakely Island shore. The currents through the passes reach a velocity of over 2 miles per hour, and eastward of Obstruction Island from heavy tide rips.

Westward of Blakely Island the depths as a rule are good, with but one danger of importance. A rock with 10 feet over it lies a little over ½ mile westward from the northern part of Blakely Island and 1⅜ miles 219° true (S by W ¼ W mag.) from the light on the southern point of Obstruction Island.

Thatcher Pass, between the southern point of Blakely Island and the north shore of Decatur Island, is about ½ mile wide in its narrowest part. The passage is clear and deep, with the exception of **Lawson Rock**, in mid-channel in the eastern end, that bares at extreme low water; the rock is marked by a red and black horizontally striped buoy placed on its southern edge. With a southerly wind and ebb tide, heavy rips will be encountered off the eastern entrance to the pass.

Lopez Sound, at the western end of Thatcher Pass, extends southward for 4¾ miles, with an average width of a little over 1 mile. The greater portion of the inlet has depths of 3 to 5 fathoms, muddy bottom, but a narrow, deeper channel runs along the eastern shore to Trump and Center Islands. The inlet is of little importance at present. **Thatcher** post village is in the shoal cove on the west side of Blakely Island. A box factory run by water power is located here. There is a small wharf. **Port Stanley** is a post village in **Swifts Bay**, on the northeast side of Lopez Island. It has a landing wharf built out to 12 feet. **Decatur** post village, with wharf out to 8 feet, is on the west side of Decatur Island, about 1 mile eastward from Trump Island. Farming and sheep raising are the principal industries in the vicinity.

Lopez Pass, at the southern point of Decatur Island, leads from Rosario Strait into Lopez Sound at a point about 2 miles from its head. It is very narrow, with depths varying from 9 to 12 fathoms; it is little used. The southern point of Decatur Island is marked by a fixed white post light.

Rosario Strait

(chart 6380) is about 20 miles in length and varies in width from 5 miles at the southern entrance to 1½ miles about midway through the channel. The water is deep as a rule, but there are several dangers, the more important of which are marked by aids to navigation.

The strait is in constant use by vessels bound to Bellingham, Anacortes, or the various ports in the San Juan Islands. Vessels bound for British Columbia or Alaska ports also frequently use it in preference to the passages farther westward, when by so doing greater advantage can be taken of the currents.

The **currents** attain velocities of from 3 to 7 knots at strength and should be carefully taken into account by vessels using the strait at night or in thick weather. On the ebb of the larger tide a southerly wind causes tide rips, dangerous to small craft, off the entrances to Lopez, Thatcher, and Obstruction Passes.

Point Colville is the western point at the southern entrance to the strait. **Watmough Head**, 240 feet high, flat-topped and wooded, rises immediately back of the point and is prominent in approaching from southwestward.

Colville Island, 40 feet high, small and bare of trees, lies 1 mile 227° true (SSW mag.) from Point Colville, and should be given a berth of not less than 1 mile. **Davidson Rock**, bare at extreme low water, lies ¼ mile eastward from Colville Island. It is marked by a black buoy in 26 feet eastward of the rock. Heavy kelp extends westward to Colville Island.

Lawson Reef lies 1⅝ miles 260° true (SW by W mag.) from the west point of Deception Island at the entrance to Deception Pass. It is of small extent, with a least depth of 17 feet, and is marked by a red and black horizontally striped bell buoy in 6 fathoms on the eastern edge of the shoal. The red sector in Burrows Island light covers this reef.

A shoal with a least depth of 35 feet lies about midway between Davidson Rock and Lawson Reef.

Kellet Ledge, 2 miles northward from Point Colville, lies 700 yards offshore; it is of small extent, marked by kelp, and is bare at lowest tides.

Burrows Bay, on the western shore of Fidalgo Island, is a broad, open bight, affording anchorage in the northern part in 15 to 16 fathoms, soft bottom. Protection from westward and northward is afforded by **Burrows** and **Allan Islands**, but the bay is exposed in southerly weather. The southeastern part of the bay has depths of 6 to 9 fathoms over sandy bottom. Eastward of the passage between Allan and Burrows Islands is a middle ground with a least depth of 5¼ fathoms. Vessels using Deception Pass bound to or from ports in the islands or Bellingham Bay pass through Burrows Bay and the passage northward of Burrows Island. The eastern end of the passage is marked by a fixed white light on the end of the small wharf on the north shore.

Burrows Island lighthouse, on the southwestern end of Burrows Island, is fixed white, with a red sector from 311° to 9°. The fog signal is a reed horn sounding a group of 2 blasts every 40 seconds.

Williamson Rocks, a cluster of bare rocks of small extent, lie about ½ mile southward of the south point of Allan Island. **Dennis Shoal**, bare at low water, lies about 500 yards off the southern shore of Allan Island and ⅝ mile 328° true (NW by W mag.) from Williamson Rocks. The red sector in Burrows Island light covers Dennis Shoal and also Lawson Reef. A small, bare rock lies 700 yards 58° true (NE by N mag.) from **Langley Point**, the southern point at the entrance to the bay, and about 500 yards offshore. A rock awash lies about ⅞ mile 32° true (N ⅝ E mag.) from Langley Point, and 650 yards off the southern point of a small cove on the eastern shore.

Bird Rocks, almost in mid-channel, 4 miles northward from Point Colville, consists of 3 rocks close together, the southernmost being the largest and 30 feet high. There is deep water close-to and passage may be made on either side.

Belle Rock, bare at extreme low water, lies ½ mile 39° true (N by E ¼ E mag.) from Bird Rocks. It is marked by a black buoy outside the kelp in 9 fathoms. If passing eastward, to clear the rock keep Tide Point, the western point of Cypress Island, on with Lawrence Point, the eastern point of Orcas Island, until Guemes Channel is open.

White Rock, about 16 feet high, lies ¼ mile off the southeastern shore of Blakely Island on the northern side of the entrance to Thatcher Pass.

Black Rock, 4 feet above high water, lies ¾ mile 58° true (NE by N mag.) from White Rock and ½ mile from Blakely Island; it is marked by a spindle surmounted by a barrel with black and white horizontal stripes. There is a passage between White and Black Rocks and Blakely Island, but it is not recommended.

Guemes and Bellingham Channels are described under separate headings following.

Cypress Island, 1,530 feet high, steep on the lower slopes, and gently rounding at the top, lies northward of the entrance to Guemes Channel, and from southward appears in the middle of Rosario Strait.

Reef Point, the southwestern point of Cypress Island, has a shoal extending 500 yards southward from it; the outer end of the shoal being marked by a black buoy. Each fishing season for a number of years a fish trap has been driven on the shoal, extending a distance of about 300 yards beyond the buoy. Vessels rounding the point at seasons when the trap is not in place should give the buoy a berth of 400 to 500 yards to avoid piles which may have been left standing, broken off below water.

Strawberry Island, small and low, lies ¼ mile from the western shore of Cypress Island; there is a passage eastward of it, but it is not recommended. An indifferent anchorage may be had in **Strawberry Bay** in 7 fathoms; it is seldom used.

A rock, having an estimated least depth of 5 feet, is reported to exist 250 to 300 yards southwestward from the south end of Strawberry Island. The position is doubtful. In passing the island vessels should keep Peapod Rocks light well open from the west point of Cypress Island.

Cypress Rock, small, round, and wooded, lies about 400 yards northward of Cypress Island. The passage between them is used by local vessels, especially those plying between Bellingham Bay and Obstruction Passes.

Cypress Reef is a dangerous, rocky patch westward of Cypress Rock. The southern point, bare at low water, lies 550 yards 289° true (W ½ S mag.) from Cypress Rock; from the southern point it extends northward for 650 yards with depths of 9 to 15 feet. It is well marked by kelp.

Lydia Shoal, of small extent and with a least depth of 3¾ fathoms, lies about 1 mile northeastward from the light on the eastern end of Obstruction Island. It is well out of the track of vessels passing through the strait.

Buckeye Shoal, with a least depth of 22 feet, lies about 1 mile 320° true (NW by W ¾ W mag.) from Cypress Rock, and is in line between Cypress Rock and the middle Peapod Rocks. It is marked by a red buoy.

Peapod Rocks are a cluster of small rocks extending about 1 mile in a general north-northeast and south-southwest direction, parallel with and a little over ½ mile from the Orcas Island shore. They are bare of trees, the northernmost being the higher and larger and marked by a flashing white light. The southern rock lies 2¾ miles 40° true (N by E ⅜ E mag.) from the light on the eastern end of Obstruction Island. A sunken rock lies off Doe Bay, a little over ⅝ mile 283° true (W by S mag.) from the southern Peapod. Vessels using the passage westward of the Peapods must favor the southern Peapod to avoid this rock. Otherwise this passage is clear. Vessels must not pass between the rocks forming the Peapod group.

Doebay, a post village on **Doe Bay,** has a wharf built out to 12 feet. Some farm produce is shipped. The wharf is inaccessible in southerly weather.

Sinclair Island, northward of Cypress Island, is wooded and comparatively low. The northern shore is foul. **Boulder Reef** is a dangerous shoal, extending over ½ mile 317° true (WNW mag.) from the northwest side of the island; portions uncover at half tide, and a large bowlder is at the inner part of the reef. It is well marked by kelp, but this is frequently drawn under by the current. The outer end of the reef is marked by a red buoy, in 12 fathoms.

Urban is a post village at the southwestern end of the island. It has a wharf built out to deep water. A fish cannery is located here, but is operated only occasionally.

Lummi Island is about 8 miles long and wooded. The northern half is low, but the southern half is occupied by **Lummi Mountain,** over 1,740 feet high. **Lummi Rock,** a small, double, rocky islet, lies off the southern shore about 3 miles northwestward from its southeastern point. Shoals extend for over ½ mile from Point Migley, the northwestern point; the northwestern extremity of the shoals is marked by a horizontally striped buoy, in 6 fathoms about ½ mile 306° true (W by N mag.) from Point Migley. Sinclair Island, open westward of Village Point, clears the shoal.

Clark Island and **Barnes Island,** with a small number of islets adjacent, form a group almost in mid-channel, 2½ miles northwestward from Lawrence Point, the eastern point of Orcas Island. They should be given a berth of ½ mile.

Alden Bank, within the 10-fathom curve, is about 3 miles long in a southeast and northwest direction with a greatest width of 1½ miles. The shoalest part, 16 to 17 feet, covering a considerable area, is at the eastern end and lies 3¼ miles 13° true (N by W mag.) from the middle of Matia Island and 5 miles 305° true (W by N mag.) from Point Migley, the western point of Lummi Island. A red and black horizontally striped buoy is placed near the shoalest point in 21 feet, and should be given a berth of at least 1 mile. The position of the bank is well indicated by numerous fish traps and weirs, which are visible from a considerable distance.

Directions, Rosario Strait.

These directions are available for vessels of any draft in clear weather. In thick weather, strangers are advised to take a pilot. A range should be steered when possible, so as to insure making the compass courses good.

Between Admiralty Inlet and the entrance to Rosario Strait the current on the flood has a tendency to set a vessel eastward toward Whidbey Island; it also sets strongly through Deception Pass and up Rosario Strait. At night avoid the red sector of Burrows Island light to clear Lawson Reef and Dennis Shoal. Through Rosario Strait the currents run with considerable velocity, ranging from 3 to 7 knots. Heavy tide rips and swirls are found off Black Rock, Obstruction Passes, Peapod Rocks, and Lawrence Point.

Having come from Admiralty Inlet, pass midway between Point Wilson lighthouse and Admiralty Head, and steer 322° true (NW by W ⅝ W mag.) for 5¼ miles to a position ½ mile west-southwestward of Point Partridge gas and bell buoy. Then steer 12° true (N by W ⅛ W mag.) for 15¼ miles to a position with Burrows Island

lighthouse abeam, distant ½ mile. Then steer 350° true (NW ⅞ N mag.) for 7½ miles, passing ¾ mile east-northeastward of Bell Rock buoy and Black Rock spindle, and to a position with Obstruction Passes light abeam, distant 1¾ miles.

From here steer 24° true (N ⅛ W mag.) for 3½ miles, passing ⅜ mile eastward of Peapod Rocks light, and to a position ¾ mile eastward of Lawrence Point. Then steer 342° true (NW ⅛ N mag.) for 3½ miles to a position with the north end of Clark Island abeam, distant ⅝ mile, and then steer 315° true (WNW ¼ W mag.) for 7¼ miles, passing ½ mile eastward of Puffin Island, to a position 2 miles west-southwestward of Alden Bank buoy, and with Patos Islands and Saturna Island lighthouses in range. The course can then be shaped up Georgia Strait as desired.

Bellingham and Padilla Bays.

These bays lie eastward of Rosario Strait and extend 20 miles in a north-northwest and south-southeast direction, and vary from 2 to 5 miles in width. **Lummi, Cypress, Sinclair, Guemes,** and several smaller islands lie in the entrances, Lummi and Cypress Islands being the highest and most prominent. There are four principal channels in entering, Guemes and Bellingham from southward, the western and widest between Lummi and Sinclair Islands, and Hale Passage from northward. The depths in the channels are great, as a rule, with the exception of Hale Passage, which at its northern end has a bar with but 13 feet over it. The depths in the bays are moderate, and except in a few places anchorage may be made almost anywhere.

Padilla Bay (chart 6380), the southernmost, is largely filled with flats, the greater portion of which bare at low water. The deepest part of the bay is on the eastern and southern sides of Guemes Island. Entrance to the bay may be had from Rosario Strait through Guemes Channel or from Bellingham Bay eastward of Guemes Island. **William Point,** the eastern point at the northern entrance, is wooded and about 100 feet high. Owing to the low land back of it, it generally appears as an island. The western end of the point is marked by a light. From William Point, flats and shoals forming the eastern side of the northern channel extend southeastward to **Saddlebag, Dot,** and **Hat Islands,** which lie about 1 mile eastward of the eastern point of Guemes Island. **Huckleberry Island,** small and low, lies nearly in mid-channel between Guemes and Saddlebag Islands. **March Point,** low and wooded, on the southern shore of the bay, is marked by a light that serves as a leading mark for the channel eastward of Guemes Island. There is a channel marked by beacons across the flats eastward of March Point which leads to Swinomish Slough. This is navigable at high tide for lightdraft vessels with local knowledge, but should not be attempted by strangers. **Fidalgo Bay,** small and shoal, lies westward of March Point.

Guemes Channel, about 3 miles long with a least width of ½ mile, leads eastward from Rosario Strait to Padilla Bay, southward of Guemes Island; the depths range from 8 to 18 fathoms. **Shannon Point,** the southern point at the western entrance, is low and rounding; a rocky shoal marked by a red buoy at its northern extremity extends 200 yards northward from the point. The velocity of the tidal currents does not exceed 3 knots as a rule.

Ship Harbor is the bight eastward of Shannon Point, at the western entrance to Guemes Channel. Several canneries are located there, with wharves built out to deep water where large steamers load.

City of Seattle Rock, with 9 feet over it, lies 200 yards offshore on the southern side of the channel, about 2 miles eastward from Shannon Point; the wharves of Anacortes now extend out almost to it.

Anacortes, on the south shore of Guemes Channel, is a thriving town and port of entry; the center of an extensive salmon canning industry. Canneries, with wharves built out to deep water, line the south shore of the channel from Ship Harbor to Fidalgo Bay. There are also a large fertilizer factory, a cement works, and several large sawmills.

Supplies and repairs.—Fuel oils, water, coal, provisions, and ship-chandlers' stores can be obtained. There is a shipyard with a marine railway for hauling out fishing launches.

Storm warnings are displayed by the Weather Bureau.

Communication is by daily steamers or rail, and by telegraph and telephone.

Anchorage may be had off the wharves in 6 to 12 fathoms.

No **harbor regulations** are prescribed.

Bellingham Channel, the one most in use by vessels from southward bound for Bellingham, leads between Cypress and Guemes Islands and between Sinclair and Vendovi Islands, and is the most direct. The depths vary from 17 to 60 fathoms in mid-channel. Between Cypress and Guemes and Sinclair Islands, the velocity of the current is nearly as great as in Rosario Strait, but between Sinclair and Vendovi Islands is much less.

The **channel from northward,** leading from Rosario Strait between Lummi and Sinclair Islands and between Viti Rocks and Lummi or Vendovi Islands is the widest and is used by deep-draft vessels. It varies from a width of 1¾ miles, between Lummi and Sinclair Islands, to a least width of ¾ mile, between Vidi Rocks and Carter Point, the southeastern extremity of Lummi Island. The depths vary from 25 to 50 fathoms, with no outlying dangers other than those extending northward from Sinclair Island.

Viti Rocks lie ¾ mile 236° true (SSW ¾ W mag.) from the southern point of Lummi Island, and extend ¼ mile northwest and southeast. The northwestern islet is about 35 feet high, 200 yards long, and 70 yards wide, and is marked by a flashing white light (3 seconds) on its highest point.

Hale Passage, northward of Lummi Island, is about 6 miles long with an average width of ¾ mile. The depths range from 20 fathoms near the eastern end to 13 feet on the bar at the western end of the channel. **Lummi Point,** on the south side of the passage nearly 1½ miles eastward of Point Migley, the northwestern end of Lummi Island, is marked by a fixed white light.

Beach post village is on the west side of Hale Passage 1 mile southward of Lummi Point. It has a landing wharf built out to 10 feet.

From **Point Frances,** the northern point at the eastern entrance, a shoal extends to Eliza Island. The depths range from 4½ fathoms to 8 feet about midway between the point and the island. The shoalest spot, 8 feet, is marked by a red and black horizontally striped buoy placed close-to and southward. The end of the spit making

eastward from Point Frances and the southwestern edge of the shoal making out from Point Frances are marked by red buoys.

Bellingham Bay (charts 6378 and 6380), from William Point to the head is about 12 miles long and 3 miles wide. The depths over the greater portion vary from 6 to 15 fathoms. The holding ground is not good, and in southeasterly weather, which is heavy, vessels frequently drag. In the southeastern part is **Samish Bay,** with flats that bare for a considerable distance at low water. It is of no commercial importance. **Chuckanut Bay,** on the eastern shore, is a cove affording shelter to small vessels. There is a cannery and a stone quarry located within it.

Bellingham, formerly Whatcom and Fairhaven, is now a town with about 30,000 people, at the head of the bay on the eastern shore. It is a port of entry. It has canneries and lumber mills. The commerce consists principally of canned fish, logs, lumber, and dairy products. There are a number of docks built out from the north and east shores.

The flats on the north shore have been improved by dredging a channel about 350 feet wide from deep water in the bay to the pierhead line at the mouth of Whatcom Creek. The inner 1,300 feet of this channel has a depth of 18 feet, and the outer 3,500 feet a depth of 26 feet at mean lower low water. The outer end of this dredged cut is marked by a group occulting white light placed on the eastern edge of the channel.

Starr Rock, with 8 feet over it, lies about 300 yards offshore, ¾ mile southward from the light. It is marked by a red buoy. Vessels should not attempt to pass inside the rock.

Harbor regulations are prescribed for Bellingham Harbor, and are enforced by a harbor master. The limit of speed for vessels within 2,000 feet of the wharves is 6 miles per hour, and from 2,000 feet to 1 mile from the wharves it is 8 miles per hour. The discharging of ballast is prohibited in water less than 20 fathoms deep, and the discharging of garbage is prohibited within 1 mile of the outer harbor line.

Marine hospital.—A relief station of the Public-Health Service, in charge of a service officer, is located here.

Storm warnings are displayed by the Weather Bureau.

Towboats and pilots for the local waters can be had.

Supplies.—Provisions and ship chandlers' stores may be obtained. Water can be had at the wharves and fuel oils at the oil docks.

Repairs.—There are carpenters and machine shops, but no facilities for docking vessels.

Communication is by steamer or rail, and by telegraph and telephone.

Directions, Bellingham Bay.

To enter Bellingham Bay from southward through Bellingham Channel, the principal entrance, follow the directions for Rosario Strait and continue the 12° true (N by W ⅛ W mag.) course for 1⅛ miles past Burrows Island lighthouse to a position with Fidalgo Head abeam, distant ¾ mile. Then steer 33° true (N ¾ E mag.) for 4⅛ miles, passing a little over ¼ mile off the point on the west side to a position in the middle of the strait with Cypress Island light in range with the eastern Cone Island.

Then steer 4° true (N by W 7/8 W mag.) for 2 1/8 miles, passing 1/4 mile eastward of Cypress Island light to a position with the eastern Cone Island abeam, distant 1/2 mile. From here steer 44° true (N by E 3/4 E mag.) for 2 3/8 miles to a position 3/8 mile westward of the western end of Vendovi Island and then steer 58° true (NNE 7/8 E mag.) for 2 1/8 miles to a position 1/2 mile eastward of the southeast end of Eliza Island.

From here a 16° true (N 3/4 W mag.) course for 4 3/4 miles will lead to a position 5/8 mile westward of Post Point gas and bell buoy, and a 46° true (N by E 7/8 E mag.) course for 2 1/4 miles will then lead westward of Starr Rock buoy and to the entrance of the dredged channel leading to Bellingham.

Birch Bay, Boundary Bay, Semiamoo Bay, and Drayton Harbor.

Birch Bay, on the eastern shore of Georgia Strait, about 10 miles northwestward of Point Migley, is an open bight, affording anchorage in 4 to 5 fathoms. It is open southward and westward, but affords some protection from northward. The bay is circular in shape and about 2 miles broad: flats, bare at low water, occupy a considerable area at the head. It is little used and no directions are considered necessary.

Boundary and **Semiamoo Bays** are included between Birch Point, the western point at the entrance to Birch Bay, and Point Roberts, about 10 miles westward from Birch Point. Nearly all of Boundary Bay and a considerable part of Semiamoo Bay lie northward of the international boundary.

Point Roberts is the prominent feature in approaching from either northward or southward. The eastern face is about 180 feet high and is composed of white, vertical bluffs. The point is well wooded, and owing to the low land behind it, is usually made as an island, especially from southward. The southwestern end of the point is marked by a fixed white light.

Boundary Bay, from Point Roberts to Kwomais Point, is 6 1/2 miles long and 4 miles wide. The greater portion of the bay is filled with flats, bare at low water; in the eastern part of the bay these are intersected by several channels leading to the Nicomekl and Kwatisalic Rivers.

Semiamoo Bay (chart 6399), immediately eastward of Boundary Bay, has its entrance between Birch and Kwomais points. It is funnel-shaped and is connected at its eastern end by a narrow channel with Drayton Harbor. The eastern part of the bay is shoal. Anchorage may be had in the bay in 5 to 9 fathoms, but it is exposed southward and westward.

Drayton Harbor is a small basinlike cove formed by the extension of a sand spit northward from Birch Point. It is about 2 miles in diameter, but flats, bare at low water, occupy a large area in the eastern and southern parts of the harbor. The anchorage within the 18-foot curve is limited to a small area, less than 3/8 mile square, eastward of the northern end of the spit. The depths range from 4 to 7 fathoms, with muddy bottom. The shelter is excellent and the tidal currents have little velocity. The entrance is 3/4 mile wide, but the navigable channel is contracted to a width of 300 yards by flats,

bare at low water, extending from the northern shore; depths in the channel range from 4½ to 12 fathoms. Semiamoo Harbor light stands on the north point of the flat at the south side of the channel. The light is occulting white (light 15 seconds, eclipse 5 seconds) and the fog signal is a reed horn sounding 2 blasts every 30 seconds. Flats, bare at low water, extend ½ mile westward from the sand spit; the western limit is marked by a red buoy. Several long wharves, some of them occupied by canneries, extend from the north shore to the edge of the flats. The town of **Blaine** is situated on the north shore near the entrance. Several buildings and canneries constituting the town of **Semiamoo** are at the northern end of the sand spit. The depths at the wharves vary from about 12 to 18 feet, according to locality. Lumber and canned salmon are the principal shipments and general merchandise is received. Water can be had at the cannery wharves, but only a small amount of coal; provisions can also be had. Communication is by rail and regular steamers; there are also telegraph and telephone facilities. Strangers are advised not to enter without a pilot, who can generally be had from the canneries or sawmills.

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APPENDIX.

COAST PILOTS OF THE COAST AND GEODETIC SURVEY.

	Price.
U. S. Coast Pilot, Atlantic Coast, Parts I–II, from St. Croix River to Cape Ann	$0.50
U. S. Coast Pilot, Atlantic Coast, Part III, from Cape Ann to Point Judith	.50
U. S. Coast Pilot, Atlantic Coast, Part IV, from Point Judith to New York, including Long Island Sound	.50
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.50
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.50
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.50
Inside Route Pilot, coast of New Jersey	.20
Inside Route Pilot, New York to Key West	.20
Inside Route Pilot, Key West to New Orleans	.20
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.50
U. S. Coast Pilot, West Indies, Porto Rico	.50
Coast Pilot Notes on Hawaiian Islands	Free.

SAILING DIRECTIONS, PHILIPPINE ISLANDS.

Section I. North and west coasts of Luzon and adjacent islands	Free.
Section II. Southwest and south coasts of Luzon and adjacent islands	Free.
Section III. Coasts of Panay, Negros, Cebu, and adjacent islands	Free.
Section IV. Coasts of Samar and Leyte and the east coast of Luzon	Free.
Section V. Coasts of Mindanao and adjacent islands	Free.
Sections VI and VII. Mindoro Strait, Palawan Island, and Sulu Sea and Archipelago	Free.

SUBOFFICES OF THE COAST AND GEODETIC SURVEY.

Boston, Mass., Bureau Foreign and Domestic Commerce, customhouse.
New York, N. Y., room 403, customhouse.
Galveston, Tex., room 413, Security Building.
San Francisco, Cal., room 310, customhouse.
Seattle, Wash., room 204, Burke Building.
Manila, P. I., Intendencia Building.

At these offices complete files of United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge.

Light Lists, Buoy Lists, and Notices to Mariners are kept for free distribution to mariners.

The suboffices are also sales agencies for the Coast and Geodetic Survey publications.

A catalogue containing lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey can be obtained from any of the agencies or suboffices, or will be sent, free of charge, upon application to the Coast and Geodetic Survey, Washington, D. C. The list of agencies is subject to frequent changes; it is published in the first notice each month of the Notices to Mariners.

Meteorological table compiled by the United States Weather Bureau.

SAN DIEGO, CAL.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in degrees F.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.											Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.07	30.48	29.51	0.97	54.0	62.3	46.3	16.0	83	25	58	70	4	2.00	6	2.49	5.1	40	8	12	7	2	5	3	5	20	0	[1] 0	3
February	30.06	30.41	29.48	.93	54.6	62.7	47.6	15.1	85	34	51	73	4	1.96	7	2.39	5.7	45	4	11	7	3	4	5	7	15	0	0	3
March	30.02	30.32	29.46	.86	56.2	63.5	49.5	14.0	99	36	63	74	4	1.70	7	2.40	6.2	43	4	9	8	4	4	5	10	18	0	0	2
April	29.99	30.29	29.68	.61	58.2	65.2	52.1	13.1	96	39	57	75	4	.74	4	1.20	6.1	40	5	8	6	2	4	7	12	16	0	0	2
May	29.95	30.13	29.67	.46	60.8	66.3	55.6	10.7	98	45	53	77	5	.41	4	1.45	6.3	33	4	4	5	2	4	11	17	15	0	0	1
June	29.92	30.03	29.66	.37	63.8	69.3	58.6	10.7	94	50	44	78	4	.03	1	.25	5.9	24	6	3	2	3	6	13	12	15	0	0	1
July	29.92	30.10	29.69	.41	66.9	72.4	62.0	10.4	93	54	39	80	4	.00	0	.83	5.7	30	7	3	1	2	3	12	14	19	1	0	1
August	29.89	30.16	29.64	.52	68.7	74.1	63.7	10.4	93	54	39	80	3	.00	1	1.80	5.6	25	8	5	1	1	3	10	14	20	1	0	2
September	29.89	30.09	29.59	.50	66.9	73.1	61.3	11.8	110	50	60	78	3	.06	1	.37	5.6	28	8	6	4	1	3	5	8	24	1	0	2
October	29.95	30.18	29.64	.54	63.0	70.4	56.5	13.9	96	44	52	76	3	.46	2	1.82	5.1	32	6	9	5	3	4	6	7	22	0	0	4
November	30.02	30.33	29.63	.70	59.0	67.5	51.3	16.2	93	38	55	70	3	.83	3	2.75	5.2	33	6	14	8	2	3	4	4	19	0	0	2
December	30.07	30.44	29.56	.88	55.7	64.5	48.2	16.3	82	32	50	66	3	1.82	6	2.52	5.0	38	7	16	7	3	2	3	4	20	0	0	1
Mean	29.98	.....	.....	.....	60.6	67.6	54.5	13.1	.....	.....	.....	74	4	.....	.....	.....	5.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.01	42	.....	.....	.....	73	100	61	28	45	84	113	223	3	0	24

[1] Four days with gales 40 miles or over in 10 years.

SAN FRANCISCO, CAL.

January	30.11	30.53	29.23	1.30	49.5	54.7	44.9	9.8	78	29	49	80	5	4.33	11	4.67	7.2	57	9	6	3	6	10	7	9	11	1	1	3
February	30.10	30.50	29.10	1.40	51.3	57.7	46.7	11.0	80	33	47	78	5	3.70	10	3.60	7.6	49	6	5	2	4	8	5	16	10	0	0	3
March	30.06	30.48	29.23	1.25	52.7	59.5	47.8	11.7	86	33	53	76	5	3.14	10	3.31	9.1	60	5	4	1	5	6	8	22	11	0	0	2
April	30.05	30.44	29.58	.86	53.7	61.5	49.0	12.5	88	40	48	76	4	1.82	7	2.43	10.3	47	3	1	1	1	5	9	33	7	0	0	1
May	29.99	30.33	29.64	.69	55.5	63.0	50.5	12.5	97	42	55	78	4	.81	4	1.42	11.5	45	1	0	0	1	4	12	38	5	1	0	1
June	29.96	30.22	29.61	.61	57.0	65.0	52.0	13.0	100	46	54	80	4	.17	2	1.23	12.9	48	0	0	0	0	2	14	38	5	1	0	1
July	29.95	30.15	29.69	.46	57.3	64.5	52.5	12.0	98	47	51	84	4	.01	1	.23	13.4	41	0	0	0	0	1	19	41	1	0	0	3
August	29.92	30.19	29.62	.57	58.0	64.7	53.1	11.6	92	46	46	85	4	.00	0	.08	12.5	42	0	0	0	0	1	20	40	1	0	0	3
September	29.94	30.15	29.57	.58	59.3	67.6	54.2	13.4	101	47	54	80	3	.29	2	3.58	10.3	40	1	0	1	1	2	12	37	4	2	0	3
October	30.01	30.29	29.56	.73	58.4	66.7	53.5	13.2	94	45	49	77	4	1.29	4	2.03	8.0	44	4	2	1	1	5	9	32	7	1	0	3
November	30.09	30.51	29.44	1.07	55.5	61.9	50.7	11.2	83	38	45	78	4	2.47	7	3.98	6.8	64	7	5	1	3	6	6	18	13	1	0	3
December	30.12	30.60	29.55	1.05	50.9	56.0	46.5	9.5	72	34	38	78	5	4.24	10	3.14	6.7	60	9	10	3	6	8	4	10	12	0	0	2
Mean	30.02	...	...	...	54.9	61.9	50.1	11.8	...	...	...	80	4	...	...	...	9.7	...	...	...	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...	...	...	...	...	22.27	68	...	...	...	45	33	13	28	58	125	331	87	7	1	28

POINT REYES, CAL.

January	30.11	30.42	29.11	1.31	49.4	54.2	44.6	9.6	74	32	42	84	6	4.94	11	3.10	16.5	86	2	1	1	4	11	2	1	9	0	14	10
February	30.10	30.38	28.94	1.44	50.0	54.6	45.3	9.3	74	33	41	84	6	3.62	10	2.21	18.6	98	3	1	0	1	6	3	1	13	0	10	9
March	30.06	30.35	29.26	1.09	50.4	55.5	45.5	10.0	88	30	58	83	6	3.94	10	2.15	20.3	108	4	1	0	1	6	3	1	15	0	13	7
April	30.05	30.24	29.59	.65	51.1	56.1	46.0	10.1	83	36	47	82	5	1.39	6	1.78	22.8	93	4	0	0	0	4	2	1	19	0	13	7
May	29.99	30.23	29.56	.67	51.7	57.0	46.5	10.5	85	36	49	85	5	1.19	4	1.80	25.6	120	3	0	0	0	4	3	1	20	0	14	11
June	29.96	30.14	29.63	.51	52.8	57.9	47.7	10.2	87	38	49	85	5	.26	1	1.53	26.9	94	4	0	0	0	2	2	1	21	0	16	13
July	29.95	30.09	29.66	.43	53.5	58.6	48.3	10.3	91	40	51	88	7	.12	0	.39	22.0	90	6	0	0	0	3	2	1	19	0	10	23
August	29.92	30.09	29.61	.48	54.6	59.3	49.8	9.5	90	41	49	89	7	.10	0	.91	18.4	76	5	0	0	0	4	3	1	18	0	10	21
September	29.94	30.15	29.59	.56	56.3	61.3	51.0	10.3	98	45	53	85	6	.73	3	2.52	17.8	75	7	0	0	0	3	2	1	17	0	8	17
October	30.01	30.23	29.56	.67	55.5	60.9	50.1	10.8	91	39	52	85	5	1.86	6	2.53	16.6	90	9	1	0	0	5	1	1	14	0	7	13
November	30.09	30.37	29.61	.76	53.9	58.9	48.8	10.1	83	34	49	84	6	2.87	10	2.35	15.9	82	7	2	1	1	4	2	1	12	0	9	10
December	30.12	30.46	29.41	1.05	50.9	55.8	45.9	9.9	73	34	39	83	6	3.64	9	2.33	15.0	92	4	1	1	3	7	2	1	12	0	10	7
Mean	30.02	...	...	...	52.4	57.4	47.4	10.0	...	...	...	85	6	...	...	...	19.7	...	...	...	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...	...	...	...	...	24.66	70	...	...	...	58	7	3	10	59	27	12	189	0	134	148

Meteorological table compiled by the United States Weather Bureau—Continued

EUREKA, CAL.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in degrees F.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.											Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	Ins.	Ins.	Ins.	°	°	°	°	°	°	°	%			Ins.		Ins.												
January	30.10	30.64	29.11	1.53	46.9	53.0	41.2	11.8	77	20	57	84	7	7.63	17	5.10	6.0	59	8	3	4	19	13	8	3	3	1	1	3
February	30.11	30.58	28.93	1.65	46.8	53.3	41.5	11.8	72	24	48	84	6	7.03	15	4.91	6.4	48	11	4	4	13	8	8	4	4	0	0	4
March	30.06	30.55	29.05	1.50	48.0	54.2	42.6	11.6	78	29	49	84	6	6.97	17	3.94	7.5	48	14	3	4	15	7	6	6	7	0	1	5
April	30.11	30.54	29.46	1.08	49.5	55.4	44.5	10.9	75	31	44	83	6	3.93	13	2.87	8.1	58	17	3	2	9	6	7	5	11	0	1	1
May	30.05	30.44	29.38	1.06	52.1	57.1	47.6	9.5	78	35	43	84	6	2.54	10	2.24	8.3	46	17	3	2	7	7	9	5	12	0	0	1
June	30.05	30.37	29.69	.68	54.6	59.1	49.8	9.3	85	40	45	86	5	1.06	6	1.99	8.0	47	18	2	1	5	4	7	6	16	1	0	3
July	30.05	30.28	29.77	.51	55.3	59.8	51.5	8.3	73	43	30	88	6	.11	2	.75	6.4	47	15	2	1	2	6	9	7	19	1	0	8
August	30.00	30.26	29.72	.54	55.8	60.1	51.7	8.4	79	45	34	88	6	.10	2	2.63	5.2	39	15	2	1	4	7	7	8	17	1	0	7
September	30.01	30.30	29.53	.77	54.9	60.5	50.1	10.4	82	36	46	87	5	1.11	5	2.77	5.1	46	14	2	3	7	6	8	8	11	1	1	11
October	30.06	30.43	29.46	.97	53.1	59.5	48.0	11.5	84	36	48	88	6	2.65	9	3.61	4.8	42	13	4	3	12	5	9	7	8	1	0	10
November	30.11	30.57	29.24	1.33	51.0	57.5	45.2	12.3	81	27	54	86	6	5.67	13	4.02	5.3	43	11	4	5	14	9	9	4	3	1	0	8
December	30.12	30.64	29.17	1.47	48.0	54.3	42.0	12.3	70	28	42	84	6	7.25	16	3.65	5.6	50	10	4	6	19	9	7	4	3	0	1	4
Mean	30.07	.....	.....	.....	51.3	57.0	46.3	10.7	.....	.....	.....	86	6	.....	.....	.....	6.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46.05	125	.....	.....	.....	163	36	36	126	87	94	67	114	7	5	65

NORTH HEAD (COLUMBIA RIVER ENTRANCE), WASH.

January	30.05	30.69	28.72	1.97	41.8	45.5	37.9	7.6	65	17	48	89	8	6.68	22	2.70	18.3	92	3	3	21	13	8	4	5	5	0	14	3
February	30.06	30.64	29.12	1.52	42.1	46.8	38.8	8.0	71	19	52	86	7	5.79	19	1.51	18.1	90	4	2	16	11	6	5	4	8	0	10	2
March	30.01	30.57	28.78	1.79	44.9	49.7	40.2	9.5	79	24	55	80	7	5.25	20	2.65	17.5	90	5	2	10	12	8	5	5	15	0	10	3
April	30.05	30.56	29.27	1.29	47.5	53.0	44.1	8.9	88	33	55	85	6	3.22	19	1.29	15.7	85	5	1	6	7	8	5	6	22	0	6	2
May	30.03	30.58	29.26	1.32	51.2	56.3	47.0	9.3	86	39	47	88	7	2.39	15	1.39	16.7	78	5	0	4	6	9	5	4	29	0	6	2
June	29.99	30.49	29.29	1.20	55.0	59.5	50.5	9.0	96	44	52	86	7	1.77	14	1.76	16.6	74	4	1	2	5	5	5	6	32	0	3	2
July	30.08	30.39	29.85	.74	57.7	62.2	53.4	8.8	97	46	51	88	6	.54	8	.82	15.8	62	6	0	1	3	6	3	4	39	0	1	6
August	30.03	30.35	29.62	.73	57.9	62.7	53.3	9.4	84	47	37	88	7	.56	7	1.52	13.9	54	8	1	1	5	7	2	3	35	0	2	8
September	30.03	30.44	29.51	.93	56.2	61.4	51.7	9.7	87	44	43	88	6	1.85	13	1.76	14.7	77	9	1	4	14	7	3	3	19	0	5	7
October	30.05	30.62	29.47	1.15	52.9	57.8	49.6	8.2	83	38	45	88	7	3.91	16	1.97	14.2	81	6	2	9	18	7	3	3	14	0	8	6
November	30.05	30.61	29.13	1.48	47.7	52.0	44.8	7.2	71	27	44	90	8	6.33	21	2.56	20.5	90	4	2	14	15	11	4	3	7	0	13	2
December	30.03	30.66	29.10	1.56	44.3	48.0	40.4	7.6	61	26	35	90	8	7.48	22	2.23	19.8	96	3	3	24	11	7	4	4	6	0	12	1
Mean	30.04	...	...	...	49.9	54.6	46.0	8.6	...	...	...	88	7	...	...	...	16.8	...	...	...	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...	...	...	...	...	45.77	196	...	...	...	62	18	112	120	89	48	50	231	0	90	44

TATOOSH ISLAND, WASH.

January	29.98	30.66	28.61	2.05	41.2	44.3	37.6	6.7	57	7	50	85	8	12.16	22	4.56	21.3	85	1	5	25	8	11	5	5	2	0	17	2
February	30.00	30.64	28.93	1.71	41.0	45.0	38.0	7.0	55	13	42	85	8	8.76	20	3.66	19.0	78	1	7	21	6	8	6	5	2	0	10	0
March	29.96	30.58	28.75	1.83	42.9	47.6	39.6	8.0	66	24	42	83	7	8.57	19	3.79	17.0	80	2	10	13	5	12	8	8	4	0	9	3
April	30.00	30.56	29.30	1.26	46.1	50.9	42.3	8.6	74	33	41	84	7	6.31	19	3.77	13.9	66	1	6	10	4	11	10	14	4	0	5	1
May	30.01	30.60	29.15	1.45	49.6	54.3	45.8	8.5	79	35	44	86	7	4.09	16	1.95	11.8	68	1	5	6	3	13	13	18	3	0	2	3
June	30.02	30.52	29.39	1.13	53.0	57.3	48.8	8.5	84	43	41	86	7	4.18	15	2.55	10.2	56	1	3	4	3	14	19	14	2	0	1	6
July	30.05	30.47	29.57	.90	55.1	59.8	51.3	8.5	82	44	38	90	6	1.78	9	2.35	9.4	60	1	3	3	1	18	23	11	2	0	0	11
August	30.00	30.41	29.70	.71	55.3	60.1	51.2	8.9	80	43	37	91	6	2.11	8	2.78	9.6	55	1	4	4	3	21	20	7	2	0	1	15
September	30.01	30.46	29.20	1.26	53.0	58.0	49.3	8.7	76	40	36	89	6	6.14	14	3.79	11.5	66	1	10	8	4	19	10	7	1	0	3	11
October	30.01	30.65	29.03	1.62	49.9	54.5	46.9	7.6	72	38	34	88	7	8.00	16	4.69	15.0	80	1	14	15	7	13	4	6	2	0	7	5
November	29.97	30.59	28.96	1.63	45.9	50.1	43.2	6.9	65	25	40	86	8	12.09	23	4.49	19.2	84	1	9	16	7	13	6	6	2	0	15	2
December	29.96	30.65	28.66	1.99	43.9	46.8	40.3	6.5	60	19	41	86	8	14.59	24	4.28	20.8	90	1	6	25	8	9	5	6	2	0	14	1
Mean	30.00	...	...	...	48.1	52.4	44.7	7.7	...	...	...	87	7	...	...	...	14.9	...	...	...	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...	...	...	...	...	88.78	205	...	...	...	13	82	150	59	162	129	107	28	0	84	60

Meteorological table compiled by the United States Weather Bureau—Continued.

NEAH BAY, WASH.

Month.	Barometer at 32° F. and mean sea level.				Air temperature, in degrees F.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.										Number of days with winds of 40 miles or over.	Number of days dense fog.
	Mean.	Extremes.			Mean.				Extremes.								Statute miles.		Average number of times (observations at 8 a. m. and 8 p. m.) from—										
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 inch or more.	Maximum fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	Ins.	Ins.	Ins.	°	°	°	°	°	°	°	%		Ins.		Ins.													
January	29.98	30.64	29.11	1.53	40.8	45.8	35.8	10.0	65	8	57	91	8	15.00	22	4.00	[1] 9.1	[1] 54	0	0	26	12	4	12	6	0	2	[1] 1	0
February	30.00	30.45	28.84	1.61	41.0	46.3	35.8	10.5	60	5	55	87	8	11.96	22	3.84	10.8	56	0	0	24	8	2	10	10	0	2	3	0
March	29.96	30.61	29.10	1.51	44.3	50.6	38.0	12.6	65	22	43	84	8	10.09	18	4.03	7.9	44	0	2	16	10	2	10	18	2	2	0	0
April	30.00	30.46	29.21	1.25	47.1	54.7	39.5	15.2	69	27	42	84	7	8.43	18	3.86	7.4	44	0	0	10	10	2	16	18	2	2	0	0
May	30.01	30.46	29.47	.99	51.7	59.6	43.8	15.8	81	33	48	88	8	5.76	22	2.34	6.8	36	0	0	6	8	2	16	24	4	2	0	0
June	30.02	30.40	29.65	.75	55.3	63.2	47.4	15.8	78	36	42	85	7	5.02	15	2.67	7.7	44	0	0	6	4	2	16	26	4	2	0	0
July	30.05	30.27	29.72	.55	58.3	66.2	50.4	15.8	80	39	41	85	6	1.78	7	1.10	7.7	36	0	0	4	2	2	20	24	6	4	0	1
August	30.00	30.40	29.71	.69	58.4	66.1	50.7	15.4	88	40	48	88	5	1.81	6	1.30	6.5	35	0	0	6	2	2	10	32	4	6	0	4
September	30.01	30.37	29.24	1.13	54.8	62.0	47.7	14.3	77	36	41	88	5	6.08	9	3.05	5.6	38	2	0	16	4	2	10	20	2	4	0	4
October	30.01	30.50	29.07	1.43	50.4	56.4	44.4	12.0	72	27	45	91	7	10.22	19	2.28	6.7	42	0	1	24	7	2	12	11	1	4	0	2
November	29.97	30.44	29.20	1.24	46.4	51.6	41.2	10.4	62	25	37	91	8	15.50	23	3.81	8.0	60	0	0	24	8	4	10	12	0	2	0	0
December	29.96	30.55	28.99	1.56	43.3	48.6	37.9	10.7	63	18	45	90	8	16.39	23	3.66	9.4	60	0	0	20	12	4	12	12	0	2	2	0
Mean	30.00	.....	.....	.....	49.4	56.0	42.7	13.3	.....	.....	.....	88	7	.....	.....	.....	7.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	108.94	204	.....	.....	.....	2	3	182	87	30	154	213	25	34	6	11

[1] Four years' record.

SEATTLE, WASH.

January	30.05	30.71	28.80	1.91	39.3	44.2	35.9	8.3	61	11	50	85	8	4.52	20	2.19	7.5	57	10	6	8	16	15	4	1	2	0	2	2
February	30.06	30.67	28.99	1.68	40.5	47.3	37.1	10.2	67	12	55	80	7	3.86	18	1.89	7.6	53	9	5	8	11	11	5	2	5	0	1	4
March	29.99	30.59	29.22	1.37	44.2	51.0	38.1	12.9	75	20	55	76	6	3.60	16	2.92	7.5	47	11	7	7	10	10	8	3	6	0	1	4
April	30.03	30.61	29.24	1.37	49.4	57.7	42.0	15.7	85	31	54	72	6	2.68	15	1.74	7.0	55	8	5	5	10	9	9	5	8	1	1	2
May	30.01	30.52	29.30	1.22	55.0	62.8	46.9	15.9	90	36	54	72	6	2.32	15	1.30	6.6	44	10	5	4	10	13	7	6	6	1	0	0
June	30.00	30.48	29.43	1.05	60.1	67.8	51.2	16.6	96	42	54	71	6	1.72	10	1.18	6.4	47	9	7	3	8	12	7	6	7	1	0	0
July	30.04	30.43	29.68	.75	63.5	73.3	54.7	18.6	95	48	47	69	4	.69	5	1.00	5.7	48	13	8	2	6	8	5	7	12	1	0	0
August	30.00	30.44	29.62	.82	63.1	72.2	54.8	17.4	92	46	46	72	4	.49	4	1.05	5.1	30	11	7	2	7	9	6	7	11	2	0	2
September	30.01	30.42	29.35	1.07	57.9	66.0	51.0	15.0	87	36	51	76	6	1.93	10	1.64	5.5	42	12	6	4	10	11	5	5	6	1	0	5
October	30.05	30.69	29.07	1.62	50.8	58.4	46.4	12.0	81	31	50	82	7	2.88	12	2.22	5.9	48	14	5	5	14	11	5	3	5	0	1	7
November	30.04	30.67	29.01	1.66	44.5	50.7	41.2	9.5	68	15	53	86	8	5.86	20	2.66	7.3	56	7	6	7	15	15	7	1	2	0	2	5
December	30.01	30.69	29.19	1.50	41.2	46.3	38.1	8.2	62	24	38	86	8	6.04	20	2.94	7.3	64	7	6	10	19	12	5	1	2	0	2	5
Mean	30.02	...	...	...	50.8	58.2	44.8	13.4	...	...	...	77	6	...	...	...	6.6	...	...	...	...	...	...	...	...	...	...	...	...
Total	...	...	...	...	...	...	...	...	...	...	...	...	...	36.59	165	...	...	...	121	73	65	136	136	73	47	72	7	10	36

CURRENTS AT LIGHT VESSELS.

Current observations have been made at San Francisco, Blunts Reef, and Columbia River light vessels for about 16 months, from February, 1915, to June, 1916, and at Umatilla Reef and Swiftsure Bank light vessels for about 6 months in the summer of 1915. These observations are sufficient to permit of the prediction of the tidal currents at the light vessels, but a longer series of observations must be obtained before the predictions can be extended to include the wind currents.

Since, however, a knowledge of the currents which existed at various seasons during one year affords some indication of those which may exist during corresponding seasons of other years, the following statement of facts indicated by the observations is furnished. Navigators are warned, however, that this statement is of value only as furnishing them information general in character, and that they should be very cautious in any attempt to apply information here given to any specific case.

SAN FRANCISCO LIGHT VESSEL.

The tidal current was rotary, turning clockwise, and largely diurnal; that is, revolving in a period of about 25 hours. The average maximum current was about 0.75 knot, setting westward about one hour after lower low water at San Francisco and eastward about the time of higher low water. The tidal current is very greatly affected by wind.

Wind currents.—During January and February the prevailing winds were from the southeast. The prevailing current was westerly to northwesterly, the average velocity at strength being from 1.6 to 2 knots. About one-quarter of the time these velocities were between 2.1 and 2.5 knots. There were short periods every day when the current might be setting easterly or southeasterly, but these periods were of short duration, and the strength was rarely as much as 1 knot. A sustained northwesterly wind of 25 to 40 miles velocity caused a southeasterly current of about 1 knot. Not once during these two months did a southerly or southeasterly current attain a velocity of as much as 1.5 knots. During about one-third of this period the current velocities averaged less than 0.5 knot.

In March the wind was prevailing northwesterly. The direction of the current was generally westerly with an average velocity at strength of 1.4 to 1.8 knots. The duration of easterly and southeasterly currents was a little longer than in January and February, and the strength of these currents was somewhat greater. Sustained northwesterly winds of 23 to 45 miles gave rise to southerly or southeasterly currents of 1.5 knots, and in one case 2 knots. . The greatest velocity observed during the series of observations occurred during March, 1916. The wind had been blowing from the northwest for about two days with a strength of 35 to 45 miles. The greatest current was 2.9 knots in a southwesterly to westerly direction. During about one-third of this period the current velocities were less than 0.5 knot.

From April to July the winds were northwesterly about two-thirds of the time. The prevailing current direction was westerly to northwesterly, the velocity at strength being between 1.3 and 1.7 knots on the average. In calm weather or with light northwesterly winds the current would reverse during the day and set easterly and southeasterly, but the velocities were generally small—less than 1 knot. However, with sustained west or northwest winds of 28 miles and more the current would sometimes run all day to the eastward or southeastward. With a strong northwesterly gale a velocity of 1.8 knots southeasterly was observed. During a little less than one-half of this period the current velocities were less than 0.5 knot.

From August to December the winds were westerly to northwesterly about half the time and the current generally northwesterly, with an average maximum at strength of 1 knot or less. During this period the current would generally revolve clockwise, setting progressively in every direction during the day, but the strongest velocity generally in a northwesterly direction. Light southeasterly winds, however, sometimes kept the current continuously in a northwesterly direction, while sustained northwest winds of 23 miles and over would keep the current continuously southeasterly. Only occasionally was the southeasterly current above 1 knot, the greatest observed being 1.3 knots, while the northwesterly current frequently exceeded 1 knot, the greatest observed being 2 knots. During about three-fourths of this period the current velocity was less than 0.5 knot.

BLUNTS REEF LIGHT VESSEL.

The tidal current was rotary but weak, the average maximum being less than 0.25 knot, and completely masked by wind currents.

Wind currents.—During January, February, and March the prevailing wind was from southeastward to eastward. The current set generally northwestward to northward, with an average maximum of 1 to 1.5 knots, without reversing except with sustained northerly winds. Sustained southerly winds of 34 to 65 miles velocity were accompanied by northerly currents of 1 to 2 knots, and sustained northerly winds of 34 to 65 miles velocity were accompanied by southerly currents of 1 to 2 knots. Sustained northerly winds of 23 miles and over kept the current continuously southerly. The greatest velocity observed during this period, 2.2 knots northwesterly, occurred with sustained southeasterly winds of 48 miles velocity. About one-third of the time the current velocities were less than 0.5 knot.

During April, May, and June the prevailing wind was from northwest to north. The current was generally southerly to southwesterly, reversing only during southerly winds or during periods of calm weather. The average maximum velocity was between 1 and 1.5 knots. The greatest velocity observed during these months was 2.1 knots, occurring with sustained northerly winds of 34 miles velocity. During about one-half of this period the current velocities were less than 0.5 knot.

No observations were taken during July.

During August, September, and October the wind was from the northeastward about half the time. The currents were generally southwesterly, but sustained southeasterly winds would reverse them. The average maximum current velocity was between 0.5 and 1 knot. The greatest velocity observed during these months was 2.4 knots, occurring with sustained northerly winds of 34 miles velocity. During about one-half of this period the current velocities were less than 0.5 knot.

During November and December the wind was from the southeastward more than one-third of the time. The currents generally set with the wind if the latter was at all sustained. Southerly winds caused northerly to northeasterly currents, and northerly winds caused southerly to southwesterly currents, the average maximum velocity being between 0.75 and 1 knot. With sustained southeasterly winds of 48 to 65 miles velocity northwesterly to northerly currents of 2 knots were observed. The greatest velocity observed was 3 knots, accompanied by southeasterly winds of 23 to 34 miles. During about one-third of this period the current velocities were less than 0.5 knot.

COLUMBIA RIVER LIGHT VESSEL.

The tidal current was weak, the average strength being less than 0.25 knot, and completely masked by currents due to the winds and river discharge.

Wind currents.—During January and February the prevailing winds were from the eastward, coming from that direction more than one-third of the time. The prevailing current direction was westerly to northwesterly. The average maximum was between 1.2 and 1.8 knots, but velocities above 2 knots were not uncommon. The greatest velocities occurred in February, the largest observed being 3 knots southwesterly, occurring with northeasterly winds. During about three-fourths of this period the current velocity exceeded 0.5 knot.

In March the prevailing wind was from southward. The prevailing current was westerly, varying from southwest to northwest, with an average maximum of 1.2 to 1.8 knots; velocities above 2 knots occurring only rarely. The greatest velocity observed was 2.2 knots westerly, accompanied by southwesterly winds. During three-fourths of the month the currents exceeded 0.5 knot.

From April to September the prevailing wind was from northwest to north, and the prevailing current set southwest to west, with an average maximum between 1.3 and 2.1 knots, velocities of 2 knots and over being of frequent occurrence. The greatest velocity observed was 3.3 knots in a southwesterly direction, occurring with sustained southwest to west winds of 18 to 28 miles. During about one-sixth of these six months the current was less than 0.5 knot.

From October to December the prevailing wind was from southeastward. The prevailing current was northwesterly with an average maximum between 1.2 and 1.9 knots. Velocities above 2 knots occurred only with strong sustained winds. The greatest velocity observed was 3.4 knots in a westerly direction, coming after strong southeasterly winds. Strong sustained winds would turn the current in their direction. During about one-fifth of these three months the current velocity was less than 0.5 knot.

UMATILLA REEF LIGHT VESSEL.

The tidal current was weak, measuring at time of strength only slightly over 0.25 knot. It set northwestward about an hour after high water at Astoria and southeastward about an hour after low water.

Wind currents.—During May the prevailing wind was from southeastward. The current set in one direction for days at a time, following the wind. The greater part of the time it was running northwestward with an average velocity at strength of 1 to 1.5 knots, although velocities of 2 knots and over were not uncommon. The greatest velocity observed was 3 knots northwesterly, accompanied by easterly and southeasterly winds of 18 to 23 miles velocity. The largest southeasterly current was 1.6 knots. About one-fifth of the time the current was less than 0.5 knot.

From June to September the prevailing winds were from the northwest. The current generally set in a southeasterly direction with average velocity at strength of less than 1 knot. The current rarely reversed, except with sustained easterly or southeasterly winds, the velocities in such cases being small. The greatest northerly velocity observed was 1.4 knots accompanied by an easterly to southeasterly wind of 13 to 40 miles velocity. The greatest velocity observed was 1.7 knots southeasterly. During about one-half of this period the current velocity was less than 0.5 knot.

During October the prevailing wind was from south to southeast. The current generally set northwestward to northward, with an average velocity at strength of a little less than 1 knot, but sustained winds of more than 25 miles an hour would greatly increase this velocity. After several days of sustained south to southeast winds of 23 to 65 miles, a northerly current of 2.5 knots and over was observed. The greatest velocity was 3.3 knots northward, accompanied by southerly to southeasterly winds of 18 to 56 miles velocity. A little more than one-third of the time the current was less than 0.5 knot. In all periods of strong winds, however, the current would run over a knot except for periods of an hour or two during the day.

SWIFTSURE BANK LIGHT VESSEL.

The tidal current was rotary, turning clockwise. At strength its average maximum velocity was a little over 1 knot, setting northwestward about half an hour after low water at Astoria and southeastward about an hour after high water. The current being rotary, there is no true slack, and the least velocity of the tidal current is about 0.75 knot, setting northeastward three and a half hours after low water at Astoria and southwestward four hours after high water. The tidal current varies during the month, largely with the declination of the moon.

Wind currents.—During May the prevailing wind was southeasterly. The current generally reversed, but the strength in the northwesterly direction was larger than in the southeasterly direction, except when continuous northwesterly winds prevailed. The average maximum velocity ranged between 1.4 and 2.1 knots. A sustained easterly or southeasterly wind of 18 miles or more would keep the current continuously westerly and northwesterly. With a northwesterly wind of 34 to 56 miles, a velocity of 2 knots southeastward was observed. About one-eighth of the time the current was less than 0.5 knot.

From June to September the prevailing winds were from west to northwest. There were numerous periods of calm, varying from several hours to more than half a day in duration. In all, calm weather constituted about one-quarter to one-third of the time. The current generally reversed, but the currents in the northwesterly direction were larger than those in the other directions The velocities at strength ranged from 1.4 to 2.1 knots, though occasionally 3 knots was observed. A sustained northwesterly wind of 18 to 28 miles would keep the current continuously southeasterly to southwesterly, but the largest velocities were not much over 1.5 knots. About one-sixth of the time the current was less than 0.5 knot.

During October the prevailing wind was from southeastward. The current generally reversed, but the velocity in the northwesterly direction was on the average the greater. The average maximum in the northwesterly direction ranged between 1.4 and 2.2 knots, though frequently velocities up to 2.4 knots occurred, but only rarely above 2.5 knots. The average maximum in the easterly direction ranged between 0.8 and 1.2 knots, and only once went as high as 2 knots, this with a sustained southerly wind of 23 miles velocity. During this month about one-fifth of the time the current was less than 0.5 knot.

The greatest velocity observed was 3 knots northwestward—twice in July and once in October—in all cases with easterly to southeasterly winds.

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Serial No. 232

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, SUPERINTENDENT

SUPPLEMENT

TO

UNITED STATES COAST PILOT

PACIFIC COAST

CALIFORNIA, OREGON, AND WASHINGTON

[3d Ed., Mar. 30, 1923]

NOTE.—This supplement gives the more important corrections and additions affecting the text of the Coast Pilot volume since its publication. The supplement is so printed that it may be cut up and the slips inserted on the pages affected.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1923

PAGE 8.

New paragraph:

Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies for the year 1923. Price, 10 cents each.

Other publications.—To first sentence of paragraph add "and are for sale from its sales agencies or from the Superintendent of Documents, Washington, D. C."

PAGE 19.

Aids to navigation.—Light and buoy lists are no longer available for free distribution, but are for sale at the sales agencies or Superintendent of Documents, Washington, D. C. The price of the light lists is 30 cents each and the buoy lists 20 cents each.

System of buoyage.—Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white, with the top for a distance of 2 feet painted dark green.

PAGE 20.

Navigation laws.—The present edition of the navigation laws of the United States is 1919.

PAGE 24.

Storm warnings.—Substitute the following:

The small-craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small-craft warnings is made.

The northeast storm warning.—A red pennant above a square red flag with black center displayed by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

The southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southeast.

The southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southwest.

The northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warning.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic, Pacific, and Gulf coasts of the United States and on the following islands

in the Atlantic: Jamaica, Turk Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

PAGE 25.

Radio service.—Add the following information:

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations on the Pacific coast and at Honolulu, as follows:

Stations.	Time.	Standard meridian.		Wave lengths.
		°	′	
San Francisco, Calif.	Noon	120	00	1,908
	10 p. m.	120	00	4,650
San Diego, Calif.	Noon	120	00	1,988 9,800
Honolulu, Hawaii	1.30 p. m.	157	30	2,250 11,500

The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The final signal is a longer contact after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by that bureau. Any of these publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each. Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Radio compass bearings.—The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with

radiotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the position of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agents; price, 20 cents each. Full directions for using them are printed on the reverse side of each chart.

Radio compass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radio compass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position or as a danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radio compass stations keep watch on *800 meters.* Only this wave should be used to call and work with these stations.

Calling a radio compass station.—To obtain a bearing from independent radio compass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal.	Meaning.
QTE.....	What is my true bearing?
QTE.....	Your true bearing is ..... degrees from ..... radio compass station.

The following radio compass stations will be of use for vessels navigating within the limits of this volume:

Stations.	Call letters.	Position.
Cattle Point, Wash.[1]	NFN	Lat. 48° 27′ 04″ N., lon. 122° 57′ 45″ W.
Smith Island, Wash.[1]	NFH	Lat. 48° 19′ 01″ N., lon. 122° 50′ 39″ W.
New Dungeness, Wash.[1]	NFT	Lat. 48° 10′ 36″ N., lon. 123° 07′ 51″ W.
Tatoosh, Wash	NPD	Lat. 48° 23′ 41″ N., lon. 124° 44′ 13″ W.
Ocean Park, Wash	NPE	Lat. 46° 27′ 53″ N., lon. 124° 03′ 16″ W.
Fort Stevens, Oreg	NZS	Lat. 46° 11′ 32″ N., lon. 123° 59′ 15″ W.
Empire, Oreg.[2]	NPF	Lat. 43° 23′ 03″ N., lon. 124° 18′ 58″ W.
Eureka, Calif	NPW	Lat. 40° 41′ 48″ N., lon. 124° 16′ 34″ W.
Point Reyes, Calif	NLG	Lat. 38° 02′ 13″ N., lon. 122° 59′ 36″ W.
Bird Island, Calif.[2]	NLD	Lat. 37° 49′ 27″ N., lon. 122° 32′ 12″ W.
Point Montara, Calif	NLH	Lat. 37° 32′ 02″ N., lon. 122° 31′ 07″ W.
Farrallon Island, Calif	NPI	Lat. 37° 41′ 58″ N., lon. 122° 59′ 56″ W.
Point Arguello, Calif	NPK	Lat. 34° 34′ 43″ N., lon. 120° 38′ 51″ W.
Point Hueneme, Calif	NMD	Ldt. 34° 08′ 43″ N., lon. 119° 12′ 30″ W.
Point Fermin, Calif	NPX	Lat. 33° 42′ 19″ N., lon. 118° 17′ 38″ W.
Point Loma, Calif.[2]	NPL	Lat. 32° 42′ 21″ N., lon. 117° 15′ 17″ W.
Imperial Beach, Calif	NPL	Lat. 32° 35′ 14″ N., lon. 117° 07′ 54″ W.

[1] Limited service. Standing watch during thick and heavy weather.
[2] Out of commission at present. Notice will be given when operation is resumed.

Information has been received from the naval communication superintendent, Pacific coast, that bearings obtained from the following-named radio compass stations are reliable only in the arc of the circle for which each station has been calibrated:

Station.	Call letters.	Arc of calibration.
Eureka	NPW	180° to 5°.
Point Reyes	NLG	120° to 2°.
Bird Island	NLD	120° to 305°.
Farallon Island	NPI	0° to 360°.
Point Montara	NLH	173° to 352°.
Point Arguello	NPK	170° to 360°.
Point Hueneme	NMD	135° to 305°.
Point Fermin	NPX	90° to 200°.
Point Loma	NPL	185° to 350°.
Imperial Beach	NPL	182° to 331°.

NOTE.—The arc of calibration is the sector of the circle of which the compass coil at the radio station is the center, and the bearings are *from* the listed position of the station.

PROCEDURE IN DETAIL.

(*a*) A ship calling the radio compass station or compass control station should make the abbreviation "QTE?" ("What is my bearing?"). This request will be answered by the radio compass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radio compass station.

(*c*) The radio compass station or control station will then reply, repeating the abbreviation "QTE" ("Your bearing from ——— was ——— degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in

degrees of the ship station from the radio compass station, and then the time group giving the time of observations in local standard time. In the case of more than one radio compass connected by land line only, the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radio compass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radio compass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes. When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel.

Mariners until thoroughly familiar with the system are advised to use radio compass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radio compass stations.

Reports.—In order that the operation of shore radio compass stations may be checked, mariners obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars: (1) Name of ship. (2) Name of radio compass station. (3) Date and local standard time at which radio bearing was taken. (4) Bearings given by radio station. (5) Estimated position of ship at above time and dates by methods other than radio. (6) The probable degree of accuracy of the estimated position. (7) Weather conditions at above time. (8) Remarks, if any. (9) Signature of master or responsible navigating officer.

There is no charge for bearings furnished by the U. S. Naval Radio Compass Station.

Radio fog signals.—The following radio fog signals are operated on the Pacific coast by the United States Lighthouse Service: San Francisco Light Vessel, Calif., series of double dashes for 30 seconds, silent 30 seconds; Blunts Reef Light Vessel, single dashes for 30 seconds, silent 35 seconds. (After about May 1, 1923.)

These radio fog signals are intended for the use of vessels equipped with radio compass. By reason of this radio compass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearing may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference. The stations transmit continuously during thick weather and also for one-half hour twice each day, beginning at 9 a. m. and 3 p. m., regardless of weather conditions.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that, through the cooperation of the Seamen's Church Institute with the United States Public Health Service, free medical advice for ships at sea is now available through the coastal radio stations operated on the Atlantic and Pacific coasts of the United States by the Radio Corporation of America.

It is expected that requests for advice will in most instances be made by vessels not carrying a physician, although consultations might be requested in some instances by ships' doctors.

An officer of the Public Health Service, upon receipt of a request for medical advice, furnishes promptly whatever advice seems indicated, couched in language intelligible to a layman.

While the Panama Canal was not included in the original scheme, several requests for medical advice have been received here from ships at sea, and have been given prompt attention.

The United Fruit Co. has established a similar system of free medical advice in the Caribbean and the Gulf of Mexico. A message from a ship's captain to any of the company's radio stations in Central America or Colombia, giving the details of a case of illness or accident on his vessel, will be answered by the company's physicians without charge.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly, but clearly, the symptoms of the person afflicted. Such radiograms should be addressed "Unifruitco" (name of place) and may be sent to any of the following United Fruit Co. hospitals: Santa Marta, Colombia; Port Limon, Costa Rica; Almirante, Panama; Tela, Honduras; Puerto Castilla, Honduras; Puerto Barrios, Guatemala.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's Doctor" followed by name of the steamship.

This free medical service is established primarily for the benefit of ships not carrying doctors. However, should occasion require, ships' doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its subsidiaries are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its subsidiaries or the physicians or surgeons giving the advice as to its accuracy, or for error in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical advice radiograms, radio operators check them "(number of words) DH Medico."

"DH Medico" radiograms will be given preference over all other radiograms, except S O S calls, throughout the radio service of the United Fruit Co. and subsidiary companies.

The coastal stations and hospitals designated to furnish the service in question are as follows:

Coastal radio stations.	Call letters.	Hospitals designated to furnish information.
Chatham, Mass.	WCC	U. S. Marine Hospital No. 70, 67 Hudson Street, New York, N. Y. Alternates: Hospitals 38, 43, 61.
Siasconset, Mass.	WSC	
New York City, N. Y.	WNY	
Cape May, N. J.	WCY	U. S. Veterans' Hospital No. 49, Gray's Ferry Road and Twenty-fourth Street, Philadelphia, Pa. Alternate: U. S. Veterans' Hospital No. 56, Fort McHenry, Baltimore, Md.
Algiers, La.	NAT	U. S. Marine Hospital, No. 14, New Orleans, La.
San Francisco, Calif.	KPH	U. S. Marine Hospital No. 19, Fourteenth Avenue and Lake Street, San Francisco, Calif. Alternate: U. S. Veterans' Hospital No. 24, Palo Alto, Calif.

PAGE 30.

Currents.—Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies for the year 1923. Price, 10 cents each.

Line 3: For "from about 50° north of Point Conception" read "from about 50° north to Point Conception."

PAGE 41.

Paragraph 6, third sentence, strike out after "approach" and substitute the following sentence: "When the log shows Point Vincente is abeam, haul up to pass ½ mile off Point Fermin whistling buoy, and feeling the way cautiously the lead will pick up bottom between Point Vincente and Point Fermin."

PAGE 43.

Last paragraph: Recent surveys confirm the report of the existence of a submarine valley 12 miles northwestward of Cape Mendocino. It is now shown on chart No. 5602.

PAGE 44.

Straits of Fuca to San Francisco.—In view of the fact that Arena Rock is only three-fourths mile inside the 30-fathom curve, and that shoaling is abrupt, vessels approaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms.

PAGE 44.

San Diego Bay and approaches.—For "5106" read "5107."

PAGE 45.

Beacons mark a channel dredged to 11 feet into Glorretta Bay.

Improvements have been made by the Navy along the north shore of San Diego Bay, including an approach channel across Dutch Flat, dredged to 15 feet in 1922; on the north point of North Island; and along the east shore of the bay near National City.

Channels.—The controlling depth to San Diego is 25 feet.

PAGE 46.

Paragraph 2: A water tank near the radio station on Point Loma is prominent.

The tower of the administration building of the Naval Air Station on the northeastern end of North Island forms an excellent landmark for vessels entering the harbor.

PAGE 47.

Strike out paragraph beginning "A light is maintained by the city of San Diego," etc.

PAGE 48.

Bishop Rock.—Last sentence, strike out "gas and."

From seaward.—Last sentence, change to read "When up the gas and whistling buoy, 2¾ miles 184° true from Point Loma Lighthouse, follow directions, San Diego Bay."

PAGE 49.

Directions, San Diego Bay.—Paragraph 2, first and second sentences, change to read, "Having made the gas and whistling buoy or Point Loma Lighthouse, proceed as convenient to a position eastward of the outside bell buoy and on the range through the dredged channel across the bar, keeping clear of the kelp which extend southward from Point Loma." Fourth sentence, after "course," insert "pass westward of a red buoy east of Ballast Point" and add "and westward of gas buoy 4B (flashing red)."

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4. After "course" insert "passing westward of red buoy No. 6, while making turn." Line 4, a nun buoy 6AA is established 35 yards 0° true from beacon No. 8, which is discontinued.

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4.

Paragraph 4, lines 2 and 4: The light maintained by the city has been discontinued. A red light is exhibited from beacon No. 10.

PAGE 52.

Los Angeles Harbor Lighthouse.—The pilasters of the tower are painted black. Extensive improvements have been made in Los Angeles Harbor since the date of this volume. A warehouse and a shed, both constructed of concrete and steel, have been built on Municipal Pier No. 1. The storm warning displays of the United States Weather Bureau are shown from a steel tower on the southeastern part of the warehouse and a light from a prominent water tank located on the roof of the same building. In the West Basin section the southern shore is occupied by shipbuilding slips and a dry dock; the eastern and western shores have been bulkheaded and filling is in progress. A large basin is being dredged in East San Pedro.

The Long Beach channel connecting the East Basin with Long Beach Harbor has been dredged to 20 with a present width of 200 feet. It is to be enlarged to 300 feet with a depth of 30 feet. A drawbridge having a clear span of about 75 feet, usually open, carries the track of the L. A. & S. L. R. R. across the channel. Long Beach Harbor is available for light-draft vessels only. Dredging has been postponed until the flood-control works are completed.

PAGE 52.

Long Beach Harbor.—The outer end of each jetty is marked by a light. The western light is fixed green and the eastern light fixed red.

PAGE 53.

The inner harbor fog bell is near the southeast corner of Municipal Pier No. 1.

Fish Harbor.—The entrance to Fish Harbor is marked by lights.

PAGE 54.

Directions, Los Angeles Harbor.—Paragraph 2: For second sentence substitute "When light No. 2 bears 345° true (NW. by N. mag.), haul to a 342° true (NW. ¾ N. mag.), course passing between gas buoy No. 3 and light No. 2 and 125 yards westward of Reservation Point." Line 6, for "100 yards westward of light No. 6," read "75 yards westward of lights Nos. 4 and 6."

PAGE 59.

Point Conception Lighthouse.—The light is flashing white every 30 seconds (flash 8 seconds, eclipse 22 seconds).

PAGE 62.

It is reported that the shoal making out from the easterly end of St. Nicholas Island has extended to the eastward, and that the outer break is fully 3 miles from the island.

PAGE 63.

Anacapa Island Lighthouse now shows flashing white every 20 seconds.

PAGE 67.

San Simeon Point.—A bell buoy is established three-eighths of a mile southeastward of the point.

San Miguel Island.—The bell buoy three-fourths of a mile southwestward of Point Bennett has been discontinued.

PAGE 78.

Point Santa Cruz.—The light is group flashing white every 15 seconds, 3 flashes.

PAGE 80.

Paragraph 1: A bell buoy has been established 0.6 mile 215° true from the southerly end of Pillar Point.

Halfmoon Bay (from northward).—A bell buoy lies 215° true 0.6 mile from the southerly end of Pillar Point.

PAGE 81.

Point Montara.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

PAGE 85.

Drakes Bay.—A bell buoy is established in 8 fathoms of water about five-eighths mile 103° true (E. ¾ N. mag.) from Chimney Rock.

PAGE 87.

San Francisco Light Vessel.—Last sentence: The submarine bell strikes a group of five strokes every 30 seconds. A radio fog signal is established on the light vessel: Series of double dashes for 30 seconds, silent 30 seconds.

PAGE 88.

Paragraph 3, substitute for last sentence: "The eastern end of Four Fathom Bank is marked by a horizontally striped gas and bell buoy, showing a flashing red light. A red spar buoy lies 330 yards west-northwestward from it."

PAGE 89.

Point Diablo.—A flashing white light, every 10 seconds, is established 50 feet above water at the end of Point Diablo. The fog signal is a siren sounding a group of 2 blasts every 30 seconds.

Lime Point Lighthouse.—The light is changed to group flashing white every 6 seconds.

Mile Rocks Light Station.—The fog signal is changed to an air diaphone. A 10-inch air whistle will be sounded if the diaphone is disabled.

A shoal with a least known depth of 27 feet lies 350 yards north by west from Fort Point Lighthouse. The Fort Point Ledge buoy is moored about 100 yards westward of the shoal in 50 feet of water.

PAGE 92.

Southhampton Shoal.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

Point Richmond (Richmond Harbor).—Improvements are in progress which contemplate a dredged channel 600 feet ~~wide and 24~~ LONG feet wide from Point Richmond to Shoal Point (Point Potrero), protected by a training wall, a suitable turning basin at Shoal Point, and a channel thence to Ellis Slough. The channel is marked by buoys.

Invincible Rock.—Change last part of sentence to read "and is marked off its south side by a red and black nun buoy."

Whiting Rock.—Change last sentence to read: "It is marked off its southern side by a red and black nun buoy." A gas buoy, No. 6, is established 420 yards 253° true from Whiting Rock.

PAGE 93.

Oakland Harbor.—San Antonio Creek fog signal established on the Southern Pacific Co.'s steel tower on the south side of San Antonio Creek, about 1½ miles above the entrance to the creek. The signal is an air siren (1 blast every 20 seconds).

Oakland Harbor fog bell is replaced by an air diaphone.

Alameda Channel Buoy No. 5 is permanently discontinued. The width of the channel at this point is being increased by about 200 feet by dredging the shoal area between the buoy and the face of the new dock of the San Francisco Shipbuilding Co.

A fog bell maintained by the Southern Pacific Co. on the south wing of Southern Pacific Co.'s ferry slip at foot of Broadway sounds a group of 2 strokes every 15 seconds.

PAGE 94.

Oakland.—A flashing red light and echo board is established in 10 feet of water on the southwest point of the shoal on the southerly side of the Southern Pacific Co.'s long wharf.

Oakland Mole fog signal is established on the outer end of south side of the Southern Pacific Co.'s passenger mole, 1,020 yards 356° from Oakland Harbor Lighthouse. The signal is a diaphone (group of 2 blasts every 30 seconds).

Last paragraph: Beacons mark a dredged channel 10 feet deep and 120 feet wide leading into Indigo Slough.

PAGE 95.

Redwood City Slough.—Paragraph 1: The entrance is marked by a flashing red light.

Anchorages, San Francisco Bay.—The explosive anchorage is an area within a radius of 500 yards of a buoy 5,135 yards 155° from Goat Island Lighthouse. Other changes have been made in the anchorage limits in the bay, and the anchorages are shown on Chart 5532.

PAGE 98.

Paragraph 5: For "306 Customhouse," read "509 Customhouse."

Buoy depot.—For "twelfth" read "eighteenth."

PAGE 102.

Bonita Channel.—A range is established. Mile Rock Lighthouse is the front object. The rear mark is 137° from Mile Rock Lighthouse and is a white day mark painted on the cliff.

PAGE 103.

If bound to Mare Island: Line 6, for "50 yards" read "75 yards." A black gas buoy (flashing white) is left 125 yards to port just before reaching the red buoy.

Line 12: The red buoy has been discontinued.

San Pablo Bay.—Dredged channel gas buoys 3 and 7 are discontinued.

PAGE 104.

Petaluma Creek.—The channel has shoaled to a controlling depth of 5 feet across the flats at the entrance to the Northwestern Pacific Railroad bridge.

Mare Island Strait.—A drawbridge connecting Mare Island with the city of Vallejo has been constructed.

PAGE 105.

Napa Creek.—The controlling depth to Napa is 6 feet.

PAGE 106.

Sacramento River.—The present low-water depths are: To Sacramento, 7½ feet; to Colusa, 3½ feet; and to Sidds Landing, 2 feet.

Suisun Slough.—The controlling depth in 1922 was 4½ feet.

Suisun Bay.—A light and echo board have been established at low-water mark near east end of the Middle Ground, 1,125 yards 61° true from Middle Point light.

Paragraph 9: For "Point Reves" read "Point Reyes."

PAGE 107.

Tomales Bay.—The entrance is marked by a bell buoy about 340 yards outside the bar and a can buoy about 300 yards inside the shoalest water on the bar.

PAGE 110.

Point Arena Light Station.—Fog signal is an air diaphone sounding a group of 2 blasts every 60 seconds; blast 1 second, silent 1 second, blast 3 seconds, silent 55 seconds.

PAGE 111.

Greenwood landing.—Line 7, for "telegraph" read "telephone."

PAGE 113.

Stillwell Point has a yellow slide on its south face.

Mendocino Bay.—Next to last line, for "could" read "should."

PAGE 114.

Russian Gulch.—The wire landing has been abandoned.

Paragraph 1, line 11: Strike out "telegraph or."

Caspar anchorage.—Next to last line, strike out "telegraph and."

PAGE 121.

Blunts Reef Light Vessel.—Last sentence change to read, "A submarine bell strikes 2 groups of 2 strokes (2–2) every 30 seconds."

A radio fog signal transmits continuously during thick or foggy weather signals consisting of single dashes for 30 seconds, silent 35 seconds.

PAGE 123.

Trinidad Head Lighthouse.—A fog bell has been established on point of bluff, 126 feet high, about 140 yards 130° true from lighthouse. The signal is 1 stroke every 10 seconds. It will be operated annually from April 1 to December 1.

PAGE 124.

Trinidad Harbor.—A fixed white light has been established on top of Prisoners Rock. It will be maintained from April 1 to November 1 of each year.

PAGE 127.

Crescent City.—A breakwater extending from Battery Point is under construction.

The bell buoy is replaced by a black spar, and a gas and bell buoy showing an occulting white light is established 200 yards eastward to mark the eastern side of the channel.

PAGE 129.

Humbolt Bay.—Paragraph 4, line 7, after "beacon," add "some of which are lighted."

PAGE 130.

Paragraph 1: For "Fairhaven" read "Rolph."

Paragraph 2: The depth of water alongside the wharf on the southwest side of Fields Landing is 20 feet.

PAGE 131.

Quarantine.—For "Fairhaven" read "Rolph."

PAGE 132.

Paragraph 4, substitute the following: "From the gas and whistling buoy steer 116° true (E. ½ S. mag.) for the outside bell buoy. Then steer 140° true (SE. by E. ⅜ E. mag.), heading for Red Bluff, to a position 250 yards southward of spar buoy No. 1. Then steer 146° true (SE. ¾ E. mag.), holding down toward the southern jetty until south of the buoy marking the southern extremity of the shoal off the north jetty. After passing the buoy starboard to pass 100 yards off the southeast point of North Spit. Then steer 34° true (N. by E. ¼ E. mag.) to leave buoy No. 4 close to on the starboard hand; then steer 48° true (NNE. ½ E. mag.) to buoy No. 6. Then steer 31° true (N. by E. mag.), heading for Brosner's wharf light, and select anchorage on the edge of the channel, as desired."

PAGE 140.

Cape Arago Lighthouse.—It has been reported that the Coast Guard lookout station on Coos Head, southern entrance to Coos Bay, under certain conditions of the atmosphere, has been mistaken for Cape Arago Lighthouse.

PAGE 147.

Columbia River Light Vessel.—The submarine bell strikes a group of 5 strokes every 30 seconds.

North Head.—Information has been received through the district communication superintendent, U. S. Navy, that North Head Radio Station, equipped as a duplex station, transmitting and receiving simultaneously and independently, has resumed service.

As a duplex station North Head receives in the former North Head Station and transmits by distant control from the former Astoria Station. The combined station is equipped to furnish continuous service to and from ships, fulfilling in this connection the duties of the former North Head single station. In addition the station conducts communication with southeastern Alaska, fulfilling in this connection the duties of the former Astoria single station.

In view of the increased and improved equipment and the ability of the station to work duplex, it is believed that efficient service to commercial shipping will be possible. It is requested that shipping interests utilize the station as much as possible in order to determine its usefulness.

PAGE 149.

Coquille River.—To enter, line 11: The buoy has been discontinued.

PAGE 150.

Coos Bay.—The controlling depth over the bar was 25 feet June 30, 1922.

PAGE 153.

Umpqua River.—The surveys of 1920 show a considerable change in the shore line and channel at the entrance to the river. The controlling depth was 19 feet in a narrow channel, with lesser depths on each side. The range lights have been discontinued. The controlling depths to Gardiner and Reedsport remain the same. Leeds Island light, bearing 170° true of Three Mile light, bearing 350° true, carries the best water across the shoals into the channel to Reedsport.

PAGE 154.

Paragraph 5: The rock southwestward of Winchester Bay is a group of rocks lying 100 yards off the present shore line.

Reedsport.—Water, gasoline, and fuel oil may be obtained. Wharves with depths of 16 feet alongside are in front of the town.

PAGE 155.

Siuslaw River.—Additional buoys have been established to mark the channel inside the entrance to North Fork Shoal.

PAGE 156.

Yaquina Bay.—Paragraph 3: The south jetty has been extended 2,500 feet beyond the light.

Paragraph 4: In June, 1922, the controlling depth on the bar was 10 feet in a channel 600 feet wide on a straight course over the bar; but there was a channel about 400 feet wide, with a depth of 16 feet, bearing to the south-southwestward from the end of the south jetty.

Newport.—An 18-foot channel has been dredged through the shoal above Newport.

PAGE 157.

The Sow and Pigs.—A beacon now marks the largest rock of the group.

The entrance.—The jetty is completed, but the outer 1,000 has subsided to below low water. In 1922 there was 16 feet over the bar.

PAGE 158.

The main channel.—Seven feet is the controlling depth. The channel to Bay City had a controlling depth of 5 feet in 1922.

Dredging a channel 16 feet and filling in behind a bulkhead has been carried on in the vicinity of the mouth of the Miami River, east of Garibaldi.

PAGE 159.

Nehalem River.—Paragraph 7: Both jetties are completed. The controlling depth across the bar in 1922 was 7 feet in a width of 150 feet and 6 feet for a width of 1,000.

Paragraph 8: The red buoy is discontinued.

PAGE 160.

Baker Bay.—Fort Canby light, fixed red, is established on the easterly extremity of Cape Disappointment. The light is to assist boats to enter the cut-off channel to the westward of Sand Island and will be screened so as to be obscured to the westward of the southerly entrance to this channel. It may be changed to conform with the movements of this channel.

PAGE 161.

Astoria.—The radio station at Astoria is closed.

PAGE 165.

A survey in June, 1922, by the Army Engineers, showed a channel with at least the project depth of 40 feet at mean lower low water for a width of 6,500 feet, including a depth of 43 feet over a width of about 2,000 feet. A draft of 34 feet is practicable at mean lower low water with a "smooth" bar.

From Portland to the sea a draft of 30 feet is usually practicable at low tide from March to July; 27 feet, August to October; and 29 feet, November to February, inclusive. By working the tides 2-foot greater drafts can usually be carried. From Vancouver drafts of 24, 18, and 19 feet are usually practicable during the same periods.

PAGE 168.

New paragraph: A branch hydrographic office is located in the customhouse, Portland. A time ball is dropped at noon (120th meridian time), Sundays and holidays excepted, on the roof of the customhouse.

PAGE 176.

Umatilla Reef Light Vessel.—The submarine bell strikes a group of 4 strokes every 20 seconds.

PAGE 178.

Willapa Bay.—The bar at the entrance is subject to change. At the last survey in 1922 there were two channels across the bar. The northern one carried 22 feet, but is unmarked and is little used. The southern one is buoyed and has a least depth of 26 feet, but spots of 22 and 23 feet were found close to the sailing line, near buoy No. 1.

PAGE 179.

The channel to Bay Center is marked by beacons and buoys.

PAGE 180.

Pilots and towboats.—There are regular pilots. Signal should be hoisted outside the bar and vessels, if possible, should telegraph their expected time of arrival to the Willapa Bay Pilots Association, South Bend, Wash.

Communication.—Line 3, strike out "stopping at Bay Center."

PAGE 187.

Swiftsure Bank Light Vessel.—The submarine bell strikes a group of 6 strokes every 30 seconds.

PAGE 194.

Minor Island light.—The light is now a flashing white every 5 seconds. There is an echo board.

PAGE 196.

Port Crescent.—Port Crescent light is discontinued, and in lieu thereof there is established a gas and bell buoy, showing a flshing white light.

PAGE 199.

Neah Bay.—There is telephone and telegraph connection at Neah Bay. Vessels displaying their signal numbers off Baaddah Point will be reported.

PAGE 200.

Port Angeles.—The cannery wharf is no longer in existence.

PAGE 205.

Admiralty Head.—The light has been discontinued. An electric siren, giving a blast of 3 seconds duration every 30 seconds during fogs, mounted on a white tower on Standard Oil Co.'s wharf at Point Wells is operated and maintained by that company.

PAGE 206.

Narrowstone Point.—The fog signal is now a reed horn, sounding 3 blasts every 30 seconds.

PAGE 207.

Apple Cove Point.—A flashing white light is established on the point.

PAGE 208.

Blakely Rock.—The rock is marked by a flashing red light.

Decatur Reef.—The buoy is a flashing white gas and bell buoy.

PAGE 209.

Irondale.—The iron smelter has been removed.

PAGE 218.

Duwanish Head.—The pleasure resort has been removed.

PAGE 219.

Duwanish River.—The entrance to the east and west waterways are marked by lights. During fogs a bell at the west waterway light sounds 2 strokes every 10 seconds.

Lake Washington Canal.—The controlling depth to Lake Washington on June 30, 1922, was: Puget Sound to locks, 30 feet at mean lower low water; between the locks and Lake Union, 31 feet; and between Lake Union and Lake Washington, 22 feet at normal upper pool level. Lights have been established at salient points along the canal. (See Chart No. 6447.)

PAGE 223.

Seattle.—A branch hydrographic office is located in the Lowman Building.

PAGE 224.

Blakely Rock.—The rock is marked by a flashing red light.

PAGE 226.

Point Brown.—The lighting characteristic of the light is a group of 3 flashes every 15 seconds.

PAGE 227.

Robinson Point.—The light is now a group flashing white every 12 seconds, flash 3 seconds, eclipse 1 second, flash 5 seconds, eclipse 5 seconds.

Gig Harbor.—A fixed red light is established on the southerly end of the sand spit on easterly side of entrance to Gig Harbor.

PAGE 229.

Agate Passage.—A light on the west side of channel through Agate Passage, opposite Agate Point, and two red buoys, mark the channel through the passage. Six buoys and two lighters mark the torpedo range in the northern part of Port Orchard. A red flag hoisted on the south dock at the torpedo station and one displayed on the southern lighter indicates that torpedo firing is in progress and vessels are to keep well to the east side of the channel clear of the range, keeping a bright lookout for torpedoes and clear of same.

PAGE 230.

Waterman Point.—The light is occulting white, every 6 seconds. A fog bell sounds 1 stroke every 5 seconds.

Direction, Port Orchard.—Two nun buoys have been established on the northeast side of Richs Passage and an unlighted range to guide northward of a ridge with 5 fathoms of water over it.

PAGE 234.

Tacoma Harbor.—A dry dock for vessels up to 500 feet long, 85 feet beam, and 26½ feet draft is at Tacoma.

PAGE 242.

Olympia Harbor.—Additional beacons are established to mark the eastern side of the easterly dredged channel into Olympia Harbor. There are shipyards at Olympia equipped for making repairs to vessels above the water line.

PAGE 244.

San Juan Island.—A fog signal has been established at Lime Kiln Light Station. It is a reed horn which sounds a group of 2 blasts every 20 seconds, blast 2 seconds, silent 4 seconds, blast 2 seconds, silent 12 seconds.

A rock with a depth of 3 feet over it has been reported to lie 0.8 mile 149° true from Lime Kiln Light. Other rocks are reported southwestward.

Kellet Bluff.—A light, flashing white every 3 seconds, is established near the southerly end of the west side of Henry Island.

PAGE 250.

Puffin Island.—A flashing white light is established 25 feet above water, on the roof of a small white house on the northeasterly side of the island.

PAGE 254.

Belle Rock.—A beacon, white square house on gray cylindrical base, has been established on Belle Rock. Strike out second sentence.

PAGE 260.

Point Roberts.—The light is now flashing white every 3 seconds.

PAGE 263.

Substitute the following information:

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY.

COAST PILOTS.

	Price.
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to New York, including Long Island Sound	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.75
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to New Orleans	.30
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
U. S. Coast Pilot, Hawaiian Islands	.30
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	.75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	.75

FIELD STATIONS.

Boston, Mass., Appraisers Building, 308 Atlantic Avenue.
New York, N. Y., Room 311, 78 Broad Street.
New Orleans, La., Room 314, Customhouse.
San Francisco, Calif., Room 509, Customhouse.
Seattle, Wash., Room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations complete files of the United States Coast and Geodetic Survey charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

○

Serial No. 253

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

SUPPLEMENT

TO

UNITED STATES COAST PILOT

PACIFIC COAST

CALIFORNIA, OREGON, AND WASHINGTON

January 2, 1924

NOTE.—This supplement gives the more important corrections and additions affecting the text of the Coast Pilot volume since its publication. The supplement is so printed that it may be cut up and the slips inserted on the pages affected.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

PAGE 8.

New paragraph:

Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies for the year 1924. Price, 10 cents each.

Other publications.—To first sentence of paragraph add "and are for sale from its sales agencies or from the Superintendent of Documents, Washington, D. C."

PAGE 19.

Aids to navigation.—Light and buoy lists are no longer available for free distribution, but are for sale at the sales agencies or Superintendent of Documents, Washington, D. C. The price of the light lists is 30 cents each and the buoy lists 20 cents each.

System of buoyage.—Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white, with the top for a distance of 2 feet painted dark green.

PAGE 20.

Navigation laws.—The present edition of the navigation laws of the United States is 1923.

PAGE 24.

Storm warnings.—Substitute the following:

The small-craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small-craft warnings is made.

The northeast storm warning.—A red pennant below a square red flag with black center display by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

The southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southeast.

The southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southwest.

The northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warnings.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic, Pacific, and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turk Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

PAGE 25.

Radio service.—Add the following information:

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations on the Pacific coast and at Honolulu, as follows:

Stations.	Time.	Standard meridian.	Wave lengths.
		° ′	
San Francisco, Calif.	Noon	120 00	1,908
	10 p. m.	120 00	4,650
San Diego, Calif.	Noon	120 00	1,988 9,800
Honolulu, Hawaii	1.30 p. m.	157 30	2,250 11,500

The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The final signal is a longer contact after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by that bureau. Any of these publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each (except Amateur Radio Stations, which sells at 25 cents). Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Radio compass bearings.—The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with ra-

diotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the position of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agent; price, 20 cents each. Full directions for using them are printed on the reverse side of each chart.

Radio compass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radio compass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position or as danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radio compass stations keep watch on *800 meters*. Only this wave should be used to call and work with these stations.

Calling a radio compass station.—To obtain a bearing from independent radio compass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal.	Meaning.
QTE.....	What is my true bearing?
QTE.....	Your true bearing is ..... degrees from ..... radio compass station.

The following radio compass stations will be of use for vessels navigating within the limits of this volume:

Stations.	Call letters.	Position.	Arc of calibration.
Cattle Point, Wash	NFN	Lat. 48° 27′ 04″ N., lon. 122° 57′ 45″ W.	120° to 280°.
Smith Island, Wash	NFH	Lat. 48° 19′ 04″ N., lon. 122° 50′ 39″ W.	0° to 360°.
New Dungeness, Wash	NFT	Lat. 48° 10′ 36″ N., lon. 123° 07′ 51″ W.	240° to 110°.
Tatoosh, Wash	NPD	Lat. 48° 23′ 41″ N., lon. 124° 44′ 13″ W.	180° to 90°.
Ocean Park, Wash	NPE	Lat. 46° 27′ 53″ N., lon. 124° 03′ 16″ W.	195° to 340°.
Fort Stevens, Oreg	NZS	Lat. 46° 11′ 32″ N., lon. 123° 59′ 15″ W.	175° to 335°.
Empire, Oreg	NPF	Lat. 43° 23′ 03″ N., lon. 124° 18′ 58″ W.	230° to 10°.
Eureka, Calif	NPW	Lat. 40° 41′ 48″ N., lon. 124° 16′ 34″ W.	180° to 5°.
Point Reyes, Calif	NLG	Lat. 38° 02′ 13″ N., lon. 122° 59′ 56″ W.	120° to 2°.
Bird Island, Calif[2]	NLD	Lat. 37° 49′ 27″ N., lon. 122° 32′ 12″ W.	120° to 305°.
Point Montara, Calif	NLH	Lat. 37° 32′ 02″ N., lon. 122° 31′ 07″ W.	173° to 352°.
Farrallon Island, Calif	NPI	Lat. 37° 41′ 58″ N., lon. 122° 59′ 56″ W.	0° to 360°.
Point Arguello, Calif	NPK	Lat. 34° 34′ 43″ N., lon. 120° 38′ 51″ W.	170° to 360°.
Point Hueneme, Calif[1]	NMD	Lat. 34° 08′ 43″ N., lon. 119° 12′ 30″ W.	135° to 305°.
Point Fermin, Calif	NPX	Lat. 33° 42′ 19″ N., lon. 118° 17′ 38″ W.	90° to 299°.
Point Loma, Calif[2]	NPL	Lat. 32° 42′ 21″ N., lon. 117° 15′ 17″ W.	185° to 250°.
Imperial Beach, Calif	NPL	Lat. 32° 35′ 14″ N., lon. 117° 07′ 54″ W.	182° to 331°.

[1] Limited service. Standing watch during thick and heavy weather.
[2] Out of commission at present. Notice will be given when operation is resumed.
NOTE.—The arc of calibration is a sector of the circle of which the compass coil at the radio station is the center; the bearings are from the station, clockwise. Compass bearings are reliable only when they fall within the calibrated arcs.

PROCEDURE IN DETAIL.

(*a*) A ship calling the radio compass station or compass control station should make the abbreviation "QTE?" ("What is my bearing?"). This request will be answered by the radio compass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radio compass station.

(c) The radio compass station or control station will then reply, repeating the abbreviation "QTE" ("Your bearing from ——— was ——— degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in degrees of the ship station from the radio compass station, and then the time group giving the time of observations in local standard time. In the case of more than one radio compass connected by land line only, the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radio compass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may

differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radio compass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes. When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel.

Mariners until thoroughly familiar with the system are advised to use radio compass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radio compass stations.

Reports.—In order that the operation of shore radio compass stations may be checked, mariners obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars: (1) Name of ship; (2) name of radio compass station; (3) date and local standard time at which radio bearing was taken; (4) bearings given by radio station; (5) estimated position of ship at above time and dates by methods other than radio; (6) the probable degree of accuracy of the estimated position; (7) weather conditions at above time; (8) remarks, if any; (9) signature of master or responsible navigating officer.

There is no charge for bearings furnished by the U. S. Naval Radio Compass Station.

Radio fog signals.—The following radio fog signals are operated on the Pacific coast by the United States Lighthouse Service: San Francisco Light Vessel, Calif., series of double dashes for 30 seconds, silent 30 seconds; Blunts Reef Light Vessel, single dashes for 30 seconds, silent 35 seconds: Columbia River Light Vessel, series of 3 dashes for 20 seconds, silent for 20 seconds.

These radio fog signals are intended for the use of vessels equipped with radio compass. By reason of this radio compass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or with-

out knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearing may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference. The stations transmit continuously during thick weather and also for one-half hour twice each day, begining at 9 a. m. and 3 p. m., regardless of weather conditions.

Radio fog signals on the San Francisco Light Vessel and on the Blunts Reef Light Vessel sound the station characteristic, on 1,000-meter wave lengths, when there is fog or thick haze within a distance of approximately 10 miles from the light vessel. The signal may be heard by vessels for a distance of 25 miles or more from the light vessel. Radio fog signals on the San Francisco and Blunts Reef Light Vessels will be sounded on 1,000-meter wave lengths upon request of a vessel desiring to test or calibrate its radio compass or to check its position.

At about 8 a. m., 12 noon, and 8 p. m. daily each light vessel will broadcast, on 600-meter wave lengths, weather reports pertaining to existing weather conditions in the immediate vicinity of the light vessel and will furnish such weather reports at other times to vessels requesting them. These reports cover only actual weather conditions and forecasts can not be furnished.

Masters of vessels are advised that there is only one radio operator on light vessels and that he is on watch and listens in during the first 15 minutes of each hour from 8 a. m. until 8.15 p. m. daily when there is no fog, and therefore requests, on 600-meter wave lengths, that the signal be sounded should be made at such times.

Beginning January 1, 1924, the radio fog signal on Blunts Reef Light Vessel will be operated during clear weather for the first 15 minutes of each even hour from 10 p. m. to 6 a. m. The radio operator on this vessel maintains watch on 600-meter wave length during the first 15 minutes of each hour from 8 a. m. to 8.15 p. m. daily, except during foggy weather, and will transmit the vessel's radio fog signal for a reasonable length of time upon request from any vessel desiring to obtain bearings by radio compass.

Masters of vessels making use of the radio fog signals transmitted during clear weather are requested to advise the Superintendent of Lighthouses, San Francisco, California, by letter if the increased service is of value to them and if they desire to have such service continued or extended to cover more frequent periods in the future.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards

Scientific Paper No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that, through the cooperation of the Seamen's Church Institute with the United States Public Health Service, free medical advice for ships at sea is now available through the coastal radio stations operated on the Atlantic and Pacific coasts of the United States by the Radio Corporation of America.

It is expected that requests for advice will in most instances be made by vessels not carrying a physician, although consulations might be requested in some instances by ships' doctors.

An officer of the Public Health Service, upon receipt of a request for medical advice, furnishes promptly whatever advice seems indicated, couched in language intelligible to a layman.

While the Panama Canal was not included in the original scheme, several requests for medical advice have been received here from ships at sea, and have been given prompt attention.

The United Fruit Co. has established a similar system of free medical advice in the Caribbean and the Gulf of Mexico. A message from a ship's captain to any of the company's radio stations in Central America or Columbia, giving the details of a case of illness or accident on his vessel, will be answered by the company's physicians without charge.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly, but clearly, the symptoms of the person afflicted. Such radiograms should be addressed "Unifruitco" (name of place) and may be sent to any of the following United Fruit Co. hospitals: Santa Marta, Columbia; Port Limon, Costa Rica; Almirante, Panama; Tela, Honduras; Puerto Castilla, Honduras; Puerto Barrios, Guatemala.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's Doctor" followed by name of the steamship.

This free medical service is established primarily for the benefit of ships not carrying doctors. However, should occasion require ships' doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its subsidiaries are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its subsidiaries or the physicians or surgeons giving the advice as to its accuracy, or for error in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical advice radiograms, radio operators check them "(number of words) DH Medico."

"DH Medico" radiograms will be given preference over all other radiograms, except S O S calls, throughout the radio service of the United Fruit Co. and subsidiary companies.

The coastal stations and hospitals designated to furnish the service in question are as follows:

Coastal radio stations.	Call letters.	Hospitals designated to furnish information.
Chatham, Mass.	WCC	U. S. Marine Hospital No. 70, 67 Hudson Street, New York, N. Y. Alternates: Hospitals 38, 43, 61.
Siasconset, Mass.	WSC	
New York City, N. Y.	WNY	
Cape May, N. J.	WCY	U. S. Veterans' Hospital No. 49, Gray's Ferry Road and Twenty-fourth Street, Philadelphia, Pa. Alternate: U. S. Veterans' Hospital No. 56, Fort McHenry, Baltimore, Md.
Algiers, La.	NAT	U. S. Marine Hospital No. 14, New Orleans, La.
San Francisco, Calif.	KPH	U. S. Marine Hospital No. 19, Fourteenth Avenue and Lake Street, San Francisco, Calif. Alternate: U. S. Veterans' Hospital No. 24, Palo Alto, Calif.

PAGE 30.

Currents.—Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Curent Tables, Pacific Coast of the United States. They are now on sale at the agencies for the year 1924. Price, 10 cents each.

Line 3: For "from about 50° north of Point Conception" read "from about 50° north to Point Conception."

PAGE 41.

Paragraph 6, third sentence, strike out after "approach" and substitute the following sentence: "When the log shows Point Vincente is abeam, haul up to pass ½ mile off Point Fermin whistling buoy, and, feeling the way cautiously, the lead will pick up bottom between Point Vincente and Point Fermin."

PAGE 43.

Last paragraph: Recent surveys confirm the report of the existence of a submarine valley 12 miles northwestward of Cape Mendocino. It is now shown on chart No. 5602.

PAGE 44.

Straits of Fuca to San Francisco.—In view of the fact that Arena Rock is only three-fourths mile inside the 30-fathom curve, and that shoaling is abrupt, vessels aproaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms.

San Diego Bay and approaches.—For "5106" read "5107."

PAGE 45.

San Diego Harbor approach—Torpedo range.—Information has been received from the Commander Aircraft Squadrons Battle Fleet that a torpedo range 4,000 yards in length has been established southward of the whistle buoy in the approach to San Diego Harbor. The range is marked by three white can buoys moored 1,000, 2,000, and 3,000 yards, respectively, 180° from the whistle buoy. Approximate position of whistle buoy, lat. 32° 37′ 20″ N., long. 117° 14′ 40″ W.

Beacons mark a channel dredged to 11 feet into Glorretta Bay.

Improvements have been made by the Navy along the north shore of San Diego Bay, including an approach channel, marked by buoys,

across Dutch Flat, dredged to 15 feet in 1922; on the north point of North Island; and along the east shore of the bay near National City.

Channels.—The controlling depth to San Diego is 35 feet.

PAGE 46.

Paragraph 2: A water tank near the radio station on Point Loma is prominent.

The tower of the administration building of the Naval Air Station on the northeastern end of North Island forms an excellent landmark for vessels entering the harbor.

PAGE 47.

Strike out paragraph beginning "A light is maintained by the city of San Diego," etc.

PAGE 48.

Bishop Rock.—Last sentence, strike out "gas and."

From seaward.—Last sentence, change to read "When up the gas and whistling buoy, 2§ miles 184° true from Point Loma Lighthouse, follow directions, San Diego Bay.

PAGE 49.

Directions, San Diego Bay.—Paragraph 2, first and second sentences, change to read, "Having made the gas and whistling buoy or Point Loma Lighthouse, proceed as convenient to a position eastward of the outside bell buoy and on the range through the dredged channel across the bar, keeping clear of the kelp which extend southward from Point Loma." Fourth sentence, after "course," insert "pass westward of a red buoy east of Ballast Point" and add "and westward of gas buoy 4B (flashing red)."

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4. After "course" insert "passing westward of red buoy No. 6, while making turn." Line 4, a nun buoy 6AA is established 35 yards 0° true from beacon No. 8, which is discontinued.

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4.

Paragraph 4, lines 2 and 4: The light maintained by the city has been discontinued. A red light is exhibited from beacon No. 10.

Newport Bay.—A jetty 2,100 feet long has been constructed from the western point of the entrance to Newport Bay. There is a depth varying from 7 to 14 feet over the bar into the bay, and a depth of 10 feet in the south channel toward the town and a depth of 14 feet in the northern channel to the railroad drawbridge. The entrance is marked by lights on the jetty, a bell buoy off the entrance and a light on the eastern entrance point. Strangers should not attempt to enter without a pilot.

Newport Landing is no longer used commercially.

PAGE 52.

Los Angeles Harbor Lighthouse.—The pilasters of the tower are painted black. Extensive improvements have been made in Los Angeles Harbor since the date of this volume. A warehouse and a

shed, both constructed of concrete and steel, have been built on Municipal Pier No. 1. The storm warning displays of the United States Weather Bureau are shown from a steel tower on the southeastern part of the warehouse and a light from a prominent water tank located on the roof of the same building. In the West Basin section the southern shore is occupied by shipbuilding slips and a dry dock; the eastern and western shores have been bulkheaded and filling is in progress. A large basin is being dredged in East San Pedro.

Drydocking facilities of approximately 12,000 tons are available.

The Long Beach channel connecting the East Basin with Long Beach Harbor has been dredged to 20 feet, with a present width of 200 feet. It is to be enlarged to 300 feet with a depth of 30 feet. A drawbridge having a clear span of about 75 feet, usually open, carries the track of the L. A. & S. L. R. R. across the channel. Long Beach Harbor is available for light-draft vessels only. Dredging has been postponed until the flood-control works are completed.

Long Beach Harbor.—The outer end of each jetty is marked by a light. The western light is fixed green and the eastern light fixed red.

PAGE 53.

The inner harbor fog bell is near the southeast corner of Municipal Pier No. 1.

Fish Harbor.—The entrance to Fish Harbor is marked by lights.

PAGE 54.

Directions, Los Angeles Harbor.—Paragraph 2: For second sentence substitute "When light No. 2 bears 345° true (NW. by N. mag.), haul to a 342° true (NW. ¾ N. mag.), course passing between gas buoy No. 3 and Light No. 2 and 125 yards westward of Reservation Point." Line 6, for "100 yards westward of light No. 6," read "75 yards westward of lights Nos. 4 and 6."

PAGE 59.

Point Conception Lighthouse.—The light is flashing white every 30 seconds (flash 8 seconds, eclipse 22 seconds).

PAGE 62.

It is reported that the shoal making out from the easterly end of St. Nicholas Island has extended to the eastward, and that the outer break is fully 3 miles from the island.

PAGE 63.

Anacapa Island Lighthouse now shows flashing white every 20 seconds.

PAGE 67.

San Simeon Point.—A bell buoy is established three-eighths of a mile southeastward of the point.

San Miguel Island.—The bell buoy three-fourths of a mile southwestward of Point Bennett has been discontinued.

PAGE 78.

Point Santa Cruz.—The light is group flashing white every 15 seconds, 3 flashes.

PAGE 80.

Paragraph 1: A bell buoy has been established 0.6 mile 215° true from the southerly end of Pillar Point.

Halfmoon Bay (from northward).—A bell buoy lies 215° true 0.6 mile from the southerly end of Pillar Point.

PAGE 81.

Point Montara.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

PAGE 83.

Santa Cruz Lighthouse.—The whistling buoy is located 2,240 yards 133° true from Santa Cruz Lighthouse.

PAGE 85.

Drakes Bay.—A bell buoy is established in 8 fathoms of water about five-eighths mile 103° true (E. $\frac{3}{8}$ N. mag.) from Chimney Rock.

PAGE 87.

The Main Ship Channel.—The controlling depth in 1923 was 36 feet.

San Francisco Light Vessel.—Last sentence: The submarine bell strikes a group of five strokes every 30 seconds. A radio fog signal is established on the light vessel: Series of double dashes for 30 seconds, silent 30 seconds. See page 6 this supplement for further information.

PAGE 88.

Paragraph 3, substitute for last sentence: "The eastern end of Four Fathom Bank is marked by a horizontally striped gas and bell buoy, showing a flashing red light. A red spar buoy lies 330 yards west-northwestward from it."

PAGE 89.

Point Diablo.—A flashing white light, every 10 seconds, is established 50 feet above water at the end of Point Diablo. The fog signal is a siren sounding a group of 2 blasts every 30 seconds.

Lime Point Lighthouse.—The light is changed to group flashing white every 6 seconds.

Mile Rocks Light Station.—The fog signal is changed to an air diaphone. A 10-inch air whistle will be sounded if the diaphone is disabled.

A shoal with a least known depth of 27 feet lies 350 yards north by west from Fort Point Lighthouse. The Fort Point Ledge buoy is moored about 100 yards westward of the shoal in 50 feet of water.

PAGE 92.

Southampton Shoal.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

The deep water channel between Red Rock Bank and the northern extension of Southampton Shoal is marked by gas buoys.

Point Richmond (Richmond Harbor).—The controlling depths in the improved sections of this harbor are: 24 feet at mean low water in San Francisco Bay to the municipal basin, thence 22 feet to the head of the project opposite Ellis Landing. The channel is marked by buoys. Fuel oil may be obtained.

Invincible Rock.—Change last part of sentence to read "and is marked off its south side by a red and black nun buoy."

Whiting Rock.—Change last sentence to read: "It is marked off its southern side by a red and black nun buoy." A gas buoy, No. 6 is established 420 yards 253° true from Whiting Rock.

PAGE 93.

San Rafael Creek.—New paragraph: There is a channel 4½ feet deep and 100 feet wide at mean lower low water across the mud flats at the mouth of the creek, thence 5 feet deep through Goose Neck Bend cut off, thence to San Rafael 4½ feet, with a municipal turning basin near the upper end of the channel 5 feet deep. A buoy marks the entrance to the dredged cut and a lighted range the center line of the same.

Oakland Harbor.—San Antonio Creek fog signal established on the Southern Pacific Co.'s steel tower on the south side of San Antonio Creek, about 1½ miles above the entrance to the creek. The signal is an air siren (1 blast every 20 seconds).

Oakland Harbor fog bell is replaced by an air diaphone.

Alameda Channel Buoy No. 5 is permanently discontinued. The width of the channel at this point is being increased by about 200 feet by dredging the shoal area between the buoy and the face of the new dock of the San Francisco Shipbuilding Co.

A fog bell maintained by the Southern Pacific Co. on the south wing of Southern Pacific Co.'s ferry slip at foot of Broadway sounds a group of 1 stroke every 5 seconds.

In 1923 the channel had a depth of 25 feet from deep water in San Francisco Bay to the western Pacific light, thence 29 feet to Webster Street Bridge; thence 30 feet to the Brooklyn Basin; thence 25 feet around the south channel of said basin and 18 feet through the tidal canal to San Leandro Bay.

PAGE 94.

Oakland.—A flashing red light and echo board is established in 10 feet of water on the southwest point of the shoal on the southerly side of the Southern Pacific Co.'s long wharf.

Oakland Mole fog signal is established on the outer end of south side of the Southern Pacific Co.'s passenger mole, 1,020 yards 356° from Oakland Harbor Lighthouse. The signal is a diaphone (group of 2 blasts every 30 seconds).

Last paragraph: Beacons mark a dredged channel 10 feet deep and 120 feet wide leading into Indigo Slough.

PAGE 95.

Redwood City Slough.—Paragraph 1: The entrance is marked by a flashing red light.

The channel dredged by local interests from the head of the Government project to East Bradford Street has shoaled so that the creek bed is bare in some places at low water. The town has established a new terminal at East Bradford Street, but access to it can be had only by vessels of small draft entering at high water

Anchorages, San Francisco Bay.—The explosive anchorage is an area within a radius of 500 yards of a buoy 5,135 yards 155° from Goat Island Lighthouse. Other changes have been made in the anchorage limits in the bay, and the anchorages are shown on Chart 5532.

PAGE 98.

Paragraph 5: For "306 Customhouse," read "509 Customhouse."

Buoy depot.—For "twelfth" read "eighteenth."

PAGE 102.

Bonita Channel.—A range is established. Mile Rock Lighthouse is the front object. The rear mark is 137° from Mile Rock Lighthouse and is a white day mark painted on the cliff.

PAGE 103.

If bound to Mare Island: Line 6, for "50 yards" read "75 yards." A black gas buoy (flashing white) is left 125 yards to port just before reaching the red buoy.

Line 12: The red buoy has been discontinued.

San Pablo Bay.—Dredged channel gas buoys 3 and 7 are discontinued.

The channel across Pinole Shoal in 1923 had a controlling depth of 34 feet, with a depth of 24 feet in Mare Island Strait channel up to dike No. 1, and above dike No. 1 in the turning basin there was a controlling depth of 23 feet in the westerly half and 18 to 24 feet in the easterly half.

PAGE 104.

Petaluma Creek.—The channel has a controlling depth of 4 feet at mean lower low water across the shoal outside the entrance, thence a channel 50 feet wide and 3 feet deep through cut off D to McNears Canal; thence one-half foot deep through the turning basin and cut off E, and above this point one-half foot deep by 35 to 50 feet wide to Washington Street Bridge, Petaluma, the present head of navigation. A bell buoy and echo board have been established near the entrance to the channel across the flats.

Mare Island Strait.—A drawbridge connecting Mare Island with the city of Vallejo has been constructed.

PAGE 105.

Napa Creek.—The controlling depth to Napa is 6 feet.

PAGE 106.

Sacramento River.—The present low-water depths are: To Sacramento, 7 feet; to Colusa, 3 feet; and to Sidds Landing, 2 feet.

Suisun Slough.—The controlling depth in 1923 was 6 feet to the harbor and 4 feet in the harbor.

Suisun Bay.—A light and echo board have been established at low-water mark near east end of the Middle Ground, 1,125 yards 61° true from Middle Point light.

Paragraph 9: For "Point Reves" read "Point Reyes."

PAGE 107.

Tomales Bay.—The entrance is marked by a bell buoy about 340 yards outside the bar and a can buoy about 300 yards inside the shoalest water on the bar.

PAGE 110.

Point Arena Light Station.—Fog signal is an air diaphone sounding a group of 2 blasts every 60 seconds; blast 1 second, silent 1 second, blast 3 seconds, silent 55 seconds.

PAGE 111.

Greenwood Landing.—Line 7, for "telegraph" read "telephone."

PAGE 113.

Stillwell Point has a yellow slide on its south face.

Mendocino Bay.—Next to last line, for "could" read "should."

PAGE 114.

Russian Gulch.—The wire landing has been abandoned.

Paragraph 1, line 11: Strike out "telegraph or."

Caspar anchorage.—Next to last line, strike out "telegraph and."

PAGE 121.

Blunts Reef Light Vessel.—Last sentence change to read, "A submarine bell strikes 2 groups of 2 strokes (2–2) every 30 seconds."

A radio fog signal transmits continuously during thick or foggy weather signals consisting of single dashes for 30 seconds, silent 35 seconds. See page 6, this supplement, for further information.

PAGE 123.

Trinidad Head Lighthouse.—A fog bell has been established on point of bluff, 126 feet high, about 140 yards 130° true from lighthouse. The signal is 1 stroke every 10 seconds. It will be operated annually from April 1 to December 1.

PAGE 124.

Trinidad Harbor.—A fixed white light has been established on top of Prisoners Rock. It will be maintained from April 1 to November 1 of each year.

PAGE 127.

Crescent City.—A breakwater extending from Battery Point is under construction.

The bell buoy is replaced by a black spar, and a gas and bell buoy showing an occulting white light is established 200 yards eastward to mark the eastern side of the channel.

PAGE 129.

Humboldt Bay.—Paragraph 4, line 7, after "beacon," add "some of which are lighted."

PAGE 130.

Paragraph 1: For "Fairhaven" read "Rolph."

Paragraph 2: The depth of water alongside the wharf on the southwest side of Fields Landing is 20 feet.

PAGE 131.

Quarantine.—For "Fairhaven" read "Rolph."

PAGE 132.

Paragraph 4, substitute the following: "From the gas and whistling buoy steer 116° true (E. ½ S. mag.) for the outside bell buoy. Then steer 140° true (SE. by E. ⅜ E. mag.), heading for Red Bluff, to a position 250 yards southward of spar buoy No. 1. Then steer 146° true (SE. ¾ E. mag.), holding down toward the southern jetty until south of the buoy marking the southern extremity of the shoal off the north jetty. After passing the buoy starboard to pass 100 yards off the southeast point of North Spit. Then steer 34° true (N. by E. ¼ E. mag.) to leave buoy No. 4 close to on the starboard hand; then steer 48° true (NNE. ½ E. mag.) to buoy No. 6. Then steer 31° true (N. by E. mag.), heading for Brosner's wharf light, and select anchorage on the edge of the channel, as desired."

Humboldt Bay.—Humboldt Bay entrance range has been discontinued.

PAGE 140.

Cape Arago Lighthouse.—It has been reported that the Coast Guard lookout station on Coos Head, southern entrance to Coos Bay, under certain conditions of the atmosphere, has been mistaken for Cape Arago Lighthouse.

PAGE 147.

Columbia River Light Vessel.—The submarine bell strikes a group of 5 strokes every 30 seconds.

North Head.—Information has been received through the district communication superintendent, U. S. Navy, that North Head Radio Station, equipped as a duplex station, transmitting and receiving simultaneously and independently, has resumed service.

As a duplex station North Head receives in the former North Head Station and transmits by distant control from the former Astoria Station. The combined station is equipped to furnish continuous service to and from ships, fulfilling in this connection the duties of the former North Head single station. In addition the sta-

tion conducts communication with southeastern Alaska, fulfilling in this connection the duties of the former Astoria single station.

In view of the increased and improved equipment and the ability of the station to work duplex, it is believed that efficient service to commercial shipping will be possible. It is requested that shipping interests utilize the station as much as possible in order to determine its usefulness.

PAGE 149.

Coquille River.—To enter, line 11: The buoy has been discontinued.

PAGE 150.

Coos Bay.—The controlling depth over the bar was 25 feet June, 1923. The controlling depth on the rocky shoal off Coos Head is 24 feet, with a depth 18 feet to the head of the bay.

The dredged channel west of the drawbridge, near North Point has shoaled to 10 feet, and to carry 20 feet vessels must keep south of the range between buoys Nos. 14 and 11.

PAGE 151.

Coos River.—Last line, for "5" read "4." The Marshfield Channel in addition to the beacons is marked by a lighted range.

PAGE 153.

Umpqua River.—The surveys of 1920 show a considerable change in the shore line and channel at the entrance to the river. The controlling depth in 1923 was 14 feet in a narrow channel, with lesser depths on each side. The range lights have been discontinued. The controlling depths to Gardiner and Reedsport remain the same. Leeds Island light, bearing 170° true of Three Mile light, bearing 350° true, carries the best water across the shoals into the channel to Reedsport.

PAGE 154.

Paragraph 5: The rock southwestward of Winchester Bay is a group of rocks lying 100 yards off the present shore line.

Reedsport.—Water, gasoline, and fuel oil may be obtained. Wharves with depths of 16 feet alongside are in front of the town.

PAGE 155.

Siuslaw River.—Additional buoys have been established to mark the channel inside the entrance to North Fork Shoal.

PAGE 156.

Yaquina Bay.—Paragraph 3: The south jetty has been extended 2,500 feet beyond the light, and a red buoy lies 40 yards off the submerged end.

Paragraph 4: In June, 1923, the controlling depth on the bar was 13 feet in a channel 400 feet wide on a straight course over the bar; at present the channel is about on the range line.

Newport.—An 18-foot channel has been dredged through the shoal above Newport.

PAGE 157.

The Sow and Pigs.—A beacon now marks the largest rock of the group.

The entrance.—The jetty is completed, but the outer 1,000 has subsided to below low water. In 1922 there was 16 feet over the bar.

PAGE 158.

The main channel.—Seven feet is the controlling depth. The channel to Bay City had a controlling depth of 7 feet in 1923.

Dredging a channel 16 feet and filling in behind a bulkhead has been carried on in the vicinity of the mouth of the Miami River, east of Garabaldi.

PAGE 159.

Nehalem River.—Paragraph 7: Both jetties are completed. The controlling depth across the bar in 1923 was 11 feet in a width of 400 feet and 9 feet for a width of 1,000.

Paragraph 8: The red buoy is discontinued.

PAGE 160.

Baker Bay.—Fort Canby light, fixed red, is established on the easterly extremity of Cape Disappointment. The light is to assist boats to enter the cut-off channel to the westward of Sand Island and will be screened so as to be obscured to the westward of the southerly entrance to this channel. It may be changed to conform with the movements of this channel.

PAGE 161.

Astoria.—The radio station at Astoria is closed.

PAGE 162.

Longview.—Just westward of the mouth of Cowlitz River, and opposite Ranier, is the city of Longview, built around the activities of a large lumber development. A dock is under construction, with a project depth of 30 feet along the face and berthing space of 1,800 feet. A temporary dock, just eastward of the permanent construction, is built out to the 30-foot contour.

PAGE 165.

A survey in June, 1923, by the Army Engineers, showed a channel with at least the project depth of 40 feet at mean lower low water for a width of 6,500 feet. Depths between the 40-foot contour ranged up to 44 feet. A draft of 34 feet is practicable at mean lower low water under ordinary weather conditions.

From Portland to the sea a draft of 30 feet is usually practicable at low tide from March to July; 27 feet, August to October; and 29 feet, November to February, inclusive. By working the tides 2-foot greater drafts can usually be carried. From Vancouver drafts of 24, 18, and 19 feet are usually practicable during the same periods.

PAGE 168.

New paragraph: A branch hydrographic office is located in the customhouse, Portland. A time ball is dropped at noon (120th meridian time), Sundays and holidays excepted, on the roof of the customhouse.

PAGE 176.

Umatilla Reef Light Vessel.—The submarine bell strikes a group of 4 strokes every 20 seconds.

PAGE 178.

Willapa Bay.—The bar at the entrance is subject to change. At the last survey in 1922 there were two channels across the bar. The northern one carried 22 feet, but is unmarked and is little used. The southern one is buoyed and has a least depth of 26 feet, but spots of 22 and 23 feet were found close to the sailing line, near buoy No. 1.

PAGE 179.

The channel to Bay Center is marked by beacons and buoys.

PAGE 180.

Pilots and towboats.—There are regular pilots. Signals should be hoisted outside the bar, and vessels, if possible, should telegraph their expected time of arrival to the Willapa Bay Pilots Association, South Bend, Wash.

Communication.—Line 3, strike out "stopping at Bay Center."

PAGE 182.

Grays Harbor.—The controlling depth across the bar in 1923 was 20 feet.

PAGE 187.

Swiftsure Bank Light Vessel.—The submarine bell strikes a group of 6 strokes every 30 seconds.

PAGE 194.

Minor Island light.—The light is now a flashing white every 5 seconds. There is an echo board.

PAGE 196.

Port Crescent.—Port Crescent light is discontinued, and in lieu thereof there is established a gas and bell buoy, showing a flashing white light.

PAGE 199.

Neah Bay.—There is telephone and telegraph connection at Neah Bay. Vessels displaying their signal numbers off Baaddah Point will be reported.

PAGE 200.

Port Angeles.—The cannery wharf is no longer in existence.

PAGE 205.

Admiralty Head.—The light has been discontinued. An electric siren, giving a blast of 3 seconds duration every 30 seconds during fogs, mounted on a white tower on Standard Oil Co.'s wharf at Point Wells, is operated and maintained by that company.

PAGE 206.

Narrowstone Point.—The fog signal is now a reed horn, sounding 3 blasts every 30 seconds.

PAGE 207.

Apple Cove Point.—A flashing white light is established on the point.

PAGE 208.

Blakely Rock.—The rock is marked by a flashing red light.

Decatur Reef.—The buoy is a flashing white gas and bell buoy.

PAGE 209.

Irondale.—The iron smelter has been removed.

PAGE 218.

Duwanish Head.—The pleasure resort has been removed.

PAGE 219.

Duwanish River.—The entrance to the east and west waterways are marked by lights. During fogs a bell at the west waterway light sounds 2 strokes every 10 seconds.

Lake Washington Canal.—The controlling depth to Lake Washington on June 30, 1923, was: Puget Sound to locks, 30 feet at mean lower low water; between the locks and Lake Union, 31 feet; and between Lake Union and Lake Washington, 22 feet at normal upper pool level. Lights have been established at salient points along the canal, and a light and fog signal in Shilshole Bay. (See Chart No. 6447.)

PAGE 223.

Seattle.—A branch hydrographic office is located in the Lowman Building.

PAGE 224.

Blakely Rock.—The rock is marked by a flashing red light.

PAGE 226.

Point Brown.—The lighting characteristics of the light is a group of 3 flashes every 15 seconds.

PAGE 227.

Robinson Point.—The light is now a group flashing white every 12 seconds, flash 3 seconds, eclipse 1 second, flash 5 seconds, eclipse 5 seconds.

Gig Harbor.—A fixed red light is established on the southerly end of the sand spit on easterly side of entrance to Gig Harbor.

PAGE 229.

A rock with little water over it at low tide lies 150 yards 150½° true from the southwest corner of the dock located about midway between Lamola and Poulsbo, on the eastern side of Liberty Bay.

Agate Passage.—A light on the west side of channel through Agate Passage, opposite Agate Point, and two red buoys, mark the channel through the passage. Six buoys and two lighters mark the torpedo range in the northern part of Port Orchard. A red flag hoisted on the south dock at the torpedo station and one displayed on the southern lighter indicates that torpedo firing is in progress and vessels are to keep well to the east side of the channel clear of the range, keeping a bright lookout for torpedoes and clear of same.

PAGE 230.

Waterman Point.—The light is occulting white, every 6 seconds. A fog bell sounds 1 stroke every 5 seconds.

Direction, Port Orchard.—Two nun buoys have been established on the northeast side of Richs Passage and an unlighted range to guide northward of a ridge with 5 fathoms of water over it.

PAGE 234.

Tacoma Harbor.—A dry dock for vessels up to 500 feet long, 85 feet beam, and 26½ feet draft is at Tacoma.

PAGE 242.

Olympia Harbor.—Additional beacons are established to mark the eastern side of the easterly dredged channel into Olympia Harbor. There are shipyards at Olympia equipped for making repairs to vessels above the water line.

PAGE 244.

San Juan Island.—A fog signal has been established at Lime Kiln Light Station. It is a reed horn which sounds a group of 2 blasts every 20 seconds, blast 2 seconds, silent 4 seconds, blast 2 seconds, silent 12 seconds.

A cluster of rocks about 80 yards in diameter, awash at mean lower low water lies 0.97 mile 148° true from Lime Kiln lighthouse.

Kellet Bluff.—A light, flashing white every 3 seconds, is established near the southerly end of the west side of Henry Island.

PAGE 250.

Puffin Island.—A flashing white light is established 25 feet above water, on the roof of a small white house on the northeasterly side of the island.

PAGE 251.

Blind Bay.—A rock partly bare at low water is reported to lie about 100 yards E. by S. ½ S. mag. from Blind Island at entrance to Blind Bay.

PAGE 254.

Belle Rock.—A beacon, white square house on gray cylindrical base, has been established on Belle Rock. Strike out second sentence.

Burrows Bay.—Last sentence: The light has been discontinued.

PAGE 260.

Paragraph 1.—Last line: A flashing white light has been established on Eliza Rock, just southward of the southern part of Eliza Island.

Drayton Harbor.—A vessel reports having struck bottom about midway between the Alaska Packers' dock and the lighthouse, with the lighthouse bearing 261° true; draft of vessel 20′ 8″ forward, 21′ 7″ aft.

Point Roberts.—The light is now flashing white every 3 seconds.

PAGE 263.

Substitute the following information:

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY.

COAST PILOTS.

	Price.
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to New York, including Long Island Sound	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.75
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to New Orleans	.30
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
U. S. Coast Pilot, Hawaiian Islands	.50
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	.75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	.75

FIELD STATIONS.

Boston, Mass., Appraisers Building, 408 Atlantic Avenue.
New York, N. Y., Room 311, 78 Broad Street.
New Orleans, La., Room 314, Customhouse.
San Francisco, Calif., Room 509, Customhouse.
Seattle, Wash., Room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations complete files of the United States Coast and Geodetic Survey Charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

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Serial No. 288

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

SUPPLEMENT

TO

UNITED STATES COAST PILOT

PACIFIC COAST

CALIFORNIA, OREGON, AND WASHINGTON

JULY 11, 1924

NOTE.—This supplement gives the more important corrections and additions affecting the text of the Coast Pilot volume since its publication. The supplement is so printed that it may be cut up and the slips inserted on the pages affected.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1924

PAGE 8.

New paragraph:

Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies for the years 1924 and 1925. Price, 10 cents each.

Other publications.—To first sentence of paragraph add "and are for sale from its sales agencies or from the Superintendent of Documents, Washington, D. C."

PAGE 19.

Aids to navigation.—Light and buoy lists are no longer available for free distribution, but are for sale at the sales agencies or Superintendent of Documents, Washington, D. C. The price of the light lists is 30 cents each and the buoy lists 20 cents each.

System of buoyage.—Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white, with the top for a distance of 2 feet painted dark green.

PAGE 20.

Navigation laws.—The present edition of the navigation laws of the United States is 1923.

PAGE 24.

Storm warnings.—Substitute the following:

The small-craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small-craft warnings is made.

The northeast storm warning.—A red pennant below a square red flag with black center display by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

The southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the southeast.

The southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a red lantern above a white lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the southwest.

The northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warnings.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic, Pacific, and Gulf coasts of the United States and on the following islands

in the Atlantic: Jamaica, Turk Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

PAGE 25.

Radio service.—Add the following information:

Time signals.—In connection with the service over the land telegraph lines time signals by radio are sent daily, Sundays and holidays excepted, from centain United States naval coastwise radio stations on the Pacific coast and at Honolulu, as follows:

Stations	Time	Standard meridian		Wave lengths
		°	′	
San Francisco, Calif.	Noon	120	00	1,908
	10 p. m.	120	00	4,650
San Diego, Calif.	Noon	120	00	1,988 9,800
Honolulu, Hawaii	1.30 p. m.	157	30	2,250 11,500

The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The final signal is a longer contact after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States are published by that bureau. Any of these publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each (except Amateur Radio Stations, which sells at 25 cents). Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Radio compass bearings.—The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with ra-

diotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radio compass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the position of vessels at sea in radio compass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing.

For plotting radio compass bearings the U. S. Coast and Geodetic Survey publishes three plotting charts, which may be obtained by application to the Director, Coast and Geodetic Survey, Washington, D. C., or the sales agent; price, 20 cents each. Full directions for using them are printed on the reverse side of each chart.

Radio compass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radio compass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position or as danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radio compass stations keep watch on *800 meters*. Only this wave should be used to call and work with these stations.

Calling a radio compass station.—To obtain a bearing from independent radio compass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal	Meaning
QTE?.....	What is my true bearing?
QTE.....	Your true bearing is ..... degrees from ..... radio compass station.

The following radio compass stations will be of use for vessels navigating within the limits of this volume:

Stations	Call letters	Position	Arc of calibration
			Degrees
Cattle Point, Wash	NFN	Lat. 48° 27′ 04″ N., lon. 122° 57′ 45″ W	120–280
Smith Island, Wash	NFH	Lat. 48° 19′ 04″ N., lon. 122° 50′ 39″ W	0–360
New Dungeness, Wash	NFT	Lat. 48° 10′ 36″ N., lon. 123° 07′ 51″ W	240–110
Tatoosh, Wash	NPD	Lat. 48° 23′ 41″ N., lon. 124° 44′ 13″ W	180– 90
Klipsan Beach, Wash	NZS	Lat. 46° 27′ 53″ N., lon. 124° 03′ 16″ W	195–340
Fort Stevens, Oreg	NZS	Lat. 46° 11′ 32″ N., lon. 123° 59′ 15″ W	175–335
Empire, Oreg	NPF	Lat. 43° 23′ 03″ N., lon. 124° 18′ 58″ W	230– 10
Eureka, Calif	NPW	Lat. 40° 41′ 48″ N., lon. 124° 16′ 34″ W	204– 25
Point Reyes, Calif	NLG	Lat. 38° 02′ 13″ N., lon. 122° 59′ 36″ W	115– 5
Bird Island, Calif.[1]	NLD	Lat. 37° 49′ 27″ N., lon. 122° 32′ 12″ W	120–305
Point Montara, Calif	NLH	Lat. 37° 32′ 02″ N., lon. 122° 31′ 07″ W	171–360
Farrallon Island, Calif	NPI	Lat. 37° 41′ 58″ N., lon. 122° 59′ 56″ W	0–360
Point Arguello, Calif[1]	NPK	Lat. 34° 34′ 43″ N., lon. 120° 38′ 51″ W	170–360
Point Hueneme, Calif	NMD	Lat. 34° 08′ 43″ N., lon. 119° 12′ 30″ W	135–305
Point Fermin, Calif	NPX	Lat. 33° 42′ 19″ N., lon. 118° 17′ 38″ W	90–295
Point Loma, Calif.[1]	NPL	Lat. 32° 42′ 21″ N., lon. 117° 15′ 17″ W	185–250
Imperial Beach, Calif	NPL	Lat. 32° 35′ 14″ N., lon. 117° 07′ 54″ W	180–340

[1] Out of commission at present. Notice will be given when operation is resumed.

NOTE.—The arc of calibration is a sector of the circle of which the compass coil at the radio station is the center; the bearings are from the station, clockwise. Compass bearings are reliable only when they fall within the calibrated arcs.

PROCEDURE IN DETAIL

(*a*) A ship calling the radio compass station or compass control station should make the abbreviation "QTE?" ("What is my bearing?"). This request will be answered by the radio compass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radio compass station.

(*c*) The radio compass station or control station will then reply, repeating the abbreviation "QTE" ("Your bearing from ——— was ——— degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in degrees of the ship station from the radio compass station, and then the time group giving the time of observations in local standard time. In the case of more than one radio compass connected by land line only, the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radio compass stations, particularly those on islands or ex-

tended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radio compass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes. When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel.

Mariners until thoroughly familiar with the system are advised to use radio compass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed in order to accustom operators to the procedure and to acquaint themselves with the degree of accuracy and dependability of bearings furnished by the radio compass stations.

Reports.—In order that the operation of shore radio compass stations may be checked, mariners obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars: (1) Name of ship; (2) name of radio compass station; (3) date and local standard time at which radio bearing was taken; (4) bearings given by radio station; (5) estimated position of ship at above time and dates by methods other than radio; (6) the probable degree of accuracy of the estimated position; (7) weather conditions at above time; (8) remarks, if any; (9) signature of master or responsible navigating officer.

There is no charge for bearings furnished by the U. S. Naval Radio Compass Station.

Radio fog signals.—The following radio fog signals are operated on the Pacific coast by the United States Lighthouse Service:

San Francisco Light Vessel:	
Series of double dashes	30 seconds
Silent	30 seconds
Blunts Reef Light Vessel:	
Single dashes	60 seconds
Silent	120 seconds
Columbia River Light Vessel:	
Series of three dashes	20 seconds
Silent	20 seconds
Swiftsure Bank Light Vessel:	
Series of double dashes	25 seconds
Silent	25 seconds

These radio fog signals are intended for the use of vessels equipped with radio compass. By reason of this radio compass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog signals, and bearing may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference. The stations transmit continuously during thick weather and also for one-half hour twice each day, beginning at 9 a. m. and 3 p. m., regardless of weather conditions.

Radio fog signals on the San Francisco Light Vessel and on the Blunts Reef Light Vessel sound the station characteristic, on 1,000-meter wave lengths, when there is fog or thick haze within a distance of approximately 10 miles from the light vessel. The signal may be heard by vessels for a distance of 25 miles or more from the light vessel. Radio fog signals on the San Francisco and Blunts there is no fog, and therefore requests, on 600-meter wave lengths, upon request of a vessel desiring to test or calibrate its radio compass or to check its position.

At about 8 a. m., 12 noon, and 8 p. m. daily each light vessel will broadcast, on 600-meter wave lengths, weather reports pertaining to existing weather conditions in the immediate vicinity of the light vessel and will furnish such weather reports at other times to vessels requesting them. These reports cover only actual weather conditions and forecasts can not be furnished.

Masters of vessels are advised that there is only one radio operator on light vessels and that he is on watch and listens in during the first 15 minutes of each hour from 8 a. m. until 8.15 p. m. daily when there is no fog, and therefore requests, on 600-meter wave lengths, that the signal be sounded should be made at such times.

The radio fog signal on Blunts Reef Light Vessel, Columbia River Light Vessel, and Swiftsure Bank Light Vessel will be operated during clear weather for the first 15 minutes of each even hour from 10 p. m. to 6 a. m. The radio operators on these vessels maintain watch on 600-meter wave lengths during the first 15 minutes of each hour from 8 a. m. to 8.15 p. m. daily, except during foggy weather, and will transmit the vessel's radio fog signal for a reasonable length of time upon request from any vessel desiring to obtain bearings by radio compass.

Masters of vessels making use of the radio fog signals transmitted during clear weather are requested to advise the Superintendent of Lighthouses, San Francisco, Calif., by letter if the increased service is of value to them and if they desire to have such service continued or extended to cover more frequent periods in the future.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Radiotelegraphic broadcasts of weather forecasts and information issued by the U. S. Weather Bureau for the benefit of marine interests is made daily on regular schedules on the Pacific coast from naval radio stations.

A major bulletin is broadcast from the naval radio station (NPG) at San Francisco, Calif. This bulletin consists of surface weather conditions based upon observations taken at 8 a. m. and p. m., seventy-fifth meridian time; reports from ships in the Pacific Ocean, reports of upper air observations, a synopsis of general atmospheric conditions and pressure distribution, location of high and low areas, and wind and weather forecasts and storm warnings for the Pacific coast offshore areas. Flying weather forecasts for each of the aviation zones in this district are also given. Code reports from ships at sea follow the data from land stations and can be translated only by means of the Radiographic Code for Vessel Weather Observers, furnished to vessel observers by the Weather Bureau.

The bulletin broadcast at 9 a. m. contains wind and weather forecasts for the ensuing 24 hours beginning at noon and the bulletin broadcast at 7.30 p. m. for the 24 hours beginning at midnight.

SAN FRANCISCO, CALIF. (NPG)

9 a. m., local time (noon, seventy-fifth meridian time), 62 kilocycles (4,850 meters), continuous wave.

7.30 p. m., local time (10.30 p. m., seventy-fifth meridian time), 225 kilocycles (1,333 meters), interrupted continuous wave.

Local bulletins are broadcast daily, including Sundays and holidays, from the following naval radio stations. These bulletins consist of wind and weather forecasts for ocean areas contiguous to the station, storm warnings and advices, weather conditions at the stations, including current barometric pressure, wind direction, and velocity and state of weather. Ships may request any one of these stations to furnish the latest weather forecasts and warnings. The time given in the schedules is local for the station, and its equivalent is given in seventy-fifth meridian time.

Inglewood, Calif. (NPX): 8.30 a. m. and p. m. (11.30 a. m. and p. m., seventy-fifth meridian time), 210 kilocycles (1,430 meters), spark.

Eureka, Calif. (NPW): 9 a. m. and 5.30 p. m. (noon and 8.30 p. m., seventy-fifth meridian time), 136 kilocycles (2,200 meters), spark or continuous wave.

North Head, Wash. (NPE): 5.30 a. m., 9.30 a. m., and 8.30 p. m. (8.30 a. m., 12.30 p. m., and 11.30 p. m., seventy-fifth meridian time), 111 kilocycles (2,700 meters), spark.

Dutch Harbor, Alaska (NPR): 4.30 a. m. and 4.30 p. m. (8.30 a. m. and 8.30 p. m., seventy-fifth meridian time), 133 kilocycles (2,250 meters), spark.

Detailed information regarding these broadcasts and the method of decoding the major bulletin will be found in Weather Bureau circular dated March 1, 1922, which may be obtained upon application to any coastal station of the Weather Bureau or to the Chief of the Weather Bureau, Washington, D. C.

Free medical advice to seamen by radio.—The Seamen's Church Institute, of New York, announces that through the cooperation of the Seamen's Church Institute with the United States Public Health Service free medical advice for ships at sea is now available through the coastal radio stations operated on the Atlantic and Pacific coasts of the United States by the Radio Corporation of America.

It is expected that requests for advice will in most instances be made by vessels not carrying a physician, although consultations might be requested in some instances by ships' doctors.

An officer of the Public Health Service, upon receipt of a request for medical advice, furnishes promptly whatever advice seems indicated, couched in language intelligible to a layman.

While the Panama Canal was not included in the original scheme, several requests for medical advice have been received here from ships at sea and have been given prompt attention.

The United Fruit Co. has established a similar system of free medical advice in the Caribbean and the Gulf of Mexico. A message from a ship's captain to any of the company's radio stations in Central America or Colombia, giving the details of a case of illness or accident on his vessel, will be answered by the company's physicians without charge.

The following information is taken from a circular issued by the United Fruit Co.:

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly, but clearly, the symptoms of the person afflicted. Such radiograms should be addressed "Unifruitco" (name of place) and may be sent to any of the following United Fruit Co. hospitals: Santa Marta, Colombia; Port Limon, Costa Rica; Almirante, Panama; Tela, Honduras; Puerto Castilla, Honduras; Puerto Barrios, Guatemala.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's doctor," followed by name of the steamship.

This free medical service is established primarily for the benefit of ships not carrying doctors. However, should occasion require ships' doctors may hold consulation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its subsidiaries are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients, no responsibility will be assumed by either the company and its subsidiaries or the physicians or surgeons giving the advice as to its accuracy, or for error in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical advice radiograms radio operators check them "(number of words) DH Medico."

"DH Medico" radiograms will be given preference over all other radiograms, except SOS calls, throughout the radio service of the United Fruit Co. and subsidiary companies.

The coastal stations and hospitals designated to furnish the service in question are as follows:

Coastal radio stations	Call letters	Hospitals designated to furnish information
Chatham, Mass	WCC	U. S. Marine Hospital No. 70, 67 Hudson Street, New York, N. Y.
Siasconset, Mass	WSC	Alternates: Hospitals 38, 43, 61.
New York City, N. Y.	WNY	
Cape May, N. J	WCY	U. S. Veterans' Hospital No. 49, Gray's Ferry Road and Twenty-fourth Street, Philadelphia, Pa. Alternate: U. S. Veterans' Hospital No. 56, Fort McHenry, Baltimore, Md.
Algiers, La	NAT	U. S. Marine Hospital No. 14, New Orleans, La.
San Francisco, Calif	KPH	U. S. Marine Hospital No. 19, Fourteenth Avenue and Lake Street, San Francisco, Calif. Alternate: U. S. Veterans' Hospital No. 24, Palo Alto, Calif.

PAGE 30.

Currents.—Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies. Price, 10 cents each.

Line 3: For "from about 50° north of Point Conception" read "from about 50° north to Point Conception."

PAGE 41.

Paragraph 6, third sentence, strike out after "approach" and substitute the following sentence: "When the log shows Point Vincente is abeam, haul up to pass ½ mile off Point Fermin whistling buoy, and, feeling the way cautiously, the lead will pick up bottom between Point Vincente and Point Fermin."

PAGE 43.

Last paragraph: Recent surveys confirm the report of the existence of a submarine valley 12 miles northwestward of Cape Mendocino. It is now shown on chart No. 5602.

PAGE 44.

Straits of Fuca to San Francisco.—In view of the fact that Arena Rock is only three-fourths mile inside the 30-fathom curve, and that shoaling is abrupt, vessels approaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms.

San Diego Bay and approaches.—For "5106" read "5107."

PAGE 45.

San Diego Harbor approach—Torpedo range.—Information has been received from the commander Aircraft Squadrons Battle Fleet that a torpedo range 4,000 yards in length has been established southward of the whistle buoy in the approach to San Diego Harbor. The range is marked by three white can buoys moored 1,000, 2,000, and 3,000 yards, respectively, 180° from the whistle buoy. Approximate position of whistle buoy, lat. 32° 37′ 20″ N., long. 117° 14′ 40″ W.

Beacons mark a channel dredged to 11 feet into Glorretta Bay.

Improvements have been made by the Navy along the north shore of San Diego Bay, including an approach channel, marked by buoys, across Dutch Flat, dredged to 15 feet in 1922; on the north point of North Island; and along the east shore of the bay near National City.

Channels.—The controlling depth to San Diego is 35 feet.

PAGE 46.

Paragraph 2: A water tank near the radio station on Point Loma is prominent.

The tower of the administration building of the naval air station on the northeastern end of North Island forms an excellent landmark for vessels entering the harbor.

PAGE 47.

Strike out paragraph beginning "A light is maintained by the city of San Diego," etc.

PAGE 48.

Bishop Rock.—Last sentence, strike out "gas and."

From seaward.—Last sentence, change to read "When up the gas and whistling buoy, 2⅝ miles 184° true from Point Loma Lighthouse, follow directions, San Diego Bay.

PAGE 49.

Directions, San Diego Bay.—Paragraph 2, first and second sentences, change to read, "Having made the gas and whistling buoy or Point Loma Lighthouse, proceed as convenient to a position eastward of the outside bell buoy and on the range through the dredged channel across the bar, keeping clear of the kelp which extend southward from Point Loma." Fourth sentence, after "course," insert "pass westward of a red buoy east of Ballast Point" and add "and westward of gas buoy 4B (flashing red)."

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4. After "course" insert "passing westward of red buoy No. 6, while making turn." Line 4, a nun buoy 6AA is established 35 yards 0° true from beacon No. 8, which is discontinued.

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4.

Paragraph 4, lines 2 and 4: The light maintained by the city has been discontinued. A red light is exhibited from beacon No. 10.

Newport Bay.—A jetty 2,100 feet long has been constructed from the western point of the entrance to Newport Bay. There is a depth varying from 7 to 14 feet over the bar into the bay, and a depth of 10 feet in the south channel toward the town and a depth of 14 feet in the northern channel to the railroad drawbridge. The entrance is marked by lights on the jetty, a bell buoy off the entrance and a light on the eastern entrance point. Strangers should not attempt to enter without a pilot.

Newport Landing is no longer used commercially.

PAGE 51.

Point Vincente.—A measured mile standardization course has been established at Point Vincente. The range is marked by beacons on shore which in line bear 34° 30′ true.

PAGE 52.

Los Angeles Harbor Lighthouse.—The pilasters of the tower are painted black. Extensive improvements have been made in Los Angeles Harbor since the date of this volume. A warehouse and a shed, both constructed of concrete and steel, have been built on Municipal Pier No. 1. The storm warning displays of the United States Weather Bureau are shown from a steel tower on the southeastern part of the warehouse and a light from a prominent water tank located on the roof of the same building. In the West Basin section the southern shore is occupied by shipbuilding slips and a dry dock; the eastern and western shores have been bulkheaded and filling is in progress. A large basin is being dredged in East San Pedro.

The following regulations are prescribed to govern the opening of the draw spans of bridges in Los Angeles and Long Beach Harbors and across Cerritos Channel connecting those harbors:

1. The draw spans shall be promptly opened for the passage of all vessels unable to pass under the closed bridge upon receiving a signal of one long blast, followed quickly by one short blast of a whistle or horn blown on the vessel.
2. Receipt and understanding of the above signal shall be acknowledged and notice of commencement of bridge opening given by the bridge tender by two short blasts of a whistle or horn blown on the bridge.

Drydocking facilities of approximately 14,500 tons displacement are available.

The Long Beach channel connecting the East Basin with Long Beach Harbor has been dredged to 20 feet, with a present width of 200 feet. It is to be enlarged to 300 feet with a depth of 30 feet. A drawbridge having a clear span of about 75 feet, usually open, carries the track of the L. A. & S. L. R. R. across the channel. Long Beach Harbor is available for light-draft vessels only. Dredging has been postponed until the flood-control works are completed.

Long Beach Harbor.—The outer end of each jetty is marked by a light. The western light is fixed green and the eastern light fixed red.

PAGE 53.

The inner harbor fog bell is near the southeast corner of Municipal Pier No. 1.

Fish Harbor.—The entrance to Fish Harbor is marked by lights.

PAGE 54.

Directions, Los Angeles Harbor.—Paragraph 2: For second sentence substitute "When light No. 2 bears 345° true (NW. by N. mag.), haul to a 342° true (NW. ¾ N. mag.) course passing between gas buoy No. 3 and light No. 2 and 125 yards westward of Reservation Point." Line 6, for "100 yards westward of light No. 6," read "75 yards westward of lights Nos. 4 and 6."

PAGE 59.

Point Conception Lighthouse.—The light is flashing white every 30 seconds (flash 8 seconds, eclipse 22 seconds).

PAGE 62.

It is reported that the shoal making out from the easterly end of St. Nicholas Island has extended to the eastward, and that the outer break is fully 3 miles from the island.

PAGE 63.

Anacapa Island Lighthouse now shows flashing white every 20 seconds.

PAGE 67.

San Simeon Point.—A bell buoy is established three-eighths of a mile southeastward of the point.

San Miguel Island.—The bell buoy three-fourths of a mile southwestward of Point Bennett has been discontinued.

PAGE 78.

Point Santa Cruz.—The light is group flashing white every 15 seconds, 3 flashes.

PAGE 79.

Ano Nuevo Island Lighthouse.—For "black" read "white."

PAGE 80.

Paragraph 1: A bell buoy has been established 0.6 mile 215° true from the southerly end of Pillar Point.

Halfmoon Bay (from northward).—A bell buoy lies 215° true 0.6 mile from the southerly end of Pillar Point.

PAGE 81.

Point Montara.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

PAGE 83.

Santa Cruz Lighthouse.—The whistling buoy is located 2,240 yards 133° true from Santa Cruz Lighthouse.

PAGE 85.

Drakes Bay.—A bell buoy is established in 8 fathoms of water about five-eighths mile 103° true (E. ⅜ N. mag.) from Chimney Rock.

PAGE 87.

The Main Ship Channel.—The controlling depth in 1923 was 36 feet. The project depth of this channel is 40 feet, and dredging is under way.

San Francisco Light Vessel.—Last sentence: The submarine bell strikes a group of five strokes every 30 seconds. A radio fog signal is established on the light vessel: Series of double dashes for 60 seconds, silent 60 seconds. See page 6 this supplement for further information.

PAGE 88.

Paragraph 3, substitute for last sentence: "The eastern end of Four Fathom Bank is marked by horizontal striped gas and bell buoy, showing a flashing red light. A red spar buoy lies 330 yards west-northwestward from it."

PAGE 89.

Point Diablo.—A flashing white light, every 10 seconds, is established 50 feet above water at the end of Point Diablo. The fog signal is a siren sounding a group of 2 blasts every 30 seconds.

Lime Point Lighthouse.—The light is changed to group flashing white every 6 seconds.

Mile Rocks Light Station.—The fog signal is changed to an air diaphone. A 10-inch air whistle will be sounded if the diaphone is disabled.

A shoal with a least known depth of 27 feet lies 350 yards north by west from Fort Point Lighthouse. The Fort Point Ledge buoy is moored about 100 yards westward of the shoal in 50 feet of water.

PAGE 92.

Southampton Shoal.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

The deep-water channel between Red Rock Bank and the northern extension of Southampton Shoal is marked by gas buoys.

Point Richmond (Richmond Harbor).—The controlling depths in the improved sections of this harbor are: 24 feet at mean low water in San Francisco Bay to the municipal basin, thence 22 feet to the head of the project opposite Ellis Landing. The channel is marked by buoys. Fuel oil may be obtained.

Invincible Rock.—Change last part of sentence to read "and is marked off its south side by a red and black nun buoy."

Whiting Rock.—Change last sentence to read: "It is marked off its southern side by a red and black nun buoy." A gas buoy, No. 6, is established 420 yards 253° true from Whiting Rock.

PAGE 93.

San Rafael Creek.—New paragraph: There is a channel 4½ feet deep and 100 feet wide at mean lower low water across the mud flats at the mouth of the creek, thence 5 feet deep through Goose Neck Bend cut-off, thence to San Rafael 4½ feet, with a municipal turning basin near the upper end of the channel 5 feet deep. A buoy marks the entrance to the dredged cut and a lighted range the center line of the same.

Oakland Harbor.—San Antonio Creek fog signal established on the Southern Pacific Co.'s steel tower on the south side of San Antonio Creek, about 1½ miles above the entrance to the creek. The signal is an air siren (1 blast every 20 seconds).

Oakland Harbor fog bell is replaced by an air diaphone.

Alameda Channel Buoy No. 5 is permanently discontinued. The width of the channel at this point is being increased by about 200 feet by dredging the shoal area between the buoy and the face of the new dock of the San Francisco Shipbuilding Co.

A fog bell maintained by the Southern Pacific Co. on the south wing of Southern Pacific Co.'s ferry slip at foot of Broadway sounds a group of 1 stroke every 5 seconds.

In 1924 the channel had a depth of 24 feet from deep water in San Francisco Bay to the Western Pacific Light; thence 28 feet to Webster Street Bridge; thence 30 feet to the Brooklyn Basin; thence 25 feet around the south channel of said basin and 18 feet through the tidal canal to San Leandro Bay.

PAGE 94.

Oakland.—A flashing red light and echo board is established in 10 feet of water on the southwest point of the shoal on the southerly side of the Southern Pacific Co.'s long wharf.

Oakland Mole fog signal is established on the outer end of south side of the Southern Pacific Co.'s passenger mole, 1,020 yards 356° from Oakland Harbor Lighthouse. The signal is a diaphone (group of 2 blasts every 30 seconds).

Last paragraph: Beacons mark a dredged channel 10 feet deep and 120 feet wide leading into Indigo Slough.

PAGE 95.

Redwood City Slough.—Paragraph 1: The entrance is marked by a flashing red light.

The channel dredged by local interests from the head of the Government project to East Bradford Street has shoaled so that the creek bed is bare in some places at low water. The town has established a new terminal at East Bradford Street, but access to it can be had only by vessels of small draft entering at high water.

Anchorages, San Francisco Bay.—The explosive anchorage is an area within a radius of 500 yards of a buoy 5,135 yards 155° from Goat Island Lighthouse. Other changes have been made in the anchorage limits in the bay, and the anchorages are shown on Chart 5532.

PAGE 96.

Pilotage.—A pilot boat mooring buoy, white spar, is established 350 yards 69° true from San Francisco Light Vessel. This buoy will show an American jack at all times.

PAGE 98.

Repairs.—The largest dock at Hunters Point is 1,020 feet long with a width of 153 feet, and can accommodate the largest ships afloat.

Buoy depot.—For "twelfth" read "eighteenth."

PAGE 102.

Bonita Channel.—A range is established. Mile Rock Lighthouse is the front object. The rear mark is 137° from Mile Rock Lighthouse and is a white day mark painted on the cliff.

Line 8, from bottom, for "24" read "33." Line 9 from bottom, for "1916" read "1924."

PAGE 103.

Line 2: A 29-foot sounding has been reported west-southwestward of Red Rock Bank buoy, and the buoy has been shifted toward this shoal. The distance given to pass this buoy will clear the shoal sounding.

If bound to Mare Island: Line 6, for "50 yards" read "75 yards." A black gas buoy (flashing white) is left 125 yards to port just before reaching the red buoy.

Line 12: The red buoy has been discontinued.

San Pablo Bay.—Dredged channel gas buoys 3 and 7 are discontinued.

The channel across Pinole Shoal in May, 1924, had a controlling depth of 33 feet with a depth of 24 feet in Mare Island Strait channel up to dike No. 1, and above dike No. 1 in the turning basin there was a controlling depth of 23 feet in the westerly half and 18 to 24 feet in the easterly half.

PAGE 104.

Petaluma Creek.—The channel has a controlling depth of 6 feet at mean lower low water across the shoal outside the entrance, thence 4 feet to Washington Street Bridge, Petaluma, the present head of navigation. A bell buoy and echo board have been established near the entrance to the channel across the flats.

Mare Island Strait.—A drawbridge connecting Mare Island with the city of Vallejo has been constructed.

PAGE 105.

Napa Creek.—The controlling depth to Napa is 6 feet.

PAGE 106.

Sacramento River.—The present low-water depths are: To Sacramento, 7 feet; to Colusa, 3 feet; and to Sidds Landing, 2 feet.

Suisun Slough.—The controlling depth in 1923 was 6 feet to the harbor and 4 feet in the harbor.

Suisun Bay.—A light and echo board have been established at low-water mark near east end of the Middle Ground, 1,125 yards 61° true from Middle Point Light.

Paragraph 9: For "Point Reves" read "Point Reyes."

PAGE 107.

Tomales Bay.—The entrance is marked by a whistling buoy 1,400 yards 333° true from Tomales Bluff, a bell buoy about 340 yards outside the bar and a can buoy about 300 yards inside the shoalest water on the bar.

PAGE 110.

Point Arena Light Station.—Fog signal is an air diaphone sounding a group of 2 blasts every 60 seconds; blast 1 second, silent 1 second, blast 3 seconds, silent 55 seconds.

PAGE 111.

Greenwood Landing.—Line 7, for "telegraph" read "telephone."

PAGE 113.

Stillwell Point has a yellow slide on its south face.

Mendocino Bay.—Next to last line, for "could" read "should."

PAGE 114.

Russian Gulch.—The wire landing has been abandoned.

Paragraph 1, line 11: Strike out "telegraph or."

Caspar anchorage.—Next to last line, strike out "telegraph and."

PAGE 121.

Blunts Reef Light Vessel.—Last sentence change to read, "A submarine bell strikes 2 groups of 2 strokes (2–2) every 30 seconds."

A radio fog signal transmits continuously during thick or foggy weather signals consisting of single dashes for 60 seconds, silent 120 seconds. (See p. 6, this supplement, for further information.)

PAGE 123.

Trinidad Head Lighthouse.—A fog bell has been established on point of bluff, 126 feet high, about 140 yards 130° true from lighthouse. The signal is 1 stroke every 10 seconds. It will be operated annually from April 1 to December 1.

PAGE 124.

Trinidad Harbor.—A fixed white light has been established on top of Prisoners Rock. It will be maintained from April 1 to November 1 of each year.

PAGE 127.

Crescent City.—A breakwater extending from Battery Point is under construction.

The bell buoy is replaced by a black spar, and a gas and bell buoy showing an occulting white light is established 200 yards eastward to mark the eastern side of the channel.

PAGE 129.

Humboldt Bay.—Paragraph 4, line 7, after "beacon," add "some of which are lighted."

PAGE 130.

Paragraph 1: For "Fairhaven" read "Rolph."

Paragraph 2: The depth of water alongside the wharf on the southwest side of Fields Landing is 20 feet.

PAGE 131.

Quarantine.—For "Fairhaven" read "Rolph."

PAGE 132.

Paragraph 4, substitute the following: "From the gas and whistling buoy steer 116° true (E. ½ S. mag.) for the outside bell buoy. Then steer 140° true (SE. by E. ⅜ E. mag.), heading for Red Bluff, to a position 250 yards southward of spar buoy No. 1. Then steer 146° true (SE. ¾ E. mag.), holding down toward the southern jetty until south of the buoy marking the southern extremity of the shoal off the north jetty. After passing the buoy starboard to pass 100 yards off the southeast point of North Spit. Then steer 34° true (N. by E. ¼ E. mag.) to leave buoy No. 4 close to on the starboard hand; then steer 48° true (NNE. ½ E. mag.) to buoy No. 6. Then steer 31° true (N. by E. mag.), heading for Brosner's wharf light, and select anchorage on the edge of the channel, as desired."

Humboldt Bay.—Humboldt Bay entrance range has been discontinued.

PAGE 140.

Cape Arago Lighthouse.—It has been reported that the Coast Guard lookout station on Coos Head, southern entrance to Coos Bay, under certain conditions of the atmosphere has been mistaken for Cape Arago Lighthouse.

PAGE 143.

Siletz River.—The entrance buoy is a whistling buoy.

PAGE 147.

Columbia River Light Vessel.—The submarine bell strikes a group of 5 strokes every 30 seconds. A radio fog signal transmits a series of 3 dashes every 20 seconds, silent 20 seconds. (See p. 6 of this supplement.)

North Head.—Information has been received through the district communication superintendent, U. S. Navy, that North Head Radio Station, equipped as a duplex station, transmitting and receiving simultaneously and independently, has resumed service.

As a duplex station North Head receives in the former North Head Station and transmits by distant control from the former Astoria Station. The combined station is equipped to furnish continuous service to and from ships, fulfilling in this connection the duties of the former North Head single station. In addition the station conducts communication with southeastern Alaska, fulfilling in this connection the duties of the former Astoria single station.

In view of the increased and improved equipment and the ability of the station to work duplex, it is believed that efficient service to commercial shipping will be possible. It is requested that shipping interests utilize the station as much as possible in order to determine its usefulness.

PAGE 149.

Coquille River.—To enter, line 11: The buoy has been discontinued.

PAGE 150.

Coos Bay.—The controlling depth over the bar was 25 feet June, 1923. The controlling depth on the rocky shoal off Coos Head is 24 feet, with a depth 18 feet to the head of the bay.

The dredged channel west of the drawbridge, near North Point, has shoaled to 10 feet, and to carry 20 feet vessels must keep south of the range between buoys Nos. 14 and 11.

PAGE 151.

Coos River.—Last line, for " 5 " read " 4." The Marshfield Channel in addition to the beacons is marked by a lighted range.

PAGE 153.

Umpqua River.—The surveys of 1920 show a considerable change in the shore line and channel at the entrance to the river. The controlling depth in 1923 was 14 feet in a narrow channel, with lesser depths on each side. The range lights have been discontinued. The controlling depths to Gardiner and Reedsport remain the same. Leeds Island light, bearing 170° true of Three Mile light, bearing 350° true, carries the best water across the shoals into the channel to Reedsport.

PAGE 154.

Paragraph 5: The rock southwestward of Winchester Bay is a group of rocks lying 100 yards off the present shore line.

Reedsport.—Water, gasoline, and fuel oil may be obtained. Wharves with depth of 16 feet alongside are in front of the town.

PAGE 155.

Siuslaw River.—Paragraph 2, last sentence, add "and a lighted range leads between the jetties."

Additional buoys have been established to mark the channel inside the entrance to North Fork Shoal.

PAGE 156.

Yaquina Bay.—Paragraph 3: The south jetty has been extended 2,500 feet beyond the light, and a red buoy lies 40 yards off the submerged end.

Paragraph 4: In June, 1923, the controlling depth on the bar was 13 feet in a channel 400 feet wide on a straight course over the bar; at present the channel is about on the range line.

Newport.—An 18-foot channel has been dredged through the shoal above Newport.

PAGE 157.

The Sow and Pigs.—A beacon now marks the largest rock of the group.

The entrance.—The jetty is completed, but the outer 1,000 feet has subsided to below low water. In 1922 there was 16 feet over the bar.

PAGE 158.

The main channel.—Seven feet is the controlling depth. The channel to Bay City had a controlling depth of 7 feet in 1923.

Dredging a channel 16 feet and filling in behind a bulkhead has been carried on in the vicinity of the mouth of the Miami River; east of Garabaldi.

PAGE 159.

Nehalem River.—Paragraph 7: Both jetties are completed. The controlling depth across the bar in 1923 was 11 feet in a width of 400 feet and 9 feet for a width of 1,000.

Paragraph 8: The red buoy is discontinued.

PAGE 160.

Baker Bay.—Fort Canby light, fixed red, is established on the easterly extremity of Cape Disappointment. The light is to assist boats to enter the cut-off channel to the westward of Sand Island and will be screened so as to be obscured to the westward of the southerly entrance to this channel. It may be changed to conform with the movements of this channel.

PAGE 161.

Astoria.—The radio station at Astoria is closed.

PAGE 162.

Longview.—Just westward of the mouth of Cowlitz River, and opposite Ranier, is the city of Longview, built around the activities of a large lumber development. A dock is under construction, with a project depth of 30 feet along the face and berthing space of 1,800 feet. A temporary dock, just eastward of the permanent construction, is built out to the 30-foot contour.

PAGE 165.

A survey in June, 1923, by the Army engineers, showed a channel with at least the project depth of 40 feet at mean lower low water for a width of 6,500 feet. Depths between the 40-foot contour ranged up to 44 feet. A draft of 34 feet is practicable at mean lower low water under ordinary weather conditions.

From Portland to the sea a draft of 30 feet is usually practicable at low tide from March to July; 27 feet, August to October; and 29 feet, November to February, inclusive. By working the tides 2-foot greater drafts can usually be carried. From Vancouver drafts of 24, 18, and 19 feet are usually practicable during the same periods.

PAGE 168.

New paragraph: A branch hydrographic office is located in the customhouse, Portland. A time ball is dropped at noon (one hundred and twentieth meridian time), Sundays and holidays excepted, on the roof of the customhouse.

PAGE 176.

Umatilla Reef Light Vessel.—The submarine bell strikes a group of 4 strokes every 20 seconds.

PAGE 178.

Willapa Bay.—The bar at the entrance is subject to change. At the last survey in 1922 there were two channels across the bar. The northern one carried 22 feet, but is unmarked and is little used. The southern one is buoyed and has a least depth of 26 feet, but shoaling to 21 feet is reported between buoy 7A and 7.

PAGE 179.

The channel to Bay Center is marked by beacons and buoys.

PAGE 180.

Pilots and towboats.—There are regular pilots. Signals should be hoisted outside the bar, and vessels, if possible, should telegraph their expected time of arrival to the Willapa Bay Pilots Association. South Bend, Wash.

Communications.—Line 3, strike out "stopping at Bay Center."

PAGE 182.

Grays Harbor.—The controlling depth across the bar in 1923 was 20 feet.

PAGE 187.

Swiftsure Bank Light Vessel.—The submarine bell strikes a group of 6 strokes every 30 seconds. A radio fog signal transmits continuously during foggy or thick weather a series of double dashes every 35 seconds, silent 25 seconds. (See p. 6 of this supplement.)

PAGE 194.

Minor Island Light.—The light is now a flashing white every 5 seconds. There is an echo board.

PAGE 196.

Port Crescent.—Port Crescent Light is discontinued, and in lieu thereof there is established a gas and bell buoy, showing a flashing white light.

PAGE 199.

Neah Bay.—There is telephone and telegraph connection at Neah Bay. Vessels displaying their signal numbers off Baaddah Point will be reported.

PAGE 200.

Port Angeles.—The cannery wharf is no longer in existence.

PAGE 205.

Admiralty Head.—The light has been discontinued. An electric siren, giving a blast of 3 seconds duration every 30 seconds during fogs, mounted on a white tower on Standard Oil Co.'s wharf at Point Wells, is operated and maintained by that company.

Point Edwards.—A wharf is built out to deep water.

PAGE 206.

Marrowstone Point.—The fog signal is now a reed horn, sounding 3 blasts every 30 seconds.

PAGE 207.

Apple Cove Point.—A flashing white light is established on the point.

Point No Point.—Last line, add "at which there is a wharf built out to deep water."

PAGE 208.

Blakely Rock.—The rock is marked by a flasning red light.

Decatur Reef.—The buoy is a flashing white gas and bell buoy.

PAGE 209.

Irondale.—The iron smelter has been removed.

PAGE 214.

Point Elliot.—Muckilteo Light is flashing white, flash 2 seconds, eclipse 3 seconds.

PAGE 218.

Duwanish Head.—The pleasure resort has been removed.

PAGE 219.

Duwanish River.—The entrance to the east and west waterways are marked by lights. During fogs a bell at the west waterway light sounds 2 strokes every 10 seconds.

Lake Washington Canal.—The controlling depth to Lake Washington on June 30, 1923, was: Puget Sound to locks, 30 feet at mean lower low water; between the locks and Lake Union, 31 feet; and between Lake Union and Lake Washington, 22 feet at normal upper pool level. Lights have been established at salient points along the canal, and a light and fog signal in Shilshole Bay. (See Chart No. 6447). The entrance channel from Puget Sound to the lock is being widened and dredged to 34 feet at mean lower low water.

PAGE 225.

The wharf 2 miles from Alki Point is gone.

Fauntleroy Cove.—The wharf is gone.

Point Pully.—The wharf is gone.

PAGE 226.

Point Brown.—The lighting characteristics of the light is a group of 3 flashes every 15 seconds.

PAGE 227.

Robinson Point.—The light is now a group flashing white every 12 seconds, flash 3 seconds, eclipse 1 second, flash 5 seconds, eclipse 5 seconds.

Gig Harbor.—A fixed red light is established on the southerly end of the sand pit on easterly side of entrance to Gig Harbor.

PAGE 229.

A rock with little water over it at low tide lies 150 yards 150½° true from the southwest corner of the dock located about midway between Lamola and Poulsbo, on the eastern side of Liberty Bay.

Agate Passage.—A light on the west side of channel through Agate Passage, opposite Agate Point, and two red buoys, mark the channel through the passage. Six buoys and two lighters mark the torpedo range in the northern part of Port Orchard. A red flag hoisted on the south dock at the torpedo station and one displayed on the southern lighter indicates that torpedo firing is in progress and vessels are to keep well to the east side of the channel clear of the range, keeping a bright lookout for torpedoes and clear of same.

PAGE 230.

Waterman Point.—The light is occulting white, every 6 seconds. A fog bell sounds 1 stroke every 5 seconds.

Direction, Port Orchard.—Two nun buoys have been established on the northeast side of Richs Passage and an unlighted range to guide northward of a ridge with 5 fathoms of water over it.

PAGE 234.

Tacoma Harbor.—A dry dock for vessels up to 500 feet long, 85 feet beam, and 26½ feet draft is at Tacoma.

PAGE 242.

Olympia Harbor.—Additional beacons are established to mark the eastern side of the easterly dredged channel into Olympia Harbor. There are shipyards at Olympia equipped for making repairs to vessels.

PAGE 244.

San Juan Island.—A fog signal has been established at Lime Kiln Light Station. It is a reed horn which sounds a group of 2 blasts every 20 seconds, blast 2 seconds, silent 4 seconds, blast 2 seconds, silent 12 seconds.

A cluster of rocks about 80 yards in diameter, awash at mean lower low water lies 0.97 mile 148° true from Lime Kiln Lighthouse.

Kellet Bluff.—A light, flashing white every 3 seconds, is established near the southerly end of the west side of Henry Island.

PAGE 250.

Puffin Island.—A flashing white light is established 25 feet above water, on the roof of a small white house on the northeasterly side of the island.

PAGE 251.

Blind Bay.—A rock partly bare at low water is reported to lie about 100 yards E. by S. ½ S. mag. from Blind Island at entrance to Blind Bay.

PAGE 254.

Belle Rock.—A beacon, white square house on gray cylindrical base, has been established on Belle Rock. Strike out second sentence.

Burrows Bay.—Last sentence: The light has been discontinued.

PAGE 260.

Paragraph 1.—Last line: A flashing white light has been established on Eliza Rock, just southward of the southern part of Eliza Island.

Drayton Harbor.—A vessel reports having struck bottom about midway between the Alaska Packers' dock and the lighthouse, with the lighthouse bearing 261° true; draft of vessel 20′ 8″ forward, 21′ 7″ aft.

Point Roberts.—The light is now flashing white every 3 seconds.

PAGE 263.

Substitute the following information:

COAST PILOTS AND FIELD STATIONS OF THE COAST AND GEODETIC SURVEY

COAST PILOTS

	Price
U. S. Coast Pilot, Atlantic Coast, Section A, from St. Croix River to Cape Cod	$0.75
U. S. Coast Pilot, Atlantic Coast, Section B, from Cape Cod to New York, including Long Island Sound	.75
U. S. Coast Pilot, Atlantic Coast, Section C, Sandy Hook to Cape Henry, including Delaware and Chesapeake Bays	.75
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West	.75
U. S. Coast Pilot, Atlantic Coast, Section E, Gulf of Mexico, from Key West to the Rio Grande	.75
U. S. Coast Pilot, West Indies, Porto Rico, and Virgin Islands	.75
Inside Route Pilot, coast of New Jersey	.30
Inside Route Pilot, New York to Key West	.30
Inside Route Pilot, Key West to New Orleans	.30
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay	.75
U. S. Coast Pilot, Pacific Coast, Alaska, Part II, Yakutat Bay to Arctic Ocean	.75
U. S. Coast Pilot, Hawaiian Islands	.50
U. S. Coast Pilot, Philippine Islands, Part I, Luzon, Mindoro, and Visayas	.75
U. S. Coast Pilot, Philippine Islands, Part II, Palawan, Mindanao, and Sulu Archipelago	.75

FIELD STATIONS

Boston, Mass., Appraisers Building, 408 Atlantic Avenue.
New York, N. Y., Room 311, 78 Broad Street (Maritime Exchange Building).
New Orleans, La., Room 314, Customhouse.
San Francisco, Calif., Rooms 305–6, Customhouse.
Seattle, Wash., Room 202, Burke Building.
Manila, P. I., Intendencia Building.

At these stations complete files of the United States Coast and Geodetic Survey Charts, Coast Pilots, Tide Tables, and other publications relating to navigation may be consulted and information affecting navigation obtained without charge. Light Lists, Buoy Lists, and Notices to Mariners are kept for sale or for free distribution to mariners. The field stations are also sales agencies for the Coast and Geodetic Survey publications. A chart catalogue, giving lists of charts, coast pilots, tide tables, and agencies of the Coast and Geodetic Survey, can be obtained from any of the field stations, or will be sent, free of charge, on application to the Coast and Geodetic Survey, Washington, D. C. Frequent changes occur in the agencies, and the list of agencies is published in the first notice each month of the Notices to Mariners.

Serial No. 321

DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

SUPPLEMENT

TO

UNITED STATES COAST PILOT

PACIFIC COAST

CALIFORNIA, OREGON, AND WASHINGTON

JULY 31, 1925

NOTE.—This supplement gives the more important corrections and additions to the text of the Coast Pilot volume since its publication. All changes, given in previous supplements and not repeated herein, are no longer in effect. The supplement is so printed that it may be cut up and the slips inserted on the pages affected. All new information should be inserted in such a manner that it can be removed if changed or canceled by a subsequent supplement.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1925

IMPORTANT NOTICE.—Supplements to the United States Coast Pilots are issued at least once each year and give all available information for bringing the Coast Pilots up to date. The Coast and Geodetic Survey must depend in a great measure upon outside sources of information pending a complete revision of a volume. Mariners and others will therefore realize the importance and great desirability of cooperation in this work, and are urgently requested to forward to the Director, United States Coast and Geodetic Survey, Washington, D. C., directly or through one of the field stations of the survey, any information affecting the Coast Pilots or charts that may come to their notice, as well as any suggestions that they may have for increasing the value of these publications.

PAGE 8.

New paragraph:

Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies for the years 1925 and 1926. Price, 10 cents each.

Other publications.—To first sentence of paragraph add "and are for sale from its sales agencies or from the Superintendent of Documents, Washington, D. C."

PAGE 19.

Aids to navigation.—Light and buoy lists are no longer available for free distribution, but are for sale at the sales agencies or Superintendent of Documents, Washington, D. C. The price of the light lists is 30 cents each and the buoy lists 20 cents each.

System of buoyage.—Buoys maintained by the United States Army Engineers for dredging purposes will hereafter be painted white, with the top for a distance of 2 feet painted dark green.

PAGE 20.

Navigation laws.—The present edition of the navigation laws of the United States is 1923.

PAGE 24.

Storm warnings.—Substitute the following:

The small-craft warning.—A red pennant indicates that moderately strong winds that will interfere with the safe operation of small craft are expected. No night display of small-craft warnings is made.

The northeast storm warning.—A red pennant below a square red flag with black center display by day, or two red lanterns, one above the other, displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northeast.

The southeast storm warning.—A red pennant below a square red flag with black center displayed by day, or one red lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the southeast.

The southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a red lantern above a white lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the southwest.

The northwest storm warning.—A white pennant above a square red flag with black center displayed by day, or a white lantern above a red lantern displayed by night, indicate the approach of a storm of marked violence with winds beginning from the northwest.

Hurricane, or whole gale warnings.—Two square flags, red with black centers, one above the other, displayed by day, or two red lanterns, with a white lantern between, displayed by night, indicate the approach of a tropical hurricane, or one of the extremely severe and dangerous storms which occasionally move across the Great Lakes and Atlantic coast.

These warnings are displayed at all stations on the Atlantic, Pacific, and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Turk Island, Bermuda, Haiti, Curacao, Porto Rico, Virgin Islands of the United States, St. Kitts, Dominica, Barbados, Trinidad, St. Lucia, St. Vincent, Grenada, Swan Island, and Cuba.

PAGE 25.

Storm warnings at San Diego are now displayed on the Municipal Pier instead of the coal bunkers. Warnings are also displayed on the tower of the Naval Air Station, North Island.

Radio service.—Add the following information:

Time signals.—In connection with the service over the land telegraph lines time signals by radio are sent daily, Sundays and holidays excepted, from certain United States naval coastwise radio stations on the Pacific coast and at Honolulu, as follows:

Stations	Call letters	Time	Standard meridian	Wave lengths
			° ′	
San Francisco, Calif.	NPG	Noon	120 00	1,908
		10 p. m.	120 00	4,650
San Diego, Calif.	NPL	Noon	120 00	1,988 9,800
Honolulu, Hawaii	NPM	1.30 p. m.	157 30	2,250 11,500

The signals begin at 5 minutes before the hour and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The final signal is a longer contact after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

The supervision of radio communication in the United States, including the Hawaiian Islands, is controlled by the Bureau of Navigation, Department of Commerce. A list of the radio stations of the United States, including shore stations, merchant vessels, and Government vessels; Radio Communication Laws and Regulations of the United States; and Amateur Radio Stations of the United States

are published by that bureau. Any of these publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each (except Amateur Radio Stations, which sells at 25 cents). Changes or additions to the stations and to the laws and regulations are published in bulletins issued monthly; price, 5 cents per copy or 25 cents per year.

The International List of Radio Stations of the World (edition in English) can be procured from the International Bureau of the Telegraphic Union (Radiotelegraphic Service), Berne, Switzerland. In addition to the information contained in the list of the United States stations published by the Bureau of Navigation, the international list shows geographical locations, normal ranges in nautical miles, radio systems, and rates. Supplements to the international list will be issued monthly and will contain new stations and tables of alterations. Inquiries as to the subscription prices of these lists should be made direct to the Berne bureau at the address given above. Remittances to Berne should be made by international postal money orders.

Radiocompass bearings.—The Naval Communication Service will furnish radio bearings to mariners of all vessels equipped with radiotelegraph transmitters. While the use of these bearings should not lead a mariner to neglect other precautions, such as the use of the lead, etc., during a fog, these bearings will greatly reduce the dangers to navigation for mariners who are compelled for any reason to proceed during foggy or misty weather.

These radiocompass stations are provided, primarily, to assist the mariner in closing the land during fog or poor visibility, but they may also be used to obtain the position of vessels at sea in radiocompass range, about 150 miles, when for any reason positions can not be obtained by other means. The maximum distance for which bearings from these stations are accurate is 150 miles. But accurate positions can not be plotted when more than 50 miles from the shore on Mercator charts, for the Mercator projection introduces a distortion of the true bearing.

Radiocompass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. These stations are located with the view of giving service to ships at a distance of not over 150 miles from the station. (*b*) Harbor entrance groups. All stations in harbor entrance groups are connected to and controlled by the master station. All stations of the group take bearings simultaneously and these bearings are transmitted to the ship requesting them by the control station. The purpose of these stations is to lead mariners to the light vessels off harbor entrances.

Where only one radiocompass station is available, the mariner may fix his position by two or more bearings from the station with the distance run between, or may use the bearings as a line of position or as danger bearing. Or the bearing may be crossed with a line of position obtained from an observation of an astronomical body to establish a fix.

Wave lengths.—All independent and group radiocompass stations keep watch on *800 meters*. Only this wave should be used to call and work with these stations. During the first 10 minutes of each hour during clear weather radiocompass stations will ordinarily not

be guarding the 800-meter wave. Ships are requested to confine their requests for bearings during clear weather to the remaining 50 minutes of the hour, if practicable. If a station chances to hear a request for a bearing during the first 10 minutes of the hour, the requested bearing will be given. During the remaining 50 minutes of the hour and at all times during inclement weather all radiocompass stations will be continuously guarding the 800-meter wave.

Calling a radiocompass station.—To obtain a bearing from independent radiocompass stations, call the station from which the bearing is desired in the usual manner and request bearings by means of the conventional signal given hereafter. Simultaneous bearings from two or more compass stations can be obtained by making the call include the other compass stations desired. To obtain bearings from the harbor entrance compass stations, carry out the procedure previously given. The compass control station only will answer.

Conventional signals.—The following abbreviated signals will be used:

Signal	Meaning
QTE?	What is my true bearing?
QTE	Your true bearing is ..... degrees from ..... radiocompass station.

The following radiocompass stations will be of use for vessels navigating within the limits of this volume:

Stations	Call letters	Position	Arc of calibration
			Degrees
Pachena Point, Vancouver	VAD	Lat. 48° 44′ N., long. 125° 06′ W.	
Cattle Point, Wash	NFN	Lat. 48° 27′ 05″ N., long. 122° 57′ 45″ W.	120–280
Smith Island, Wash	NFH	Lat. 48° 19′ 04″ N., long. 122° 50′ 39″ W.	0–360
New Dungeness, Wash	NFT	Lat. 48° 10′ 36″ N., long. 123° 07′ 51″ W.	240–115
Tatoosh, Wash.[1]	NPD	Lat. 48° 23′ 41″ N., long. 124° 44′ 13″ W.	180–90
Klipsan Beach, Wash	NZS	Lat. 46° 27′ 53″ N., long. 124° 03′ 16″	195–340
Destruction Island, Wash	NOJ	Lat. 47° 40′ 29″ N., long. 124° 29′ 02″	
Fort Stevens, Oreg	NPE	Lat. 46° 11′ 32″ N., long. 123° 59′ 15″ W.	175–335
Empire, Oreg	NPF	Lat. 43° 23′ 03″ N., long. 124° 18′ 58″ W.	230–10
Point St. George, Calif	NYW	Lat. 41° 47′ 00″ N., long. 124° 15′ 05″ W.	
Eureka, Calif	NPW	Lat. 40° 41′ 49″ N., long. 124° 16′ 33″ W.	180–5
Point Reyes, Calif	NLG	Lat. 38° 02′ 13″ N., long. 122° 59′ 36″ W.	120–2
Point Montara, Calif	NLH	Lat. 37° 32′ 02″ N., long. 122° 31′ 07″ W.	173–252
Farrallon Island, Calif	NPI	Lat. 37° 41′ 59″ N., long. 122° 59′ 56″ W.	0–360
Point Arguello, Calif.[2]	NPK	Lat. 34° 34′ 38″ N., long. 120° 38′ 32″ W.	170–360
Point Hueneme, Calif	NMD	Lat. 34° 08′ 43″ N., long. 119° 12′ 30″ W.	135–305
Point Fermin, Calif	NPX	Lat. 33° 42′ 19″ N., long. 118° 17′ 37″ W.	90–290
Point Loma, Calif.[3]	NPL	Lat. 32° 42′ 21″ N., long. 117° 15′ 17″ W.	185–250
Imperial Beach, Calif	NPL	Lat. 32° 35′ 14″ N., long. 117° 07′ 54″ W.	182–331

[1] Bearings furnished in the sector 232° to 264° should be used with caution until reported unreliability has been investigated.

[2] The calibrated area between 135° and 160° is overland, and bearings in this sector should therefore be used with caution until several months of checking have shown what accuracy may be expected there.

[3] Out of commission at present. Notice will be given when operation is resumed.

NOTE.—The arc of calibration is a sector of the circle of which the compass coil at the radio station is the center; the bearings are from the station, clockwise. Compass bearings are reliable only when they fall within the calibrated arcs.

PROCEDURE IN DETAIL

(*a*) A ship calling the radiocompass station or compass control station should make the abbreviation "QTE?" ("What is my bearing?"). This request will be answered by the radiocompass sta-

tion or control station, and when ready to observe the radio bearing it will send the signal "K," indicating the ship to commence "testing"; that is, repeating its distinguishing signal for a period of 50 seconds. The signal should be made slowly with the dashes considerably prolonged.

(*b*) The testing should be made on 800 meters, upon the completion of which the ship should await reply from the radiocompass station.

(*c*) The radiocompass station or control station will then reply, repeating the abbreviation "QTE" ("Your bearing from ——— was ——— degrees"), followed by the bearing in degrees given by a group of three figures 000 to 360, indicating the true bearing in degrees of the ship station from the radio compass station, and then the time group giving the time of observations in local standard time. In the case of more than one radiocompass connected by land line only, the station originally called will answer. This station will combine all the bearings taken by itself and associated stations into one message, which gives each bearing observed immediately after the name of the station making the observation. *All compass stations transmit on 800 meters.*

Danger from reciprocal bearings.—Attention is invited to the fact that when a single bearing is furnished there is a possibility of an error of approximately 180°, as the operator at the compass station can not always determine on which side of the station the vessel lies. Certain radiocompass stations, particularly those on islands or extended capes, are equipped to furnish two corrected true bearings for any observation. Such bearings when furnished vessels may differ by approximately 180°, and whichever bearing is suitable should be used.

Caution.—Mariners receiving bearings which are evidently the approximate reciprocal of the correct bearing should never attempt to correct these bearings by applying a correction of 180°, as such correction would not include the correction necessary on account of deviation at the compass station. An error of as large as 30° may be introduced by mariners applying an arbitrary correction of 180° to such bearings. Vessels receiving bearings manifestly requiring an approximate 180° correction should request the other bearing from the radiocompass station if not previously furnished.

Bearings, except in the case of approximate reciprocal bearings, should be accurate within 2° of arc provided the transmitting equipment on board vessels is tuned sharply to 800 meters. Operators should use sufficiently wide coupling to obtain low decrement. If radio transmitters are not tuned sharply, it is difficult to obtain bearings that are sufficiently accurate for navigational purposes. When bearings from three or more compass stations are not over 2° of arc in error, but do not meet at a fixed point, the geometric center of the triangle formed by the bearings can generally be taken as the approximate position of the vessel.

Mariners until thoroughly familiar with the system are advised to use radiocompass stations frequently, especially in clear weather, when positions of vessels can be accurately fixed, in order to accustom operators to the procedure and to acquaint themselves with the

degree of accuracy and dependability of bearings furnished by the radio compass stations.

Reports.—In order that the operation of shore radiocompass stations may be checked, mariners obtaining bearings are requested to forward a brief report to the Director Naval Communications, Navy Department, Washington, D. C., containing the following particulars: (1) Name of ship; (2) name of radiocompass station; (3) date and local standard time at which radio bearing was taken; (4) bearings given by radio station; (5) estimated position of ship at above time and dates by methods other than radio; (6) the probable degree of accuracy of the estimated position; (7) weather conditions at above time; (8) remarks, if any; (9) signature of master or responsible navigating officer.

There is no charge for bearings furnished by the United States Naval Radiocompass Station.

Radio fog signals.—The following radio fog signals are operated on the Pacific coast by the United States Lighthouse Service:

San Francisco Light Vessel (call letters WWBV):	
Series of double dashes	60 seconds
Silent	60 seconds
Blunts Reef Light Vessel (call letters WWBU):	
Single dashes	60 seconds
Silent	120 seconds
Columbia River Light Vessel (call letters WWBQ):	
Series of three dashes	60 seconds
Silent	30 seconds
Swiftsure Bank Light Vessel (call letters WWBO):	
Series of double dashes	60 seconds
Silent	30 seconds

These radio fog signals are intended for the use of vessels equipped with radiocompass. By reason of this radiocompass (also termed radio direction finder) the bearing of the radio fog signal station may be determined with an accuracy of approximately 2° and at distances considerably in excess of the range of visibility of the most powerful coast lights. The apparatus is simple and may be operated by the navigator without the assistance of a radio operator or without knowledge of the telegraph code. The radio direction-finding apparatus consists of a radio receiving set, similar in operation to those used for radio telegraph or telephone reception, and a rotatable coil of wire in place of the usual antenna. By rotating the coil the intensity of the signal received from the transmitting station is caused to vary, and by noting the position of the coil when the signal is heard at its minimum intensity the bearing of the transmitting station is readily obtained.

It is important to note that the bearing of an incoming radio wave is subject to errors not unlike the deviation of a magnetic compass. Those using radio direction finding on shipboard are cautioned to bear these errors in mind and to keep radiocompasses calibrated at all times. This may be done during clear weather by comparing the bearing obtained by radiocompass with the bearing determined by other methods in general use. All radiocompasses are subject to what is called "night effect," an indeterminate error sometimes experienced near nightfall and sunrise.

The signals from the light vessels have definite characteristics for identifying the stations, as have the flashing lights and sound fog

signals, and bearing may be obtained with even greater facility than sight bearings on visible objects. The radio fog signals are transmitted on a wave length of 1,000 meters, which is exclusively reserved for this purpose to avoid interference.

The stations transmit continuously during fog or thick weather. In clear weather signals are transmitted as follows: Blunts Reef Light Vessel, the first 15 minutes of each even hour from 10 p. m. to 6.15 a. m.; Columbia River and Swiftsure Bank Light Vessels, the first 15 minutes of each even hour from 10 p. m. to 6.15 a. m., and also from 9 to 9.30 a. m. and 3 to 3.30 p. m.: San Francisco Light Vessel, from 9 to 9.30 a. m. and 3 to 3.30 p. m. (all one hundred and twentieth meridian time).

Operators maintain watch on 600 meters for the first 15 minutes of each hour from 8 a. m. to 9.15 p. m., one hundred and twentieth meridian time, except when radio fog signal is in operation. Radio requests for special transmission of radio fog signals for a reasonable time from light vessels for the purpose of checking bearings or calibrating the radiocompass should be made during such watch periods, using 600-meter wave.

At about 8 a. m., 12 noon, and 8 p. m. daily each light vessel will broadcast, on 600-meter wave lengths, weather reports pertaining to existing weather conditions in the immediate vicinity of the light vessel and will furnish such weather reports at other times to vessels requesting them. These reports cover only actual weather conditions and forecasts can not be furnished.

Masters of vessels making use of the radio fog signals transmitted during clear weather are requested to advise the Superintendent of Lighthouses, San Francisco, Calif., by letter if the increased service is of value to them and if they desire to have such service continued or extended to cover more frequent periods in the future.

A general description of this method of navigation and the instruments required may be obtained from the Commissioner of Lighthouses, Washington, D. C., upon request. The Bureau of Standards Scientific Paper No. 428, the Radio Direction Finder and Its Application to Navigation, may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

Radiotelegraphic broadcasts of weather information.—The United States Weather Bureau issues daily (Sundays and holidays included) bulletins containing weather reports, forecasts, and warnings for the benefit of marine and aviation interests in the eastern waters of the Pacific and in the States bordering on that ocean. These bulletins are broadcast from naval radio stations.

A major bulletin is broadcast from the San Francisco Naval Radio Station (call letters NPG) twice daily as follows:

Morning bulletin at 9 a. m. (one hundred and twentieth meridian time) on a wave length of 7,000 meters (42.8 kilocycles).

Evening bulletin at 7.30 p. m. (one hundred and twentieth meridian time) on a wave length of 7,000 meters (42.8 kilocycles) and 2,607 meters (115 kilocycles) simultaneously.

The bulletins are divided into two parts and invariably begin with the letters USWB (United States Weather Bureau). The first part consists of upper air data and surface-weather conditions. Weather reports from ships in the North Pacific Ocean follow the reports from land stations. The second part consists of a summary

of general atmospheric pressure distribution over land and sea, including the locations of "high" and "low" areas, and the barometer readings at their centers; wind and weather forecasts for Pacific offshore areas; storm warnings for these areas; and flying-weather forecasts for each of three aviation zones.

Complete details of the service furnished by this and other stations, including the method of decoding the bulletins, is included in Weather Bureau Circular No. 10–Radio (second edition revised), which will be furnished free upon application to any United States Weather Bureau office on the Pacific coast.

Free medical advice to seamen by radio.—The Seamen's Church Institute of New York announces that, through the cooperation of the Seamen's Church Institute with the United States Public Health Service, free medical advice for ships at sea is now available through governmental and commercial coastal radio stations operated on the Atlantic and Pacific coasts of the United States.

On the Pacific coast, *United States Marine Hospital No. 19, at San Francisco, Calif.*, has been designated to furnish this service.

Ships desiring medical advice can secure prompt service by addressing a radiogram to this hospital through any radio station with which communication is established, the radiogram to state briefly the symptoms of the person afflicted and to be signed by the master of the vessel.

The advice given by the hospital will be phrased in language (English) intelligible to the layman.

This free medical service has been established primarily for the benefit of ships not carrying physicians. However, should occasion require, consultations may be had by radio by ship's physicians with the hospital staff.

While the Panama Canal was not included in the original scheme, several requests for medical advice have been received here from ships at sea and have been given prompt attention.

The United Fruit Co. has established a similar system of free medical advice in the Caribbean and the Gulf of Mexico. A message from a ship's captain to any of the company's radio stations in Central America or Colombia, giving the details of a case of illness or accident on his vessel, will be answered by the company's physicians without charge.

The following information is taken from a circular issued by the United Fruit Co.:

The following is a list of radio stations of the United Fruit Co. and of the Tropical Radio Telegraph Co. through which medical service may hereafter be obtained without charge, so far as these companies are concerned, by ships of all nationalities:

Station	Call letters	Station	Call letters
Boston, Mass	WBF	Tegucigalpa, Honduras	UG
Miami, Fla	WAX	Puerto Barrios, Guatemala	UF
New Orleans, La	WNU	Managua, Nicaragua	UL
Burrwood, La	WBW	Bluefields, Nicaragua	UQ
Fort Morgan, Ala	WIO	Cape Gracias, Nicaragua	UW
Mobile, Ala	WNN	Puerto Limon, Costa Rica	UX
Swan Island, Caribbean Sea	US	Almirante, Panama	UB
Santa Marta, Colombia	UJ		

Radiograms requesting medical advice should be signed by the captain of the ship and should state briefly but clearly the symptoms of the person afflicted. Such radiograms, if intended for a United Fruit Co. hospital should be addressed "Unifruitco," followed by the name of the place where the hospital is located. United Fruit Co. hospitals giving this service are located at the following places, and also may be reached through any of the above-mentioned radio stations: Santa Marta, Colombia; Puerto Limon, Costa Rica; Almirante, Panama; and Puerto Barrios, Guatemala.

All United Fruit Co. passenger steamships carry doctors and free medical advice may be secured by radio from any of them by a radiogram addressed "Ship's doctor," followed by name of the steamship.

This free medical service is established primarily for the benefit of ships not carrying doctors. However, should occasion require ships' doctors may hold consultation by radio with the United Fruit Co. ships' doctors and hospital staffs.

The physicians and surgeons comprising the medical staff of the United Fruit Co. and its associated companies are thoroughly qualified, but in view of the fact that radio medical advice to ships at sea is given free and without an opportunity for a personal examination of the patients no responsibility will be assumed by either the company and its associated companies or the physicians or surgeons giving the advice as to its accuracy, or for error or delay in the receipt or transmission of any message sent or received in connection therewith.

It is requested that when sending medical advice radiograms radio operators check them "(number of words) DH Medico."

"DH Medico" radiograms will be given preference over all other radiograms, except SOS calls, throughout the radio service of the United Fruit Co. and the Tropical Radio Telegraph Co.

PAGE 30.

Currents.—Current information which heretofore has been published as a part of the Tide Tables will be issued separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States. They are now on sale at the agencies. Price, 10 cents each.

Line 3: For "from about 50° north of Point Conception" read "from about 50° north to Point Conception."

PAGE 41.

Paragraph 6, third sentence, strike out after "approach" and substitute the following sentence: "When the log shows Point Vincente is abeam, haul up to pass ½ mile off Point Fermin whistling buoy, and, feeling the way cautiously, the lead will pick up bottom between Point Vincente and Point Fermin."

PAGE 43.

Last paragraph: Recent surveys confirm the report of the existence of a submarine valley 12 miles northwestward of Cape Mendocino. It is now shown on chart No. 5602.

PAGE 44.

Straits of Fuca to San Francisco.—In view of the fact that Arena Rock is only ¾ mile inside the 30-fathom curve, and that shoaling is abrupt, vessels approaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms.

San Diego Bay and approaches.—For "5106" read "5107."

PAGE 45.

San Diego Harbor approach—Torpedo range.—Information has been received from the commander Aircraft Squadrons Battle Fleet that a tropedo range 4,000 yards in length has been established southward of the whistle buoy in the approach to San Diego Harbor. The range is marked by three white can buoys moored 1,000, 2,000, and 3,000 yards, respectively, 180° from the whistle buoy. Approximate position of whistle buoy, lat. 32° 37′ 20″ N., long. 117° 14′ 40″ W.

Beacons mark a channel dredged to 8 feet into Glorretta Bay.

Improvements have been made by the Navy along the north shore of San Diego Bay, including an approach channel, marked by buoys, across Dutch Flat, dredged to 15 feet in 1923; on the north point of North Island; and along the east shore of the bay near National City.

Channels.—The controlling depth to San Diego is 32 feet.

Prominent features.—A mooring mast (skeleton structure with black and white horizontal bands) located on the western side of North Island, about ¾ mile northward from Zuninga Point, forms an excellent landmark for vessels entering San Diego Harbor.

PAGE 46.

Point Loma.—Line 8, change information in parenthesis to read (1½-second flash every 15 seconds).

Paragraph 2: A water tank near the radio station on Point Loma is prominent.

The tower of the administration building of the naval air station on the northeastern end of North Island forms an excellent landmark for vessels entering the harbor.

PAGE 47.

Strike out paragraph beginning "A light is maintained by the city of San Diego," etc.

PAGE 48.

Bishop Rock.—Last sentence, strike out "gas and."

From seaward.—Last sentence, change to read "When up to the gas and whistling buoy, 2⅝ miles 184° true from Point Loma Lighthouse, follow directions, San Diego Bay.

PAGE 49.

Directions, San Diego Bay.—Paragraph 2, first and second sentences, change to read, "Having made the gas and whistling buoy or Point Loma Lighthouse, proceed as convenient to a position eastward of the outside bell buoy and on the range through the dredged channel across the bar, keeping clear of the kelp which extends southward from Point Loma." Fourth sentence, after "course," insert "pass westward of a red buoy east of Ballast Point" and add "and westward of gas buoy 4B (flashing red)."

Paragraph 3, line 2: A flashing red light is exhibited from beacon No. 4. After "course" insert "passing westward of red buoy No. 6, while making turn."

Shoaling has been reported along the south side of the channel north of and in the vicinity of beacon No. 8.

Paragraph 4, lines 2 and 4: The light maintained by the city has been discontinued. A red light is exhibited from beacon No. 10.

PAGE 50.

Newport Bay.—A jetty 2,100 feet long has been constructed from the western point of the entrance to Newport Bay. There are depths varying from 7 to 14 feet over the bar into the bay, a depth of 10 feet in the south channel toward the town and a depth of 14 feet in the northern channel to the railroad drawbridge. The entrance is marked by lights on the jetty, a bell buoy off the entrance and a light on the eastern entrance point. Strangers should not attempt to enter without a pilot.

Newport Landing is no longer used commercially.

PAGE 51.

Point Fermin.—Line 4, for "occulting," read "flashing." Change information in parenthesis to read (flash 1 second, eclipse 2 seconds, flash 1 second, eclipse 6 seconds).

Point Vincente.—A fog signal (chime whistle) has been installed on the southwesterly part of this point. A measured mile standardization course has been established off Point Vincente. The range is marked by shore beacons that bear 34½° true when in line.

PAGE 52.

Los Angeles Harbor Lighthouse.—The pilasters of the tower are painted black. Extensive improvements have been made in Los Angeles Harbor since the date of this volume. A warehouse and a shed, both constructed of concrete and steel, have been built on Municipal Pier No. 1. The storm warning displays of the United States Weather Bureau are shown from a steel tower on the southeastern part of the warehouse and a light from a prominent water tank located on the roof of the same building. In the West Basin section the southern shore is occupied by shipbuilding slips and a dry dock; the eastern and western shores have been bulkheaded and filling is in progress. A large basin is being dredged in East San Pedro.

The following regulations are prescribed to govern the opening of the draw spans of bridges in Los Angeles and Long Beach Harbors and across Cerritos Channel connecting those harbors:

1. The draw spans shall be promptly opened for the passage of all vessels unable to pass under the closed bridge upon receiving a signal of one long blast, followed quickly by one short blast of a whistle or horn blown on the vessel.

2. Receipt and understanding of the above signal shall be acknowledged and notice of commencement of bridge opening given by the bridge tender by two short blasts of a whistle or horn blown on the bridge.

The Secretary of War has issued the following regulations relative to a 600-foot channel now being dredged at the entrance to the inner harbor:

1. The area constituting a strip 600 feet wide running from the east side of the main channel about opposite Beacon No. 2, southeastwardly along the northeastern side of the triangular area being dredged by the United States, to the 6-fathom line, is hereby set aside and closed to general navigation during the progress of dredging operations therein and until the Secretary of

War shall declare the area again open to navigation. The area herein described will be marked by suitable buoys while these regulations are in force.

2. All vessels and other water craft, except the plant operated by the United States or by a contractor under the direction and supervision of the United States (and inspection boats of the United States), are forbidden to enter upon or pass through the area herein described.

3. The suitable buoys above referred to, marking the sides of the cut, consist of San Pedro Entrance Light No. 2 and a spar buoy on or near the northeastern side of the cut and of two spar buoys on or near the southwestern side of the cut. These spar buoys are painted white and green in horizontal bands.

Drydocking facilities of approximately 14,500 tons displacement are available.

The Long Beach channel connecting the East Basin with Long Beach Harbor has been dredged to 20 feet, with a present width of 200 feet. It is to be enlarged to 300 feet with a depth of 30 feet. A drawbridge having a clear span of about 75 feet, usually open, carries the track of the Los Angeles & Salt Lake Railroad across the channel. Long Beach Harbor is available for light-draft vessels only. Dredging has been postponed until the flood-control works are completed.

Long Beach Harbor.—The outer end of each jetty is marked by a light. The western light is fixed green and the eastern light fixed red.

PAGE 53.

The inner harbor fog signal is near the southeast corner of Municipal Pier No. 1. It is now a siren sounding a 4-second blast every 15 seconds.

Fish Harbor.—The entrance to Fish Harbor is marked by lights.

PAGE 54.

Directions, Los Angeles Harbor.—Paragraph 2: For second sentence substitute "When light No. 2 bears 345° true (NW. by N. mag.), haul to a 342° true (NW. ¾ N. mag.) course passing between gas buoy No. 3 and light No. 2 and 125 yards westward of Reservation Point." Line 6, for "100 yards westward of light No. 6," read "75 yards westward of lights Nos. 4 and 6."

PAGE 57.

Point Hueneme.—Lines 4 and 5, change information in parenthesis to read (½-second flash every 5 seconds).

PAGE 59.

Point Conception Lighthouse.—The light is flashing white every 30 seconds (flash 8 seconds, eclipse 22 seconds).

PAGE 62.

San Nicolas Island.—A sand spit making out 0.8 mile from the easternmost point of San Nicolas Island affords good protection for small craft when anchored just south of it. There is a channel with a depth of from 8 to 10 fathoms between the end of this spit and an offlying kelp patch.

It is reported that the shoal making out from the easterly end of St. Nicholas Island has extended to the eastward, and that the outer break is fully 3 miles from the island.

PAGE 63.

Anacapa Island Lighthouse now shows flashing white every 20 seconds.

PAGE 67.

San Simeon Point.—A bell buoy is established 3/8 mile southeastward of the point.

San Miguel Island.—The bell buoy 3/4 mile southwestward from Point Bennett has been replaced by a gas and whistling buoy established 1 mile southwestward from the point.

PAGE 78.

Carmel Bay.—Add the following new information: At the northeast head of Carmel Bay and north of the Carmel River is the city of Carmel, with a population of about 2,000. Its buildings by day and lights at night are easily distinguished.

Point Santa Cruz.—Line 5, for "white tower" read "black square tower." Line 6, the light is now group flashing white (3 flashes every 15 seconds. At end of paragraph 2 add the following: About 3½ miles westward from the lighthouse an oil derrick, about 80 feet high, is very prominent in clear weather.

Point Pinos.—A fog signal (electric siren) has been established 535 yards northwestward from Point Pinos Lighthouse.

PAGE 79.

Ano Nuevo Island Lighthouse.—For "black" read "white."

PAGE 80.

Paragraph 1: A bell buoy has been established 0.6 mile 215° true from the southerly end of Pillar Point.

Halfmoon Bay (from northward).—A bell buoy lies 215° true 0.6 mile from the southerly end of Pillar Point.

PAGE 81.

Point Montara.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

Monterey Harbor.—Line 7: The oil wharf has been destroyed by fire and is in ruins.

Add the following: *Pacific Grove*, a city of about 5,000 population, is a continuation of Monterey to the westward and extends to within ½ mile of Point Pinos. There are no wharves, all shipping being done through Monterey.

PAGE 82.

Moss Landing.—Coasting steamers do not call at Moss Landing. The wharf has been practically destroyed by storms and all shipping is done by rail.

Santa Cruz Harbor.—The railroad wharf is no longer is existence. There are two wharves; the municipal wharf which handles all freight and commerce, and the Casino wharf which does not extend into deep water, being used only for pleasure boats during the summer, as an accessory to the Casino.

PAGE 83.

Santa Cruz Lighthouse.—The whistling buoy is located 2,240 yards 133° true from Santa Cruz Lighthouse.

PAGE 84.

The Farallones.—Lines 8 and 9, for "flashing white," read "group flashing white." Change information in parenthesis to read (flash 0.3 second, eclipse 3.5 seconds, flash 0.3 second, eclipse 3.5 seconds, flash 0.3 second, eclipse 22.1 seconds).

PAGE 85.

Drakes Bay.—A bell buoy is established in 8 fathoms of water about five-eighths mile 103° true (E. 3/8 N. mag.) from Chimney Rock.

PAGE 87.

The Main Ship Channel.—The controlling depth in March, 1925, was 39 feet. The project depth of this channel is 40 feet.

San Francisco Light Vessel.—Last sentence: The submarine bell strikes a group of five strokes every 30 seconds. A radio fog signal is established on the light vessel: Series of double dashes for 60 seconds, silent 60 seconds. This vessel exhibits a fixed white riding light from the forestay.

PAGE 88.

Paragraph 3, substitute for last sentence: "The eastern end of Four Fathom Bank is marked by horizontal striped gas and bell buoy, showing a flashing red light. A red spar buoy lies 330 yards west-northwestward from it."

PAGE 89.

Point Diablo.—A white light, flashing every 10 seconds, is established 50 feet above water at the end of Point Diablo. The fog signal is a siren sounding a group of 2 blasts every 30 seconds.

Lime Point Lighthouse.—The light is changed to group flashing white every 6 seconds.

Mile Rocks Light Station.—The fog signal is changed to an air diaphone. A 10-inch air whistle will be sounded if the diaphone is disabled.

A shoal with a least known depth of 27 feet lies 350 yards north by west from Fort Point Lighthouse. The Fort Point Ledge buoy is moored about 100 yards westward of the shoal in 50 feet of water.

PAGE 92.

Southampton Shoal.—The fog signal is changed to an air diaphone (2 blasts every 30 seconds).

The deep-water channel between Red Rock Bank and the northern extension of Southampton Shoal is marked by gas buoys.

Point Richmond (Richmond Harbor).—The controlling depths in the improved sections of this harbor are: 21 feet at mean low water in San Francisco Bay to the municipal basin, thence 20 feet to the head of the project opposite Ellis Landing. The channel is marked by buoys. Fuel oil may be obtained.

Red Rock.—A fog bell on a rock about 60 yards off the southeast end of Red Rock operates from October 1 to March 31.

Invincible Rock.—Change last part of sentence to read "and is marked off its south side by a red and black nun buoy."

Whiting Rock.—Change last sentence to read: "It is marked off its southern side by a red and black nun buoy." A gas buoy, No. 6, is established 420 yards 253° true from Whiting Rock.

PAGE 93.

San Rafael Creek.—New paragraph: There is a channel 4½ feet deep and 100 feet wide at mean lower low water across the mud flats at the mouth of the creek, thence 5 feet deep through Goose Neck Bend cut-off, thence to San Rafael 4½ feet, with a municipal turning basin near the upper end of the channel 5 feet deep. A buoy marks the entrance to the dredged cut and a lighted range the center line of the same.

Oakland Harbor.—San Antonio Creek fog signal is established on the Southern Pacific Co.'s steel tower on the south side of San Antonio Creek, about 1½ miles above the entrance to the creek. The signal is an air siren (1 blast every 20 seconds).

Oakland Harbor fog bell is replaced by an air diaphone.

Alameda Channel Buoy No. 5 is permanently discontinued. The width of the channel at this point is being increased by about 200 feet by dredging the shoal area between the buoy and the face of the new dock of the San Francisco Shipbuilding Co.

A fog bell maintained by the Southern Pacific Co. on the south wing of Southern Pacific Co.'s ferry slip at foot of Broadway sounds a group of 1 stroke every 5 seconds.

In 1924 the channel had a depth of 28 feet from deep water in San Francisco Bay to Webster Street Bridge; thence 29 feet to the Brooklyn Basin; thence 24 feet around the south channel of said basin and 18 feet through the tidal canal to San Leandro Bay.

PAGE 94.

Oakland.—A flashing red light and echo board is established in 10 feet of water on the southwest point of the shoal on the southerly side of the Southern Pacific Co.'s long wharf.

Oakland Mole fog signal is established on the outer end of south side of the Southern Pacific Co.'s passenger mole, 1,020 yards 356° from Oakland Harbor Lighthouse. The signal is a diaphone (group of 2 blasts every 30 seconds).

Last paragraph: Beacons mark a dredged channel 10 feet deep and 120 feet wide leading into Indigo Slough.

PAGE 95.

Redwood City Slough.—Paragraph 1: The entrance is marked by a flashing red light.

The channel dredged by local interests from the head of the Government project to East Bradford Street has shoaled so that the creek bed is bare in some places at low water. The town has established a new terminal at East Bradford Street, but access to it can be had only by vessels of small draft entering at high water.

Anchorages, San Francisco Bay.—The explosive anchorage is an area within a radius of 500 yards of a buoy 5,135 yards 155° from Goat Island Lighthouse. Other changes have been made in the anchorage limits in the bay, and the anchorages are shown on Chart 5532.

Pilotage.—A pilot boat mooring buoy, white spar, is established 350 yards 69° true from San Francisco Light Vessel. This buoy will show an American jack at all times.

PAGE 98.

Repairs.—The largest dock at Hunters Point is 1,020 feet long with a width of 153 feet, and can accommodate the largest ships afloat.

Buoy depot.—For "twelfth" read "eighteenth."

PAGE 102.

Bonita Channel.—A range is established. Mile Rock Lighthouse is the front object. The rear mark is 137° from Mile Rock Lighthouse and is a white day mark painted on the cliff.

Line 8, from bottom, for "24" read "33." Line 9 from bottom, for "1916" read "1924."

PAGE 103.

Line 2: A 29-foot sounding has been reported west-southwestward of Red Rock Bank buoy, and the buoy has been shifted toward this shoal. The distance given to pass this buoy will clear the shoal sounding.

If bound to Mare Island: Line 6, for "50 yards" read "75 yards." A black gas buoy (flashing white) is left 125 yards to port just before reaching the red buoy.

Line 12: The red buoy has been discontinued.

San Pablo Bay.—The channel across Pinole Shoal in May, 1925, had a controlling depth of 32.8 feet with a depth of 30 feet in Mare Island Strait channel up to the turning basin.

PAGE 104.

Petaluma Creek.—The channel has a controlling depth of 7 feet at mean lower low water across the shoal outside the entrance, thence 3 feet to Washington Street Bridge, Petaluma, the present head of navigation. A bell buoy and echo board have been established near the entrance to the channel across the flats.

Mare Island Strait.—A drawbridge connecting Mare Island with the city of Vallejo has been constructed.

In June, 1925, the controlling depth at mean lower low water in the improved channel up to the turning basin was 30 feet.

PAGE 105.

Napa Creek.—The controlling depth to Napa is 5 feet.

Carquiniez Strait.—There is a pinnacle rock with a depth at mean lower low water of 15 feet in line with the east face and 35 feet off the north corner of the Selby Smelting Works dock at Selby. Pending removal of this rock do not approach this dock from the eastward.

PAGE 106.

Sacramento River.—The present low-water depths are: To Sacramento, 7 feet; to Colusa, 3 feet; and to Sidds Landing, 2 feet.

Suisun Slough.—The controlling depth in 1924 was 6 feet to the harbor and 4 feet in the harbor.

Suison Bay.—An echo board has been established at low-water mark near the east end of the Middle Ground, 1,125 yards, 61° true from Middle Point light. A light (fixed white) has been established about 50 yards, 0° true from this echo board.

Paragraph 9: For "Point Reves." read "Point Reyes."

PAGE 107.

Tomales Bay.—The entrance is marked by a whistling buoy 1,400 yard 333° true from Tomales Bluff, a bell buoy about 340 yards outside the bar and a can buoy about 300 yards inside the shoalest water on the bar.

PAGE 110.

Point Arena Light Station.—Fog signal is an air diaphone sounding a group of 2 blasts every 60 seconds; blast 1 second, silent 1 second, blast 3 seconds, silent 55 seconds.

PAGE 111.

Greenwood Landing.—Line 7, for "telegraph" read "telephone."

PAGE 113.

Stillwell Point has a yellow slide on its south face.

Mendocino Bay.—Next to last line, for "could" read "should."

PAGE 114.

Russian Gulch.—The wire landing has been abandoned.

Paragraph 1, line 11: Strike out "telegraph or."

Caspar anchorage.—Next to last line, strike out "telegraph and."

PAGE 120.

Cape Mendocino.—There is a bank with depths of from 7 to 10 fathoms about 5 miles northwestward from Cape Mendocino.

PAGE 121.

Blunts Reef Light Vessel.—Last sentence change to read, "A submarine bell strikes 2 groups of 2 strokes (2–2) every 30 seconds."

A radio fog signal transmits continuously during thick or foggy weather signals consisting of single dashes for 60 seconds, silent 120 seconds.

PAGE 123.

Trinidad Head Lighthouse.—A fog bell has been established on point of bluff, 126 feet high, about 140 yards 130° true from lighthouse. The signal is 1 stroke every 10 seconds. It will be operated annually from April 1 to December 1.

PAGE 124.

Trinidad Harbor.—A fixed white light has been established on top of Prisoners Rock. It will be maintained from April 1 to November 1 of each year.

PAGE 127.

Crescent City.—A breakwater extending from Battery Point is under construction.

The bell buoy is replaced by a black spar, and a gas and bell buoy showing an occulting white light is established 200 yards eastward to mark the eastern side of the channel.

PAGE 128.

Point St. George.—There is a United States naval radiocompass station here.

PAGE 129.

Paragraph 4, line 6, for "½ mile," read "1¼ miles." Line 7, for "14 feet," read "12 feet": after word "beacons," insert "some of which are lighted." Paragraph 5, line 5, for "19 feet," read "15 feet."

PAGE 130.

Paragraph 1: For "Fairhaven" read "Rolph."

Paragraph 2: The depth of water alongside the wharf on the southwest side of Fields Landing is 20 feet.

The Bar.—In August, 1924, the controlling depth at mean lower low water across the bar was 27 feet. The range has been discontinued.

PAGE 131.

Quarantine.—For "Fairhaven" read "Rolph."

PAGE 132.

Strike out fourth paragraph. The changes in the channels are so frequent that no directions of value to strangers can be given. The entrance is well marked by buoys that are moved frequently to conform with the channel changes. While the buoys do not always mark the best water, strangers with a draft of not over 17 feet should have no difficulty in entering at high tide and with a smooth sea, being guided by the buoys and the latest edition of the chart.

PAGE 140.

Cape Arago Lighthouse.—It has been reported that the Coast Guard lookout station on Coos Head, southern entrance to Coos Bay, under certain conditions of the atmosphere has been mistaken for Cape Arago Lighthouse.

PAGE 143.

Siletz River.—Line 2, for "buoy," read "whistling buoy and a lighted range (both lights fixed red)."

PAGE 147.

Columbia River Light Vessel.—The submarine bell strikes a group of 5 strokes every 30 seconds. A radio fog signal transmits a series of 3 dashes every 60 seconds, silent 30 seconds.

North Head.—Information has been received through the district communication superintendent, United States Navy, that North Head Radio Station, equipped as a duplex station, transmitting and receiving simultaneously and independently, has resumed service.

As a duplex station North Head receives in the former North Head Station and transmits by distant control from the former Astoria Station. The combined station is equipped to furnish continuous service to and from ships, fulfilling in this connection the duties of the former North Head single station. In addition the station conducts communication with southeastern Alaska, fulfilling in this connection the duties of the former Astoria single station.

In view of the increased and improved equipment and the ability of the station to work duplex, it is believed that efficient service to commercial shipping will be possible. It is requested that shipping interests utilize the station as much as possible in order to determine its usefulness.

PAGE 148.

Coquille River.—In June, 1924, the controlling depth on the bar at mean lower low water was 15 feet with a depth of 7 feet to Bandon. In April, 1925, the controlling depth at mean lower low water in the channel on Bandon shoal was 8½ feet, with a depth of 6½ feet above the shoal. There is a fog bell on the south jetty at the entrance.

PAGE 149.

Coquille River.—To enter, line 11: The buoy has been discontinued.

PAGE 150.

The entrance, Coos Bay.—A 15-foot shoal spot, 50 feet southward from the range line and 33° from Guano Rock, has been reported: keep about 50 feet northward of the range line from abeam of the wreck on the north jetty to abeam of Guano Rock.

The controlling depth over the bar on the range was 21½ feet, May, 1925. The controlling depth on the rocky shoal off Coos Head is 21 feet, with a depth 18 feet to the head of the bay.

The dredged channel west of the drawbridge, near North Point, has shoaled to 10 feet, and to carry 20 feet vessels must keep south of the range between buoys Nos. 9 and 11.

PAGE 151.

Coos River.—Last line, for "5" read "4." The Marshfield Channel in addition to the beacons is marked by a lighted range.

PAGE 153.

Umpqua River.—The surveys of 1920 show considerable change in the shore line and channel at the entrance to the river. The controlling depth was reported in April, 1925, to be 10 feet with the

channel shifting northward. The range lights have been discontinued. The controlling depths to Gardiner and Reedsport remain the same. Leeds Island light, bearing 170° true of Three Mile light, bearing 350° true, carries the best water across the shoals into the channel to Reedsport.

PAGE 154.

Paragraph 5: The rock southwestward of Winchester Bay is a group of rocks lying 100 yards off the present shore line.

Reedsport.—Water, gasoline, and fuel oil may be obtained. Wharves with depth of 16 feet alongside are in front of the town.

PAGE 155.

The entrance, Siuslaw River.—A lighted range leading between the jetties has been established. It should not be used without local knowledge. In June, 1925, the controlling depth at mean lower low water across the bar on the new entrance range was 14 feet. General shoaling has occurred between Florence and Cox Island.

Additional buoys have been established to mark the channel inside the entrance to North Fork Shoal.

PAGE 156.

Yaquina Bay.—Paragraph 3: The south jetty has been extended 2,500 feet beyond the light, and a red buoy lies 40 yards off the submerged end.

Paragraph 4: In December, 1924, the controlling depth on the bar was 17 feet in a channel 400 feet wide.

Newport.—An 18-foot channel has been dredged through the shoal above Newport.

PAGE 157.

Tillamook Bay.—At end of third paragraph add "There is a 7-foot rock about 360 yards, 255° true from Green Hill."

The Sow and Pigs.—A beacon now marks the largest rock of the group.

The entrance.—The jetty is completed, but the outer 1,000 feet has subsided to below low water. In 1924 there was 17 feet over the bar.

PAGE 158.

The main channel.—Seven feet is the controlling depth. The channel to Bay City had a controlling depth of 7 feet in 1923.

Dredging a channel 16 feet and filling in behind a bulkhead has been carried on in the vicinity of the mouth of the Miami River, east of Garabaldi.

PAGE 159.

Nehalem River.—Paragraph 7: Both jetties are completed. The controlling depth across the bar in 1924 was 8 feet.

Paragraph 8: The red buoy is discontinued.

PAGE 160.

Baker Bay.—Fort Canby Light, fixed red, is established on the easterly extremity of Cape Disappointment. The light is to assist

boats to enter the cut-off channel to the westward of Sand Island and will be screened so as to be obscured to the westward of the southerly entrance to this channel. It may be changed to conform with the movements of this channel.

PAGE 161.

Astoria.—The radio station at Astoria is closed.

PAGE 162.

Longview.—Just westward of the mouth of Cowlitz River, and opposite Ranier, is the city of Longview, built around the activities of a large lumber development. A dock has a project depth of 30 feet along the face and berthing space of 1,800 feet. A temporary dock, just eastward of the permanent construction, is built out to the 30-foot contour.

PAGE 165.

A survey in June, 1924, by the Army engineers showed a channel with at least the project depth of 40 feet at mean lower low water for a width of 7,000 feet. Depths between the 40-foot contour ranged up to 45 feet. A draft of 35 feet is practicable at mean lower low water under ordinary weather conditions.

From Portland to the sea a draft of 31 feet is usually practicable at low tide from February to June; 28 feet, August to October; and 29 feet, November to February, inclusive. By working the tides 2-foot greater drafts can usually be carried. From Vancouver drafts of 24, 18, and 19 feet are usually practicable during the same periods.

PAGE 168.

New paragraph: A branch hydrographic office is located in the customhouse, Portland. A time ball is dropped at noon (one hundred and twentieth meridian time), Sundays and holidays excepted, on the roof of the customhouse.

PAGE 172.

Destruction Island.—A United States naval radiocompass station has been established here.

PAGE 176.

Umatilla Reef Light Vessel.—The submarine bell strikes a group of 4 strokes every 20 seconds.

PAGE 178.

Willapa Bay.—The bar at the entrance is subject to change. At the last survey there were two channels across the bar. The northern one had a controlling depth at mean lower low water of 23 feet while the southern channel had shoaled to 21 feet. The northern channel has been buoyed and it is planned to remove the buoys from the south channel at an early date.

PAGE 179.

The channel to Bay Center is marked by beacons and buoys.

PAGE 180.

Pilots and towboats.—There are regular pilots. Signals should be hoisted outside the bar, and vessels, if possible, should telegraph their expected time of arrival to the Willapa Bay Pilots Association, South Bend, Wash.

Communications.—Line 3, strike out "stopping at Bay Center."

PAGE 182.

Grays Harbor.—A lighted range has been established to mark the channel across the bar. In 1925 the least depth at mean lower low water in this channel was 23 feet with a depth of about 30 feet on the lighted entrance range between the jetties. In August, 1924, the controlling depth from the entrance to Aberdeen was 24 feet, and to Cosmopolis 20 feet.

PAGE 187.

Swiftsure Bank Light Vessel.—The submarine bell strikes a group of 6 strokes every 30 seconds. A radio fog signal transmits continuously during foggy or thick weather a series of double dashes every 60 seconds, silent 30 seconds. The oval gratings have been removed.

PAGE 194.

Minor Island Light.—The light is now a flashing white every 5 seconds. There is an echo board.

PAGE 196.

Port Crescent.—Port Crescent Light is discontinued, and in lieu thereof there is established a gas and bell buoy, showing a flashing white light.

PAGE 197.

New Dungeness Lighthouse.—Paragraph 2: It is reported that the shoal off the end of the spit is extending farther northward, a depth of 20 feet having been found 500 feet outside the buoy.

PAGE 199.

Neah Bay.—There is telephone and telegraph connection at Neah Bay. Vessels displaying their signal numbers off Baaddah Point will be reported.

PAGE 200.

Port Angeles.—The cannery wharf is no longer in existence.

PAGE 205.

Admiralty Head.—The light has been discontinued. An electric siren, giving a blast of 3 seconds duration every 30 seconds during fogs, mounted on a white tower on Standard Oil Co.'s wharf at Point Wells, is operated and maintained by that company.

Point Edwards.—A wharf is built out to deep water. A fog signal is established on its outer end.

PAGE 206.

Marrowstone Point.—The fog signal is now a reed horn, sounding 3 blasts every 30 seconds.

PAGE 207.

Apple Cove Point.—A flashing white light is established on the point.

Point No Point.—Last line, add "at which there is a wharf built out to deep water."

PAGE 208.

Blakely Rock.—The rock is marked by a flashing red light.

Decatur Reef.—The buoy is a flashing white gas and bell buoy.

PAGE 209.

Irondale.—The iron smelter has been removed.

Oak Bay.—Line 2, for "15 feet deep," read "12 feet deep in July, 1924."

PAGE 214.

Point Elliot.—Muckilteo Light is flashing white, flash 2 seconds, eclipse 3 seconds.

PAGE 218.

Duwanish Head.—The pleasure resort has been removed.

PAGE 219.

Duwanish River.—In June, 1924, the controlling depth at mean lower low water in East and West Waterways was 34 feet. In the southwest corner of East Waterway a shoal with a depth of 13 feet extended out about 100 feet. The entrances to these waterways are marked by lights. During fog a bell at West Waterway light sounds 2 strokes every 10 seconds. A bell at East Waterway light sounds 1 stroke every 5 seconds.

Lake Washington Canal.—The controlling depth to Lake Washington in August, 1924, was: Puget Sound to locks, 29 feet at mean lower low water; between the locks and Lake Union, 31 feet; and between Lake Union and Lake Washington, 23 feet at normal upper pool level. Lights have been established at salient points along the canal, and a light and fog signal in Shilshole Bay. (See Chart No. 6447). The entrance channel from Puget Sound to the lock is being widened and dredged to 34 feet at mean lower low water.

PAGE 222.

Table of drawbridges.—The city bridge at Fourteenth Avenue NW. has been removed. The signal for opening the city bridge at Tenth Avenue NE. is one long and three short blasts of the whistle.

Vessels approaching from either direction and desiring to enter the locks should sound two long and two short blasts of the whistle. When approaching from Puget Sound this signal follows the signal for the first bridge.

PAGE 224.

Tyee Shoal.—Last word, for "buoy" read "bell buoy."

PAGE 225.

The wharf 2 miles from Alki Point is gone.

Fauntleroy Cove.—The wharf is gone.

Point Pully.—The wharf is gone.

PAGE 226.

Point Brown.—The lighting characteristics of the light is a group of 3 flashes every 15 seconds.

PAGE 227.

Robinson Point.—The light is now a group flashing white every 12 seconds, flash 3 seconds, eclipse 1 second, flash 5 seconds, eclipse 5 seconds.

Gig Harbor.—A fixed red light is established on the southerly end of the sand spit on easterly side of entrance to Gig Harbor.

PAGE 229.

A rock with little water over it at low tide lies 150 yards 150½° true from the southwest corner of the dock located about midway between Lamola and Poulsbo, on the eastern side of Liberty Bay.

Agate Passage.—A light on the west side of channel through Agate Passage, opposite Agate Point, and two red buoys mark the channel through the passage. Six buoys and two lighters mark the torpedo range in the northern part of Port Orchard. A red flag hoisted on the south dock at the torpedo station and one displayed on the southern lighter indicates that torpedo firing is in progress and vessels are to keep well to the east side of the channel clear of the range, keeping a bright lookout for torpedoes and clear of same.

PAGE 230.

Waterman Point.—The light is occulting white, every 6 seconds. A fog bell sounds 1 stroke every 5 seconds.

Direction, Port Orchard.—Two nun buoys have been established on the northeast side of Richs Passage and an unlighted range to guide northward of a ridge with 5 fathoms of water over it.

PAGE 234.

Tacoma Harbor.—A dry dock for vessels up to 500 feet long, 85 feet beam, and 26½ feet draft is at Tacoma.

PAGE 242.

Olympia Harbor.—Additional beacons are established to mark the eastern side of the easterly dredged channel into Olympia Harbor. There are shipyards at Olympia equipped for making repairs to vessels.

PAGE 244.

San Juan Island.—A fog signal has been established at Lime Kiln Light Station. It is a reed horn which sounds a group of 2 blasts every 20 seconds, blast 2 seconds, silent 4 seconds, blast 2 seconds, silent 12 seconds.

A cluster of rocks about 80 yards in diameter, awash at mean lower low water lies 0.97 mile 148° true from Lime Kiln Lighthouse.

Kellet Bluff.—A light, flashing white every 3 seconds, is established near the southerly end of the west side of Henry Island.

PAGE 250.

Puffin Island.—A flashing white light is established 25 feet above water on the roof of a small white house on the northeasterly side of the island.

PAGE 251.

Blind Bay.—A rock partly bare at low water is reported to lie about 100 yards E. by S. ½ S. mag. from Blind Island at entrance to Blind Bay.

PAGE 254.

Belle Rock.—A beacon, white square house on gray cylindrical base, has been established on Belle Rock. Strike out second sentence.

Burrows Bay.—Last sentence: The light has been discontinued.

PAGE 260.

Paragraph 1.—Last line: A flashing white light has been established on Eliza Rock, just southward of the southern part of Eliza Island.

Drayton Harbor.—There is an obstruction with a depth of 16 feet at mean lower low water off the Alaska Packers wharf, about 1,025 yards, 87° true from Semiamoo Harbor light.

Point Roberts.—The light is now flashing white every 3 seconds.

PAGE 263.

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