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DEPARTMENT OF COMMERCE

U. S. COAST AND GEODETIC SURVEY

E. LESTER JONES, DIRECTOR

UNITED STATES COAST PILOT

PACIFIC COAST

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4th ed.
(1926)

CALIFORNIA, OREGON, AND WASHINGTON

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DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
Washington, May 28, 1926.

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 1925.

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 (fourth) edition was prepared by Lieut. R. R. Lukens, United States Coast and Geodetic Survey, under the supervision of Lieut. Commander J. H. Hawley, chief, coast pilot section.

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 May 28, 1926.

Navigators are requested to notify the Director 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,
Director.

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NOTE

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 359°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., and all courses given in points, are magnetic.

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

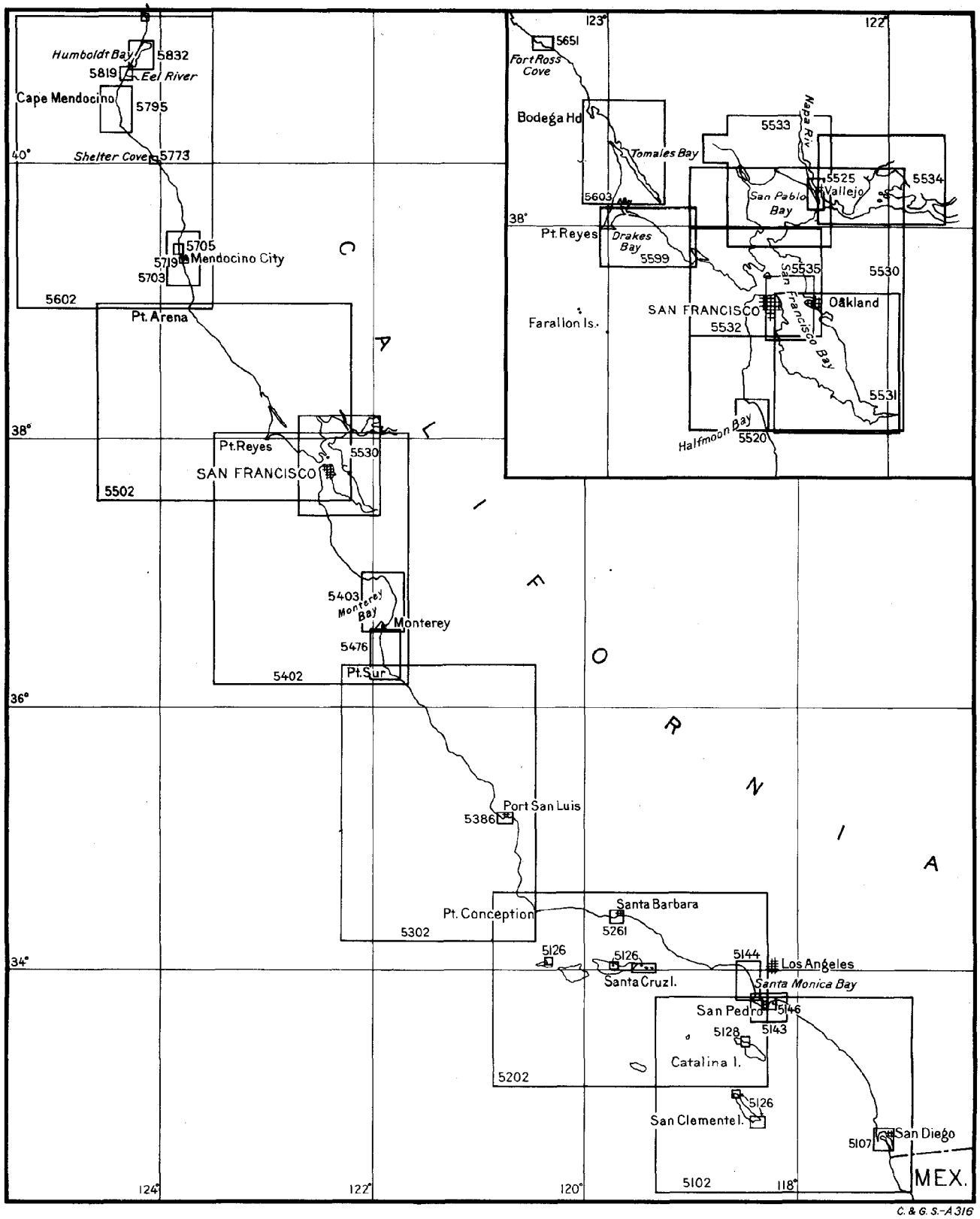
Currents are expressed in knots, which are nautical miles per hour.

All depths, except where otherwise stated, are at *mean lower low water*. In accordance with the desire of the International Hydrographic Conference, the equivalent expressed in meters follows in parentheses.

Heights are given in feet followed by the metric equivalent in parentheses.

Changes and other corrections affecting all coast pilot volumes are included in the Notice to Mariners published weekly by the United States Department of Commerce. About one year after a Coast Pilot is published, and at approximately yearly intervals thereafter until a new edition is brought out, a supplement, giving the more important corrections and additions to its text since the date of its publication, is issued. The date of the latest supplement to each Coast Pilot, for which a supplement has been issued, is shown in the list of Coast Pilots published each week in the Notice to Mariners. Any supplement may be obtained, free of charge, upon application to the Coast and Geodetic Survey, Washington, D. C., or any of its field stations. Each supplement is complete in itself and cancels all previous supplements.

Do not use this Coast Pilot except with reference to the latest supplement that may have been published and Notices to Mariners issued after the date of the supplement.



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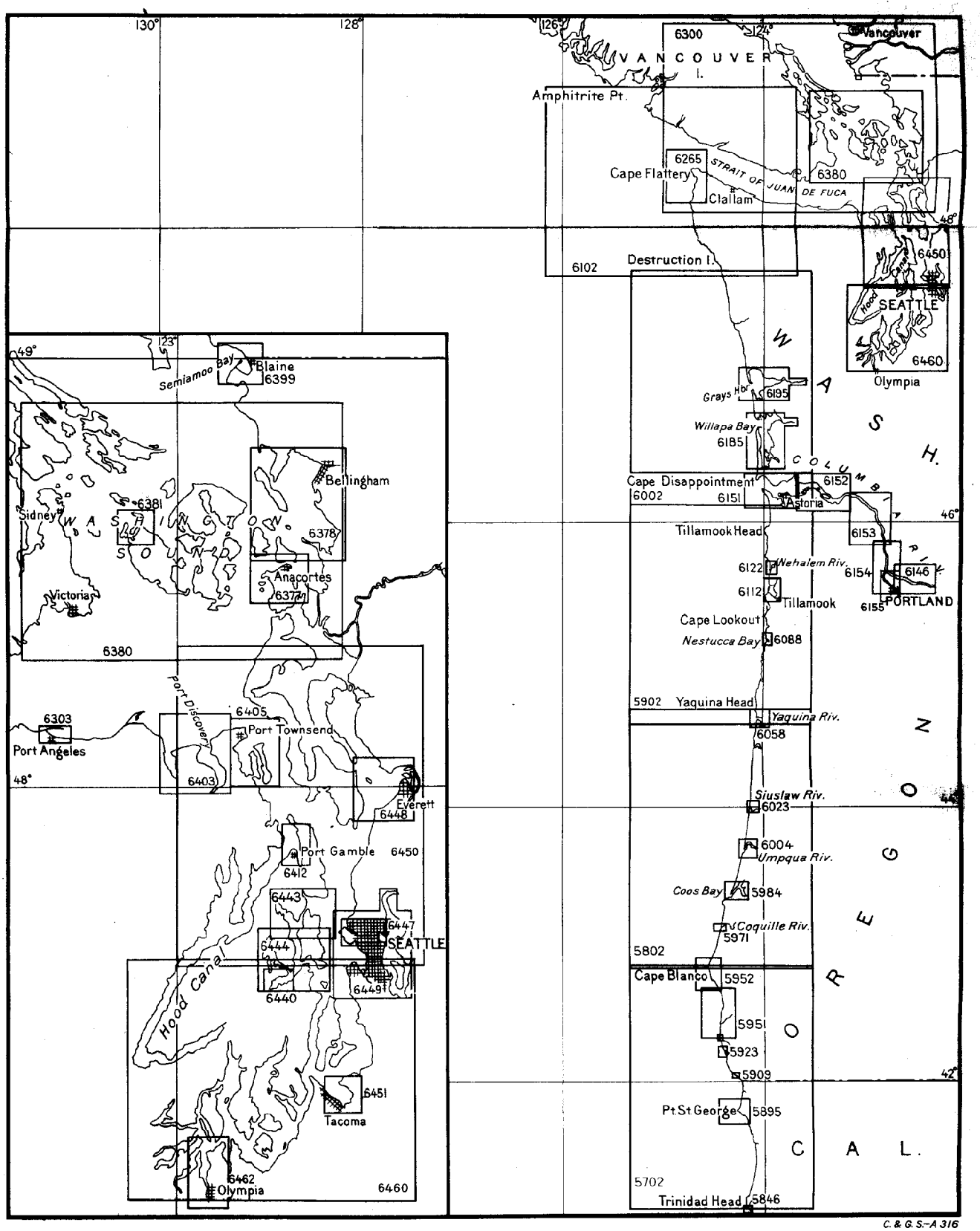

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UNITED STATES COAST PILOT

PACIFIC COAST—CALIFORNIA, OREGON, AND WASHINGTON

GENERAL INFORMATION

This volume 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 Farralones, 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 (183 m.) curve to greater depths is very abrupt, as is the case in many places from the 30-fathom (55 m.) curve to 100 fathoms (183 m.) The 100-fathom (183 m.) 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 vicinity 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.

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, Humbolt Bay, Coos Bay, Tilamook 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. Lightships 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 lightships 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 from the Division of Publications, Department of Commerce, Washington, D. C. The light lists are priced 30 cents each and the buoy lists 20 cents each.

All lightships and some light stations are equipped to give radio fog signals, and there are numerous radiocompass stations located along the coasts and particularly in the vicinity of the entrances to the main ports.

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.

Buoys maintained by the United States Army Engineers for dredging purposes are painted white with the top painted dark green for a distance of 2 feet.

Bridge regulations.—Regulations for lighting bridges over navigable waters, also for lights on sheer booms, piers, dams, and similar obstructions to navigation are prescribed by the Department of Commerce. A copy of these regulations will be sent free of charge to any shipmaster, pilot, or bridge owner upon application to the Division of Publications, Department of Commerce, Washington, D. C. The lighthouse inspectors have immediate authority over lighting of structures in their respective districts and are charged with the enforcement of the regulations.

Regulations for the operation of drawbridges, and for the navigation of certain sections of the inland waterways, are prescribed by the Secretary of War for many places; extracts from the regulations are given in some cases under the description of the waters affected.

Communication is by regular lines of coasting steamers, by rail, and by telegraph, telephone, and radio. A number of the light stations are equipped to receive messages by the international signal code, and transmit them by telegraph. There are several lines of trans-Pacific steamers, and a number of transcontinental railroads. There is an improved highway along the coast from border to border.

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.

The majority of vessels on the Pacific coast are now oil burners, and in general the facilities for bunkering with fuel oil are much superior to coal.

Repairs.—Extensive repairs to large vessels can be made only in Los Angeles Harbor, San Francisco, Portland, and Seattle. Minor repairs to machinery can be made at a number of places, but those mentioned are the only ports provided with dry docks.

The following table shows the dimensions of the largest dry docks available at the various ports:

Port	Type	Length of bottom	Width of bottom	Depth of water over sill at high water	Lifting capacity
		Feet	*Feet*	*Feet*	*Tons*
Los Angeles	Floating, sectional.	[1] 480	90	27 (8.2 m.)	15, 000
San Francisco	Graving	1, 000	110	40 (12.2 m.)	
Portland	Floating, sectional.	468	94	27 (8.2 m.)	15, 000
Seattle	do	520	89	26 (7.9 m.)	15, 000
Bremerton (Navy)	Graving	[2] 809	[3] 145	42 (12.8 m.)	
Esquimalt, British Columbia.	do.[4]	1, 150	126	40 (12.2 m.)	
Vancouver, British Columbia.	do	702	[5] 116	30 (9.1 m.)	

[1] Can take vessels up to 575 feet in length.
[2] Will take vessel up to 800 feet in length.
[3] Top.
[4] To be completed in 1926.
[5] At coping.

PILOTS AND PILOTAGE

Pilots will be found cruising off the port of San Francisco and off the mouth of the Columbia River. Pilots are available at most of the other ports, but do not cruise off the entrances. Vessels desiring pilots are urged to radio ahead, and state probable time of arrival off the entrance. Extracts from the laws governing pilotage will be found under the headings of the various localities.

Towboats are available at all the principal ports, but as a rule no longer cruise off the entrances. Arrangements for towboats should be made by radio or telegraph.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of 4 years, the present edition being that of 1923. 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, and are included in the appendix to this volume.

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.

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 running 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 special 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.

QUARANTINE

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

California:
- San Diego.
- San Pedro.
- Santa Barbara.
- Port San Luis.
- San Francisco.
- Monterey.

California—Continued.
- Fort Bragg.
- Eureka.

Oregon:
- North Bend.
- Newport.
- Astoria.

Washington:
- South Bend.
- Aberdeen.
- Port Angeles.
- Port Townsend.

A fumigation station with a medical officer of the Public Health Service in charge, is maintained at Seattle.

Medical relief.—American merchant seamen are entitled to free medical relief at the expense of the Government, through the United States Public Health Service at its established relief stations. A list of such stations on the Pacific coast is given below.

An American merchant seaman is defined as one "engaged on board in the care, preservation, or navigation of any registered, enrolled, or licensed vessel of the United States, or in the service, on board, of those engaged in such care."

Relief stations of the Public Health Service are located at the addresses given, in the following ports:

California:
- San Diego (306 Federal Building).
- San Pedro (Out-patient office, Appraisers' Building). (111 West Seventh Street).
- Los Angeles (544 Wilcox Building).
- San Francisco (Marine Hospital No. 19, Fourteenth Avenue and Lake Street).
- Eureka (407 First National Bank Building).

Oregon:
- Marshfield (Irving Building).
- Newport (Hurlburt Street).
- Astoria (408 Spexarth Building).
- Portland (320 Park Building).

Washington:
South Bend (Lumber Exchange).
Aberdeen (Electric Building).
Port Angeles (116 Laurel Street).
Port Townsend (Marine Hospital No. 17, Franklin and Quincy Streets).
Seattle (3130 Arcade Building).
Tacoma (930 Rust Building).
Everett (302 Central Building).
Bellingham (303 Medical Building).

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 or 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 the 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

NOTE.—It should be borne in mind that the amount of fog encountered in any month may vary widely from the mean values given above. For example, in February, 1925, there were 158 hours of fog in Los Angeles Harbor. At Farallon Island there were 153 hours of fog in January, 1925, while the average shown in the table is 28 hours. The winter of 1925 was an exceptionally foggy one for the coasts of southern California.

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 during 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.

STORM WARNINGS

Storm warnings are displayed by the United States Weather Bureau at numerous places on the coasts of the United States and the Great Lakes.

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.

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.

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.

Southwest storm warning.—A white pennant below a square red flag with black center displayed by day, or a white lantern below a red lantern displayed by night, indicates the approach of a storm of marked violence with winds beginning from the southwest.

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.

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

California:
- San Diego.
- Coronado Beach.
- Point Loma.
- North Island.
- Newport Bay.
- Avalon, Catalina Island.
- San Pedro (near Point Fermin).
- Santa Monica.
- Santa Barbara.
- Port San Luis.
- San Francisco (Merchants' Exchange Building).
- San Francisco (wharfinger's office).
- Point Reyes Light.
- Mendocino.
- Fort Bragg.
- Humboldt Bay Coast Guard Station.
- Eureka.

Oregon:
- Coos Bay Coast Guard Station.
- Marshfield.
- Point Adams Coast Guard Station.
- Astoria.

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

MARINE REPORTING STATIONS

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

- Honolulu, Hawaii.
- San Diego, Calif.
- San Pedro, Calif.
- Redondo Beach, Calif.
- Hueneme, Calif.
- Ventura, Calif.
- Santa Barbara, Calif.
- Point Conception, Calif.
- Surf, Calif.
- Port San Luis, Calif.
- Santa Cruz, Calif.
- Point Lobos, Calif.
- Point Reyes, Calif.
- Mendocino, Calif.
- Fort Bragg, Calif.
- Westport, Calif.
- Eureka, Calif.
- Bandon, Oreg.
- Marshfield, Oreg.
- Seaside, Oreg.
- Astoria, Oreg.
- Willapa Harbor, Wash.
- South Bend, Wash.
- Raymond, Wash.
- Westport, Wash.
- Hoquiam, Wash.
- Aberdeen, Wash.
- Tatoosh, Wash.
- Port Angeles, Wash.
- Port Townsend, Wash.
- Port Gamble, Wash.
- Bremerton, Wash.
- Winslow, Wash.
- Port Blakely, Wash.
- Richmond, Wash.
- Seattle, Wash.
- Tacoma, Wash.
- Olympia, Wash.
- Everett, Wash.
- Bellingham, Wash.
- Vancouver, British Columbia.
- Victoria, British Columbia.

RADIO SERVICE

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 the bureau. Either of the first two publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price, 15 cents each; the last one, 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 geographic 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.

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	Position (latitude, longitude)	Time		Wave length (meters)
			G. C. T.	Standard	
		° ′ ″			
San Diego, Calif.	NPL	32 44 30 N. 117 03 51 W.	17 00 00	9 00 00	9,798 (C.W.) 2,939 (C.W.)
San Francisco, Calif.	NPG	38 04 56 N. 122 16 04 W.	20 00 00 6 00 00	12 00 00 22 00 00	2,776 (C.W.) 2,776 (C.W.)
Eureka, Calif., Table Bluff	NPW	40 41 45 N. 124 16 19 W.	20 00 00	12 00 00	2,883 (C.W.)
North Head, Wash.	NPE	46 11 05 N. 123 50 51 W.	20 00 00	12 00 00	2,677 (spark)
Pearl Harbor, Hawaiian Islands	NPM	21 20 45 N. 157 58 00 W.	00 00 00	13 30 00	2,677 (spark) 11,490 (C.W.)

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 time signal is the beginning of the dash after this long break. Hydrographic information, weather reports, and other information of benefit to shipping are sent out from these stations.

Radiocompass bearings.—The increasing use of radio directional bearings for locations of ships' positions at sea, especially during foggy weather, has made it particularly desirable to be able to apply these radio bearings sent out by the shore stations directly to the nautical chart. The radio bearings sent out by radiocompass stations are the bearings of the great circles passing through those stations and the ship, and unless in the plane of the Equator or of a meridian, would be represented on a Mercator chart as curved lines. Obviously it is impracticable for a navigator to plot such lines on his chart, so it is necessary to apply a correction to a radiocompass bearing to convert it into a Mercator bearing; that is, the bearing of a straight line on a Mercator chart laid off from the sending station and passing through the receiving station.

On page 14 is given a table of corrections for the conversion of a radio bearing into a Mercator bearing. It is sufficiently accurate for practical purposes for distances up to 1,000 miles.

The only data required are the latitudes and longitudes of the radiocompass stations and of the ship by dead reckoning. The latter is scaled from the chart and the former either scaled from the chart or taken from the list of radiocompass stations printed in the Coast Pilots or in the publication, Radio Aids to Navigation (H. O. No. 205), issued by the Hydrographic Office, United States Navy. The largest scale chart available should be used for this purpose.

The table is entered with the difference in longitude in minutes between the ship and shore station (the nearest tabulated value being used), and opposite the middle latitude between the ship and shore station (to the nearest tabulated value) the correction to be applied is read.

The sign of the **correction,** when bearings are read clockwise from north, will be as follows: In **north latitude,** the plus sign is used when the ship is **east** of the compass station; the minus sign is used when the ship is **west** of the compass station; in **south latitude,** the minus sign is used when the ship is **east** of the compass station; the plus sign is used when the ship is **west** of the compass station. If the radio bearings are observed on the ship, the signs will be reversed. The corrected bearing is then the Mercator bearing from ship to the sending station, and to facilitate plotting 180° should be added to it and the result plotted from the sending station.

Should the position by dead reckoning differ greatly from the true position of ship as determined by plotting the corrected radio bearings, a retrial should be made, using the new value as the position of the ship.

Example.—A ship in latitude 37° 20′ N., longitude 69° 20′ W., by dead reckoning receives a radio bearing of 64° from a radiocompass station located in latitude 35° 14′ N., longitude 75° 32′ W. Find the Mercator bearing of the ship from the station—

Radiocompass station latitude	35°	14′ N.,	long.	75°	32′ W.
Dead reckoning position of ship	37	20		69	20
Middle latitude	36	17	Diff.	372′	

Entering table with difference of longitude=360′, which is the nearest tabulated value to 372′ and opposite 36° middle latitude (the nearest tabulated value to 36° 17′) the correction 106′ is read. The ship being east of the station the correction is plus. The Mercator bearing will then be the radio bearing received plus the correction from the table, 64° 00′+106′=64°+1° 46′=65° 46′.

For more accurate determinations the following formula should be used and on which the table of corrections are based.

Formula for the conversion of radio bearings into Mercator bearings.—The Mercator bearing is equal to the radio bearing received, plus or minus one-half the convergence of the meridians in minutes, which expressed as a formula is

$$M = R \pm \frac{D}{2} \sin\left(\frac{B+B'}{2}\right) \text{ in which}$$

M=Mercator bearing required.
R=radio bearing received from the radiocompass station.
D=difference in longitude, in minutes, between the radiocompass station and the ship's position by dead reckoning.
B=latitude of the radiocompass station.
B'=latitude of the ship's position by dead reckoning.

Example.—A ship in latitude 37° 20′ north, longitude 69° 20′ west by dead reckoning receives a radio bearing of 64° from a radiocompass station located in latitude 35° 14′ north, longitude 75° 32′ west. Find the Mercator bearing of the ship from the station.

By the formula—

$R=64°$
$D=75°\ 32'-69°\ 20'=6°\ 12'=372'$
$\frac{D}{2}=186'$

$B=37°\ 20'$
$B'=35°\ 14'$
$B+B'=72°\ 34'$
$\frac{B+B'}{2}=36°\ 17'$
$\sin 36°\ 17'=.59176$ (from the table of natural sines p. 13)

Substituting these values in the formula, and observing that since the ship is in north latitude and east of the radiocompass station, the + sign is used (see p. 12 for determination of signs), we have—

$$M=64°+186'\times 0.59176=64°+110'=64°+1°\ 50'=65°\ 50'$$

Table of natural sines

Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine	Mid. L.	Sine
0°	0. 00000	17°	0. 29237	34°	0. 55919	50°	0. 76604
1°	. 01745	18°	. 30902	35°	. 57358	51°	. 77715
2°	. 03490	19°	. 32557	36°	. 58779	52°	. 78801
3°	. 05234	20°	. 34202	37°	. 60182	53°	. 79864
4°	. 06976	21°	. 35837	38°	. 61566	54°	. 80902
5°	. 08716	22°	. 37461	39°	. 62932	55°	. 81915
6°	. 10453	23°	. 39073	40°	. 64279	56°	. 82904
7°	. 12187	24°	. 40674	41°	. 65606	57°	. 83867
8°	. 13917	25°	. 42262	42°	. 66913	58°	. 84805
9°	. 15643	26°	. 43837	43°	. 68200	59°	. 85717
10°	. 17365	27°	. 45399	44°	. 69466	60°	. 86603
11°	. 19081	28°	. 46947	45°	. 70711	61°	. 87462
12°	. 20791	29°	. 48481	46°	. 71934	62°	. 88295
13°	. 22495	30°	. 50000	47°	. 73135	63°	. 89101
14°	. 24192	31°	. 51504	48°	. 74314	64°	. 89879
15°	. 25882	32°	. 52992	49°	. 75471	65°	. 90631
16°	. 27564	33°	. 54464				

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Table of corrections, in minutes

[Difference of longitude in minutes]

Mid. L	30′	60′	90′	120′	150′	180′	210′	240′	270′	300′	330′	360′	390′	420′	450′	480′	510′	540′	570′	600′
5°	1	3	4	5	7	8	9	10	12	13	14	16	17	18	20	21	22	24	25	26
6°	2	3	5	6	8	9	11	13	14	16	17	19	20	22	23	25	27	28	30	31
7°	2	4	5	7	9	11	13	15	16	18	20	22	24	26	27	29	31	33	35	37
8°	2	4	6	8	10	13	15	17	19	22	23	25	27	29	31	33	35	38	40	42
9°	2	5	7	9	12	14	16	19	21	23	26	28	30	33	35	37	40	42	45	47
10°	3	5	8	10	13	16	18	21	23	26	29	31	34	36	39	42	44	47	49	52
11°	3	6	9	11	14	17	20	23	26	29	31	34	37	40	43	46	49	51	54	57
12°	3	6	9	12	16	19	22	25	28	31	34	37	41	44	47	50	53	56	59	62
13°	3	7	10	13	17	20	24	27	30	34	37	40	44	47	51	54	57	61	64	67
14°	4	7	11	15	18	22	25	29	33	36	40	44	47	51	54	58	62	65	69	73
15°	4	8	12	16	19	23	27	31	35	39	43	47	50	54	58	62	66	70	74	78
16°	4	8	12	17	21	25	29	33	37	41	45	50	54	58	62	66	70	74	79	83
17°	4	9	13	18	22	26	31	35	39	44	48	53	57	61	66	70	75	79	83	88
18°	5	9	14	19	23	28	32	37	42	46	51	56	60	65	70	74	79	83	88	93
19°	5	10	15	20	24	29	34	39	44	49	54	59	64	68	73	78	83	88	93	98
20°	5	10	15	21	26	31	36	41	46	51	56	62	67	72	77	82	87	92	98	103
21°	5	11	16	21	27	32	38	43	48	54	59	64	70	75	81	86	91	97	102	108
22°	6	11	17	22	28	34	39	45	51	56	62	67	73	79	84	90	96	101	107	112
23°	6	12	18	23	29	35	41	47	53	59	64	70	76	82	88	94	100	105	111	117
24°	6	12	18	24	31	37	43	49	55	61	67	73	79	85	92	98	104	110	116	122
25°	6	13	19	25	32	38	44	51	57	63	70	76	82	89	95	101	108	114	120	127
26°	7	13	20	26	33	39	46	53	59	66	72	79	85	92	99	105	112	118	125	131
27°	7	14	20	27	34	41	48	54	61	68	75	82	89	95	102	109	116	123	129	136
28°	7	14	21	28	35	42	49	56	63	70	77	84	92	99	106	113	120	127	134	141
29°	7	15	22	29	36	44	51	58	65	73	80	87	95	102	109	116	124	131	138	145
30°	7	15	22	30	38	45	53	60	68	75	83	90	98	105	113	120	127	135	143	150
31°	8	15	23	31	39	46	54	62	70	77	85	93	100	108	116	124	131	139	147	155
32°	8	16	24	32	40	48	56	64	72	79	87	95	103	111	119	127	135	143	151	159
33°	8	16	25	33	41	49	57	65	74	82	90	98	106	114	123	131	139	147	155	163
34°	8	17	25	34	42	50	59	67	75	84	92	101	109	117	126	134	143	151	159	168
35°	9	17	26	34	43	52	60	69	77	86	95	103	112	120	129	138	146	155	163	172
36°	9	18	26	35	44	53	62	71	79	88	97	106	115	123	132	141	150	159	168	176
37°	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	163	172	181
38°	9	18	28	37	46	55	65	74	83	92	102	111	120	129	139	148	157	166	175	185
39°	9	19	28	38	47	57	66	75	85	94	104	113	123	132	142	151	160	170	179	189
40°	10	19	29	39	48	58	68	77	87	96	106	116	125	135	145	154	164	174	183	193
41°	10	20	30	39	49	59	69	79	89	98	108	118	128	138	148	157	167	177	187	197
42°	10	20	30	40	50	60	70	80	90	100	110	120	130	140	151	161	171	181	191	201
43°	10	20	31	41	51	61	72	82	92	102	113	123	133	143	153	164	174	184	194	205
44°	10	21	31	42	52	63	73	83	94	104	115	125	135	146	156	167	177	188	198	208
45°	11	21	32	42	53	64	74	85	95	106	117	127	138	149	159	170	180	191	201	212
46°	11	22	32	43	54	65	76	86	97	108	119	129	140	151	162	173	183	194	205	216
47°	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	186	197	208	219
48°	11	22	33	45	56	67	78	89	100	111	123	134	145	156	167	178	190	201	212	223
49°	11	23	34	45	57	68	79	91	102	113	125	136	147	158	170	181	192	204	215	226
50°	11	23	34	46	57	69	80	92	103	115	126	138	149	161	172	184	195	207	218	230
51°	12	23	35	47	58	70	82	93	105	117	128	140	152	163	175	186	198	210	221	233
52°	12	24	35	47	59	71	83	95	106	118	130	142	154	165	177	189	201	213	225	236
53°	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240
54°	12	24	36	49	61	73	85	97	109	121	133	146	158	170	182	194	206	218	231	243
55°	12	25	37	49	61	74	86	98	111	123	135	147	160	172	184	197	209	221	233	246
56°	12	25	37	50	62	75	87	100	112	124	137	149	162	174	187	199	211	224	236	249
57°	13	25	38	50	63	75	88	101	113	126	138	151	164	176	189	201	214	226	239	252
58°	13	25	38	51	64	76	89	102	115	127	140	153	165	178	191	204	216	229	242	254
59°	13	26	39	51	64	77	90	103	116	129	141	154	167	180	193	206	219	231	244	257
60°	13	26	39	52	65	78	91	104	117	130	143	156	169	182	195	208	221	234	247	260

Accuracy of bearings.—The accuracy with which bearings can be taken depends on the conditions outlined below; but, although in general the bearings taken by a station within the sector of calibration can generally be considered accurate to within 2°, the Government can not accept any responsibility for consequences of a bearing's inaccuracy.

It is pointed out that if at least 3 radiocompass stations can be employed and if they are situated so as to give good intersections, considerable reliance can be placed on the result of 3 simultaneous bearings thus obtained, provided that the "triangle of error" formed by the bearings is small.

In the case of bearings which cut the coast line at an oblique angle, errors of from 4° to 5° have been reported.

Bearings obtained between about half an hour before sunset and half an hour before sunrise, are generally unreliable, on account of the excessive error introduced. These errors are not so great when only an expanse of sea separates the two stations, but in the case of the bearing passing over land, particularily if it is hilly country, the amount of error is abnormal. Changes in the intensity of the signal received also occur at sunset and sunrise, and apart from the above-mentioned variations, changes in the signal strength of the transmitting station have been observed at these times.

Bearings signaled as "approximate" or "second class" must be treated with grave suspicion, as very considerable errors may exist in such bearings.

The following radiocompass stations will be of use for vessels navigating on the Pacific coast. In plotting bearings furnished by these stations the *position of the receiver* must be used. Vessels equipped with radiocompass may also use these stations as radio beacons. For this purpose a station will transmit, upon request, its call letter for 45 seconds on 800-meter wave. When the bearing is taken on the vessel, the *position of the transmitter* must be used for plotting.

Station	Call letters	Position of receiver						Position of transmitter						Arc of calibration
		Latitude			Longitude			Latitude			Longitude			
		North			West			North			West			Degrees
		°	′	″	°	′	″	°	′	″	°	′	″	
Imperial Beach, San Diego, Calif.	NPL	32	35	14	117	07	54	32	44	15	117	03	53	182–331
Point Loma, San Diego, Calif.	NPL	32	42	21	117	15	17							85–250
Point Fermin, San Pedro, Calif. [1]	NPX	33	42	19	118	17	37	33	42	22	118	17	36	90–290
Point Hueneme, Hueneme, Calif.	NMD	34	08	43	119	12	30	34	08	43	119	12	12	135–305
Point Arguello, Calif. [2]	NPK	34	34	38	120	38	32	34	34	38	120	38	41	170–360
Farallon Island, Calif. [3]	NPI	37	41	59	122	59	56	37	41	52	123	00	00	0–360
Point Montara, Calif. [3]	NLH	37	32	02	122	31	07	37	32	04	122	31	05	185–340
Point Reyes, Calif. [3]	NLG	38	02	13	122	59	36	38	02	10	122	59	36	210– 02
Eureka, Calif.	NPW	40	41	49	124	16	33	40	41	45	124	16	19	204– 10
St. George Point, Calif.	NYW	41	47	00	124	15	05							178– 10
Empire, Oreg.	NPF	43	23	03	124	18	58	43	20	38	124	13	36	230– 10
Fort Stevens, Oreg.	NPE	46	11	32	123	59	15	46	09	12	123	49	36	175–335
Klipsan Beach (Ocean Park), Wash.	NZS	46	27	53	124	03	16	46	27	54	124	03	11	195–340
Destruction Island, Wash.	NOJ	47	40	29	124	29	02	47	40	30	124	29	00	
Tatoosh Island, Wash. [4]	NPD	48	23	41	124	44	13	48	23	28	124	44	04	180– 90
Pachena Point, Wash.	VAD	48	44	00	125	06	00							
New Dungeness, Wash.	NFT	48	10	32	123	07	56	48	10	26	123	08	06	240–115
Smith Island, Wash.	NFH	48	19	04	122	50	39	48	19	12	122	50	35	0–360
Cattle Point, Wash.	NFN	48	27	05	122	57	45	48	27	17	122	57	41	120–280
Soapstone Point, Alaska [5]	NUW	58	06	13	136	29	51	58	05	39	136	29	44	245– 50
Cape Hinchinbrook, Alaska	NRM	60	14	00	146	38	55	60	14	07	146	39	08	112–294

[1] Out of commission at present.

[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] The San Francisco entrance stations are under the control of Point Montara radio station. Point Montara will obtain bearings from the remaining stations in the group and furnish them to the ship after corrections have been applied.

[4] Bearings furnished in the sector 232° to 264° should be used with caution until reported unreliability has been investigated.

[5] Limited service. Standing watch during thick and heavy weather.

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.

United States naval radiocompass stations 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 positions 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. (See preceding pages for reduction of observed bearings to Mercator bearings.)

Radiocompass stations are divided into two classes: (*a*) Single stations, operating independently and furnishing a single bearing. (*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.

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 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 radiocompass stations keep watch on 375 kilocycles (800 meters). Only this wave should be used to call and work with these stations.

Hours of service.—During the first 10 minutes of each hour during clear weather radiocompass stations ordinarily will not be guarding this wave. Ships are requested to confine their requests for bearings during clear weather to the remaining 50 minutes of the hour, as far as is practicable. Should a station chance to hear a request for a bearing during the first 10 minutes of the hour, the required bearing will be given. During the remaining 50 minutes and at all times during inclement weather, all radiocompass stations will be continuously guarding the 375-kilocycle (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 from_____radiocompass station was____degrees.

Procedure in detail.—(*a*) A ship calling the radiocompass station or compass control station should make the abbreviation "QTE?" ("What is my true bearing?"). This request will be answered by the radiocompass station or control station, and when ready to observe the radio bearing it will send the signal "K," indicating to 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 true bearing from _____ was _____ degrees"), followed by the bearing in degrees given by a group of three figures 000 to 359, indicating the true bearing in degrees of the ship station from the radiocompass 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 radiocompass 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 stations.

Radio fog signals.—The following radio fog signals are operated on the Pacific coast by the United States Lighthouse Service. Stations for which no call letters are given do not maintain radio communication service:

	Seconds
Los Angeles Harbor Light:	
Single dashes	60
Silent	60
Point Arguello Light Station:	
Groups of 3 dashes	60
Silent	45
Point Sur Light Station:	
Groups of 1 dot, 2 dashes, 1 dot	60
Silent	90
San Francisco Lightship (call letters WWBV):	
Groups of 2 dashes	60
Silent	60
Blunts Reef Lightship (call letters WWBU):	
Single dashes	60
Silent	120
Cape Blanco Light Station:	
Groups of 1 dash, 1 dot	60
Silent	30
Columbia River Lightship (call letters WWBQ):	
Groups of 3 dashes	60
Silent	30
Swiftsure Bank Lightship (call letters WWBO):	
Groups of 2 dashes	60
Silent	30

The ships and stations transmit continuously during thick or foggy weather and from 9 to 9.30 a. m. and 3 to 3.30 p. m. during clear weather. Blunts Reef, Columbia River, and Swiftsure Bank Lightships also transmit during the first 15 minutes of each even hour from 10 p. m. to 6.15 a. m., in clear weather (all 120th meridian time).

At about 8 a. m., 12 noon, and 8 p. m. daily each lightship will broadcast, on 600-meter wave lengths, weather reports pertaining to

existing weather conditions in the immediate vicinity of the lightship 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.

These radio fog signals are intended for the use of vessels equipped with radiocompass. By means 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 radiotelegraph 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 with the radiocompass with the bearing as given 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 lightships and stations 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.

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 7,005 meters (42.8 kilocycles).

Evening bulletin at 7.30 p. m. (one hundred and twentieth meridian time) on a wave length of 7,005 meters (42.8 kilocycles) and 2,776 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.* (call letters KPH), 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.

UNITED STATES COAST GUARD STATIONS

Coast Guard stations included in this volume are maintained at the places named in the following table. The stations are manned continuously 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 found in the appendix, page 288.

Name of station	State	Locality
Southside [1]	California	4½ miles south of Point Lobos.
Golden Gate	do	¾ mile south of Point Lobos.
Fort Point	do	¾ mile east of Fort Point Light.
Point Bonita	do	Bonita Point.
Bolinas Bay	do	Bolinas Bay.
Point Reyes	do	3½ miles north of Point Reyes Light.
Arena Cove	do	3 miles southeast from Point Arena Light.
Humboldt Bay	do	Near old lighthouse tower, north side entrance to Humboldt Bay.
Coquille River	Oregon	Bandon, Oreg., south side Coquille River.
Coos Bay	do	South side entrance Coos Bay, about ⅜ mile east of Coos Head.
Umpqua River	do	North side entrance Umpqua River.
Siuslaw	do	Near mouth Siuslaw River.
Yaquina Bay	do	North side entrance Yaquina Bay, Newport, Oreg.
Tillamook Bay	do	North side entrance, Tillamook Bay.
Point Adams	do	Near mouth of Columbia River, ¾ mile southeast of Fort Stevens.
Cape Disappointment.	Washington	Fort Canby, north side entrance of Columbia River.
Klipsan Beach [1]	do	11¼ miles north of Cape Disappointment Light.
Willapa Bay	do	1¼ mile east Willapa Bay Light.
Grays Harbor	do	Just south of Grays Harbor Light.
Baadah Point	do	Neah Bay.
Nome	Alaska	At Nome.

[1] Discontinued as an active unit.

VARIATION OF THE COMPASS

The magnetic variations for 1927, and annual decrease, at points mentioned are as follows:

Locality	Compass variation, east		Annual decrease
	°	′	′
Point Loma, Calif	15	15	1
Point Fermin, Calif	15	45	1
Point Arguello, Calif	16	25	1
Point Sur, Calif	17	25	1
Farallon Lighthouse, Calif	18	00	1
Point Arena, Calif	18	45	1
Cape Mendocina, Calif	19	35	1
Point St. George, Calif	20	20	1
Cape Blanco, Oreg	20	50	2
Heceta Head, Oreg	21	45	2
Cape Lookout, Oreg	22	30	2
Cape Disappointment, Wash	23	00	2
Cape Elizabeth, Wash	23	40	2
Cape Flattery, Wash	24	35	2
Point Wilson, Wash	24	10	2
West Point (Seattle Harbor), Wash	23	40	2

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 (0.3 to 0.6 m.), and the average difference in the heights of the two low waters from 2 to 3 feet (0.6 to 0.9 m.). 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 (1.5 m.) off southern California to about 7½ feet (2.3 m.) off the coast of Washington. Extreme variations from 3 feet (0.9 m.) below to 10 feet (3.0 m.) 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 (1.5 m.) 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 (0.7 m.) 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 about 1 foot (0.3 m.) 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 (0.3 m.) greater. It requires about 5 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 (0.6 m.) and at Sacramento about 1 foot (0.3 m.).

In **Humboldt Bay** the tide is from ½ to 1 hour later than on the outer coast. The mean high-water lunitidal interval is approximately 12 hours and the mean rise is about 6 feet (1.8 m.) above the plane of reference.

In **Coos Bay** the tide is from ½ to 1½ hours later, and the rise of high water about the same as in Humboldt Bay.

In **Yaquina Bay** the mean lunitidal interval is about 12 hours, and the mean rise about 7 feet (2.1 m.) above the plane of reference.

At the entrance to the **Columbia River** high water occurs about ½ hour before the transit of the moon and the mean rise is about 7½ feet (2.3 m.) above the plane of reference. It requires about

6 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 1½ feet (0.4 m.) 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 (7.5 m.) 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 near the time of the transit of the moon and the mean rise is about 9 feet (2.7 m.) 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 (2.1 m.) above the datum at Cape Flattery to 8 feet (2.4 m.) at Port Townsend. There is an increase in the average inequality between the two low waters of each day from 3 feet (0.9 m.) at Cape Flattery to 5½ feet (1.7 m.) at Port Townsend, 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 (2.4 m.) above the datum of mean lower low water at Port Townsend to 14 feet (4.3 m.) at Olympia. In Puget Sound the average difference between the two low waters of each day is 6 feet (1.8 m.). At Seattle an extreme range from 4½ feet (1.4 m.) below the datum of mean lower low water to 15 feet (4.6 m.) above the same datum has been observed. At Olympia, in the southern part of the sound, an extreme high water 18 feet (5.5 m.) above the datum has been noted.

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 (2.4 m.) above the plane of reference. In this sound an extreme range from 4½ feet (1.4 m.) below the plane of reference to 12 feet (3.7 m.) 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 15 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. 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 along 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 currents; 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 or strength of current, reference should be made either to figures given for various places in this volume of the Coast Pilot or to the Pacific Coast Current Tables, where the predicted times of slack water and strength of current are given for a number of points on the Pacific coast of the United States, British Columbia, and Alaska.

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 to Point Conception, where it bends southward and westward. The estimated velocity is about ¾ knot, 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 Lightship 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 lightships.—Current observations have been made on the five light vessels along the Pacific coast for several years. A discussion of these observations will be found in Special Publication No. 121, entitled "Coastal currents along the Pacific coast of the United States," published by the Coast and Geodetic Survey. A short discussion is given in the appendix to this volume. The greatest velocity observed at the light vessels was 3 to 3½ knots.

Wind currents.—This subject is very complex. In general it may be said that along the Pacific coast of the United States at a distance of from 5 to 10 miles offshore, the wind brings about a current having a velocity about 2 per cent that of the wind. The direction of this wind-driven current, however, is not with the wind. With winds from the northeast, southeast, and northwest quadrants, the current sets about 20° to the right of the wind, while with winds from the southwest quadrant the current sets about 20° to the left of the wind. It is evident, however, that these are but average values, for strong currents are sometimes experienced when the local winds are light.

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 has been that they follow the prevailing winds, setting, in general, southward in summer and northward in winter. Recent observations indicate that the current is apt to be from 20° left to 20° right of the direction of the wind. See page 25.

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 and 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.

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 (55 m.) he will pay out the wire so slowly that he probably will not find the bottom in a depth of 60 or 70 fathoms (110 or 128 m.). If he expects 80 to 100 fathoms (146 to 183 m.) he may get bottom in 25 or 30 (46 or 55 m.) 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. A statement regarding the errors usually found in sounding tubes will be found in the appendix to this volume.

The introduction of radiocompass stations ashore, and of radiocompasses on board ship, have given the navigator additional ways of determining his position with a fair degree of accuracy, but the lead should never be abandoned.

Due to the fact that there are certain conditions under which radio bearings may be subjected to grave error, the additional check of sounding in critical places should be carried out. One of the worst marine disasters of recent years on the Pacific coast was due to an erroneous radio bearing being received from a shore station. In the last analysis, the lead is the navigator's best safeguard.

Table of distances in nautical miles

[Based on courses recommended in this volume]

	Seattle (Coleman Dock)	Aberdeen (port docks)	South Bend	Portland (Broadway Bridge)	Astoria (port terminal)	Marshfield	Eureka (railroad wharf)	San Francisco (Ferry Building)	Santa Barbara (wharf)	Los Angeles Harbor (foot of Fifth St.)
San Diego (municipal pier)	[1] 1,124	1,028	1,016	1,071	985	815	650	452	172	92
Los Angeles Harbor (foot of Fifth St.)	[1] 1,140	945	932	988	902	730	567	368	87	------
Santa Barbara (wharf)	[1] 1,059	861	850	907	821	648	484	287	------	------
San Francisco (Ferry Building)	[1] 804	607	597	651	565	397	228	------	------	------
Eureka (railroad wharf)	[1] 591	393	382	436	350	182	------	------	------	------
Marshfield	442	241	230	285	199	------	------	------	------	------
Astoria (port terminal)	270	69	58	86	------	------	------	------	------	------
Portland (Broadway Bridge)	356	155	144	------	------	------	------	------	------	------
South Bend	245	44	------	------	------	------	------	------	------	------
Aberdeen (port docks)	234	------	------	------	------	------	------	------	------	------

[1] One course from Umatilla Lightship to Cape Blanco.

NOTE.—All distances to San Francisco are via the San Francisco Lightship.

DESCRIPTIONS AND SAILING DIRECTIONS

DIRECTIONS, SAN DIEGO TO THE STRAITS OF FUCA

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 off-shore 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 34.

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 (16.4 to 18.3 m.), 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 buoy at Point Fermin and Point Vincente Light 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 (91 m.). 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 (183 m.) 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 (183 m.) 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 (183 m.) 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 (55 m.), haul to a south-southeast (mag.) course, keeping in that depth, and if the water deepens to over 40 fathoms (73 m.) 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, formerly considered the most difficult point to make on the southward track, is now marked by a light and fog signal. 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. From Hueneme, the course should be shaped to pass about 2 miles off Vincente, and the lead should be used as the point is approached.

When the lead and fog signal show Point Vincente is abeam, haul up to pass ½ mile off Point Fermin whistling buoy. Feeling the way cautiously, the lead will 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 (55 m.) 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 (55 m.) 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--	322
8. To Cape Flattery Lighthouse bearing 145° true (SE. by E. ⅜ E. mag.) distant 2¾ miles.	10	N. by W. ¼ 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 and erroneous conclusion that the vessel is wide of the point. If Punta Gorda is passed in not less than 50 fathoms (91 m.) 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 (110 m.) 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 (128 to 146 m.) 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 (58 to 64 m.) 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 (55 m.) 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 (55 m.) 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 (55 m.) 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.

Cape Blanco should be passed with caution. If the lead shows less than 60 fathoms (110 m.), haul out parallel to the coast until you lose bottom; the vessel will then be past Cape Blanco. Recent surveys shows the area off Cape Blanco to be of even bottom with the 60-fathom (110 m.) curve 5½ miles off the cape.

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 vessels 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 (55 m.) curve somewhere off Table Bluff; then hauled out parallel to the shore, keeping in depths of 30 to 35 fathoms (55 to 64 m.) until the light vessel is made.

This course should lead across the head of a submarine valley about 10 miles northwest of Cape Mendocino. Here the navigator will lose the bottom, as the depths drop off suddenly to 200 fathoms (366 m.), but in about 3 miles bottom should again be picked up in about 60 fathoms (110 m.). Cape Mendocino is a dangerous point and many vessels have been lost here. The mariner can not be too careful in rounding this point. The charts now show complete hydrographic surveys of this area, and should be studied carefully with the soundings obtained. After changing course the sounding should be continued to pick up the submarine valleys south of the cape.

Approaching Point Arena, start sounding 10 or 15 miles north of the point, and if at any time the lead shows 40 fathoms (73 m.) or less, haul out on a south (magnetic) course in not less than 40 fathoms (73 m.). In this way the fog signal will usually be made; if not, and the water deepens to 60 fathoms (110 m.), the vessel will be past the point and the course may be changed for Point Reyes. Arena Rock, with 13 feet (4.0 m.) over it, is only ¾ mile inside the 30-fathom (55 m.) curve.

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 5107) 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 point 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 (5.4 to 10.0 m.), according to the locality. The municipality maintains two modern piers, capable of accommodating large modern vessels. Due to lack of dredging only the south side of the new mole-type pier was available in 1925. There is a large amount of foreign and domestic commerce by rail and water. Lumber, iron, cement, guano, and general merchandise are imported; fruit, farm produce, and general merchandise are exported. The customhouse barge office is located on 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 to San Diego by passenger and automobile ferry. The Coronado Hotel is prominent from seaward, and the southern tower is shown on the harbor chart.

North Island is low and flat and is an extensive aviation field. The tower of the naval administration building shown on chart 5107 is an important landmark.

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

1. A channel 750 feet wide, 35 feet (10.7 m.) deep at mean lower low water, and marked by a lighted range and by buoys, has been dredged through the bar at the entrance. The range does not show well by day and is not easy to pick up at night. A jetty has been

built southward across **Zuninga Shoal** a distance of about 7,500 feet. The outer half of this jetty is at present submerged.

2. A channel, including an approach, has been dredged across **Dutch Flats** along the north shore of the bay. The channel was originally dredged to 15 feet (4.6 m.) at mean lower low water, but subsequent shoaling has reduced this depth somewhat. The approach channel is marked by buoys. This channel is but little used.

3. There is a dredged channel, marked by beacons, for entering **Glorieta Bay,** Coronado Island. This channel has least depths of 8 to 9 feet (2.4 to 2.7 m.) at mean lower low water, and is used mainly by small pleasure craft.

The channel for deep-draft vessels leading through the bay varies from 300 to 600 yards in width with average depths of 6 to 8 fathoms (11.0 to 14.6 m.), except in the dredged sections, as far as San Diego, beyond which it shoals to 3 and 4 fathoms (5.5 to 7.3 m.). It is well marked by beacons (most of which are lighted) and buoys.

The channel above San Diego has a least depth of 17 feet (5.2 m.) and a least width of 200 yards between the 12-foot (3.7 m.) curves to the oil-products factory about 5 miles above San Diego, and is well marked by beacons and buoys to this point. The wharf here extends out to 22 feet (6.7 m.), but it is old and in poor repair. There is a depth of 12 feet (3.7 m.) in an unmarked channel for about 1 mile above the oil-products factory wharf.

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 2⅝ miles 184° true (S. by 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 13 fathoms (23.8 m.). 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 (183 to 4.6 m.); 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, on which the clipper ship *Bishop* struck in 1855, has but 15 feet (4.6 m.) over it and is the shoalest point on Cortes Bank. It is located in latitude 32° 25′ north and longitude 119° 08′ west. This rock is the farthest outlying danger on the coast. The currents in this vicinity are variable in direction and have a velocity of from 1 to 2 knots.

In January, 1920, the buoy broke adrift and when picked up it was found to have drifted in a direction 142° true (SE. ¾ E. mag.) at a rate of a little over ½ mile per hour.

These currents cause considerable swell and even in moderate weather the rock usually shows a breaker. Navigators should use great care when in this vicinity. The rock is marked by a whistling buoy.

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 depths 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 on page 39.

From northward.—Follow the directions for southbound vessels, page 30, to a position 2 miles southwestward of Point Loma Lighthouse. Then proceed as directed on page 39.

Prominent features.—Table Mountain, 2,244 feet (684 m.) 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 off shore. The northwestern island, 467 feet (142 m.) high, lies nearly 14 miles 192° true (S. ¼ E. mag.) from Point Loma; the southeastern and largest is 672 feet (205 m.) 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 (122 m.) 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 1½ seconds, eclipse 13½ seconds), 88 feet (26.8 m.) 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 will be made out. Other prominent objects along the crest of the ridge are the radio masts with a large black water tank close by, 2½ miles northward from the light, and the glass dome surmounting the main building of the Theosophical Institute, 3¼ miles northward from the light.

The dirigible mooring mast near the west end of the North Island and the tower of the Naval Administration Building at the north point of the island, show well from the entrance, while the high brick chimney at the Marine Barracks is prominent from the western portion of the bay. A small red gas light, visible about 2 miles, is

displayed from the top of the mooring mast. The above features are shown on chart No. 5107 and afford the navigator means for determining his position frequently in navigating the bay.

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 up 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 the Santa Fe Railroad 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 (5.5 to 12.8 m.). 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 (11.0 to 16.4 m.) anywhere eastward of the line joining the bell and whistling buoys.

The anchorage grounds above the municipal piers are usually occupied by naval craft when the fleet is in home waters. Fore and aft mooring is not required and during slack water the main channel is often partially obstructed by vessels tailing in different directions.

PORT FACILITIES

Pilots are usually employed by strangers. The pilot station is at Ballast Point, and pilots may be obtained by signaling the light station at Point Loma. If possible, vessels desiring a pilot should radio ahead, stating the expected time of arrival off the entrance. 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 per foot (0.3 m.) draft and 2 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 per foot (0.3 m.) 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 the international "P," or by night displaying a torch or flare-up within a distance of 1 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 commercial steam towboats available at present (1925). Gas tugs up to 100 horsepower may be had and naval tugs have been arranged for in emergencies.

Quarantine.—National regulations only are enforced. Vessels subject to quarantine 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 LaPlaya. The office of the Quarantine Service is in the Federal Building, San Diego.

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

Supplies.—Fuel oil may be had in any quantity from the oil docks with depths of 22 to 23 feet (6.7 to 7.0 m.) alongside. Arrangements may be made also to fuel from barges. Coal bunkers are no longer maintained in San Diego, but coal can be supplied by arrangement.

Fresh water may be had at the wharves or by water boat. The city water is satisfactory both for drinking and boiler purposes. Provisions and ship chandlers' stores may be had in San Diego.

Repairs.—There are no graving or floating dry docks in San Diego. Only minor repairs to hulls and machinery are possible. There is one marine railway that can haul out boats under 75 feet in length. There are machine shops that can take care of gas-engine repairs.

Communications.—San Diego now has direct transcontinental railway connection, and has communications with points north and south by rail and coasting steamers. There are complete telegraph, telephone, and radio facilities. It is a port of call for many of the intercoastal steamship lines.

Harbor regulations are enforced by a harbor master, with offices on Municipal Pier No. 1. He has police powers to enforce port regulations.

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.

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.
3. Vessels discharging, loading, or lying idle while occupying outside berths.
4. Vessels while moored in docks, slips, basins, or canals.
5. Vessel with no cargo on board while undergoing repairs.
6. Vessels taking on fresh water.

Toll rates (the charge made on merchandise passing over city premises) and **wharfage charges** (charge made on merchandise left on city premises) vary with the class of freight. Rates can be had from the harbor master upon application.

A complete set of harbor regulations may be had upon application to the harbor master.

Storm warnings displays of the United States Weather Bureau are shown from the naval radio station on Point Loma; Municipal Pier No. 1; Coronado Hotel boathouse, and from the tower of the naval administration building on North Island. Day signals only are shown.

Fogs occur occasionally, there being on the average about 20 dense fogs per year. These are mostly night fogs, and seldom occur between the hours of 9 a. m. and 6 p. m.

Winds.—The prevailing winds are from the northwest and west; the heaviest, from the south and west in winter and early spring. They seldom exceed 30 miles per hour, and shipping is considered safe at all times.

Currents.—The currents set generally in the direction of the channels and vary from 1 to 2½ knots, depending upon the stage of the

tide. Westward of 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 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 about 1.5 knots.

For daily predictions of the times of slack water and times and velocities of strength of current see the Pacific Coast Current Tables published in advance annually by the Coast and Geodetic Survey.

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

DIRECTIONS, SAN DIEGO BAY

The following directions are good for a draft of 28 feet (8.5 m.). Strangers of deeper draft should take a pilot.

Having made the whistling buoy or Point Loma Lighthouse, proceed as convenient to a position 175 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. This range consists of lighted beacons of nearly the same height and it is not as easily picked up as would be desirable. Follow the 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 mid-channel between the aids, which are arranged in pairs, to a position 400 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 400 yards northward of beacon No. 8, follow mid-channel courses until off the municipal piers, then shape course for the desired berth or anchorage.

The records show 31 feet (9.4 m.) as the deepest-draft merchant vessel that has entered and docked in San Diego Bay.

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 and motor vehicles; there is at present (1925) 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.

About 1¼ miles northward of the entrance to False Bay is an extensive amusement park, the central building of which has a red-tile roof which should show well from sea.

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 (250 m.) 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.

La Jolla has electric rail connections with San Diego. It is a resort city and has no water-borne commerce.

About 1 mile to the northward of La Jolla is situated the Scripps Institute devoted to research work in oceanography and marine biology. The institute maintains a concrete pier for observation purposes.

Del Mar, about 7 miles northward from La Jolla, is a resort town with a pleasure pier extending out to the surf line. The hotel with many gables is prominent from the sea.

From Del Mar the coast extends northward for 31 miles to San Mateo Point, as a low flat table-land with abrupt cliffs seaward, 60 to 130 feet (18.2 to 40 m.) high, with broad, low-water beaches. The table-land is intersected by numerous steep valleys containing streams that are usually dry in the summer. In the northern portion the high mountain ridges of the interior approach much nearer the coast. This section of the coast is paralleled by the Pacific Highway and the Santa Fe Railroad.

Oceanside, 22 miles northward from Point La Jolla, is a small town, the buildings of which are prominent from seaward. There is a pleasure pier built out to the surf line.

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

San Onofre Mountain, 1,720 feet (524 m.) in elevation, lies 1 mile from the coast, 12 miles northwestward from Oceanside and 3 miles eastward from San Mateo Point.

San Mateo Point, terminating in cliffs about 60 feet (18.3 m.) high, is the north head at the mouth of San Mateo Creek. Both the 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 and Pacific Highway run along the beach under the bluffs in this stretch of the coast to the San Juan Capistrano Valley.

San Juan Point, 54 miles northwestward from Point Loma, is the seaward end of a high ridge. The spur forming the point ends in a moderately bold sandstone cliff 220 feet (67 m.) high, with a precipitous broken face, and outlying rocks and ledges extend offshore for 350 yards. San Juan Rock, 10 feet (3.0 m.) high, is about 50 feet in extent and lies 340 yards southward of the highest point on the cliff.

San Juan Capistrano Anchorage, now seldom used, lies 116° true (E. by S. mag.) from San Juan Point, in about 5½ fathoms (10 m.) outside the kelp. Small vessels with local knowledge may

anchor inside the kelp in 3 fathoms (5.5 m.) ⅜ mile from the beach with San Juan Point bearing 279° true (W. ½ S. mag.).

San Juan Capistrano is a small town 2½ miles inland. It is the location of an old mission founded in 1776. Some of the buildings are still in a fair state of preservation.

From San Juan Point to Newsport Bay, 12 miles, the coast is bold, with rocky cliffs 40 to 100 feet (12.2 to 30.5 m.) 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.

Santiago Mountain, 5,685 feet (1,733 m.) 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 northwestward of San Juan Point and is visible 80 miles.

Newport Bay is an extensive lagoon which has undergone considerable improvement in recent years. Extensive improvements by Orange County were contemplated in 1925.

A jetty 2,100 feet long has been constructed from the west point of the entrance to the bay. There are depths varying from 7 to 12 feet (2.1 to 3.7 m.) over the bar, and a narrow channel along the jetty into the bay. The entrance is marked by a bell buoy off the end of the jetty and by lights on the inner and outer ends of the jetty. There is a depth of 14 feet (4.3 m.) in the north channel to the railroad drawbridge, and 10 feet (3 m.) in the south channel toward the town. The buoyed channel leads to the west end of the town, approximately 4 miles, where the fishing and yachting fleets are anchored.

Storm warning displays are shown by the United States Weather Bureau from a tower at the life-saving station on the high ground just back of the entrance.

Pilots and small towboats may be obtained by signaling the life-saving station.

Supplies.—Gasoline, water, provisions, and ship chandlery may be obtained.

Repairs.—There are facilities for repairing launches and small craft only.

Communication.—There is communication by rail, trolley, and motor truck with the interior, also telegraph and telephone facilities. The city of Santa Ana is situated 10 miles back from Newport Bay.

Newport pier is no longer used for commercial purposes.

Winds.—Severe storms are rare. 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 (12.8 m.), sticky bottom, blue mud.

From Newport Bay to Point Fermin, nearly 20 miles, the coast is low with several lagoons in the vicinity of the beach. The country is treeless and has been largely built up in recent years. The towns and resorts along the beach are nearly continuous.

Huntington Beach, about 5 miles northwestward from Newport, is a city of several thousand inhabitants. There is a concrete fishing and pleasure pier, but no landing facilities. The city is identified by the numerous oil derricks most of which are lighted at night by electric lights strung from top to bottom.

Seal Beach is a city about 7 miles northwestward from Huntington Beach. There is a short pleasure pier with a small tower at its outer end, and numerous resort structures along the beach.

A **high concrete chimney** from a power house at Seal Beach affords an excellent landmark along this section of the coast. It is visible for 15 miles at sea on a clear day.

Long Beach, 6 miles northeastward of Point Fermin, is a city of 140,000 population. Long Beach is easily recognized by a cluster of high office buildings just back of the beach. There are several pleasure and fishing piers extending out beyond the surf line and numerous resort structures along the beach.

Signal Hill rises to a height of 355 feet (108 m.) about 2 miles back from the beach, and is literally covered by oil derricks by which it is readily recognized. Signal Hill is shown on chart 5143 as Los Cerritos.

A deep-water harbor is being constructed at Long Beach, which is described under a separate heading following.

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

San Pedro Hill, 1,479 feet (451 m.) 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 (18.2 m.) 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 (30.5 m.) high. **Point Fermin Lighthouse** is a white square tower on dwelling, situated near the end of the point. The light is group occulting white (first eclipse 1 second; light 2 seconds; second eclipse 1 second; light 6 seconds; period 10 seconds), 154 feet (47 m.) above high water and visible 18 miles.

A **rock,** with 3 feet (0.9 m.) 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 (37 m.) 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 (7.6 m.) high, lies ⅓ mile eastward from Point Vincente, close inshore.

Point Vincente Lighthouse.—There is established on Point Vincente a light (flashing white twice every 20 seconds), 185 feet (56 m.) above high water on a white cylindrical tower 55 feet (16.8 m.) high. The fog signal is a chime whistle operated by compressed air (blast 1 second, silent 2 seconds, blast 4 seconds, silent 53 seconds).

Measured mile.—A measured mile standardization course has been established at Point Vincente. The ranges are marked by beacons on shore which bear 34° 30′ true (N. by E. 5/8 E. mag.) when in line.

SAN PEDRO BAY AND LOS ANGELES HARBOR

The portion of San Pedro Bay (charts 5143 and 5146) 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 (22.2 m.) above the water and visible 14 miles; the fog signal is an air siren (blast 2 seconds, silent 2 seconds, blast 2 seconds, silent 24 seconds).

A radio fog signal station has been established at the Los Angeles Harbor Light. The station sounds single dashes for 60 seconds, and is silent 60 seconds.

The sheltered area inside this breakwater is known as the outer harbor, and a depth of 35 feet (10.7 m.) at mean lower low water is maintained to Pier No. 1. The area at the entrance to the dredged channel leading to the inner harbor has been dredged to 35 feet (10.7 m.) at the date of this volume.

The entrance channel, dredged to 30 feet (9.1 m.) at mean lower low water is 550 feet in width to a point just above Reservation Point where it widens to 1,000 feet to the turning basin, which is 1,600 feet in diameter. From the turning basin, channels lead to the east and west basins. The **Cerritos Channel,** dredged to 32 feet (9.8 m.) at mean lower low water, connects Los Angeles Harbor with Long Beach Harbor. The project has been approved for deepening the main channel to 35 feet (10.7 m.) up to and including the turning basin, and for widening its entrance to 1,000 feet, but this work has not been started (1925).

The channel leading to the west basin is crossed by a 180-foot span bascule railway bridge. The signal for opening this bridge is 1 long blast of the whistle, followed quickly by 1 short and 1 long blast.

Cerritos Channel is crossed by the Badger Avenue bascule bridge with a 229-foot span. The signal for opening this bridge is 1 long blast followed by 1 short blast.

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.

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 near its western end, has been formed by dredging to a depth of 12 feet (3.7 m.) at mean lower low water, and by the construction of a protecting breakwater. This harbor is intended for the use of small fishing craft, and each side of the entrance is marked by a light. The sea wall along the north side of the harbor is lined with canneries and other fishworks.

Reservation Point, 40 feet (12.2 m.) 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 (5.2 m.) over it, lies ¾ mile 331° true (NW. mag.) from Los Angeles Harbor light. It is marked by a gas and bell buoy situated 100 yards southward of it.

Caution.—A small rocky patch with a least depth of 15 feet (4.6 m.) at mean lower low water, lies 280 yards, 215° true (S. by W. ¾ W. mag.) from the extreme southern point of Watchorn Basin. The obstruction is in line with the outside face of this terminal. About 100 yards to the northward of this spot is another small rocky patch with a least depth of 14 feet (4.3 m.).

There are rocky spots of 19 and 18 feet (5.8 and 5.5 m.), respectively, 100 yards southward and 150 yards southwestward from the 15-foot (4.6 m.) spot. Caution should be exercised by vessels anchoring near this area.

Inner harbor light and fog signal is located near the pilot lookout station at the southeast corner of Pier No. 1. The light is fixed green, and the fog signal is a siren sounding a blast every 15 seconds, blast 4 seconds in duration.

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.

There are 200 acres of anchorage grounds between the 30 foot (9.1 m.) contour and the breakwater, and 300 acres of additional anchorage between the 20 and 30 foot (6.1 and 9.1 m.) contours.

The "Santa Ana," a local and exceptional wind of considerable strength from the eastward, is the only wind dangerous to vessels anchored inside the breakwater. With such a wind all small vessels should seek shelter in the inner harbor, but large vessels with good ground tackle will have no difficulty in holding on.

HARBOR FACILITIES

Pilots.—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, and the pilot boat flies the international "P." Any vessel, whether in foreign or domestic trade, whose master has a pilot's license for this port may be brought in by the master without a municipal pilot and without payment of pilotage fees.

All vessels under enrollment and licensed and engaged in coastwise or intercoastal trade between the port of Los Angeles and any

other port of the United States, while under the control and direction of a pilot duly licensed under Federal law, shall, when entering or leaving, or moving from point to point within the port of Los Angeles, be exempt from all pilotage charges, unless a municipal pilot be actually employed.

All other vessels entering or leaving, or moving from point to point within the port of Los Angeles, must be piloted by a municipal pilot and shall pay to the city of Los Angeles the following pilotage charges:

Full pilotage rate of $1 per foot (0.3 m.) deepest draft and 1 cent per net registered ton both upon entering and leaving the port; 50 per cent full pilotage rate is charged, both on entering and leaving the port, in the case of vessels subject to pilot charges that enter the port solely for the purpose of taking on supplies, provided such vessels do not discharge or take on passengers or cargo.

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

The pilotage charge for moving a vessel from point to point within the port is $1 per foot (0.3 m.) of deepest draft.

Towboats.—There are towboats available for any kind of towing. Large vessels navigating the main channel usually have a towboat in attendance to assist in turns and as a guard against sheers.

Quarantine.—The quarantine station is located on the west channel of the outer harbor. National regulations are in force. There is no prescribed quarantine anchorage. Vessels undergoing quarantine usually anchor in the outer harbor, where they are boarded while at anchor by the doctor.

Marine hospital.—There is a relief station of the United States Public Health Service at San Pedro.

Steamboat Inspection Service.—The office of the local inspector embracing the district from San Diego to Santa Barbara is at 524 Sixth Street, San Pedro.

Supplies.—Fuel oil, water, provisions, and ship chandlery can be had in any quantity. Fuel oil may be had from the oil docks or by barge service. While but few coal-burning vessels now make the port of Los Angeles, arrangements can be made for bunkering in the outer harbor.

Repairs.—The port is well equipped with marine repair plants, and repairs of any magnitude can be undertaken. The largest dry dock has a lifting power of 15,000 tons and will accommodate vessels 575 feet in length. There is a depth of 22 feet (6.7 m.) over the blocks at low water. There are no graving docks.

Communications.—Los Angeles Harbor is a port of call for many lines of foreign, intercoastal, and coastwise steamers. There are rail connections with two transcontinental lines, and one standard-gauge electric line. There are complete radio, telegraphic, and telephone facilities.

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

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 (6.1 m.) draft must not exceed 6 nautical miles per hour; under 20 feet (6.1 m.) draft must not exceed 7½ nautical miles per hour; motor boats must not exceed 10 nautical miles per hour.

Explosives.—It is unlawful for any vessel to discharge or load explosives from any wharf in Los Angeles Harbor. Any vessel upon entering the harbor with gunpowder, dynamite, or any other explosive on board, shall first discharge same into barge or lighter provided for the purpose, at such point in the outer harbor as may be designated by the traffic manager.

Crude oil.—No vessel loaded with crude oil which will flash below 110° F. shall be permitted to haul along any vessel or structure.

Oil refuse.—No petroleum refuse of any description is allowed to pass into the waters of Los Angeles Harbor.

A complete set of harbor regulations may be obtained from the harbor office.

Dockage.—Dockage charges for vessels berthing at or making fast to a wharf are as follows:

For vessels of 3,200 net registered tons and over, per net registered ton per hour or fraction thereof, $0.00025.

For vessels between 2,000 and 3,199 net registered tons, inclusive, per hour or fraction thereof, $0.80.

For vessels under 2,000 net registered tons, per net registered ton per hour or fraction thereof, $0.0004.

One-half the full dockage rate is charged all vessels subject to dockage when such vessels are occupying an outside berth, or when lying at berth not in commission, or awaiting charter or orders, or undergoing repairs, provided no cargo or passengers are received or discharged.

No deduction is made for Sundays, holidays, or on account of weather conditions.

Storm signals.—Day and night storm signals of the United States Weather Bureau are displayed from a steel tower near Point Fermin at Thirty-sixth and Carolina Streets.

Fog.—Fogs occur throughout the year, but most frequently during the early spring and fall months. Ordinarily they are of comparatively short duration, and occur during the night, clearing before 9 a. m. There have been times, however, when the fog has hung in the San Pedro Channel for several days. The outer harbor is usually clear of fog first, then the San Pedro Channel gradually clears.

Winds.—The prevailing winds during the summer are from the northwest and in winter from the southward and westward; the heaviest winds for each season come from the prevailing direction. Southeast gales occur occasionally during the winter. The only wind which blows home in the outer harbor is a local wind known as the "Santa Ana" which comes from the eastward. These winds occur but occasionally, and are dangerous for small craft only; large vessels with good ground tackle have no difficulty in holding on.

Tidal currents.—The currents follow the axis of the channels. They rarely exceed 1 knot, and are generally negligible.

Tides.—The mean range of tide at San Pedro is 4 feet (1.2 m.), while the diurnal range is 5.8 feet (1.8 m.). See the tide tables

published annually in advance by the United States Coast and Geodetic Survey, in which the tides are predicted for every day in the current year.

Directions.—No directions are given. The chart is the guide for entering Los Angeles Harbor.

LONG BEACH HARBOR

Extensive development work is now under way in Long Beach Harbor. The main basin is being dredged to 40 feet (12.2 m.), and the upper parts of the extensions to this basin to 32 feet (9.8 m.) at mean lower low water.

It is connected with Los Angeles Harbor by the Cerritos Channel, which has been dredged to 32 feet (9.8 m.) at mean lower low water. In March, 1926, the old entrance channel was being dredged to form a direct deep-water entrance, and work was under way on the rock breakwater which was being built to protect the channel. This breakwater will ultimately be extended to meet the present Los Angeles breakwater and will then shelter a large area of San Pedro Bay. The entrance channel is crossed by a railroad bridge with a single leaf bascule span.

Prominent objects.—The large power house with many stacks at the western side of the entrance shows prominently. The elevated tank with a red band painted on it, at the shipbuilding plant, West Long Beach, forms a good mark that is easily identified.

The cluster of high office buildings in Long Beach, just east of the diversion channel, show plainly from offshore.

The shipbuilding plant was inactive in 1925, and there were facilities for the repair of small craft only.

The control of the water front at Long Beach is vested in the Public Service Commission of Long Beach, and the harbor is under different control from that of Los Angeles.

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 (30.5 m.) 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 (914 m.) 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 (18.3 m.) 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 (18.3 m.) is found 400 yards from the beach.

Rocky Point, 2 miles northwestward of Point Vincente, is a bold, bluff point, 120 feet (37 m.) high, rising rapidly to the western extremity of San Pedro Hill. There are no dangers off the point, but heavy kelp extends out about ⅝ 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 in 6 to 7 fathoms (10.7 to 12.8 m.), 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, considerable lumber being received for local use. The wharf has 22 to 23 feet (6.7 to 7.0 m.) at its inner face and 38 to 40 feet (11.6 to 12.2 m.) at its outer end.

The wharf is used the year around, and it is seldom rough enough to cause a vessel to leave. The wharf has rail connections with the Pacific Electric Co., and two mooring buoys are maintained to assist vessels in breasting off.

Submarine oil seepage.—At the head of a deep submarine valley, 1½ miles off Redondo, the water is covered with petroleum, which evidently comes from a submarine seepage, the oil being carried west by the current. The extent of the surface indications is 1½ by ⅜ of a mile, and the bottom is sand and green mud.

Landmark.—About 1 mile northward from Redondo Beach and ¼ mile inshore is a large power house with three huge smokestacks placed in a line normal to the beach.

Hermoso Beach is a resort town with a pleasure pier about 1½ miles to the northward of Redondo Beach.

Manhattan Beach is another resort town about 3 miles northward from Redondo Beach. There is a small pleasure pier here.

About 5 miles northward of Redondo Beach is an oil-loading pier, built out to 28 feet (8.5 m.) at mean lower low water. Considerable oil is shipped from here during the summer months.

About 1 mile north of the oil-loading pier is the pier carrying the outfall sewer of the city of Los Angeles. It is built out to 39 feet (11.9 m.) at mean lower low water. Immediately inshore from the pier is the purification works consisting of a large brick building.

El Segundo.—About 1 mile back from the oil pier is the city of El Segundo with extensive oil refineries. The city is conspicuous by upwards of 100 large white oil tanks located on the high ground.

Playa Del Rey, at the south end of Ballona Lagoon, is the scene of recent real estate development, and there has been considerable building on the sand dunes here.

Venice, situated at the north end of the lagoon, is an important resort city. The roller coasters and beach buildings make it conspicuous from the sea. There is a pleasure pier here, but no water commerce. Venice is part of the city of Los Angeles.

Santa Monica is a city and seaside resort of importance. The buildings and the structures along the beach are prominent from seaward. There is a large pleasure pier, but no water commerce. The old railroad wharf 2 miles north of Santa Monica has been removed and the piles pulled.

Kellers Shelter, 7 miles northeastward from Point Dume, is an open bight which affords protection from northerly and westerly winds in 5 to 7 (9.1 to 12.8 m.) fathoms, sandy bottom. A reef, marked by kelp, extends a short distance offshore about ½ mile westward of the anchorage.

An improved highway extends along the beach from Santa Monica to Malibu Point. The navigator should take care not to confuse headlights of automobiles with aids to navigation.

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 (61 m.) 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 (18.3 m.) 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.

Hueneme Landing has a moderate amount of domestic trade, receiving general merchandise and oil, and shipping grain, beans, and farm products from the Santa Clara Valley westward. The wharf is about 1,600 feet long and has a depth of 23 feet (7.0 m.) at the outer end, decreasing gradually to 22 feet (6.7 m.) at the inner end of the loading faces. Mooring buoys are placed off each side of the wharf. Vessels making the wharf try to arrive early in the morning, as it is usually much smoother in the mornings than in the afternoons.

The best anchorage is southward of the wharf in 6 to 7 fathoms (11.0 to 12.8 m.) mud and sand, good holding bottom. Water is piped on the wharf, and fuel oil for the use of sugar mills near by, is pumped ashore.

Oxnard, 3½ miles to the northward, is the nearest town of any size, and communication may be had by rail, irregular coasting steamers, motor truck, and bus. The lighthouse and buildings, the

warehouse buildings painted white, and the oil tank on the beach one-half mile to the eastward are the prominent features in approaching..

Point Hueneme, low, rounding, and sandy, is the outermost point of the low land at the mouth of the Santa Clara Valley.

Point Hueneme Lighthouse is prominent. It is a white square tower on a dwelling; the light is flashing white (flash ½ second, eclipse 4½ seconds), 52 feet (15.8 m.) above high water, and visible 13 miles. The fog signal is an air siren (blast 4 seconds, silent 26 seconds).

The United States Navy maintains a **radiocompass station** (call letters NMD) at Point Hueneme.

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, lying about 8½ miles northwestward from Point Hueneme, and 23 miles eastward from Santa Barbara, is a city of some 5,000 inhabitants. There is a wharf, with moorings provided, about 1,700 feet long, with a depth of 19 feet (5.8 m.) at mean lower low water at the outer end, and 18 feet (5.5 m.) at the inner end of the 200-foot loading face. The outer end of the wharf is marked by a fixed red light 25 feet (7.6 m.) above the water. Fresh water and fuel oil are piped to the dock. The prevailing winds are westerly, and gales are rare. 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 Ventura River immediately west of the town, are prominent features in approaching.. There is also a submarine oil loading float at Ventura, to the eastward of the wharf.

A gas and bell buoy has been placed 2,365 yards 224° true (SSW. ½ W. mag.) from the outer end of the wharf.

Communication may be had by irregular coasting steamers, and by the main line of the Southern Pacific Railroad north and south.

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 (610 m.) 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 (640 m.) 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 a small town 7 miles eastward of Santa Barbara.

Serena is a small place on the bight just east of **Loon Point.** There is a small wharf here.

Summerland is a small town 4½ miles eastward of Santa Barbara. There are a number of small wharves built out to oil derricks which are built in the water near the beach. None of the wharves are suitable for landings.

La Vigia Hill, 592 feet (180 m.) 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 (15.2 m.) high, while **Santa Barbara Point,** its southeastern extremity, is a high cliff and the eastern limit of the narrow table-land upon which the light is located.

Santa Barbara Lighthouse was destroyed by the earthquake of 1925, but pending the erection of a new lighthouse, a light with the same characteristics as the former, is shown from a skeleton tower, 175 yards 205° true (S. ¾ W. mag.) from the old tower. Characteristics: Flashing white (flash 1 second, eclipse 14 seconds). The temporary light is 155 feet (47 m.) above water.

Santa Barbara (chart 5261), a city of some 20,000 inhabitants, is situated immediately northeast from La Vigia Hill.

The business section was destroyed by an earthquake in 1925 and the work of rebuilding is now (1925) under way. There is an extensive wharf with depths from 18 feet (5.5 m.) at the inner end of the loading face, and gradually deepening to 24 feet (7.3 m.) at mean lower low water at the outer end. Water is piped on the dock, but there is no fuel oil. Moorings are provided. Considerable general freight and lumber are handled over this dock.

There is a heavy bed of kelp in front of the dock with a break in it that is usually kept clear by steamers. The prevailing winds are westerly. Good anchorage may be had anywhere inside the kelp, but large vessels usually anchor outside the kelp on account of better holding ground. Southwesterly gales occur occasionally during the winter months, and during such time vessels generally run to the islands for a lee.

Water and provisions may be had. Coal may be obtained, but the handling is inconvenient, while there are no fuel-oil facilities on the dock. Communication may be had by rail, motor vehicle, and regular coasting steamers, and there are complete 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.

At night the electric lights of Santa Barbara are prominent from the channel, but La Vigia Hill obscures them when approaching from the westward.

Goleta Point, 6½ miles westward from Santa Barbara Point, is low and terminates in a cliff about 30 feet (9.1 m.) 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.

The Pacific Highway parallels the coast from Santa Barbara to Gaviota, where it turns inland.

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 (4.6 m.) 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 30 feet (9.1 m.) at mean lower low water to carry oil pipes. There is 23 feet (7.0 m.) at the inner end of the loading face. There is water on the dock. Five moorings are provided for holding vessels while at the dock. Fuel may be had here in emergencies only, as it is an oil-shipping dock.

Coxo Anchorage, 1½ miles eastward of Point Conception, affords protection from moderate westerly and northwesterly winds, in 5 to 10 fathoms (9.1 to 18.3 m.), 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 (67 m.) 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 8 seconds, eclipse 22 seconds), 133 feet (40 m.) 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.

Winds.—Point Conception has been called the Cape Horn of the Pacific on account of the heavy northwest gales that are encountered off it, on coming through the Santa Barbara Channel. A great change of climatic and mteorological conditions is experienced off the point, the transition often being remarkably sudden and well defined.

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 (30.5 to 122 m.) 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 (110 m.) high, 5½ miles northward from Point Conception; the cliffs on each side drop sharply to less than 100 feet (30.5 m.) 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 2.3 seconds, flash 0.2 second, eclipse 7.3 seconds), 100 feet (30.5 m.) 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 radiocompass station (call letters NPK) near the lighthouse.

A **radio fog signal** has been established at the light station. It sounds a group of 3 dashes for 60 seconds and is silent 45 seconds. The signal will be sounded during thick or foggy weather, and daily from 9 to 9.30 a. m. and 3 to 3.30 p. m. (one hundred and twentieth meridian time) in clear weather. The station does not maintain radio communication.

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 Perdernales, 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 (599 m.) 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 sky line as viewed from the northeast or southwest shows as a table-land, and it is impossible to identify any particular point for taking bearings. 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 (183 m.) curve lying in many places but little over ¼ mile from the beach. On the south side the depths are less, the 100-fathom (183 m.) curve near the southeast extremity lying over 3 miles offshore.

Pyramid Head, the eastern point of the island, is about 900 feet (274 m.) 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 (18.3 m.).

A line of reefs and rocks extends ½ mile out from the northwestern extremity of the island, ending in a detached guano-covered islet some 70 yards in extent. This islet shows up prominently in approaching from the northeast or southwest.

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 (12.8 to 14.6 m.). Kelp grows close inshore. There are two or three houses on the beach. Wilson Cove, which is now locally known as **Gallagher Bay,** is the principal anchorage where a vessel from San Pedro occasionally calls with supplies for the sheepherders.

Pyramid (Smuggler) 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 (18.3 to 27.4 m.), sandy bottom, about ⅓ mile offshore, at the western limit of the kelp, with the windmill bearing 341° true (NW. by N. mag.).

Seal Harbor is a small indentation on the southwestern shore, about midway between the two ends. It affords a boat landing, and a launch anchorage in northwest weather.

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 (643 m.) 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 (55 m.) 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 (14.6 m.) sandy bottom. There is a depth of 20 fathoms (37 m.) 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. The anchorage is not safe during the "Santa Ana" winds that occasionally blow from the eastward during the fall and winter months.

Avalon is an extensive resort and the principal settlement on the island. There are several wharves here, and daily steamer service with San Pedro. A road has been cut along the beach some distance on each side of the cove, and at night the lights along this road show prominently from San Pedro Channel. The cove is important as a yacht anchorage, and there is a radio station on the island.

White Cove, 3½ miles northwestward from Avalon, affords an anchorage in 8 fathoms (14.6 m.); the protection is similar to that at Avalon.

Lone Point Light is a flashing white light on a small white structure, 75 feet (22.9 m.) above the water, at **Lone Point,** 4 miles northwestward from 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 out to 17 feet (5.2 m.) at mean lower low water, and there are several prominent buildings on shore. There is an automobile road to Avalon, and during the season, there is a launch service to that point.

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 (20.1 m.) 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 (9.1 m.) 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 (2.1 and 5.5 m.) over them, lie 100 yards northwestward from White Rock, and a shoal extends 100 yards from the southern face. A rock, with 6 feet (1.8 m.) 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 (7.3 to 9.1 m.), 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 (5.5 m.) curve is marked by kelp, and vessels entering should give the shores a berth of 150 yards. The wreck of a Chinese junk lies at the head of the cove formed by Ballast Point.

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 (167 m.) 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 (18.3 m.) 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 (78 m.) 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 (38 m.) 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 (14.6 m.) 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.

Osborn Bank, 7 miles 180° true (S. by E. ½ E. mag.) from Santa Barbara Island, is 5 miles long in a northwesterly and southeasterly direction, and has an average width of 1¼ miles. The least depth on the bank as shown by the survey of 1925 is 24 fathoms (44 m.).

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 (271 m.) and the island is visible about 38 miles. From a distance, the island has a gently rounding profile, and there are no features that can be identified for taking bearings. 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.

A bank with 30 to 40 fathoms (55 to 73 m.) over it extends 7 miles easterly from the eastern point of the island. From the 40-fathom (73 m.) curve, the depths increase rapidly to the eastward and southward.

Anchorage may be had under the lee of the sand spit (0.8 mile in length), which extends in an easterly direction from the eastern

point of the island. This forms a comfortable and safe anchorage in the prevailing westerly and northwesterly weather and is much used by the fishing fleet as a shelter in heavy weather. Vessels anchor in 9 to 10 fathoms (16.5 to 18.3 m.), along the edge of the kelp. **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.

A **bank** with depths from 52 to 70 fathoms (95 to 128 m.) over it, lies 20 miles 180° true (S. by E. ½ E. mag.) from the eastern point of the island. The bank extends 9 miles in a northwesterly and southeasterly direction, and has an average width of 2 miles. The least depth found in the survey of 1925 was 52 fathoms (95 m.). The bottom is hard with fine gray sand and shells. This bank is fished extensively during the winter season.

Begg Rock, 15 feet (4.6 m.) 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 (91 m.) 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 Island, 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. 60) 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 countereddies 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** on a red, square pyramidal skeleton tower. The light is flashing white every 20 seconds, with a flash 2 seconds in duration. 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, about 260 feet (79 m.) high, and rather level on top. The middle one is nearly 1¾ miles long, ¼ mile wide, and 320 feet (98 m.) high. The western and largest island is 2 miles long, ¾ mile wide, and rises to a peak 980 feet (299 m.) 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 (20.1 to 21.9 m.), 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 (20.1 m.), and also about ¼ mile 163° true (SE. by S. mag.) from the eastern passage in 12 fathoms (21.9 m.). 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 (91 m.).

Anacapa Passage, separating Anacapa Island from Santa Cruz Island, is described on page 57.

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 (734 m.) high, and in the eastern part 1,770 feet (539 m.). 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 (46 m.) 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 landing 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 (9.1 to 11.0 m.). 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 (4.9 m.). The best **anchorage** is in 12 to 15 fathoms (21.9 to 27.4 m.) 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.

Pelican Bay, a small indentation 1 mile west-northwestward from Prisoners Harbor, is used as a yacht anchorage during the summer season. There is a camp consisting of several buildings on shore.

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 (9.1 m.), 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 (12.8 to 14.6 m.). 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 (476 m.) 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 (183 m.) curve is over 5 miles and the 20-fathom (37 m.) 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 (4.9 m.) over it, lies in the kelp ⅔ mile 16° true (N. mag.) from East Point, and a shoal,

with 4¼ fathoms (7.6 m.) 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 (76 m.) 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 (134 m.).

Foul ground extends about ⅓ mile northward from Carrington Point, terminating in **Beacon Reef;** there is from 3 to 4 fathoms (5.5 to 7.3 m.) over it, with spots of 10 to 15 feet (3.0 to 4.6 m.). 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 (122 m.) high extending inland. These white sand dunes are prominent when approaching from southward or westward.

Talcott Shoal, with 11 feet (3.4 m.) 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 (8.2 to 21.9 m.); the shoal breaks only in heavy weather.

South Point, the south point of the island, terminates in a rocky bluff 100 feet (30.5 m.) high, and rises rapidly to a height of 460 feet (140 m.); the southwestern face of the point is formed by ½ mile of cliffs several hundred feet high. It is marked by **South Point Light,** about 300 feet (91.4 m.) above the water, and flashing white every 12 seconds, flash 1 second in duration.

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 surrounded 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 Johnson 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 (4.9 m.) at its outer end. The best anchorage is in 6 to 7 fathoms (11.0 to 12.8 m.) 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 11 m.) sandy bottom.

Johnson 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 (9.1 to 16.5 m.), 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, is described on page 57.

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 (262 and 259 m.), 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 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 (12.2 m.) feet high. A dangerous reef extends ½ mile eastward from the point, and foul ground extends ¾ mile north-northwestward.

Prince Island, 303 feet (92 m.) 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 (168 m.) high, 1 mile southward; there are no outlying dangers and the water is bold close-to.

Wilson Rock, 15 feet (4.6 m.) 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 (12.2 m.) high, rising rapidly to 380 feet (116 m.); 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 gas and whistling buoy is located about 1 mile 227° true (SSW. ¾ W. mag.) from the point in 18 fathoms (33 m.) of water. The light flashes white every 10 seconds; duration of flash, 2 seconds.

Castle Rock, 145 feet (44 m.) 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 (2.4 m.) 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 (7.3 m.) 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 (6.4 m.) over it, lies ¾ mile eastward of the point and ⅓ mile offshore.

Wyckoff Ledge, with 15 feet (4.6 m.) 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 (12.8 to 14.6 m.). 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 (11.0 to 15.5 m.), 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 (15.2 m.) 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 (55 to 73 m.) 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 (37 m.) 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 (37 m.) 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 (55 m.). 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 Purisma 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 (499 m.) high, in 3 miles to the eastward; from southward the hills are not so well defined. **Seal Rock,** 45 feet (13.7 m.) 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 (12.8 to 16.5 m.) 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 (12.8 m.), 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.

Oceano is a small summer resort about 12 miles northward from Point Sal. There is a small hotel on the beach, and the inshore end of an old pleasure pier is standing (1925).

Pismo is a resort town 6 miles eastward from Point San Luis. There is a substantial wharf here, built out to 27 feet (8.2 m.) at mean lower low water. At present there is no shipping, the wharf being used for fishing and pleasure purposes only. The Pismo beach is noted for its clams.

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 (40 m.) 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 (22.8 m.) 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 600 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 (15.8 m.) 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 (4.9 m.) 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 (35 m.). 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 (12.2 to 18.3 m.) 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 (14.6 m.) over it lies 1⅜ miles 197° true (S. mag.) from San Luis Obispo Lighthouse.

Westdahl Rock, with 18 feet (5.5 m.) 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 (16.5 and 18.3 m.). A black buoy is placed about 450 yards southwestward from the rock. Vessels should not pass northward of the buoy.

Santa Rosa Reef, with a least depth of 18 feet (5.5 m.), lies 1⅜ miles 261° true (SW. by W. ¾ W. mag.) from San Luis Obispo Lighthouse; this reef rises abruptly from depths of 9 and 10 fathoms (16.5 and 18.3 m.).

Lone Black Rock, 6 feet (1.8 m.) high and of small extent, lies ½ mile westward from the lighthouse and ¼ mile offshore.

Pecho Rock, 31 feet (9.4 m.) 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 (34 m.) 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 (12.2 m.) high with a low table-land behind it, which rises rapidly to a bare hill 1,280 feet (390 m.) high, 1 mile eastward from the point. There are a few detached rocks close under the cliffs.

Point Buchon is marked by a gas and whistling buoy placed 1 mile southward from the western extremity of the point.

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 (559 m.) 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 (12.2 to 30.5 m.) high. Beyond these for 1½ miles is a narrow table-land, terminating in cliffs about 40 feet (12.2 m.) 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 (213 m.) 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 (4.3 m.) 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 a narrow-gauge railway, is ¾ mile northward from Point San Luis in the most sheltered part of the bay, where a wharf known as the **Port San Luis 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 26 feet (7.9 m.), but the bottom in its immediate vicinity is lumpy, and vessels drawing over 23 feet (7.0 m.) 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.).

Pier No. 2, known as the "middle dock," is built out 3,150 feet from **Fossil Point** and has a depth of 32 feet (9.8 m.) at low water at its outer end. About 200 yards inside its outer end the wharf crosses a rocky patch having 17 feet (5.2 m.) over it, and care should be exercised in that vicinity. The oil tankers, which are the only deep-draft vessels entering the bay, use 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 (7.6 m.), but it has never been used.

Anchorage.—The best anchorage for small vessels is in 3½ to 4 fathoms (6.4 to 7.3 m.), 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 (5.5 m.) 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 between 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. 7/8 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. 3/8 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 (610 to 1,524 m.) 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 (55 m.) curve is a good guide in thick weather. Several of the higher mountain peaks are good 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 along the southern side of Morro Rock, but it is available for small, light-draft craft only in smooth weather. The depths in the channel are variable, and the position shifts so that a stranger should not attempt an entrance without local knowledge. Once inside, there is good protection for launches. A pilot may be had by making a signal off the town. The post village of **Morro** is situated on the eastern shore of the bay near the entrance. Gasoline, water, and a limited amount of provisions may be had. There is a good highway to San Luis Obispo.

Morro Rock, 573 feet (175 m.) 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 (30.5 m.) 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 (15.2 to 27.4 m.) high.

Cayucos Landing is 11 miles northward from Point Buchon, in the northeastern corner of Estero Bay. The landing is no longer used (1925) and the wharf is falling to pieces. There is a large general store here, and a limited amount of provisions may be had. **Mouse Rock,** the outer danger, is marked by a bell buoy, and the best anchorage is south of this bell buoy. Southerly storms occur six or seven times during the winter season; northwesterly gales occur during the summer, causing a heavy swell that breaks on the reef and off the end of the dock. Travel is by motor stage over a good highway to San Luis Obispo.

Constantine Rock, with 8 feet (2.4 m.) 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 (6.1 to 18.3 m.) high, backed by a steep range of grassy hills 500 to 700 feet (152 to 213 m.) 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 (4.6 m.) 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 (6.1 to 9.1 m.) high and backed by low, rolling hills, here and there covered with trees.

Cambria Rock, about 10 feet (3.0 m.) 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 (3.7 m.) 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. It is marked by a bell buoy placed in 7 fathoms (12.8 m.) of water ⅜ mile southeast of the point.

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 16 (4.9 m.) 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 (9.1 to 14.6 m.), 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 (48 m.) 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 (40 m.), close under it to the westward, and the other, a double rock 82 feet (25 m.) 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 (7.3 to 9.1 m.), 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 (25.6 m.).

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 (0.3 m.) 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 (14.6 m.) 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 (61 to 152 m.) high, and the land rises rapidly to elevations of 2,500 to 5,000 feet (762 to 1,524 m.) in 2 to 3 miles. There are few beaches and few outlying rocks.

Salmon Cone, about 500 feet (152 m.) high, is 10 miles northward from Piedras Blancas. It is a prominent rocky butte close to the beach. A conspicuous white rock, 39 feet (11.9 m.) high, lies just southward of the butte ½ mile offshore.

From Salmon Cone to Cape San Martin, 6 miles, the coast in intersected by several narrow, deep gulches or canyons, **Villa Canyon** and **Alder Creek** being the most prominent. A white rock, 64 feet (19.5 m.) 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 (13.4 m.) high, being about ½ mile offshore. The inner one, 168 feet (51 m.) high, lies 100 yards offshore, and the middle and lowest one, 34 feet (10.4 m.) 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 (30.5 m.) high, projecting a short distance from the high land. **Lopez Rock,** 20 feet (6.0 m.) 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 (9.1 m.), 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 (1,784 m.) 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 (1,433 m.) high, and **Cone Peak,** 5,020 feet (1,530 m.) 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 parallel with the shore and the 100-fathom (183 m.) curve only 500 yards from it. At the head 51 fathoms (93 m.) 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 (122 to 152 m.) high, and the seaward termination of a long ridge 2,000 feet (610 m.) 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 (16.5 to 18.3 m.), sandy bottom. In making this anchorage take care to avoid a sunken rock lying just inside the 10-fathom (18.3 m.) 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 (122 m.) 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 white every 15 seconds, 270 feet (82 m.) above the water, and visible 23 miles. The fog signal is an air siren (blast 5 seconds, silent 35 seconds).

A **radio fog signal** sounds groups of 1 dot, 2 dashes, 1 dot for 60 seconds, silent 90 seconds. It operates on 1,000-meter wave length and will be sounded in clear weather daily from 9 to 9.30 a. m. and 3 to 3.30 p. m., one hundred and twentieth meridian time. The station does not maintain radiocommunication services. Mariners may communicate with this station by telephone by calling Monterey 4 - F - 1.

False Sur, 210 feet (64 m.) 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 (8.2 m.) 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 (55 m.).

A bank with 24 and 33 fathoms (44 to 60 m.) over sand and broken shells lies 3½ miles southwestward from Point Sur. There is slightly deeper water between it and the point. The 100-fathom (183 m.) 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 (732 m.).

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 77) 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 approached, 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 (55 m.) 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 (91 m.) 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 (61 m.) high, lies immediately behind, with a grassy ridge extending back and rising to 1,600 feet (488 m.) 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 (37 m.) but there is foul ground between them.

Pico Blanco (Sur Peak), 3,680 feet (1,122 m.) 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 (1,346 m.) 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 (30.5 m.) high. **Whalers Knoll,** 200 feet (61 m.) 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 (2.7 m.) 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 (91 m.) 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.

Carmel.—On the northeastern shore of Carmel Bay and northward of Carmel River, is the growing city of Carmel, with a population of about 2,000. The lights of Carmel are prominent on a clear night.

Communication may be had by stage over good highways. There is no rail transportation at Carmel.

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 (27.1 m.) above the water, and visible 15 miles. Point Pinos whistling buoy is ¾ mile northwestward of the lighthouse.

Point Pinos fog signal is an electric siren sounding a group of 2 blasts every 30 seconds, thus; first blast 3 seconds, silent 2 seconds, second blast 3 seconds, silent 22 seconds. The signal is located 535 yards northwestward from 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 (12.2 m.) high, with two flat rocks close under the point, the outer one being the higher.

Santa Cruz Lighthouse, a black tower on dwelling, is situated near the southern extremity of the point, and is a good leading mark. Immediately back of the light is a grove of trees higher than

the light. The light is flashing white (first flash 1 second, eclipse 2 seconds, second flash 1 second, eclipse 2 seconds, third flash 1 second, eclipse 8 seconds), 67 feet (20.4 m.) above high water, and visible 14 miles.

About 3½ miles westward from the lighthouse is an oil derrick 80 feet (24.4 m.) in height that is prominent by day in clear weather.

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 Ano Nuevo Island Lighthouse. It is composed of sandstone cliffs about 50 feet (15.2 m.) 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 at Davenport. 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.

Loma Prieta is a prominent flat-topped peak surmounting the high mountainous ridge 13 miles north-northeastward from Santa Cruz Light. It is 3,793 feet (1,156 m.) in height, and is the predominating mountain feature of this section.

Point Ano Nuevo is formed by sand dunes 20 to 100 feet (6.1 to 30.5 m.) high; a low, black, rocky islet lies ¼ mile off the point.

Ano Nuevo Island Lighthouse, a white skeleton tower, is located on the islet. The light is occulting white (light 15 seconds, eclipse 5 seconds), 73 feet (22.2 m.) above high water and visible 14 miles. The fog signal is an air siren, sounding a group of 3 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 (14.6 m.) 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 Ano 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 Ano Nuevo, the coast between them being low and rocky. This point is about 50 feet (15.2 m.) high and rises in a gentle slope to the coast hills; several moderately large, detached rocks extend 350 yards southwestward.

There is a cable landing here, but it is rarely used, and then only for shipments of ties. Pigeon Point was named from the wreck at this place of the clippership *Carrier Pigeon.*

Pigeon Point Lighthouse is a white conical tower. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 148 feet

(45 m.) 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 lighthouse buildings on the point are painted white with red roofs.

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 (4.3 m.) over it lies ⅓ mile offshore, ½ mile southward of the hotel, and well outside the 3-fathom (5.5 m.) curve. Another rock, with 17 feet (5.2 m.) 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 (30.5 m.) 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 (55 m.) 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 (16.5 m.) 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 (4.3 to 5.5 m.) over it except on the southeast end where there is a rock with only 4 feet (1.2 m.). The northern extremity lies 1⅝ miles southeastward from Sail Rock; depths of 5 fathoms (9.1 m.) 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 (3.7 m.) at the end in summer but only 9 to 10 feet (2.7 to 3 m.) 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. The wharves are used principally by fishing boats.

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 (591 m.) 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 (18.3 m.) 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 (55 m.) in its vicinity.

Point Montara Lighthouse is a white square tower. The light is occulting white (flash 2.5 seconds, eclipse 2.5 seconds), 70 feet (21.3 m.) above high water, and visible 14 miles. The fog signal is an air diaphone sounding a group of blasts every 30 seconds (first blast 3 seconds, silent 1 second; second blast 1 second, silent 25 seconds).

A **radiocompass station,** call letters NLH, and maintained by the United States Navy, is located near the lighthouse.

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 (195 m.) 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 (30.5 m.) 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 (18.3 m.) 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 (91 m.) 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.

Pacific Grove, an important summer resort, is situated just southeast from Point Pinos. There are no wharves here, all shipping being done from Monterey.

Monterey Harbor, 3 miles southeastward from Point Pinos, affords good shelter in southerly weather. It is an oil-shipping port of some importance, and has a small amount of domestic commerce by water. It is the home port for a large fishing fleet, and there are several canneries, canning sardines and abalone. There is a municipal wharf with 2 extensions built out to 17 and 18 feet (5.2 and 5.5 m.) at mean lower low water; with depths of 12 to 14 feet (3.7 to 4.3 m.) at the head of the slip.

Supplies.—Provisions may be had, and fresh water is piped to the dock. There are no facilities for obtaining fuel oil, but launch fuels may be obtained.

Repairs.—There are small machine shops and facilities for repairing launches only.

Communications.—There is a regular service by small coasting steamers from San Francisco, and direct rail connection with that city. There are complete telegraph and telephone facilities.

The oil tanks and wharves adjacent to Monterey were destroyed by fire in 1924, and the tanks have been rebuilt at Seaside, across the bay from Monterey. A submerged pipe line with floating connections has been installed and tankers now moor alongside this float and receive their cargo. Moorings are planted for holding the vessels in position.

Monterey is a safe anchorage in southerly weather, but it is wide open to northerly gales which occur occasionally during the winter and spring months. During such storms, the fishing fleet runs to Santa Cruz for protection.

Monterey was the capital of California under the Mexican rule, and for some time after it became a State. The old adobe customhouse is still standing.

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. 3/8 E. mag.) for 5¾ miles, passing over ½ 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. 5/8 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. 1/8 E. mag.) for 35 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. 5/8 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 northward from Point Pinos. The wharf has fallen to pieces and the landing is no longer used for commercial purposes. There is a shore whaling station here, and two small steam whalers are employed in whaling in the vicinity of Monterey Bay. There is rail connection via narrow-gauge railroad to Watsonville, on the main line of the Southern Pacific. It is also on the Pacific Highway.

The anchorage is unprotected, but the holding ground is good. The prevailing winds are northwesterly, with a few southeasterly and northerly gales during the winter season.

Monterey Wind Gap.—The great mountain barriers north and south of Monterey Bay and the receding shore line to the eastward offer a broad entrance to the cold, foggy, northwest winds of the summer, and they drive over the bay and well into the Salinas Valley to the southward.

Soquel Cove is in the northeastern part of Monterey Bay, eastward of Santa Cruz Harbor. Fair shelter is afforded in northwesterly weather, but it is open in southerly weather. The best anchorage is southeastward of the mouth of Soquel Creek in 5 to 6 fathoms (9.1 to 11.0 m.), sandy bottom.

Capitola is a summer resort and a post office. The hotel situated on the beach just eastward of the mouth of the creek is prominent in approaching. There is a small wharf for fishing and pleasure purposes. Communication is by rail and motor stage and there are telegraph and telephone facilities.

A number of houses have been built on the bluffs 1½ miles eastward from Capitola, and considerable beach improvement is planned here.

Santa Cruz Harbor, on the northern shore of Monterey Bay, has a small amount of domestic commerce, lumber and general merchandise being received, and cement, lime, and farm produce shipped. There is a substantial municipal wharf built out to 28 feet (8.5 m.) at mean lower low water, with a cargo shed at its outer end. Vessels may land here in all but heavy southerly weather. Due to the ocean swell sweeping around the point, there is usually considerable surge, and heavy lines are required. A regular line of small coasters call here, and there is rail connection on the wharf. Good shelter is afforded in northerly weather, but in northwesterly weather a heavy swell is apt to sweep into the anchorage. During southerly weather there is no protection, and vessels run to Monterey for shelter.

There is good anchorage anywhere off the wharf in 5 to 6 fathoms (9.1 to 11 m.), sandy bottom. The city of **Santa Cruz** is situated on the northwest shore. **Seabright, Del Mar,** and **Twin Lakes** are suburbs of Santa Cruz along the beach to the eastward. The spire at Twin Lakes has been obscured by trees, and is not visible from the bay.

The Casino Building and roller coaster immediately to the eastward of it are prominent in approaching.

Supplies.—Provisions and launch fuels may be had, and city water is piped to the dock. Neither fuel oil nor coal are to be had in quantity.

Repairs.—There are no repair facilities except for machine work on launches.

Communication.—There is direct rail connection with San Francisco and motor-stage service with the interior. There is a regular freight service, but no passenger traffic by water.

Santa Cruz Lighthouse is a black tower on dwelling. The light is group flashing white (first flash 1 second, eclipse 2 seconds, second flash 1 second, eclipse 2 seconds, third flash 1 second, eclipse 8 seconds), 67 feet (20.4 m.) above high water and visible 14 miles. There is no fog signal. A whistling buoy is placed 1⅛ miles 133° true (SE. by E. ¾ 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 0° true (N. by W. ½ W. mag.) for 22 miles for the whistling buoy and thence to the anchorage off the wharf, as desired.

From northward.—From a position 2 miles southwestward from the Ano 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 84° true (ENE. mag.) for the whistling buoy and pass nearly 1 mile southward of the light. When the lighthouse is abeam, round up to the anchorage off the wharf.

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 (183 m.) 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 1.0 second, eclipse 4 seconds), 294 feet (90 m.) above the water, and visible 24 miles. The fog signal, an air diaphone (blast 5 seconds, silent 40 seconds), is established on the western pitch of Point Reyes about 130 feet (40 m.) below the lighthouse. The fog signal sounds 5 or 6 sharp blasts and a 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. There is a telephone line to San Francisco.

A **radiocompass station,** call letters NLG, operated by the United States Navy, is located on the beach 2¾ miles northward from the light.

Mount Tamalpais, about 7 miles northward from Point Bonita, is a prominent mountain 2,604 feet (794 m.) 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. ⅞ E. mag.) from Point Reyes Lighthouse, and 23 miles 252° true (SW. ¾ 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 (107 m.) high and surmounted by **Farallon Lighthouse,** a white conical tower. The light is a group flashing white showing flashes of 0.3 second duration with eclipses of 3.5, 3.5, and 22.1 seconds. The fog signal is an air diaphone, sounding a group of 3 blasts of 2 seconds duration every 60 seconds, silent intervals 4, 1, and 49 seconds.

The fog signal, keeper's dwelling, and Navy radiocompass station are located on the lowland on the south side, and the fog signal can seldom be heard northwestward of the island. The call letters for the **radiocompass station** are NPI.

This station, together with the Point Reyes and Montara Point Station, gives the navigator an excellent opportunity to frequently

verify his position by three radio bearings in approaching the Golden Gate in foggy weather, and it is an opportunity that should not be neglected.

The western and smaller island known as **Maintop** is 220 feet (67 m.) high. There are several rocky islets lying close-to, the largest of which, **Sugarloaf**, 200 feet (61 m.) high, lies northwestward from the lighthouse and forms a small cove where anchorage can be had in 8 fathoms (14.6 m.) 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 ⅝ mile 152° true (SE. ⅛ E. mag.) from the lighthouse. It is of small extent, with a least depth of 6 fathoms (11 m.), and breaks only in heavy weather. The **Middle Farallon** lies 2¼ miles 319° true (NW. by W. ¼ W. mag.) from the lighthouse. It is a single black rock 50 yards in diameter and 20 feet (6.1 m.) high. A rock, with 5½ fathoms (10 m.) over it, lies ½ miles southwestward from it. The **North Farallones** lie 6½ miles 311° true (WNW. mag.) from the lighthouse, and 14 miles 195° true (S. ¼ 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 ⅞ mile, with an average width of ¼ mile. The highest rock, 155 feet (47 m.), is in the southeastern group. **Noonday Rock**, with 14 feet (4.3 m.) over it, lies 3 miles 296° true (W. ⅝ 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 (37 m.) 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 (51 m.), 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 (37 to 55 m.)

Noonday Rock derives its name from the clipper ship of that name which struck it in 1862 and within an hour sank in 40 fathoms (73 m.).

Point San Pedro is described on page 76.

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 (183 m.). 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.

Two tall **radio masts**, 1¾ miles southward from Point Lobos and 150 yards back from the beach, are prominent.

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 (9.1 to 11.0 m.), 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 (70 m.) 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 (7.3 m.), 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 (30.5 to 61 m.) high extend eastward and southward for 6 miles to Double 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 (49 m.) 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 (49 m.) 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, a dangerous reef upon which many vessels have been lost, is long, narrow, and partly bare at low water. It extends 1¼ miles southeastward from Duxbury Point. A ledge from 5 to 6 fathoms (9.1 to 11 m.) over it extends southward from the reef, its outer end lying 1⅜ miles 183° true (S. by E. ⅜ mag.) from the point.

A gas and whistling buoy is placed in 12 fathoms (21.9 m.), 2 miles 172° true (SSE. ⅜ E. mag.) from Duxbury Point. Great care should be exercised in passing this reef, and vessels should not pass to the 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 (7.3 to 11 m.), 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 (0.6 m.) over it, lies 150 yards westward of the first rock. A rock awash, and a rock having 13 feet (4 m.) 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 (30.5 m.) 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 (152 m.) 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 (30.5 m.) high, increasing in height to 300 feet (91 m.) on its seaward face ¼ mile northward. From northwestward it shows as 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 (38 m.) above the water, and visible 17 miles. The fog signal is a steam siren (blast 5 seconds, silent 35 seconds), and sounds 5 or 6 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 (11 m.) 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 (11 m.) 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 (7.3 m.) locally known as the "**Potato Patch,**" which name is said to have originated from the fact that

schooners from Bodega Bay frequently lost their deck loads of potatoes while crossing it. Over the remainder of the bar (except the dredged portion of the Main Ship Channel) the depths range from 31 to 36 feet (9.4 to 11 m.), 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 (14.6 m.) 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,** which has been the one in most general use, is now being improved by the Government. The project calls for a channel 40 feet (12.2 m.) deep at mean lower low water, and 2,000 feet wide on the axis of the old range, Fort Point Lighthouse in range with Alcatraz Island Lighthouse. This range bears 70° true (NE. ⅝ E. mag.).

In 1925 there was a least depth of 40 feet (12.2 m.) on this range, but the work of dredging was not finished.

San Francisco Lightship 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 (17.4 m.) 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 a group of 5 strokes every 30 seconds.

The radio fog signals are groups of 2 dashes for 60 seconds, silent 60 seconds. The lightship receives and transmits radio messages, call letters WWBV.

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 (11 m.) 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. 75.)

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, the outer one being **Centissima Rock** with 40 feet (12.2 m.) over it.

Near the position of Centissima Rock, there has been reported a **rock** with 33 feet (10 m.) over it. It is marked by a black gas and bell buoy.

The southern portion of the channel is marked by a lighted range of which Mile Rock Light is the front range, and a light on the Palace of the Legion of Honor on Point Lobos, is the rear range. The latter is a large square white building and shows unmistakably from the channel.

Bonita Channel carries a least depth of about 54 feet (16.5 m.) and is used by deep-draft ships, and all ships when the Main Ship Channel is breaking. It has been used successfully by some of the largest vessels on the Pacific.

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 (42 m.) at the western end to over 60 fathoms (110 m.) 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 (183 m.).

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 (11 m.) 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 ⅛ mile. It rises abruptly to a height of over 200 feet (61 m.), 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.

Point Diablo Lighthouse.—The point is marked by a flashing white light on a white wooden house 50 feet (15.2 m.) above the water and visible 12 miles. The fog signal is an electric siren sounding a group of 2 blasts every 30 seconds.

Lime Point is high and precipitous and rises abruptly to a height of nearly 500 feet (152 m.) in less than ¼ mile. The southern face shows the effect of blasting, and the rock in the vicinity of the light is whitewashed.

Lime Point Lighthouse and fog signal are located on the extremity of the point and the buildings are white. The light is a group flashing white, showing 2 flashes each 6 seconds, and the fog

signal is a steam whistle (blast 10 seconds, silent 30 seconds). The whistle sounds 5 or 6 sharp blasts and a blast of 15 seconds to warn the Coast Guard when vessels are in distress.

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 ¼ 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 ⅜ mile northwestward from the sharp projecting point on the north face of Point Lobos. They are 20 feet (6.1 m.) high and about 100 feet apart, with deep water reported between them.

Mile Rocks Lighthouse (white cylindrical tower on dwelling) and fog signal are situated on the outer and larger rock; the light is group occulting white (2 eclipses every 20 seconds), and the fog signal is an air diaphone (blast 3 seconds, silent 27 seconds).

A rock with 6 feet (1.8 m.) 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 (4.6 m.) 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 square, 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.

Fort Point Lighthouse, which is the front range for entering by the Main Ship Channel, is occulting white, flashing 1 second and eclipsing 1 second. The fog signal is an air diaphone (blast 2 seconds, silent 18 seconds).

Fort Point Ledge, on which the steamship *Rio de Janeiro* was lost in 1901 with a heavy loss of life, is a dangerous sunken ledge extending 200 yards northward from the point. The outer end is marked by a red buoy placed in 7½ fathoms (13.7 m.) 200 yards westward of the ledge and 400 yards northwestward from Fort Point Lighthouse.

Presidio Shoal, with 3½ to 4¾ fathoms (6.4 to 8.5 m.) and rising abruptly from deep water, is about ⅝ 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 ⅝ mile 76° true (NE. by E. mag.) from Fort Point, the shoal extending about parallel with, and ½ 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 Cavello on the north side, and Black Point on the south. Beyond these the islands within the bay are the most prominent features.

Wire-drag surveys.—The Golden Gate and main channels of San Francisco Bay have been swept by the wire drag, and all dangers within this area are charted. The area swept includes the Golden Gate and narrows, the upper bay to Point San Pedro, and the lower bay to Point Avisadero.

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 limit 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. There is also a **prominent brick chimney** on the eastern side of the point.

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 (45 m.) high, with numerous buildings of the military post and prison 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 2 blasts, each of 4 seconds dura-

tion, 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 (8.8 to 9.4 m.) lie northwestward of Alcatraz Island, the most northwesterly being a 29-foot (8.3 m.) 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 (9.1 m.) over it. Heavy tide rips occur in the vicinity of the rock.

Goat Island, about 345 feet (105 m.) high, lies 2½ miles eastward from Alcatraz Island; it is of rather small extent and irregular in shape. On the summit of the island is a small elevated tank with a mast with signal yards close by. The island is covered with a scrubby growth of trees. The wharves of the Lighthouse Service, naval training station, and Army Engineers are in the small cove on the eastern face of the island. A shoal extends 1½ miles northwestward from the island; the northwestern end is marked by a red buoy.

Goat Island Lighthouse and fog signal are on the extreme southeastern point of the island. The buildings are white; part of the bluff is whitewashed to make the station more discernible. The light is fixed white, and the fog signal is a steam whistle (blast 4 seconds, silent 16 seconds).

China Basin, located just northwestward from Mission Rock, is used principally as a lumber terminal, and is also a car-ferry terminal of the Santa Fe Railroad. A dredged slip, crossed by several drawbridges, extends about ½ mile in a southwesterly direction from the basin. This channel is used by coastwise vessels in the lumber trade.

Islais Creek, just south of Potrero Point, has been improved by dredging, and there is a 25-foot (7.6 m.) channel in the entrance with depths of 30 feet (9.1 m.) along the docks. Improvements were being carried on here in 1925.

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 (238 m.), 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 (4.9 m.) 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 (18.3 m.) 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 (2 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 Stewart, the westerly point of Angel Island, has a light (occulting white, light 10 seconds, eclipse 10 seconds), and a fog signal (electric siren, 2 blasts every 20 seconds).

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.

Caution.—In navigating Raccoon Straits with a deep-draft vessel care should be taken to avoid the 30-foot (9.1 m.) spot 800 yards 219° true (S. by W. ¾ W. mag.) from Stewart Point Lighthouse, also the 28-foot (8.5 m.) spot, 600 yards 12° true (N. ½ W. mag.) from the same point.

Southampton Shoal extends in a northwest and southeast direction for 2 miles, with an average width between the 18-foot (5.5 m.) contours of ¼ mile. On the western side the slope is abrupt from 6 fathoms (11.0 m.) to 9 and 12 feet (2.7 and 3.6 m.) while on the eastern side the shoaling is gradual. The least water is 9 feet (2.7 m.) on the western edge of the shoal, about midway between the northern and southern points. The channel eastward of the shoal has a depth of 3 to 4 fathoms (5.5 to 7.3 m.), and is little used, except by vessels bound for the wharves between Point Richmond and Point San Pablo.

Southampton Shoal Lighthouse, a square frame building on piers, marks the southern end of the shoal. The light is flashing white (flash 0.3 second, eclipse 2.7 seconds) and the fog signal is 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.

Red Rock, 169 feet (51 m.) 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.

Red Rock fog signal station is located on an iron stand just south of the rock. It is maintained from October 1 to March 31 each year and sounds 1 stroke of the bell every 15 seconds.

A shoal, with depths of 3¾ to 5 fathoms (6.7 to 9.1 m.), 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 (9.1 m.) curve surrounding it. It is

marked by a red buoy placed in about 5 fathoms (9.1 m.) near the western edge and by a gas and bell buoy placed on its southeastern point in 30 feet (9.1 m.) of water.

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 showing an occulting white light. 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. The light is occulting white (light 7.5 seconds, eclipse 2.5 seconds). From April 1 to September 30 each year the fog signal is a bell (1 stroke every 15 seconds). For the rest of the year the fog signal is a steam whistle sounding 2 unequal blasts every 58 seconds.

Invincible Rock, with 7 feet (2.1 m.) over it, lies ½ mile 216° true (S. by W. ½ W. mag.) from East Brother Island Lighthouse, and is marked on its southern side by a red and black nun buoy. **Whiting Rock,** with 12 feet (3.7 m.) over it, lies northward of Invincible Rock, and nearly ⅜ mile 229° true (SSW. ¾ W. mag.) from East Brother Lighthouse. It is marked off its southern side by a red and black nun buoy. A gas buoy, No. 6, is located 460 yards 250° true (SW. ½ W. mag.) from Whiting Rock.

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

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 long wharf is marked by fixed white lights placed both on the northern and southern ends of the loading face. A fog bell is also sounded at the northern end.

A State prison is located at San Quentin.

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 (43 m.). A railway wharf with warehouse upon it is built southward from the point, parallel with the channel. There are several oil tanks just to the southward from Point San Pablo.

San Rafael is located 3 miles westward from Marin Island. A channel marked by an outer buoy and a lighted range has been dredged through the flats to the mouth of San Rafael Creek, and the creek improved to the city. In 1925 there were least depths of 4½ to 6 feet (1.4 to 1.8 m.) in the channel across the flats, thence a controlling depth of 4½ feet (1.4 m.) at mean lower low water to the municipal turning basin which had a depth of 3 feet (0.9 m).

Present plans call for the deepening of this channel to its project depth by January, 1926; that is, 8 feet (2.4 m.) across the flats, and 6 feet (1.8 m.) to the head of navigation.

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. In former years there was an extensive oyster culture in the southern end of the bay, but recently this culture has been largely abandoned, due, it is said, to the increasing oil pollution. A number of the oyster houses, frame houses built on piling amongst the beds, are still standing, and are prominent.

Dunbarton Point.—The bay here is crossed by a railway bridge with a draw span of 125 feet, and a clearance of 10 feet (3.0 m.) above extreme high water with the span in position. The railway company maintains a tug at the bridge, and towage through the draw is furnished without expense. In a fog a bell is sounded from the bridge-keeper's house (1 stroke overy 20 seconds). The signal for opening this bridge is 3 blasts.

A highway bridge is under construction just northward of the railway span. This is to be a toll bridge with a lift span. The horizontal clearance is to be 200 feet, while the vertical clearance is to be 135 feet (41 m.) above mean high water. There is a clearance of 9 feet (2.7 m.) above mean high water with the span in position. Two flumes supplying the city of San Francisco with water cross the bay at this point; one tunnels the entire way, while the other is carried on a trestle except at the channel, where it tunnels.

Alviso is located at the headwaters of Alviso Slough. There is considerable water traffic here by scow schooners and light-draft vessels. The trade consists of fruit, farm products, and general merchandise.

Jagel Landing, on a branch of Indigo Slough, has a small amount of domestic trade similar to that of Alviso. The channel to Jagel Landing has been improved by dredging and is feasible for scow schooners and light-draft vessels.

Redwood City is located 3 miles back from the mouth of the creek of that name. The dredged channel to Redwood City has filled up and can no longer be used. In the natural channel there is a least depth of 13 feet (4.0 m.) at mean lower low water to the cement plant at the junction of Redwood Creek and Westpoint Slough.

The **cement plant** is prominent and can always be recognized by the cloud of dust that hangs about it. The shells in the old oyster beds are being utilized in the manufacture of cement, and consequently there is constant dredging on the former beds.

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.

The **port of San Francisco** is under the control of the State of California, and its management is vested in the Board of State Harbor Commissioners. The office of the chief wharfinger is on the Embarcadero, just north of the ferry building. The port maintains

extensive terminals with belt-line rail connections and modern cargo-handling facilities.

HARBOR FACILITIES

Pilots.—The San Francisco pilot boats keep station between the lightship and the bar. When on station under sail, a white light is carried at the masthead; when under power, a red light is displayed under the white light. A flare or torch is also burned frequently. To signal for a pilot in fog, approach the lightship as closely as possible, blow four whistles, and lie still. In answer, the pilot boat will sound four blasts with the electric siren. When clear, burn blue light, or by day show the union jack at the fore. Pilot boats fly the union jack at the mainmast.

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 draft.

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 (0.3 m.); all vessels over 500 tons, $2 per draft foot (0.3 m.) 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 (0.3 m.); all vessels over 500 tons, $1 per draft foot (0.3 m.) 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.

Towboats may be had at San Francisco, but they no longer cruise 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.

Anchorage.—The usual anchorage for vessels is northwestward of Goat Island, and in the general anchorage off Mission Rock. There are 13 anchorage grounds prescribed by the War Department, and the limits of these are shown on chart No. 5532. Anchorage

regulations are enforced by an officer of the Coast Guard designated as captain of the port, with offices in the customhouse. A pamphlet giving the limits of the anchorages and the rules and regulation thereof may be procured from the chief wharfinger's office.

Quarantine.—Quarantine regulations for San Francisco Bay are prescribed by the Secretary of the Treasury, and are embodied in the national quarantine regulations.

Vessels are boarded near Alcatraz Island, and if subject to inspection should not pass a line drawn from Alcatraz Island to Black Point until boarded by the doctor. When awaiting or undergoing examination, vessels must anchor in the space shown on Chart No. 5532 as "Temporary Anchorage."

The national quarantine station is at Hospital Cove, Angel Island. Vessels should in no case proceed to Hospital Cove unless so directed by the quarantine officer.

The quarantine anchorage is situated in the channel leading to San Pablo Bay, midway between Bluff and San Quentin Points, and 3 miles north-northwest of Angel Island. It is no longer marked with buoys, and vessels use the anchorage only when so directed by the quarantine officer.

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. Fuel oil is usually delivered by barge, for which there is no extra charge. Coal can be had at the wharves or in lighters. Water can be obtained on the wharves or by water boat.

Repairs.—Repairs to vessels and machinery of all kinds and sizes can be made. The largest dock is the graving dock at Hunters Point. It has a length of 1,015 feet, breadth at top, 153 feet, at bottom 110 feet, and a depth over the sills of 42 feet (12.8 m.). It will take a vessel drawing 40 feet (12.2 m.). There are several smaller dry docks on the San Francisco side, and several marine railways on the Oakland side.

Compass ranges.—There are many ranges in San Francisco Bay that can be used by mariners in correcting their compasses. These ranges are shown in Special Publication No. 1 of the Coast and Geodetic Survey. Copies can be purchased from the inspector at the San Francisco field station of the Coast and Geodetic Survey, 306 Customhouse, at the price of 10 cents each.

Communications.—San Francisco is the terminus of several trans-Pacific steamship lines and is the port of call of numerous lines of coastal and intercoastal vessels. It is served by four lines of transcontinental railways, and has through rail connection with all points north and south. A large fleet of river steamers ply on the Sacramento and San Joaquin Rivers, and there is an extensive interbay steamer service. There are complete radio, telegraph, and telephone facilities. It is the terminus of a trans-Pacific cable via Honolulu and Midway Islands.

Harbor regulations 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 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.
2. 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.
3. Vessels must at all times have on board at least one person in charge with authority to take such action in any emergency as may be demanded.
4. Vessels of 1,000 net tons or over are cautioned not to use the dolphins on the outer ends of the wharves to warp around when making a landing.
5. Vessels lying at wharf are strictly prohibited from stretching mooring lines across the slip to the opposite wharf without first obtaining permission from the chief wharfinger.
6. Vessels while lying across the end of any pier or wharf or whose sterns extend beyond the end of any pier or wharf, will be responsible for any and all damage to themselves or to any other vessel while occupying that position.
7. No gunpowder or any other explosive shall be discharged on or loaded from any wharf or structure or vessel.
8. All vessels carrying explosives and desiring to proceed to the anchorage provided therefor, must first obtain a written permit from the captain of the port, and no vessel shall occupy a berth in such anchorage except by authority of such permit.
9. A vessel upon being notified to move into the anchorage limits or to shift its position on anchorage grounds, must get under way at once, or signal for a tug, and must change position as directed with reasonable promptness.

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.

Tariff charges for dockage, tolls, demurrage, and rentals may be had on application to the chief wharfinger.

A **Coast and Geodetic Survey field station** is located at 306 Customhouse, San Francisco, where information relating to the coasts of the United States, Alaska, Hawaii, and the Philippine Islands is furnished without charge. The station also has for sale charts, coast pilots, and other publications of the Coast and Geodetic Survey.

Mariners noting any dangers, changes in channels, shoals, etc., are requested to forward the information as promptly as possible to the inspector in charge of the field station.

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.

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 20h. 0m. 0s. Greenwich civil time. The instant of noon is marked by the beginning of the fall of the ball. A notice is furnished for publica-

tion in the San Francisco daily papers stating whether the ball has fallen at the correct time, or giving the amount of error if any.

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.

The **Lighthouse Service** and **Steamboat Inspection Service** have their offices in the customhouse.

For variation of the compass see page 21.

Bridges.—The following is a tabulation of the various bridges over navigable waters of the San Francisco Bay region.

Bridge	Width of opening (feet)	Signal for opening
Third Street, San Francisco, over Channel Street.	84	4 long blasts.
Fourth Street, San Francisco, over Channel Street.	75	3 long blasts.
Sixth Street, San Francisco, over Channel Street.	56	6 blasts.
Third Street, San Francisco, Islias Creek.	100	3 blasts.
New Highway, Dunbarton Point lift span.	200	Not completed. 135 feet (41 m.) vertical clearance above high water when lifted.
Railway, Dunbarton Point	125	3 blasts. Tug in attendance to assist vessels. No charge.
Webster Street, Oakland	134 north side. 143 south side.	3 long blasts.
Park Street, Oakland, over tidal canal.	115	Do.
Fruitvale Avenue, Oakland, over tidal canal.	51	Do.
High Street, Oakland, over tidal canal.	63	Do.
New highway, Carquinez Strait (under construction).	1,060 between piers.	Fixed bridge with 135 feet (41 m.) vertical clearance above high water.

Rules and regulations governing the opening of the Webster Street Bridge, Oakland

1. Vessels shall signal for the opening of the bridge at a distance of three-fourths mile therefrom by three long blasts of whistle or horn. The same signal shall be repeated at a distance of about one-half mile, and again when nearer the bridge, if necessary.

2. Except as provided in rule 5, the bridge tenders shall open the bridge promptly upon the approach of a vessel that has signaled for an opening and in time to prevent any delay to the signaling vessel.

3. If any delay is anticipated from unavoidable causes in opening the draw after receiving the signal of an approaching vessel, the bridge tender shall display the "delay signal" in a conspicuous and visible position at the operating tower or room, thus warning the approaching vessel to slow or stop under control. As soon as the cause of delay has ceased, the bridge tender shall remove the "delay signal" and shall then promptly open the bridge.

4. All vessels shall go to the right and pass through the right-hand opening of the draw.

5. Between the hours of 7.20 a. m. and 7.45 a. m. daily, except Sunday, the draw shall not be opened for the passage of vessels other than police or fire boats and vessels employed or controlled by the United States Government. The "delay signals" prescribed in rule 3 shall be continuously displayed during the closed periods herein specified.

6. The bridge draw shall habitually be swung so as to open away from an approaching vessel; that is, in a direction contrary to the motion of the hands of a clock.

7. Tugboats, launches, barges, and other small and low craft shall lower their poles or masts whenever by so doing they can pass under the bridge, and the bridge shall not be required to open for such boats, launches, barges, or other small or low craft.

8. These rules and regulations shall be in force on and after October 15, 1925, and will supersede the regulations approved October 2, 1924, for this bridge.

Rules and regulations for the three bridges across the Tidal Canal of Oakland Harbor

Between the hours of 8 a. m. and 4 p. m. of every day the draws shall be promptly opened upon the approach of any vessel or water craft desiring to pass through said bridges, and may remain closed during the remaining hours of every day: *Provided,* That whenever the interests of navigation, as determined by the Secretary of War, shall require longer or other hours for the opening of the said bridges, the same shall be provided for by the county of Alameda upon notice from the Secretary of War.

Oakland, the second largest city on the bay, is situated on the eastern shore opposite San Francisco. The inner harbor has been improved by dredging San Antonio (Oakland) Creek and by the construction of several well-equipped terminals.

Oakland Harbor is under the jurisdiction of the city of Oakland, and is entirely separate from the Port of San Francisco. In 1925 the controlling depth at the entrance to San Antonio Creek was 27 feet (8.2 m.) at mean lower low water, with a least depth of 28½ feet (8.7 m.) to the Brooklyn Basin. The South Channel through the basin is being dredged to a project depth of 30 feet (9.1 m.) at mean lower low water, with a turning basin at its eastern end, and the project calls for a continuance of the 30-foot (9.1 m.) channel through the Tidal Canal to the Park Street Bridge. It is expected that the project depths will be attained in the spring of 1927.

Shipyards.—A large shipyard with building ways, marine railways, and extensive repair facilities, is located on the north side of the channel, 2 miles eastward of the entrance. There are several other shipyards located on the Oakland and Alameda sides.

Oakland Creek is crossed by the Webster Street Bridge, with two openings. The signal for opening the bridge is three long blasts of the whistle. (See preceding table for details.)

Oakland Mole, just north of the Oakland Harbor entrance, is the terminus of the Southern Pacific Railroad, and is used largely for passenger and automobile ferry service. A channel with a least depth of 22 feet (6.7 m.) at mean lower low water and marked by range boards has been dredged through the flats to the three freight piers at the southern side of the outer end of the mole.

Key Route Mole, just north of the Oakland Mole, extends southwestward from Emeryville to a point within ½ mile of Goat Island, and is used for passenger ferry traffic only.

Outer Harbor.—Between the Oakland and Key Route Moles, the city of Oakland has dredged a channel to 30 feet (9.1 m.) at mean lower low water, leading to a shipyard and several wharves along a northerly extension of the Oakland Mole.

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, the seat of the University of California, is a rapidly growing city northward and adjoining Oakland. The Berkeley wharf has been condemned and is not in use (1925). In clear weather, the **Campanile** at the university shows prominently from the bay.

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 (Richmond Harbor), on the eastern shore of the bay, nearly 4 miles southward from Point San Pablo, is the terminus of the Santa Fe Railroad, and an important oil-refining center.

The inner harbor has been improved by dredging a channel from deep water off Point Richmond toward Point Potrero thence to the northward to Ellis Landing. The controlling depth to Ellis Landing in 1925 was 19 feet (5.8 m.) at mean lower low water. There were depths of 24 feet (7.3 m.) in the channel leading to the municipal wharf on the south side of Point Richmond.

The railway-car ferry slips are built out from Point Richmond just northward of the dredged channel. A fog signal sounding 1 blast every 15 seconds has been established on the end of the Santa Fe ferry slip. There is also an automobile ferry slip just southward from the car ferries. Midway between Point Potrero and Point San Pablo there are a large number of oil tanks.

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.

Sausalito, on the western shore about 2 miles northward from Lime Point, is the terminus of a railroad extending northward to Humboldt Bay. The anchorage off Sausalito is much used by yachts and small pleasure craft. There is passenger and automobile ferry service to San Francisco.

Richardson Bay, northward of Sausalito, is shoal and of little importance commercially.

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.

California City, ½ mile northward from Bluff Point, is a naval coaling station.

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 2½ miles at its northern end to less than ¼ 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 transporting farm produce from some of the landings reached by the sloughs connecting with the channel.

CURRENTS, SAN FRANCISCO BAY AND TRIBUTARIES

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 some detail under currents at lightships, page 286. 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 vicinity of Mile Rocks the currents attain a considerable velocity within a few minutes after slack on both flood and ebb.

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 Golden Gate the current attains its average maximum rate (2.8 knots) inward about 2 hours before the time of high water at Fort Point and its average maximum rate (3 knots) outward 1½ hours before the time of low water.

Slack water in the Golden Gate occurs on the average approximately 1½ hours after the time of high water at Fort Point and 2 hours after the time of low water.

When the diurnal inequality in the tide is considerable the ebb stream turns to flood about 2 hours after the time of higher low water.

Daily predictions of the times of slack water and the times and velocities of maximum flood and ebb in the Golden Gate, together with factors and differences for obtaining the times and velocities of the current for other points in San Francisco Bay, are given in the Pacific Coast Current 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. 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 approximately two hours earlier than in the Golden Gate (shortly before the time of high water at Fort Point), and from ebb to flood 1½ hours earlier than in the Golden Gate (about one hour after the time of low water at Fort Point). Farther out in the bay the current turns somewhat later.

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 approximately one, two, and three hours, respectively.

For a detailed description of tides and currents in San Francisco Bay, see United States Coast and Geodetic Survey Special Publication No. 115. This document may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 20 cents. It gives the results of a systematic current survey made in 1923.

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 lightship. **From southward,** vessels should make the lightship, 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 25.

Vessels equipped with radio should not fail to obtain radio bearings from the three stations located in the vicinity of the entrance, while those equipped with the radiocompass should get frequent bearings from the San Francisco Lightship. (See Radio Service on p. 10.)

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 (55 m.) 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 (55 m.) 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 (55 m.) 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 (46 m.), rocky bottom, but 19 fathoms (35 m.) have been reported. Between the bank and Point Reyes the depths increase to 66 fathoms (121 m.); outside the bank the depths increase rapidly to 100 fathoms (183 m.) in 2 miles, and over 200 fathoms (366 m.) 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 (183 m.), and if inside of 50 fathoms (91 m.) 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 (91 m.) curve followed southward should lead within sound of the fog signal, after making which a course can be shaped for the lightship.

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 (46 m.). When abreast Montara Point a course can be shaped for the lightship, 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 (18.3 m.) 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 31, 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. Then 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 lightship, bring Fort Point Lighthouse to bear 70° true (NE. ⅝ E. mag.) with Alcatraz Island Lighthouse in range, and steer for it on that range until Point Bonita Lighthouse bears 344° true (NW. by N. mag.). Then make good a 60° true (NE. ¼ N. mag.) course until Lime Point is abeam, distant ⅜ mile. Then proceed as directed in section 4 following. The above range leads over the axis of the new dredged channel over the bar.

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 102° true (E. ½ N. mag.) for 6½ 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.

After passing Bonita Channel gas and bell buoy, the channel is marked by a lighted range, of which Mile Rock Lighthouse is the front range, and a fixed red light on a black box on top of a large white square building approximately 400 feet (122 m.) above water, is the rear range. The building carrying the rear range light is the new California Palace of the Legion of Honor at Landsend, Point Lobos.

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 in any of the anchorages shown on chart 5532.

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 (9.1 m.) westward of Alcatraz Island in a least depth of about 32 feet (9.8 m.) (1925) in the dredged channel through San Pablo Bay and about 31 feet (9.4 m.) (1925) 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 ⅜ mile southwestward of Red Rock Bank buoy to a position with Red Rock abeam. distant ⅞ mile. Then steer 3° true (N. by W. ⅜ 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 ½ mile.

From this position, steer 40° true (NNE. mag.) for 5⅜ 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. ½ N. mag.) for 2¼ miles to the bend, then 79° true (NE. by E. ⅜ E. mag.) for 2¼ 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 1⅝ miles, to a position ¼ mile south-southwestward of the entrance to the strait, with a black buoy ⅛ mile on the port beam. Then steer north-northeastward for ¼ mile to a position midway between the ends of the jetties and then follow the channel to a point midway between the black gas buoy and the red buoy opposite it. From this point steer 330° true (NW. ¼ W. mag.) for 1⅜ miles, then follow a 318° true (NW. by W. ½ W. mag.) course to a point off the navy yard.

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, while many oil tankers and sugar-laden vessels pass through the bay bound for Crocket and Martinez.

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 (5.5 m.) curves is a little over 1¼ miles, being a little wider at the southern end and about ¾ mile wide at the eastern end. The channel across Pinole Shoal has been improved by dredging, and in 1925 the controlling depth was 32 feet (9.8 m.) at mean lower low water. The dredged channel is marked on the north side by gas and bell buoys at each entrance, and a gas buoy at the turn.

Point San Pablo is described on page 90.

There are several 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 improved under a project to obtain a least depth of 5 feet (1.5 m.) to the turning basin, thence 4 feet (1.2 m.) to the head of navigation in the city of **Petaluma,** which is the center of an extensive poultry and egg industry. In 1925 there were depths of 6½ feet (2 m.) through the flats to the entrance of the creek, 4 feet (1.2 m.) to the turning basin, 2½ feet (0.8 m.) in the turning basin, and gradually shoaling above. The full project depths were to be restored by dredging in 1925.

Considerable amounts of farm and dairy produce are carried in small vessels, and general merchandise is received. There is a regular freight service with San Francisco. A bell buoy and an echo board have been established near the entrance to the channel across the flats. This channel is marked by lighted beacons, and above the entrance the chart is the guide. The creek is crossed by a railroad drawbridge near its mouth.

Pinole Point is a moderately high, rocky bluff projecting 1 mile from the southeastern shore of San Pablo Bay, with a wharf built out from the east side of it. Powder works are located on the point, and 2 miles back of it there are numerous oil tanks, known as a "tank farm." 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 Selby Smelting Works, on the southern shore abreast Mare Island, are prominent. There is a wharf here with 30 feet (9.1 m.) alongside.

Ferry slip.—Just westward of Selby there is a ferry slip, connected to the highway by a high trestled viaduct.

Landmark.—The high white pyramidal skeleton towers on each side of Carquinez Straits that carry electric-power cables across the straits 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 (9.1 m.) 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 1925 was about 31 feet (9.4 m.). 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 (3.0 to 6.4 m.) 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.

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. There is a regular launch freight service to **Napa** at the head of navigation on Napa River. The United States naval station, located on the western side of Mare Island Strait, has two dry docks and extensive facilities for repairing and building vessels of all sizes. A time ball is dropped from a building near the ferry gate at noon, one hundred and twentieth meridian, or 20h. 0m. 0s. Greenwich civil time.

There is a bridge with a draw span connecting Mare Island with the city of Vallejo at the northern end of the navy yard.

Napa River, the continuation of Mare Island Strait above the navy yard, has been improved by dredging, and in 1925 there was a least depth of 6 feet (1.8 m.) mean lower low water to Napa, 17

miles from the entrance to Mare Island Strait. The mean tidal range is about 5 feet (1.5 m.) and the river channel is subject to some shoaling. A considerable amount of farm and dairy produce is carried in vessels of 4 to 6 feet (1.2 to 1.8 m.) 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 102.

For currents see page 98.

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.

A highway bridge crossing the straits at Semple Point is under construction (1925) with one pier located in the middle of the strait. The bridge will be high enough to clear all shipping.

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.

A shoal spot, with a least depth of 10 feet (3 m.) at mean lower low water, lies ½ mile 137° true (SE. by E. ½ E. mag.) from the light on the car-ferry slip at Benicia.

Crockett, on the southern shore, is built around a large sugar refinery. The wharves accommodate the deep-draft vessels that discharge sugar from the Hawaiian Islands.

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. There are two wharves off the town, one for the automobile ferry service to Benicia, and the other for light-draft vessels with local freight. Just to the eastward of the town are two piers built out to deep water, and used for handling oil.

Bullhead Point shows as a rounding hill and is 100 feet (30.5 m.) in elevation. The high brick chimney located on the point is prominent. There is an oil-refining plant here with many storage tanks located between it and Martinez.

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.

Pittsburg is a steel manufacturing town situated at the mouth of New York Slough. It has rail connections and a small amount of water-borne commerce. It is the center of a considerable fishing industry.

Antioch, about 5 miles eastward from Pittsburg, is also a manufacturing city with but little water-borne commerce. The water of the San Joaquin River is fresh at this point and is used as the city water supply. During parts of the year, and especially in dry years, it becomes brackish.

Sacramento River had a depth in 1925 at low-river stage of 7 feet (2.1 m.) to **Sacramento,** 4 feet (1.2 m.) to **Colusa,** and 3 feet (0.9 m.) to **Sidds Landing.** There is regular steamer service between San Francisco and river landings as far as Colusa, 130 miles above the mouth.

San Joaquin River had a depth in 1925 of 9 feet (2.7 m.) at mean lower low water to **Stockton,** 40 miles above the entrance, and 6 feet (1.8 m.) at high-river stage (April to July) 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, and in 1925 there were least depths of 6 to 3 feet (1.8 to 0.9 m.) at mean lower low water to the head of navigation at the town of **Suisun,** 15 miles above the entrance. The range of tide is about 5 feet (1.5 m.). Fuel oil is carried by vessels of not over 6 feet (1.8 m.) draft, and rock for building purposes is barged out.

Anchorage grounds for San Pablo Bay, Carquinez Strait, and Suisun Bay, and rules and regulations pertaining thereto are set forth in a publication of the War Department. The officer of the Coast Guard, designated as captain of the port with offices at 419 Customhouse, San Francisco, is charged with the enforcement of the regulations.

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 (55 m.) 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 (18.3 m.) 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 80.

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 (43 m.) 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 (18.3 m.) high, lies ⅝ mile southward from the point, about ¼ mile offshore.

Bodega Head, 240 feet (73 m.) high, lies 4½ 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 ⅓ mile southeastward from the southeastern face of the head. Foul ground extends ⅜ mile southward and southeastward from the rock. A gas and whistling buoy (flashing white light) is placed 1⅛ 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 1½ 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 (2.1 to 2.4 m.) 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 ¾ mile, until Bodega Head bears 280° true (W. ¾ S. mag.) just open northward of Bodega Rock; then steer 333° true (NW. mag.) for about ¾ mile and anchor in 5 to 6 fathoms (9.1 to 11.0 m.), ½ mile from the beach, with Bodega Rock bearing about 215° true (S. by W. ½ 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 the southern part of Bodega Bay immediately eastward of Tomales Point and extends southeastward for 12 miles with an average width of ½ mile. There is a whistle buoy ¾ mile northwestward from Tomales Bluff, and the bar with 8 to 9 feet (2.4 to 2.7 m.) over it is marked by an outer bar bell buoy and an inside bar black can buoy. Some farm products, fish, and clams are shipped from here to San Francisco. Communication may be had by rail and telegraph from points at 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 (61 m.) in height for 2 miles, and are then succeeded by a broad sand beach 2 miles long, backed by sand dunes 120 feet (37 m.) 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 (6.1 to 40 m.) high, lie offshore in some cases over ¼ mile. **Gull Rock,** 100 feet (30.5 m.) high, lies 1¼ 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 (25.9 m.) high and flat on top. This is the largest arched rock on this part of the coast.

Ross Mountain, 2,205 feet (672 m.) 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 (10.7 m.) 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 (4.3 m.) over it. The cove is divided into two bights, the western one being slightly the larger. 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.

Fort Ross was first settled by the Russians in 1811, and the old Russian church is still standing. There is no commerce here now, and the landing facilities have been abandoned.

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 (55 m.) 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 (10.7 m.) high, very rocky, and bare of trees. It is bordered by outlying rocks for about 200 yards. The 30-fathom (55 m.) 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 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 (55 m.) high, with a depression of 60 feet (18.3 m.) 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 (18.3 m.) high, bordered by numerous outlying rocks. The tree line is from ⅛ to ½ mile back from the edge of the cliffs.

Stewart Point is a post village 3 miles northward from Horseshoe Point. It is on a small cove that was formerly used as a shipping point, but except for an occasional shipment of timber products, it is now abandoned. About 350 yards off the southern point of the cove are two sunken rocks, each of which is well marked with kelp. It is a fair shelter for small craft in northwesterly weather. There is a general store, and the buildings are readily made from seaward. Communication may be had by telephone and stage over unimproved roads north and south and to the interior.

Black Point Landing is 5½ miles northwestward from Horseshoe Point. It is unprotected and the landing is no longer used.

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 for loading is no longer used.

Gualala Point Island lies 15¾ miles southeastward from Point Arena and 1 mile south of the Gualala River. It is 42 feet (12.8 m.) 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 mills at Gualala are no longer in operation (1925).

Robinson Reef lies northward of the mouth of the Gualala River and 1⅛ miles northward of Gualala Point Island. It is a cluster of 25 or 30 rocks above water about 600 yards offshore, with a sunken rock, 70 yards west-northwestward from the outer visible rock.

Bowen Landing is 1½ miles northwestward of the Gualala River. It is connected by railway with the mills on the Gualala River, but the mills are now closed and the railroad is not in use. The anchorage is exposed and can be used only in the summer. The cable landing is no longer in use. Local knowledge is necessary on account of several sunken rocks in the approaches. Lumber from the Gaulala mills was formerly shipped from here. There is an unimproved road paralleling this section of the coast.

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 have been 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 (46 m.) high, and the inner 100 feet (30.5 m.) high and 100 yards offshore; a rock, 40 feet (12.2 m.) high, lies 175 yards southeastward from the outer rock.

Havens Neck is a prominent head 145 feet (44 m.) high ⅝ mile northwestward from Fish Rock; it is bare of trees and connected with the bluffs by a low neck.

Gualala Mountain, 2,210 feet (674 m.) 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 (13.4 m.) high, is a sharp, pyramidal rock 800 yards offshore 2¾ miles northwestward from Fish Rock. From off Point Arena it resembles a small vessel under sail.

Saunders Reef, 4½ miles northwestward from Fish Rock, lies a little over ½ 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 (31 m.) ⅜ mile southwestward from the outer rock and 7½ miles southeastward from Point Arena. Vessels should not pass inside the buoy.

Arena Cove lies 2½ 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 14 feet (4.3 m.) at its outer end. There are mooring buoys provided. 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 ⅝ 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. ⅞ E. mag.) and stand in on this course. This

leads about 150 feet southward of a rock, with 16 feet (4.9 m.) over it, that lies 300 yards 264° true (SW. by W. ¾ 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 ¾ 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 (18.3 m.) high. It is bare of trees for about 1 mile back of the point.

Point Arena Lighthouse is a white cylindrical tower at the extremity of the point. 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 (47 m.) above the water, and visible 19 miles. The fog signal is an air diaphone sounding a group of 2 blasts every 60 seconds (first blast 1 second, silent 1 second, second blast 3 seconds, silent 55 seconds).

A sunken reef, usually showing breakers, extends ⅝ mile northwestward from the extremity of the point.

Arena Rock, with 13 feet (4 m.) over it, lies a little over 1¼ miles 346° true (NW. by N. mag.) from Point Arena Lighthouse, and shows a breaker except in very smooth weather.

Caution.—In view of the fact that Arena Rock is only ¾ mile inside the 30-fathom (55 m.) curve, and that the shoaling is abrupt, vessels approaching Point Arena from northward in thick weather are advised to keep outside a depth of 40 fathoms (73 m.).

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 (55 m.) 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 111.

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 (85 m.) high.

Red Bluff, a prominent reddish cliff about 200 feet (61 m.) high, is 8 miles northward of Point Arena.

A rocky islet, 93 feet (28.4 m.) 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 (11 to 12.8 m.); the shelter is only fair. Considerable lumber is shipped. Communication may be had by stage and telegraph. 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. After being idle some years, the mills here were resuming operations in 1925.

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.

Cuffey 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 (43 m.) high, with a rocky islet 46 feet (14 m.) 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 Cuffey Cove to the Navarro River, about 3 miles, the coast consists of cliffs 200 feet (61 m.) 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 (123 m.) 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 (30.5 m.) 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 (55 m.) 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 (24.3 m.) 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 (9.1 m.) 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 (4 to 4.3 m.) and load from it. Larger vessels are moored southward from the rock in 28 to 30 feet (8.5 to 9.1 m.) 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 but no coal may be had. A railroad extends from Albion to Christine, a distance of 26 miles.

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 (58 m.) high, 1½ miles northward from Albion River. A rocky islet, 150 feet (46 m.) high, lies close inshore on its northwestern side. There is a yellow slide on the southern face of Stillwell Point.

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 (1.8 m.) 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 (37 m.) curve with 7 to 15 fathoms (12.8 to 27.4 m.) 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 (7.3 to 9.1 m.). Some lumber and farm produce were formerly shipped, but there is no

traffic at present, and the wharf is gone. 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. 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 (12.2 to 18.3 m.) 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 (18.3 m.) high, bordered by numerous rocks close inshore. The southern point is a rocky, irregular cliff 100 feet (30.5 m.) 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 (6.1 m.) at low water, extends northwestward from the outermost bare rock a farther distance of 500 yards. This area should be avoided when there is any swell running.

A knoll, 156 feet (47 m.) 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 (11 m.). 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 (9.1 to 11 m.), 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.

Russian Gulch, 2 miles northward from Mendocino City, is a small indentation of no commercial importance. A small wharf suitable for launches has been built in the northern cove.

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 (15.2 to 18.3 m.) high, terminating seaward in nearly vertical cliffs; numerous low rocks extend offshore over 200 yards and the

30-fathom (55 m.) 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 (25.6 m.) 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, partly wooded to the face of the cliffs, and is broken by several indentations and small streams. The 30-fathom (55 m.) 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. Steam schooners are loaded by means of a wire cable. 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 telephone. Provisions may be had in limited quantities.

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 (12.2 to 18.3 m.) 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 (6.4 to 12.8 m.). 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 (10.7 m.). Two cables are used in loading large ships, and 300,000 feet of lumber per day can be landed on the ship. 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 river entrance has been improved by the construction of jetties to make it available for small craft and fishing boats. In 1925 there was a least depth of 5 feet (1.5 m.) at mean lower low water in a narrow channel through the entrance. Above this point the channel crosses a sand bar with a least depth of ½ foot (0.1 m.)

at the plane of reference. The mean range of tide here is about 4 feet (1.2 m.). 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 (8.2 m.). The 109° true (E. mag.) course in entering passes 100 yards northward of a rock, with 10 feet (3 m.) 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 (12.2 to 18.3 m.) 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 (6.1 m.) 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. Vessels are loaded from both sides of the wharf, but the water is slightly deeper on the north side, where vessels can be loaded to a draft of 18½ feet (5.6 m.). Fort Bragg is on a branch line of the railroad that connects with the main line of the Northwestern Pacific Railroad at Willits.

There is communication 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 plainly visible from the harbor are displayed by the United States Weather Bureau.

The buildings of the town are prominent by day and the electric lights by night.

A gas and 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 (9.1 m.) 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 (247 m.) 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 (12.2 to 30.5 m.) in height. The high, rugged mountains in the vicinity of the coast, which reach elevations of 3,000 to 4,000 feet (914 to 1,219 m.), are prominent.

Bruhel and **Bell 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 Bell Point, is 1,040 feet (317 m.) 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. The wharf supporting the cable landing is still in position, but it is only rarely used for shipment of ties. There are a few buildings around the landing, but

they are mostly abandoned. The sawmill has been destroyed by fire. No supplies are available.

Gordon Hill, 772 feet (235 m.) high, lies 6½ miles northward from Ten Mile River; it is bare to the summit and terminates seaward in **Abalone Point,** 60 feet (18.3 m.) 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. They were formerly wire-cable landings, but are now abandoned.

From Abalone Point the coast trends northwestward for 4 miles to **Cape Vizcaino,** which is a broad, irregular line of precipitous cliffs, 100 feet (30.5 m.) high, very broken and bordered by low rocks, 200 to 300 yards offshore. A rocky islet, **Island Knob,** 200 yards long and 100 feet (30.5 m.) 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 (6.1 m.) 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.

Rockport (Cottaneva Cove) lies ½ mile northward from Cape Vizcaino. It was formerly used as a cable landing for loading lumber, and in 1925 plans were being made to revive the landing and build facilities for loading large steamers.

The narrow **Cottaneva Valley,** with a small stream running through it, opens on the seashore here and forms an outlet for a vast amount of standing redwood timber.

Cahto Mountain, about 4,231 feet (1,290 m.) 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, tanbark, 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 **Monroe Landing, Ussal, Bear Harbor,** and **Needle Rock.**

Double Rocks, 15 and 20 feet (4.6 and 6.1 m.) high, lie 3½ miles northward from Cape Vizcaino, and 300 yards offshore.

Ussal Rock, 5½ miles northward from Cape Vizcaino, is 50 feet (15.2 m.) 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 (30.5 m.) 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 (207 m.) high, with one large rock and numerous smaller ones close inshore.

Cluster Cone, 80 feet (24.3 m.) 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 (30.5 m.) 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. The point is marked by a gas and whistling buoy placed 1¼ miles southwest from the point.

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 14 feet (4.3 m.) at the end.

Shelter Cove is extensively used as an anchorage by the large fishing fleet, and there is a cold-storage plant for handling fish, which are shipped to San Francisco by water. Land communication is by unimproved road only, and is feasible during the summer season only. The best anchorage is in 5 fathoms (9.1 m.), a little over ¼ mile southeastward from the wharf, with the southern extremity of Point Delgada bearing 200° true (W. mag.). Two pinnacle rocks close together, with 15 feet (4.1 m.) 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 (4.3 m.) 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 (12.8 m.) about 3 miles 180° true (S. by E. ¾ E. mag.) from the point. At the tail of the ridge is 20 fathoms (37 m.), from which the depths increase rapidly to 30 fathoms (55 m.).

Caution.—It is reported that a number of slides just south of Shelter Cove have deposited rocks along the shores. Even small vessels should approach the shore with care.

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 (457 m.) high, overhangs the southern end of the sand beach.

King Peak, 4,090 feet (1,247 m.) 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 (183 m.) 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 (183 m.) curves for 3½ miles, and then expands funnel-shaped for 3 miles more. Over 400 fathoms (731 m.) are found at its mouth, and 300 fathoms (549 m.) 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 (6.1 m.) 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 (244 m.) high.

Rodgers Break is a sunken rock, with 3 feet (0.9 m.) over it, ½ mile westward of Reynolds Rock. It lies 4 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 (244 or 274 m.), 400 yards back from the beach, and the point of it is a smaller spur, 140 feet (43 m.) 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 (22.9 m.) above the water, and visible 14 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds.

Gorda Rock, 15 feet (4.6 m.) high, is a conical rock a little over ¾ mile southward from Punta Gorda and ⅝ mile offshore.

Conical Rock, about 20 feet (6.1 m.) 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 (183 m.) a little over 1 mile from the beach; and another makes in 4½ miles southward of Cape Mendocino, with 100 fathoms (183 m.) 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 (110 m.) 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. The landing at Mattole has been abandoned for several years, and there is very little of the structure left.

A rock with 7 feet (2.1 m.) over it at low water lies 400 yards west-northwestward from the end of the wharf, and another rock with 10 feet (3.0 m.) over it lies 200 yards west-southwestward from the end of the wharf.

Sea Lion Rock, 12 feet (3.7 m.) 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 (3.7 m.) high, consists of two small rocks, close together, 800 yards offshore, and ½ mile northward of Sea Lion Rock.

Devils Gate Rock, 20 feet (6.1 m.) 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 (14 m.) 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.—This mountainous headland is the famous landmark of the old Spanish navigators, and the galleons from the Indies. It is in the latitude of much climatic change. The winds do not blow home so violently in the bight south of it, and the amount of rainfall increases rapidly to the northward. The seaward face of the cape is steep, rocky, and waterworn toward the shore line; above the lighthouse, the general appearance is rolling and grass-covered, except in the deep ravines and upon some of the

steep hillsides where the northern exposure is covered with forest or brush. For three miles southward of the cape the beach is bordered by numerous rocks and sunken ledges, extending in some cases to over ½ mile offshore.

Cape Mendocino Lighthouse, a white pyramidal tower, is situated on one of the western spurs about 400 feet (122 m.) above the sea. The light is flashing white (flash 4.5 seconds, eclipse 25.5 seconds) 422 feet (129 m.) above the water and visible 28 miles.

Sugar Loaf Rock, 331 feet (101 m.) 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 (66 m.) 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 (27.4 and 14 m.) 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 (27.4 m.) 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 Lightship is moored in 28 fathoms (51 m.), 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 (15.2 m.) 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.

The submarine bell sounds 2 groups of 2 strokes every 30 seconds. The **radio fog signal** sounds single dashes for 60 seconds every 3 minutes. The signal is given in clear weather for the first 15 minutes of every even hour from 10 p. m. to 6.15 a. m., one hundred and twentieth meridian time. The call letters of the lightship are WWBU. The station receives and transmits messages.

Northward from the lightship, there is a **ridge** extending in an northeasterly and southwesterly direction with 14 to 18 fathoms (25.6 to 33 m.) over it. At the northeastern end of the ridge, 4 miles 17° true (N. ¼ W. mag.) from the lightship, there is a rocky spot with 7 to 10 fathoms (12.8 to 18.3 m.) over it. This area was examined carefully, but was not wire dragged; therefore there is a possibility of less water, and the spot should be avoided. Breakers have been reported here.

A rock, with 9 feet (2.7 m.) over it, lies ½ mile 170° true (SSE. ⅝ E. mag.) from the outer rock of Blunts Reef. The **Great Break,** with 4¼ fathoms (7.7 m.) 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 (16.5 to 18.3 m.) in this locality.

A **submarine valley** extending in a northwest and southeast direction comes to a head 10 miles northwest from Cape Mendocino. This feature was discovered in the survey of 1919, and is shown on the charts. Vessels are cautioned against mistaking this valley for one of those southward of the cape.

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 northward. 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 286.

COAST FROM 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 (30.5 to 152 m.) 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 (183 m.) 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 (66 m.) high, lies nearly ½ mile westward from the cape, with two rocky islets, 90 and 46 feet (27.4 and 14 m.) 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 (3.6 m.) 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 (4.3 m.) but generally it is about 8 or 9 feet (2.4 or 2. 7 m.).

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 (50 m.) high, very steep, and has a narrow sand beach under it.

The **radio masts** and **elevated tank** at Table Bluff are prominent.

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 (54 m.) 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 with **radiocompass service** 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 131.

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 (30.5 m.) 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 (6.1 to 18.3 m.), 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 (37 m.) 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 (3 m.) 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 (116 m.). 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 (38 m.) 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 (60 m.) above the water, and visible 20 miles.

The fog signal is a bell, sounding 1 stroke every 10 seconds. This signal is not sounded from December 1 to April 1 of each year.

A whistle buoy is placed 1¼ miles westward of the head.

Blank Rock, 100 feet (30.5 m.) 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 (4.6 m.) over it lie 275 yards southeastward from Blank Rock.

Off Trinidad Rock, 80 feet (24.4 m.) 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 (31 m.) high, lies ½ mile southward from Trinidad Head. It is of small extent, conical, and whitish in color, rising abrutly from depths of 8 and 9 fathoms (14.6 and 16.5 m.) on all sides.

Prisoners Rock, 60 feet (18.3 m.) 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 (2.3 m.) over it, lies 150 yards north-northwestward from it. Prisoners Rock is marked by a fixed white light which is shown only from April 1 to November 1 of each year.

Flat Rock, low and small, lies 350 yards northeastward from Prisoners Rock; a rock, with 5 feet (1.5 m.) over it, lies 150 yards southeastward from it.

A rock with 3¾ fathoms (6.7 m.) 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 and the holding ground is only fair. There is a shore whaling station and reduction works in the cove. Small steam whalers fish in the adjacent waters. There is no wharf, and the bay is of no commercial importance at present.

Trinidad is a village on the north shore of the cove. It is on the Redwood Highway which parallels this section of the coast, and is connected by rail with Eureka on Humboldt Bay.

The best **anchorage** is in 7 fathoms (12.8 m.), 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 (6.7 m.) 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 (4.6 m.) 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 (30.5 m.). 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 (918 m.) high and heavily wooded, lies nearly 7 miles northeastward from Rocky Point, and is easily made out. **Mount Hoopah,** 4,050 feet (1,234 m.) high, lies farther inland, 16 miles eastward from Rocky Point.

Green Rock, 108 feet (33 m.) 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 (6.7 m.) over it, lies about ½ mile 267° true (WSW. mag.) from Green Rock; it seldom breaks, and rises abruptly from 15 fathoms (27.4 m.). Two sunken rocks lie ⅗ and ⅘ mile 329° true (NW. ½ W. mag.) from Green Rock.

White Rock, 130 feet (40 m.) 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 (46 m.) high, lies 1 mile northward from White Rock.

Cone Rock, 40 feet (12.2 m.) 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 (12.2 m.) high, lies ½ mile eastward.

Turtle Rocks, two rocks 20 and 50 feet (6.1 and 15.2 m.) 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 (61 m.) 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 (76 m.) 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 (30.5 to 152 m.) 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 (28.7 m.) 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 (37 m.), 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 (35 m.) 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 (104 m.) high.

White Rock, 107 feet (33 m.) 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 (41 m.) 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 (1.8 to 3.0 m.) at low water, but is narrow, leads through

rocky ledges, and is subject to change. It should not be attempted without a pilot.

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 when depths on the bar permit. A highway bridge is being constructed across the Klamath about 1 mile above Requa.

Mount Toorup, 4,225 feet (1,288 m.) 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 (5.2 m.) 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 (59 m.) 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 (0.8 m.) 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 (5.2 m.) 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 (250 m.) 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 covering a limited area; the outer one is 92 feet (28.0 m.) and the inner one 89 feet (27.1 m.) 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 port has been improved by the construction of a breakwater, which in 1925 extended to a point 750 yards from **Battery Point** in a direction toward Round Rock. This breakwater gives good protection from the northwest, but the anchorage is open to the southward. A wharf is built out from the town and vessels are moored off the wharf, and load by means of a crane on the dock. There is a least depth of 13 feet (4 m.) at mean lower low water, alongside the face of the wharf and vessels load to 15 to 16 feet (4.6 to 4.9 m.) draft in smooth weather. Lumber is shipped to the wharf by rail from near-by sawmills. There is a limited water

supply on the dock, but no fuel oil. Neither pilots nor towboats are available. Communication may be had by irregular coasting steamers, and motor vehicles over highways north and south and toward the interior. There is no through rail connection.

The approaches to the harbor are bad, and the greatest caution must be observed in making the anchorage.

Crescent City Lighthouse, situated on a small rocky islet 45 feet (13.7 m.) high, 200 yards southward of Battery Point, is a white tower on dwelling. The light is a flashing white (flash 2 seconds, eclipse 13 seconds), 77 feet (23.5 m.) above high water and visible 14 miles.

The **dangers** in the cove and approaches are too numerous to mention in detail. From Crescent City Lighthouse numerous rocks above and under water extend southward for ½ mile and also east-southeastward for nearly ¾ mile to a black spar buoy which marks the western side of the entrance. The eastern side of the entrance channel is marked by a red gas and bell buoy showing an occulting white light (flash 5 seconds, eclipse 5 seconds). **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 (23.5 m.) high, largest in cove); the channel between the westernmost of these rocks and **Fauntleroy Rock** is marked by the buoys mentioned above.

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 (33 m.) 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 between the black spar buoy and the gas and bell buoy. After passing these buoys, haul gradually westward for the wharf and anchor in 3½ fathoms (6.4 m.).

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 (63 m.) 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 ⅝ 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 (15.5 m.) high and lies at the end of the reef of visible rocks which extends ½ mile west-northwestward from the northwest end of Point St. George; the reef extends 250 yards southwestward from Brown Rock.

There is a **radiocompass station** on Point St. George, with call letters NYW. The station renders continuous service.

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 6½ miles northwestward and westward from Point St. George. There are nine visible rocks in the group.

St. George Reef Lighthouse on **Northwest Seal,** the outermost rock, is a white square 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 (44 m.) above high 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 (19.5 m.) high and lies 2 miles 277° true (WSW. ¾ 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 (4.6 to 13.7 m.). Southward of this line of visible rocks are two sunken ledges, **Mansfield Break** and **Jonathan Rock.** The latter lies 2½ miles 289° true (W. ⅛ S. mag.) from Star Rock and 3⅛ 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 2¼ miles 162° true (SE. ½ S. mag.) from Northwest Seal Rock and nearly 3½ miles 298° true (W. ⅝ N. mag.) from Star Rock. It is about 100 yards in extent, with 20 fathoms (37 m.) close-to and around it. The **Great Break** lies ½ mile 149° true (SE. ⅝ 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 2⅛ and 1⅝ miles, respectively, 349° true (NNW. ⅞ 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 near ⅜ mile is a rocky patch with but 4¾ fathoms (8.5 m.), in which a rock, with but 5 feet (1.5 m.) over it, has been reported. **Flat Rock** lies nearly midway between Long and Whale rocks, and about ½ mile from the former. **Mussel Rock** lies nearly ½ mile 284° true (W. ⅝ 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, livestock, 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 is now abandoned; the latter has a depth of 20 feet (6.1 m.) until within 1¼ miles of the railroad wharf, where it shoals to a least depth of 12 feet (3.7 m.). 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,** the other past Fields Landing to **Hookton,** at the head of **Hookton Slough.** The **Southport Channel** has a least depth of 9 feet (2.7 m.), but is little used. The **Hookton Channel** has a controlling depth of 17 feet (5.2 mag.) to Fields Landing, and is marked by beacons and buoys. In 1925 the northern entrance to this channel was changing and considerable difficulty was experienced in getting the lumber schooners in and out.

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 17 feet (5.2 m.) at mean lower low water. In 1925 this channel had shoaled along the docks and there was need of dredging.

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.

The old wharf ⅜ mile eastward of the Arcata Wharf is now in ruins. The rock for the jetties, which was formerly shipped from this wharf, is now shipped direct to the north jetty by rail.

Samoa, on the western shore opposite Eureka, is the terminus of a railroad from Arcata. There are large sawmills here, and a considerable amount of lumber is shipped. There is a least depth of about 18 feet (5.5 m.) in the channel leading to Samoa, and 20 feet (6.1 m.) alongside the docks. The stacks of the mills here are prominent. There is regular ferry service between Samoa and Eureka.

Rolph is a small town on the western shore 2 miles southward of Samoa. There was formerly a large wooden shipyard here but it is not in operation now.

Fields Landing, on the eastern shore of the south basin, is reached by the Hookton Channel. There is a large sawmill here and considerable lumber is shipped. There are depths of 18 to 20 feet (5.5 to 6.1 m.) alongside the loading wharf. It is on the railroad and highway.

Along the eastern shore of the bay southward from Eureka are several sawmills, with docks built out to the channel, from which lumber is shipped.

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 (30.5 m.) 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 outer bar bell buoy is located in 11 fathoms (20.1 m.) of water ¾ mile west-northwestward from the same point.

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. This jetty has settled in places, and work is under way restoring it to its former height. The north jetty has been lengthened 80 yards during the past year, and now extends to within 65 yards of its projected length.

In August, 1925, there was a least depth across the bar of 27 feet (8.2 m.), in a channel 500 feet wide. The channel over the bar is subject to considerable shifting and shoaling at times, especially during the winter months. For this reason there are no range marks established, and buoys are changed frequently. The local pilots keep careful watch over the bar conditions and often sound out the channel before attempting to take out deep-draft vessels. Due to conditions of the inside channels as well as the bar, 21½ feet (6.6 m.) is the usual maximum draft to which vessels are loaded in Humboldt Bay.

The Humboldt Bar is a treacherous one, and many disasters have occurred here. The bar is smoothest during the last of the flood

tide, and it is often passable at this time and impassable two hours later, when the ebb tide has set in.

Within the jetties is an area of rapid changes which must be navigated with great caution.

Strangers without local knowledge are advised to employ a pilot in entering.

From within the jetties the channel curves northward and passes close under the eastern point of the north spit, then continues northward for 3¼ miles to the entrance to the north basin. Here it divides into three branches, the eastern one 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 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 (27.4 m.) sand and clay bottom; anchors as a rule are hard to break out.

Pilots and Towboats.—Pilots and towboats are available. Vessels desiring their services should radio ahead to the Humboldt Stevedoring Co. at Eureka. Pilots may also be obtained by making a flag signal to the Coast Guard station accompanied by three blasts of the whistle. The master of the towboat acts as a pilot. The towboat is rated at 700 horsepower, and is well equipped for bar work.

Towage charges for light vessels inward and loaded vessels outward or vice versa are 60 cents per 1,000 feet lumber cargo, and 15 cents per ton general cargo.

Pilotage rates vary from $50 (in and out) for a vessel under 500 gross tons, to $400 for a tramp steamer (in and out and moves between docks).

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 Rolph.

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 at the North Jetty.

The **customhouse** is at Eureka.

Supplies.—Fuel oils, provisions, water, and ship chandlers' stores can be obtained at Eureka. Coal can be had in limited quantities only.

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 about 2 knots, with a maximum of about 4 knots.

DIRECTIONS, HUMBOLDT BAY

Strangers of deep 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 (27.4 m.) 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 (37 m.) between Turtle Rocks and Trinidad Head, and when southward of the head the depths should not be shoaled to less than 15 fathoms (27.4 m.) 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 (55 m.) 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 (91 m.). 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 Mendocino to Point St. George," page 123.

From the gas and whistling buoy: Due to the frequent changes in the entrance, no directions of permanent value can be given. The latest chart and the buoys are the guides. Once inside the bay, the channels are well marked by beacons and buoys and are easy to follow.

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 (55 m.) curve follows the general trend of the coast, and in thick weather may be considered as the limit inside of which it is unsafe to approach, but in the vicinity of Rogue River and Orford Reefs the depths should not be shoaled to less than 50 fathoms (91 m.).

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 (6.1 m.) 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 (76 m.) high, marks the north point of Smith River.

Prince Island, of small extent and 187 feet (57 m.) 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 (30.5 to 61 m.) 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 (21.3 m.) 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.

A wharf with its piling resting on rock has been built out to 25 feet (7.6 m.) at mean lower low water, with 18 feet (5.5 m.) at the inner end of the loading face. The wharf is held in place with heavy guys to the rocks on either side and vessels are not allowed to make fast to it, but moor close alongside it and load lumber. Vessels are loaded to a maximum draft of 23½ feet (7.2 m.)

Lumber schooners waiting to go alongside the wharf usually **anchor** in the vicinity of the whistling buoy in 16 or 17 fathoms (29.3 or 31 m.). Anchorage may be had farther in, in 8 to 10 fathoms (14.6 to 18.3 m.) but the bottom is rocky and very irregular.

There is a whistling buoy located 1 mile southward from Chetko Point. On two occasions a **silent zone** has been noted about this buoy. It was heard at a distance of 3 miles, then the sound was lost, to be picked up distinctly at a distance of ½ mile.

No directions are necessary.

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 (66 m.) 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. The island is readily identified. Its profile closely resembles that of Prince Island off the mouth of Smith River.

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.

Whale Head is the outer of two rocky islets 134 feet (41 m.) high, 2¼ miles northward from Cape Ferrelo. A rock awash lies 800 yards southward from the highest point of Whale Head.

A rugged cliff from 200 to 300 feet (61 to 91 m.) 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 (213 to 244 m.).

Leaning Rock, 77 feet (23.5 m.) high, lies close inshore, 3½ miles northward from Whale Head; it has a perpendicular face on its northwest side and slopes gradually southeastward. Several other rocks are in its vicinity.

Between Whale 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 (610 m.); the southern one is known as **Rocky Prairie.** These are noticeable when off this section of the coast.

Yellow Rock, 84 feet (25.6 m.) high, lies 4½ miles northward from Whale Head, and ½ mile offshore. The rock is yellowish in color and can be recognized from 4 miles offshore.

Bosley Mountain, 3,403 feet (1,037 m.) in height, from westerly and northwesterly positions offshore, shows above the coast ridges as flat-topped, with two summits separated by a slight depression. From offshore what appears as the northeasterly summit shows rounded, and appears somewhat larger and slightly lower than the eastern summit.

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 (69 m.) 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 (12.2 m.) high, is under the eastern summit and shows prominently from southward. A rock awash lies 125 yards southward from the eastern point.

Anchorage.—The bight to the eastward of Mack Arch has been used as a temporary anchorage during moderate northwest weather. The rocks and reefs break the swell. In approaching the anchorage, pass to the southward of Mack Arch about midway between it and Yellow Rock. Anchor in 11 fathoms (20.1 m.), sand bottom with Mack Arch bearing 296° true (W. ½ N. mag.) and Yellow Rock bearing 155° true (SE. mag.). No breaks were noted, but caution is to be exercised as the place has not been closely surveyed. There is a farm in the cove to the northeastward of Mack Arch.

Mack Reef extends from Mack Arch to Crook Point, and is a collection of some 30 rocks, visible or sunken, varying in height from awash to 110 feet (34 m.). 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 (11.0 to 12.8 m.), 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 (3.7 m.) find smoother water by continuing the 352° true (NNW. 5/8 W. mag.) course through the kelp and anchoring in 4 fathoms (7.3 m.) 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 (49 m.) high, with a slight depression immediately behind it. The rocks close to the point often show up during moderately thick weather, several being of very noticeable pinnacle formation.

From the vicinity of Crook Point to the mouth of the Pistol River are sand dunes which show up prominently in clear weather and distinctly mark this section of the coast. In thick weather these dunes can not readily be distinguished. 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 (52 m.).

Cape Sebastian is prominent from either northward or southward. It is the seaward termination of a bridge transverse to the coast, and rises abruptly from seaward to a height of 720 feet (219 m.), with a depression behind it, and then more gradually to a height of about 2,000 feet (610 m.). 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 1/2 mile offshore, 1 mile 341° true (NW. 1/2 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 (37 m.) high; shoal water extends from it eastward to the beach. The cove is used occasionally by launches and small craft. During strong northwesterly weather, the sea at the entrance is rather lumpy for small boats. There is a small stream at the head of the cove which furnishes good clear water. With moderate southwesterly weather a heavy sea piles up across the entrance between the cape and Hunters Island. The cove is not recommended as an anchorage.

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 1/2 mile offshore.

Rogue River (chart 5951) is the first important stream north of San Francisco. Tanbark, 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 (1.5 m.) of water at low tide. The bar at the entrance has a depth of 4 to 5 feet (1.2 to 1.5 m.) 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.

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 (213 m.) 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 (3.0 m.) in height.

Caution.—A vessel is reported to have struck an obstruction ¾ mile westward from Northwest Rock. The locality was visited by a surveying ship during heavy northwest weather, but no breakers were seen. Until this locality is thoroughly examined vessels are advised to give this rock a berth of at least 1½ miles. **Needle Rock,** 120 feet (37 m.) 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 (15.2 and 19.8 m.) high, respectively. A rock with 16 feet (4.9 m.) 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 (8.5 m.) 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 (21.9 m.). **North Rock,** about 10 feet (3.0 m.) 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 (122 m.) high, lying close to a projecting, rocky point 265 feet (81 m.) high. The second one lies 250 yards south of the first and is 150 yards in diameter and 200 feet (61 m.) high. The southern and outermost is about 150 yards long and only 5 feet (1.5 m.) 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 tanbark to San Fran-

cisco. The warehouses and buildings on the cliff behind the largest islet can be seen for some distance in clear weather.

Colebrook Butte, 2,050 feet (625 m.) high, appears from the westward as a cone with gentle sloping sides. The upper part usually shows against the sky line and is readily recognized. From the southward it shows as a rounded peak which resembles Brushy Bald Mountain, though it is somewhat lower. The northern part of the summit is tree covered and dark green in color. The southern part is grass and brush covered and light green in color. The slopes are timbered except for the lower part of the seaward side which is bare and brown in color.

Brushy Bald Mountain, 2,493 feet (760 m.) in height, shows up in hazy weather as a flat rounded peak with a gentle slope in easterly and southerly directions.

Lookout Rock, 2¼ miles northward of The Sisters, is a prominent, projecting cliff, 550 feet (168 m.) high, with a marked depression behind it. The seaward face is precipitous.

Bald Mountain, 2,954 feet (900 m.) in height, appears from offshore as an irregular knob at the northwesterly end of a long ridge. **Rocky Peak,** the southeastern end of the ridge, is a sharp conical peak. From a southwesterly direction, three peaks or knobs show; from north-northwesterly directions, two show.

Humbug Mountain, 1,740 feet (530 m.) high, lies 5¼ miles northward from The Sisters and 4 miles southward of Port Orford. It is conical in shape, and its seaward face is steep and rugged. It is a prominent feature from seaward.

Island Rock, 219 feet (68 m.) 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 (35 m.) 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 (18.3 to 43 m.) 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 Heads, 300 feet (91 m.) high, forming the western point of the cove, appear from the southward as a long ridge with three knobs. The inner two are slightly higher and tree covered. **Tichenor Rock,** 90 feet (27.4 m.) high, lies 175 yards southward from The Heads.

Battle Rock, high, narrow, and black, lies in the northern part of the cove close to the shore and is detached only at extreme high tides. Battle Rock is named from a desperate battle which occurred here between the first settlers who were barricaded on the rock, and the Indians who drove them away.

A wharf has been built in the northern part of the cove, close under a high point. The depths alongside increase from 15 feet (4.6 m.) at mean lower low water at the inner end of the loading face, to 24 feet (7.3 m.) at the outer end. Vessels moor alongside the wharf and load yellow cedar logs.

Caution.—There is a rock with least depth of 8½ feet (2.6 m.) at low water, 200 feet off the inner end of the dock. It is usually marked by kelp.

Water in limited quantities is piped to the dock.

Anchorage may be had slightly to the westward of the center of of the cove, in 10 fathoms (18.3 m.), sand bottom. Small craft may anchor closer to the Heads where better protection is afforded against the northwest winds which sweep with considerable force through the depression at the head of the cove. Two rocks, awash at high tide, lie near the western side of the cove, near the Heads.

Port Orford is a small town situated on the cove. It is noted chiefly as being the home of the famous Port Orford yellow cedar. Communication is by stage and telephone.

In approaching Port Orford at night, a few lights in the village usually will be seen.

Klooqueh Rock, 60 feet (18.3 m.) high, black and conical, lies ⅓ mile off the northwest face of Port Orford Head. It is prominent, especially when coming from the northward inside Orford Reef.

About midway between Klooqueh Rock and the Heads, but slightly nearer the Heads, is a small rock, awash at high water.

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 (49 m.), 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 (46 m.) 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.

Orford Reef gas, whistle, and submarine bell buoy is located 1¼ miles 218° true (S. by W. ½ W. mag.) from Fox Island. This buoy is the guide for clearing 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 (3.0 m.) high, and lies 5¾ miles 291° true (W. mag.) from Port Orford Head; the latter is 12 feet (3.7 m.) 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 (34 m.) high, is so named on account of its shape, the highest point being on the northwest side.

Arch or **Fin Rock** is 149 feet (45 m.) 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 (24.7 m.) high, is nearly in the middle of Orford Reef, and a little over ¼ mile northward from Arch Rock.

Table Rock, 147 feet (45 m.) 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 (16.2 m.) high, is large and lies ¼ mile about southeastward from Table Rock. **Long Brown Rock,** 70 feet (21.3 m.) 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 (21.9 m.) 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 (6.1 m.) high, the northwesternmost rock of the reef, lies 3 miles 226° true (SSW. ¼ W. mag.) from Cape Blanco Lighthouse.

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 (24.4 m.) 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 (4.0 m.) 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 (5.5 m.) 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 table-land, terminating seaward in a cliff 225 feet (69 m.) 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 occult-

ing white (eclipse 2 seconds, light 3 seconds, eclipse 2 seconds, light 13 seconds), 245 feet (75 m.) above the water, and visible 22 miles.

A radio fog signal has been installed at the light. It sounds groups of 1 dash and 1 dot for 60 seconds, and is silent 30 seconds. The station does not maintain radio communication service.

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, the coast is only partially surveyed, and the shores should be given a berth of at least two miles.

Cape Blanco and **Blanco Reef** are described above.

Gull Rock, 118 feet (36 m.) 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 (57 m.) 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 (58 m.) 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 (24.4 to 30.5 m.) high, extends west-southwestward from the point for ¾ mile. **Tower Rock,** 126 feet (38 m.) 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 (12.2 m.) high and pyramidal in shape.

A sunken rock having a depth of 10 feet (3 m.) 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 (1925) 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 (12.2 to 24.4 m.) 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 (305 m.) in 2½ to 3 miles.

Coquille River and Coquille River Lighthouse are described under a separate heading on page 152.

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 (18.3 m.) high, with a cluster of rocks 10 to 40 feet (3 to 12.2 m.) high extending more than ¼ mile offshore.

Northward of Five Mile Point the coast consists of cliffs, 40 to 80 feet (12.2 to 24.4 m.) high, which 2 miles southward of Cape Arago increase to heights of 100 to 250 feet (30.5 to 76 m.), 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 is a narrow sparsely wooded tableland 50 feet (15.2 m.) 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 (30.5 m.) 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 (3.4 m.) 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 (12.8 m.) of water close around it. It is marked by a bell buoy placed about 200 yards northwestward from it.

Coos Head, 220 feet (67 m.) 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 (30.5 m.) high and terminate in several small rocky points with sand beaches between them.

Coos Bay is described under a separate heading on page 154.

From Coos Bay to Heceta Head, about 48 miles, the coast consists of sand dunes backed by moderately low wooded hills. In the north-

ern 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 158.

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 (79 m.), 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 (30.5 to 61 m.) high. The summit of the head reaches an elevation of 1,000 feet (305 m.) in ½ mile from the cliffs and is covered with grass and a few pines. A sharp, black, conical rock, 180 feet (55 m.) 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 (62 m.) 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 (30.5 m.) 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 (244 m.) 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 (244 m.) a short distance from the beach and 1,000 feet (305 m.) 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 immediately northward from Cape Perpetua.

The coast northward of Cape Perpetua for 2½ miles consists of cliffs, 15 to 30 feet (4.6 to 9.1 m.) 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 (869 m.) 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 north point is low, broad, and sandy; the south point is an abrupt rounding, sandstone cliff about 100 feet (30.5 m.) high, covered with trees. There is a black and white can buoy 1 mile off the bar. The entrance has the usual shifting bar, with about 6 feet (1.8 m.) at low water. With the flood tide the bar fills in with sand, and the full effect of the tide can not be counted on. There is considerable fishing and crabbing here, and a gas boat from Astoria makes irregular calls. **Lutgens** and **Waldport** are the two principal settlements. There are no improved roads north or south, but the sand beach is utilized as a highway for light vehicles. 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 (21.3 to 30.5 m.).

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 (6.1 m.) 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.

Mary Peak, a prominent mountain 4,097 feet (1,249 m.) 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 161.

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 (110 m.) high and the inner 407 feet (124 m.) high, with a low saddle, 200 feet (61 m.) 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 (49 m.) 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 (11 m.) 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 (9.1 m.) 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 (18.3 m.) 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 (131 m.) high; ⅝ mile eastward of this point the hills rise to a height of 1,100 feet (335 m.). 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 (12.2 to 30.5 m.) 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 whistling buoy ¾ mile off the bar. The channel changes frequently, and 7 feet (2.1 m.) is considered to be the maximum draft that can be taken over the bar at high water. Some logging is being done here. A light-draft boat tows rafts of logs out over the bar, where the seagoing tug picks them up. A gas boat from Astoria makes irregular calls.

The north point at the entrance is a low bluff with a narrow sand beach; the south point is a low sand spit with dunes extending ⅝ mile northward from the yellow, sandy bluffs. The bay within the entrance is shoal. **Taft** is the principal town on the bay. 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 (24.4 to 30.5 m.) high. At this point they cease altogether for ¼ mile at the outlet of **Devils Lake,** a large body of fresh water, 10 feet (3 m.) 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 (6.1 to 18.3 m.) 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 (143 m.) high; extending southward and eastward from this to the river is a rolling, grassy plateau with but few trees. A rock, 74 feet (22.5 m.) 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 (23.1, 6.1, and 15.2 m.) 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 miles long, in places over 700 feet (213 m.) high, and is cut by several deep gorges through which the waters of three creeks are discharged from cascades 60 to 80 feet (18.3 to 24.4 m.) high. Several rocks lie about ⅛ mile offshore.

Two Arches Rock, 30 feet (9.1 m.) high, lies ⅞ 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 (152 m.) 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 fish 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 (122 to 152 m.) high, which at this point approach very closely to the beach. The north point is the southern extremity of the sand pit and dunes that extend to Cape Kiwanda.

Haystack Rock, 327 feet (100 m.) 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 (152 m.) 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 (15.2 to 30.5 m.) 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 (130 m.) 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 (762 m.) 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 (11 to 14.6 m.) 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 (1.8 to 2.1 m.). 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 (15.2 to 37 m.) high. These cliffs are covered by sand dunes varying in height from 150 to 200 feet (46 to 61 m.), 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 (140 m.) high. The western point is narrow, covered with fern and brush, and terminates seaward in a cliff about 200 feet (61 m.) 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 (66 m.) above the water, and visible 21 miles.

A pillar rock, 75 feet (22.9 m.) 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 (33 m.) high, which leans outward.

Bald Mountain, 550 feet (168 m.) 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 (84 to 93 m.). 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 (12.2 to 15.2 m.) high; it forms the western shore of Tillamook Bay.

Tillamook Bay is described under a separate heading on page 162.

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 (305 to 488 m.) 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 (26.8 m.) high and has an arch in it; the other is 75 feet (22.9 m.) high.

Nehalem River is described under separate heading on page 164.

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 (12.2 to 30.5 m.) 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 (61 m.) high and is partially bare of timber.

Falcon Rock, 50 feet (15.2 m.) 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 (518 m.) 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 (152 m.) 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 (846 m.) 3 miles eastward. It is bare of timber on the south side for a short distance from the point. A rock, 120 feet (37 m.) high, lies close under the cape, and is connected with it at low water; a smaller rock, 25 feet (7.6 m.) 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 (34 m.) 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 (55 m.) 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 (305 m.) 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 (30.5 m.) high and ¼ mile long. A rock, 100 feet (30.5 m.) high, lies close to and abreast of the southern end of the cliff, and another, 76 feet (23.2 m.) 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 (171 m.) high, and at the northern point are 1,000 feet (305 m.) 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 (13.7 to 46 m.) high, the outer one being the lowest. The summit of the head is 1,200 feet (366 m.) 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 (30.5 m.) 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 (41 m.) 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,** is 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.

Seaside is an important summer resort situated in the bight 3 miles to the northward of Tillamook Head. It has rail connections north to Astoria.

Saddle Mountain, double-headed and 3,266 feet (995 m.) 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 (58 m.) 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 (82 m.) 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 (59 m.) 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 165.

Columbia River Lightship is located on the Main Channel range for entering Columbia River, and is 8¼ miles 213° true (S. ⅞ W. mag.) from North Head Lighthouse. It has a red hull with "Columbia" on each side, and two masts. The lights, shown from each masthead, are fixed white, 50 feet (15.2 m.) above the water, and visible 11 miles. The fog signal is a steam whistle, blast 2 seconds, silent 18 seconds. The submarine bell strikes a group of 5 strokes every 30 seconds. Radio fog signals are sent out in the form of groups of 3 dashes for 60 seconds, silent 30 seconds. The radio station, call letters WWBQ, receives and transmits messages.

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 (18.3 m.) high, with several outlying rocks, of which the highest is 65 feet (19.8 m.). 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 (14.3 m.) above the water, and visible 12 miles. The fog signal is a reed horn (blast 5 seconds, silent 25 seconds).

The river has been improved by the Government, and the entrance channel is confined between jetties built out to 12 feet (3.7 m.). The outer portions of both jetties are submerged.

Fog signal.—A fog bell striking 1 stroke every 10 seconds, is located on the outer end of standing part of the south jetty. A number of lights are strung along the south jetty for the benefit of vessels entering at night. Upon a signal of 2 whistles, the lights will be turned on, for which service a small charge is made.

The **bar** is narrow, and in May, 1925, there was a controlling depth of 12 feet (3.7 m.) at mean lower low water over it. Dredging was in progress to secure a least depth of 12 feet (3.7 m.) to Bandon. In 1925, 13½ feet (4.1 m.) was about the maximum draft that was being taken over the bar from Bandon.

A number of outcropping rocky ledges, with depths of 3 to 7 feet (0.9 to 2.1 m.) 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 have consisted of the removal of snags and sunken logs, and of dredging a channel 10 feet (3 m.) deep at mean lower low water, to Coquille. In 1925, 8½ feet (2.6 m.) was reported as the controlling depth in this channel, and 3½ feet (1.1 m.) between Coquille and Myrtle.

Bandon, on the south bank at the mouth of the river, is the principal port. Lumber, railroad ties, farm produce, and dairy products are shipped; general merchandise, machinery, and agricultural implements are received. The depths at the wharves vary from 12 to 17 feet (3.7 to 5.2 m.)

Prosper, 4½ miles above the mouth, ships considerable quantities of lumber when the mills are in operation. The depths at the wharves are ample for the vessels that can ascend the river. It is the head of navigation for the coastwise lumber schooners.

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.—Pilots are available, and there is a towboat owned and operated by the port of Bandon. Vessels desiring a pilot should signal the Coast Guard station, or radio ahead to the port of Bandon.

Supplies.—A limited amount of provisions and ship chandlery are available. Some fuel oil may be had, but in drums only. There are some coal mines on the river above Bandon, but in 1925 they were closed.

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 water front at Bandon. The lookout station is at Coquille Point.

Communication is by steamers from Bandon, and stage over the highways to Coquille, and southward along the coast. Launches and river boats ply on the river from Bandon to Myrtle. There are telegraph and telephone connections. Coquille is on the railroad.

To enter.—At high water and with a smooth bar, vessels drawing less than 11 feet (3.4 m.) 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 water front, shows midway between the ends of the jetties. Follow the range, course 111° true (E. mag.) until Coquille Lighthouse bears 67° true (NE. mag.), then haul to the northward and pass the water front 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. In 1925, work was under way on the construction of the south jetty, which extends from Coos Head in a direction parallel to the north jetty.

At the close of the dredging season of 1924, there was a controlling depth of 30 feet (9.1 m.) on the ocean bar, but the winter storms shoaled it 19 feet (5.8 m.) at mean lower low water. During 1925 it was being dredged to its former depth of 30 feet (9.1 m.). Since the construction of the south jetty has started, a shoal has formed between the jetties off Coos Head. This shoal is being dredged to 26 feet (7.9 m.) at mean lower low water.

The outer end of the north jetty is submerged, and caution is necessary in entering to avoid the jetty on one hand, and the dangerous shoals off the south entrance point, on the other. Vessels should make sure of the entrance range before standing close in. There is usually a current sweeping either to the north or south just off

the jetty, and this current should be guarded against, especially with vessels passing out. The shore range should be observed carefully until clear of all dangers.

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 (7.6 m.) 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 22 feet (6.7 m.). 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 (4.6 to 5.5 m.), contract the channel to a width of 100 yards between the 18-foot (5.5 m.) curves. In entering with a strong northwest wind, large vessels have difficulty in making the turn and are apt to find themselves being set down towards the submerged jetty. Caution is required here under these circumstances.

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 (30.5 m.). 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. The slough is crossed by a highway bridge with a draw span, at a point ⅜ mile southward of the back entering range light.

Haynes Slough and **North Slough** join the bay through a common entrance on the north side of the bay at the end. These are navigated 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 4 feet (1.2 m.) 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 (7.6 m.) 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 prominent oil tank at Empire, and the Government has constructed a dock for the use of the seagoing dredge employed in dredging the bar.

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. Considerable lumber is shipped from here.

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 9 to 18 feet (2.7 to 5.5 m.).

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 (7 m.) 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 (9.1 to 11 m.), but this is dangerous if the wind shifts to southwest.

Pilots are available, and can be arranged for by radio with the port of Coos Bay, or can be had by signal to the Coast Guard Station. Pilot charges are $50 each way for steam schooners; $200 for vessels of up to 3,000 gross tons (sea to sea), and $300 (sea to sea) for vessels of over 3,000 gross tons.

Towboats.—The port of Coos Bay owns a towboat, but in 1925 it was laid up, and could not be had on short notice.

Port Terminal.—Midway between North Bend and Marshfield the port of Coos Bay owns and operates a dock 1,005 feet long with

cargo-handling gear and rail connections. Ample depths alongside are maintained for the vessels that can reach the dock. In 1925, 21 feet (6.4 m.) was the usual maximum draft to which vessels were loaded at Marshfield. Full effect of the tide can not be had, for vessels must leave their berths before high water in order to reach the bar on the tip of high water.

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. Vessels with communicable disease on board should not pass Empire until boarded by the quarantine officer. Facilities are available for fumigation by sulphur only.

Customs.—Marshfield is the port of entry for southern Oregon, embracing the following ports: Umpqua, Siuslaw, Bandon, Port Orford, and Gold Beach (Rogue River). Vessels subject to customs inspection are boarded in the upper harbor.

Storm warnings, day and night, are displayed by the United States Weather Bureau from a steel tower at Marshfield.

Supplies.—Fuel oils, coal, water, provisions, and ship chandlers' stores can be obtained at Marshfield and North Bend. The city water is reported to be of poor quality, but is suitable for boilers.

Repairs.—There are no facilities for extensive repairs. Machine shops are available, but there are no dry-docking facilities except for scows and small gas boats.

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. There is a naval radio station, call letters NPF, located at Marshfield.

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 current 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 current—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. In thick weather advantage should be taken of the radiocompass station, call letters NPF, and located 1⅞ miles northward from the north jetty on the outside coast line.

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 25.

Under the above conditions particular care is necessary in this locality. The depths should not be shoaled to less than 50 fathoms (91 m.) 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. The most favorable time for crossing the bar is on the last of the flood current, and on many occasions it is passable only at this time. Vessels entering Coos Bay are usually light, and therefore are not often bar-bound outside, but when loaded with lumber outward bound, a fairly smooth bar has to be selected, and bar-bound vessels inside, especially during the winter months, are not uncommon.

Vessels of 20 feet (6.1 m.) 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 (91 m.). 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 (50 m.) 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 (30.5 to 38 m.).

The **entrance** is under improvement by the construction of a jetty from the north entrance point. This work is being carried on jointly by the Government and the port of Umpqua. The bar is a shifting one, and in 1925 the conditions were bad, and the pilots had difficulty in getting vessels of 13 feet (4.0 m.) draft over the bar. When the jetty is finished it is thought that the channel will become more stable and better water will result.

Inside the entrance the channel has been improved to Reedsport, and in 1925 there was a controlling depth of about 13 feet (4 m.) at mean lower low water. At high tide the river is navigable by vessels of 6 feet (1.8 m.) draft to **Scottsburg,** 23 miles above the entrance. The channel to Gardiner is no longer marked, and in 1925 there was no shipping from that point. The channel to Reedsport is marked by lights and buoys. 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 Bolon 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.

A **rocky reef,** bare at extreme low tide, lies 600 yards southward from the south point of Winchester Bay. The reef is about 100 yards offshore.

Ork Reef, a patch of rocks and sand awash at half tide, lies abreast the northern end of Winchester Bay. Depths of 3 to 5 feet (0.9 to 1.5 m.) extend 350 yards southwestward from the reef.

Gardiner is located on the north bank of the river 7½ miles inside the entrance. In 1925 the sawmill was shut down, and there was no shipping at Gardiner. There is a ferry service (passenger, freight, and automobile) with Reedsport.

Reedsport is a station on the railway, and the principal town on the lower river. The sawmills here are in operation, and considerable lumber is shipped by water. There is ample water at the wharves for vessels that can cross the bar.

Supplies.—Provision, water, gasoline, and fuel oil for launches may be obtained.

Pilots and towboats.—Pilots may be obtained by making a signal to the lighthouse or Coast Guard station. There is a 90-horsepower gas tug available for work on the bar.

A **Coast Guard station** is located on the north bank of the river, 1 mile inside the entrance.

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.

The Roosevelt Highway connecting all ports along the Oregon coast is being constructed through Reedsport and Gardiner..

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 river is in the Oregon collection district; the port of entry is at Marshfield, on Coos 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 (15.2 to 30.5 m.) elevation.

Cannery Hill, 145 feet (44 m.) 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 1925 there was a controlling depth of 14 feet (4.3 m.) at mean lower low water on the bar, and a least depth of 17 feet (5.2 m.) between the jetties. The controlling depth to Florence was about 9 feet (2.7 m.). In 1925 most of the mills were shut down, and there was no shipping in the bay. Lumber products were shipped by rail.

Light-draft vessels can ascend the river to **Mapleton,** but the channel is narrow and crooked.

Florence is a small town on the north bank of the river, 4 miles inside the entrance. The sawmill here is closed and there is no commerce. There is an improvised automobile ferry between Florence and Glenada.

Glenada, on the south bank of the river, opposite Florence, is a small town of no commercial importance.

Cushman (Acme), on the north bank of the river 2 miles above Florence, has lumber and shingle mills. The product from these mills is shipped by rail.

About 1 mile above Cushman, 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 1 long blast of the whistle, followed quickly by 1 short and 1 long blast. During foggy weather, an answering signal of 1 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.—Neither pilots nor towboats are available. Stranger desiring a pilot might obtain the services of fishermen with local knowledge by signaling the Coast Guard station.

Supplies.—Water and limited amounts 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 located on the east bank, ½ mile south of Cannery Hill. The lookout station is on Cannery Hill.

Communication is 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 feet (3.0 m.) 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 (36.6 m.) high; the old lighthouse tower, situated at the extremity, and the hotels and cottages northward of it, are prominent as day marks. The south point is a low sand beach backed by sand dunes rising to 150 feet (45.7 m.).

The entrance has been improved by the Government by building jetties out from the north and south entrance points, and several rocky patches between the ends of the jetties have been removed to 18 feet (5.5 m.) at mean lower low water. In 1925 there was a least depth of 16 feet (4.9 m.) in the buoyed channel over the ocean **bar,** 22 feet (6.7 m.) to Newport, and 19 feet (5.8 m.) to Yaquina City. The entrance is also marked by a lighted range (both lights fixed white).

In 1925 there was also a channel at the entrance with least depths of 19 feet (5.8 m.) bearing nearly south (true) from a point 200 yards off the south jetty. This channel is unmarked and is not recommended to strangers.

The maximum draft to which vessels are loaded in Yaquina Bay (1925) is 17 feet (5.2 m.). A smooth bar is necessary for this draft.

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 (2.1 to 3.7 m.) 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 1¾ 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 (3 m.) deep at mean lower low water. This channel is well marked by aids, a number of which are lighted.

Above Toledo to the head of navigation the controlling depth is 2 feet (0.6 m.) at mean lower low water.

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. Considerable lumber is now shipped from Newport. It is barged down from upriver mills and loaded on the lumber schooners at the wharves in Newport.

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. A steamer carrying freight and passengers makes regular trips between Yaquina City and Newport, making connections with trains at the former point.

Toledo, 11 miles above the entrance, ships some lumber by both water and rail. The wharves have 10 to 12 feet (3 to 3.7 m.) at low water. There is an extensive spruce mill here.

Anchorage.—No regulations are prescribed. Vessels choose anchorage in the channel at points suited to the draft.

Pilots and towboats.—Licensed pilots are available and can be obtained by signaling the Coast Guard station on the hill at the north point of the entrance. The local mill company has a towboat that is available at times, but it can not be depended on.

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.

Storm signals are displayed by local interests from the boat landing of the Newport water front.

Communication is by rail to the interior, and by irregular coasting vessels to Astoria. There is a good highway to the interior, but none north or south. There is 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. There is a 7-foot (2.1 m.) rock about 360 yards, 255° true from Green Hill.

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 largest rock of the ledge is marked by a day beacon.

The entrance has been improved by the Government by the construction of a jetty extending 1,900 yards in a westerly direction from the northern entrance point.

In June, 1925, there was a least depth of 18 feet (5.5 m.) over the ocean **bar,** and a channel with depths of 20 to 48 feet (6.1 to 14.6 m.) along the jetty to the bay. The entrance is marked by a whistling buoy placed ¾ mile southwestward from the end of the jetty. The outer portion of the jetty is submerged. It is marked by a black buoy placed off its end.

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 100 feet long have difficulty in rounding the bends.

The Main Channel, formerly improved by dredging, has shoaled badly and now has a controlling depth of about 7 feet (2.1 m.) at mean lower low water. A depth of 6 feet (1.8 m.) is maintained in the channel connecting it with Bay City. This crossover is marked by a fixed red light.

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 with a least width of 60 feet, and a least depth of 4 feet (1.2 m.) at mean lower low water. Vessels drawing 9 feet (2.7 m.) (if not over 100 feet long) can reach Tillamook at 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 to Portland. There is but little water-borne commerce here.

Bay City, about midway of the eastern shore of the bay, has a cannery and sawmill. There is a controlling depth of about 7 feet (2.1 m.) at mean lower low water to Bay City.

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 (1.5 m.). From Garibaldi northward the beach is thickly lined with summer hotels and cottages.

Miami Cove, ¾ mile eastward from Garibaldi, has a large sawmill and a loading dock. A channel has been dredged to this dock. Vessels drawing 15 feet (4.6 m.) can enter the bay and proceed to this wharf by using the channel between the Sow and Pigs Reef and the shore, where there is about 10 feet (3.0 m.) at mean lower low water. A project has been adopted to obtain a least depth of 18 feet (5.5 m.) to Miami Cove and Hobsonville, but as yet no dredging has been done (1925).

Lumber schooners using the bay do not go above Miami Cove.

Pilots and towboats.—A pilot can be obtained by making a signal to the Coast Guard station. There are no towboats available.

A **Coast Guard station** is located on the north shore at the entrance, ½ mile northwestward from Green Hill. The lookout station is on the jetty about 1,100 yards from its outer end.

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 (122 m.).

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 (3.0 m.).

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 (1.8 to 2.4 m.) 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 (1.8 m.) at the wharf.

The entrance has been improved by the Government by the construction of two jetties, but the depths on the bar and within the bay are not sufficient for coastwise shipping, and all lumber is now shipped out by rail.

In 1925 there was a controlling depth of 8 feet (2.4 m.) at mean lower low water on the ocean bar, 18 feet (5.5 m.) between the jetties and 7 to 8 feet (2.1 to 2.4 m.) to Wheeler.

Communication may be had by rail to Portland and Tillamook. 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.

COLUMBIA RIVER

(charts 6151, 6152, 6153, 6154, 6155, 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, manufacturers, 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 151.

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 (3.0 m.) 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 northeastern side of Point Adams, was once a steamship terminal but is now abandoned as such and the wharf is no longer in repair.

Warrenton, on the **Skipanon River,** has several sawmills, a glazed-clay plant, canneries, and fertilizer works. The Skipanon has been improved by dredging, and there is a 20-foot (6.1 m.) channel from deep water to Warrenton. Lumber schooners load here, and ocean vessels often take part cargoes. Warrenton has rail connection with Astoria.

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. The shipyards of Youngs Bay are no longer in operation. A power house with a **prominent brick stack** is located on the north shore of the bay, just westward of the highway bridge.

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 150 feet width of opening; the signal for opening is one long blast followed quickly by two short blasts. The Lewis and Clark River is crossed by a highway bridge with a draw span of the bascule type.

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 35 feet (6.1 to 10.7 m.).

The **Port of Astoria,** which embraces the five incorporated towns of Astoria, Warrenton, Hammond, Seaside, and Gearhart, has built and operates a well-equipped modern terminal of three piers near the western end of the Astoria water front.

Dredges will usually be found at work in the channels of the Columbia and Willamette Rivers. These dredges should be passed with caution and reduced speed. The lights carried by various types of dredges are given on page 306 of the appendix.

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 one hour within the following-described district in the Columbia River off the mainland of the city of Astoria, Oreg., to wit:

On the west by a line drawn due north from the foot of Melbourne Avenue in the city of Astoria, Oreg., 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 8 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 alongside 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 putrefying 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.

Supplies.—Coal, fuel oils, provisions, and ship chandlery may be obtained at Astoria.

Pilots.—Pilotage across the Columbia River Bar is not compulsory, but pilots are always available, and a pilot boat will usually be found cruising off the bar. Vessels desiring a pilot should radio the Columbia River Bar Pilots at Astoria, stating the probable time of arrival at the lightship. The pilot boat, which is a power schooner, flies the union jack at the mainmast.

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 (0.3 m.) draft and 2 cents per registered ton.

The actual rates in 1925 were $1.50 per foot (0.3 m.) draft and 1 cent per net registered ton for bar pilotage and $1.50 per foot (0.3

m.) draft and 1½ cents 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.

The river pilots board vessels off Astoria, and their call is 1 long blast of the whistle followed by 3 short blasts. Both the bar pilots and river pilots maintain offices in Astoria.

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.

Towboats.—Towboats are always available. For rates of towage, see page 171.

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.

Repairs.—There are no facilities for extensive repairs at Astoria. There are machine shops and foundries, but there is no dry dock.

Storm warnings are displayed by the United States Weather Bureau from a steel tower back of Astoria. Both day and night signals are displayed here. Day signals are also displayed at Point Adams. Day and night signals are also displayed from a tower at North Head, the northern entrance to the river.

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 coastwise steamers. Several transcontinental railroads pass through Portland, and lines of steamers across the Pacific and through the Panama Canal call at Astoria and Portland. There is communication by telegraph, telephone, and radio. Astoria is on the Columbia River Highway which extends from Seaside, Oreg., to Astoria, thence along the south bank of the Columbia to The Dalles.

The **Merchants' Exchange** of Portland requests that vessels entering the Columbia River send the following "TR's" to station KEK of the Federal Telegraph Co. at Portland:

1. TR to KEK when crossing bar (inbound).
2. TR to KEK when leaving Astoria (upbound).

3. TR to KEK when passing St. Helens (upbound).
4. TR to KEK when crossing bar (outbound).

This information will be telephoned to agents, stevedores, and others concerned, and there will be no cost to the vessel.

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 **Wauna, Rainier, Kalama, St. Helens, Linnton,** or **St. Johns,** 36, 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 (1.2 m.) to **Ostrander,** about 8 miles above the mouth, and 2 feet (0.6 m.) to **Toledo,** the head of navigation, 33 miles above the mouth. Considerable amounts of lumber and farm and dairy products are shipped.

Longview.—Just westward of the mouth of the Cowlitz River and opposite Rainier is the city of Longview, built around the activities of an extensive lumber development.

There is one exporting dock with a face of 1,800 feet, and another similar dock is planned. Ocean-going vessels load lumber here for export and intercoastal trade.

Two huge smokestacks of the power plant are very prominent. The city is built on the flat land about 2 miles back from the river.

Lewis River, which enters the Columbia 75 miles above the mouth, has also been improved by the Government, but shoaling has occurred. There is a low-water-stage depth of 2 feet (0.6 m.) to **Woodland** and 1 foot (0.3 m.) to **La Center.** The commerce consists of farm and dairy produce, lumber, 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 (9.1 m.) can be carried from the mouth to Portland, 6 feet (1.8 m.) to **Oregon City,** 11½ miles, and 2 feet (0.6 m.) to **Salem.**

The entrance to the Columbia has been improved by the construction of north and south jetties, and by dredging. The result of this improvement has been most satisfactory, for in June, 1925, there was a least depth of 46 feet (14 m.) at mean lower low water on the crest of the bar, and the tendency is toward gradual deepening. The improvement makes it possible for the largest vessels on the Pacific to enter and leave at any normal stage of the tide, and in any weather except during the most severe storms. Bar-bound vessels, once so common here, are now rarely to be seen.

Due to the strong current during the strength of the ebb, heavy rips and steep seas are encountered, and the bar is termed a "mean one" by the local pilots.

Extensive improvements have been made throughout the lower reaches of the Columbia, and with the exception of the channel at Harrington Point, where 28 feet (8.5 m.) is the controlling depth, there is a least depth of 30 feet (9.1 m.) to Portland in a channel 300 feet in width. Vessels drawing 29 and 30 feet (8.8 and 9.1 m.) use the channel to Portland constantly.

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 a depth on all bars. In the Willamette River the project depth of 30 feet (9.1 m.) is at present being maintained. Under normal conditions of shoaling and redredging a draft of 30 feet (9.1 m.) is considered practicable from February to September and 29 feet (8.8 m.) for the balance of the year.

Freshets occur annually, the high-water stage being reached about June. The heights above normal range from about 20 feet (6.1 m.) at Portland, to practically nothing 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.

Ice forms occasionally in both the Willamette and Columbia Rivers, but it is seldom heavy enough seriously to affect navigation.

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. Large steamers drawing up to 30 feet (9.1 m.) now navigate the river night and day, and are delayed only by fog.

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 (305 m.), 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 (73 m.) high and the one behind it is much higher. There is an automobile ferry service from Point Ellice to Astoria. The shore in this vicinity is closely built up with fish traps, pile structures extending well out into the river.

Smith Point, on the south bank, at the junction of Young 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 (197 m.) high, behind Astoria.

A high brick smokestack 1 mile eastward from Smith Point is prominent from off Point Adams. Since the fire of 1922 Astoria has been rebuilt mostly with concrete construction, and the town shows up very prominently. A **tank** surmounting the elevator on Pier 1 of the Port Docks is a prominent feature and is shown on chart 6151.

Tongue Point, on the south bank, about 4 miles northeastward from Smith Point, is a bold, rocky peninsula 300 feet (91 m.) 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 Service is situated on the western side of the peninsula, near its inner end. On the east side of the peninsula, opposite the lighthouse depot is the naval base site. Four short piers have been constructed here and some dredging done, but in 1925 the project was practically abandoned.

Mount St. Helens, nearly 10,000 feet (3,048 m.) 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 151.

Mount Hood and **Mount Adams** are also lofty snow-covered peaks, visible from parts of the Columbia River on a clear day.

Portland (chart 6155), on the Willamette River, about 9 miles from its mouth, is the principal city of the Columbia River Valley.

It has an extensive commerce, both foreign and domestic, and is a port of call for many lines of coastwise, intercoastal, and trans-Pacific lines of steamships.

The administration of the port of Portland is vested primarily in the municipal corporation known as the "**Port of Portland,**" which has general jurisdiction over the physical development of the harbor and its channels from the mouth of the Willamette, and in the **Commission of Public Docks,** with jurisdiction over the construction and operation of municipal water terminals. The Port of Portland was established by the State legislature, while the Commission of Public Docks is a department of the city of Portland.

Pilots.—See page 167.

Towboats.—Towboats are operated by the Port of Portland, and are always available. Charges are given below.

(1) Between sea and Portland for tow in each direction for sailing and dismantled vessels:

1 to 500 gross tons	$260
501 to 1,000 gross tons	350
1,001 to 1,500 gross tons	400
1,501 to 2,000 gross tons	450
2,001 to 2,500 gross tons	475
2,501 to 3,000 gross tons	525
3,001 to 4,000 gross tons	575
Over 4,000 gross tons	615

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(2) Between sea and the following points:

Astoria, Knappton	70 per cent of Portland rate
Westport, Wauna	85 per cent of Portland rate
Rainier, Prescott, Kalama, St. Helens	90 per cent of Portland rate
Vancouver, Wash., North Portland, Oreg	100 per cent of Portland rate

Points not named take same rate as nearest point named above.

Minimum tow between sea and any point, $200.

(3) Steamers, motor or auxiliary power vessels:

Steamers, motor or auxiliary power vessels will be towed, or convoyed, between sea (vicinity No. 2 buoy) and anchorage inside Columbia River, if vessels' power is used during movement, at rate of $200 for assistance in each direction. Towing of steamers and power vessels on the Willamette and Columbia Rivers will be done at rates consistent with conditions.

(The above rates for towage and assistance require that vessels be in charge of a regular licensed pilot employed by the vessel, its owners, or operators, which pilot shall give all orders to the towboats supplied by the Port of Portland. The Port of Portland disclaims all responsibility for any loss or damage occurring in connection with the carrying out of said orders.)

(4) For moves in Portland harbor, the charges vary from $30 for a vessel of 500 gross tons, to $130 for a vessel of over 7,000 gross tons using two tugs.

Quarantine.—Officers of the Public Health Service in charge of the enforcement of quarantine regulations on the Columbia River are stationed at Astoria. Incoming vessels subject to quarantine are boarded below Smith Point, and should not pass beyond that point until pratique has been granted. The quarantine station for the river is near Point Ellice, about 85 miles below Portland. Vessels detained for quarantine treatment generally proceed to that station, although in some cases vessels have been fumigated at Portland.

Marine hospital.—A relief station of the Public Health Service is located at Portland.

Customs.—The headquarters of the Oregon customs district are in Portland. The customhouse is located at the corner of Eighth and Davis Streets.

Supplies.—Fuel oil, coal, water, provisions, and ship chandlery may be had in any quantity.

Repairs.—Repairs of all kind can be made in Portland. The Port of Portland operates two sectional dry docks, the larger of which has the following dimensions:

Length	feet	492
Width between wings	do	94
Depth over keel blocks	do	27 (8.2 m.)
Lifting capacity	tons	15,000

A machine shop is operated in connection with the dry docks.

The following are the dry-dock rates for 1925:

For steam or power vessels, gross tonnage, up to 999 tons, 20 cents per ton for the first day and 10 cents per ton per lay day. For 1,000 tons and over, 18 cents per ton for the first day and 10 cents per ton per lay day. Cargo will be charged for at one-half tonnage rates. No charge is made for vessels in dock on Sunday or holidays unless work is performed on the vessel.

Storm warnings are displayed by the United States Weather Bureau at North Head, Point Adams, and Astoria.

A **Coast Guard station** is located on the eastern side of Point Adams.

A **United States branch hydrographic office** is established in the customhouse. Bulletins are posted here giving information of

value to mariners, who are also enabled to avail themselves of publications pertaining to navigation, to compare barometers, and to correct their charts from standards. No charge is made for this service.

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.

Harbor regulations are enforced by a harbor master. The following are the most important items of the regulations in force in 1925:

Anchoring vessels.—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 the 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 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 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 or within 400 feet of any bridge or ferry line, unless at dock.

Obstructing public docks.—It shall be unlawful for any person to anchor, moor or dock any vessel or other water craft so that any portion of such vessel or water craft shall overlap or obstruct any public wharf or landing owned or operated by the City of Portland. It shall be unlawful for any person to anchor, moor or dock any raft, barge or other obstruction between the Hawthorne Avenue and Broadway Bridges in such manner that the same will interfere with the berthing or docking of any vessel at any dock within said area. All barges, scows, and rafts anchored, moored, or docked at any wharf in the Willamette River shall have lights displayed thereon from sunset to sunrise each night.

Vessels changing docks.—Every vessel, unless propelled by its own engine, moving from one dock to another or from one place to another, when necessary to pass through the draw of any bridge or across 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.

Care of vessels at anchor or at docks.—A seagoing vessel anchored or moored in the harbor or lying at the dock must at all times have at least one officer and a sufficient number of seamen on board to take 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 damage and expense that shall arise thereby.

Removal of vessels from docks or wharves.—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.

Lights and gangways on vessels at wharves.—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 appliance 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 vessel, 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.

Safety nets on vessels.—Whenever practicable, every vessel lying at a wharf, except river steamboats, shall have such a safety net suspended below any landing stage or gangplank as will prevent any person from falling into the water in the event such person slips off such landing.

Hawsers or ropes—how safeguarded.—Every hawser or rope by which a vessel arriving from a foreign or island port is made fast to any wharf or the shore shall be equipped with at least one metal disk or rat guard of such size and pattern as shall be approved by the harbor master and the vessel fended off a distance of 6 feet, 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 the harbor master: Provided that when river conditions prevent the loading or discharging of any vessel when fended off 6 feet the harbor master may grant permission for the removal of the float to facilitate the loading or discharging of such vessel, but when such vessel is not loading or discharging cargo, the same shall be immediately fended off said required distance.

Precautions on vessels at night.—All openings in the ship's sides shall be closed at sundown, gangways raised clear of the dock, and all cargo skids shall be unrigged at sundown, except during such times 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. In case gangways are not lifted from the ship or dock at night both ends of the gangway shall be lighted and a man constantly on watch at the head of such gangway on the vessel.

Dead animals, refuse, etc.—It shall be unlawful to throw, place, or leave any dead animal or putrefying matter into or on any part of the port, or to place or deposit any rubbish, refuse matter, or articles of any offensive character likely to create a nuisance upon any wharf, or any wharf road, or street leading to a wharf, except at the places and in the manner pointed out by the harbor master.

Obstructing channel.—It shall be unlawful for any person to dump, 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, or dump or deposit or cause to be dumped or deposited, any sawdust, slabs, ashes, gravel, loose earth, rubbish, or other débris, at any point within the corporate limits of the city of Portland where the same will be carried away and into said river, or into or through any sewer within the city limits, by freshets or otherwise.

Speed of steamers.—It shall be unlawful for any person to run or propel any steamboat on the Willamette River within the corporate limits of the city of Portland at a greater speed than 8 miles per hour, except between the bridges crossing said river, when masters and pilots are to govern their speed for the safe navigation of vessels, and 12 miles per hour between the head of Swan Island and the city limits of Linnton.

Explosives.—It shall be unlawful for any vessel or other water craft propelled by its own power to enter the city limits with any blasting powder, gunpowder, dynamite, or other explosive compounds on board, but said gunpowder, blasting powder, dynamite or other explosive compound shall be discharged onto a barge or scow before entering the city limits and then the same may be transferred from barge or scow to dock or wharf and removed from said dock or wharf as soon as landed thereon. This section shall not be considered to include water craft of any description having any such cargo on board which may be passing up or down the Willamette River to points outside the city limits. It shall be unlawful for any water craft to remain at any wharf or dock longer than six (6) hours after gunpowder, blasting powder, dynamite or other explosive substances have been deposited on any wharf or dock for shipment on such watercraft and all such explosives so deposited shall be placed immediately on board the vessel which is to receive the same. All vessels and water craft with any explosive on board shall fly a red flag at some prominent point at all times while said vessel or water craft is within the city limits.

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 vicinty of Portland is crossed by six **drawbridges,** as follows:

(1) Railway bridge above St. Johns; openings 230 feet wide; signal for opening, 1 long blast of whistle followed quickly by 1 short and 1 long blast.

(2) Broadway Bridge; opening 250 feet wide; signal 2 long blasts and 1 short blast.

(3) Railroad bridge, Glison Street; opening 205 feet; signal, 1 long and 1 short blast.

(4) Burnside Street Bridge; opening 209 feet; signal, 1 long and 2 short blasts.

(5) Morrison Street Bridge; openings 157 feet; signal, 1 long and 3 short blasts.

(6) Hawthorne Avenue Bridge; openings 200 feet; signal, 1 long and 4 short blasts.

Vancouver is situated on the north bank of the Columbia, 92 miles above the mouth. The commerce is largely local and consists of general merchandise, farm products, and lumber. A channel dredged to 20 feet (6.1 m.) at extreme low water leads through the shoals below the town and constitutes the controlling depth. A paper mill, veneer plant, and sawmills are the principal industries of the town. There are no facilities for repairs.

Two bridges cross the Columbia at Vancouver:

(1) Interstate Highway Bridge; vertical lift, horizontal clearance 250 feet, vertical clearance above high water, 154 feet (47 m.); signal 1 long and 2 short blasts.

(2) Railway bridge; openings, 200 feet; signal, 1 long and 1 short blast.

Upper Columbia and Snake Rivers.—Above Vancouver the Columbia is navigable by high-power, light-draft river steamers to Priest Rapids, about 340 miles above its mouth. The Snake River, which formerly formed one of the main highways to the Pacific coast, is navigable by the same type of boats to Pittsburg Landing, 463 miles above the mouth of the Columbia. Stern wheel steamboats of about 500 horsepower have been used on the upper Columbia and Snake Rivers for the past 60 years. They carry a maximum load of about 200 tons on a draft of from 3½ to 4½ feet (1.1 to 1.4 m.). During the low-water season the draft should be limited to 4 feet (1.2 m.) on the Columbia above Celilo, and 2½ to 3 feet (0.8 to 0.9 m.) on the Snake.

In 1925, a small motorboat made an all-water trip (excepting a 400-mile portage from the headwaters of the Snake River) from Astoria, Oreg., to New York on the Atlantic coast.

Currents.—The currents at the Columbia River Lightship are described on page 287 in the appendix.

In the entrance the currents are variabie and at times reach a velocity of over 5 knots on the ebb; on the flood they seldom exceed a velocity of 2 knots.

The mean velocity of the tidal current is about 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 hours before the time of high water at Astoria, and the strength of the ebb, 2 hours before the time of low water.

Slack water before flood occurs on the average 2 hours after the time of low water at Astoria; slack before ebb occurs at about the time of high water.

Above Astoria the current averages 1 to 2 knots, except during the freshet period, when it is considerably increased, although not enough to affect navigation seriously.

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 25. Under such conditions vessels should keep outside the 30-fathom (55 m.) 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 28 feet (8.5 m.) draft should have little dif-

ficulty 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 (6.1 m.) 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.

The **Klipsan Beach radiocompass station,** call letters NZS, is located near the Coast Guard station.

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 (15.2 m.) high. The light is fixed white, with a white flash of 0.4 second duration every 20 seconds, 81 feet (24.7 m.) above the water, and visible 14 miles.

A **Coast Guard station** is situated just inside Cape Shoalwater on North Cove.

Willapa Bay is described under a separate heading on page 186.

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 (37 m.) above the water, and visible 17 miles. The fog signal is an electric siren sounding a group of 2 blasts every 30 seconds (blast 4 seconds, silent 2 seconds, blast 4 seconds, silent 20 seconds).

Announcement has been made that a **radio fog signal** is to be established at the Grays Harbor Lighthouse. The signal will be groups of 4 dashes sounded for 60 seconds, silent 60 seconds. The station will not maintain radio communication.

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. A jetty extends southwestward from the point.

Grays Harbor is described under a separate heading on page 189.

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 (29.3 m.) 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 (15.2 m.) 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 (30.5 m.) high. Numerous rocks extend for some distance off the point. **Grenville Arch,** 82 feet (25.0 m.) 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 Greenville Arch. The western rock off the western end of the point is 200 yards off the cliff and 92 feet (28.0 m.) high; there are a number of rocks inside of it, but none outside. Two rocks over 90 feet (27.4 m.) 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 (7.3 m.), 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 (24.4 to 30.5 m.) 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 (61 m.). 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.

Pratt Cliff, 3 miles northward from Cape Elizabeth, is a sharp point with cliffs 100 feet (30.5 m.) high.

Split Rock, 85 feet (25.9 m.) high, lies 3½ miles 330° true (NW. ¾ W. mag.) from Cape Elizabeth and 1 mile offshore abreast the north end of Pratt 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 (37 m.) 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 (4.6 m.) high, small and black, lies 3 miles 324° true (NW. by W. ¼ W. mag.) from Split Rock and 2¾ miles offshore.

From Pratt Cliff to Raft River, 3½ miles, the coast consists of broken cliffs over 100 feet (30.5 m.) 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 (30.5 m.) high and 300 yards long. A vertical pillar, 114 feet (35 m.) 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 (24.4 m.) 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 (24.4 m.) 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 (15.2 m.) 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 (27.4 m.) 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 2 seconds, eclipse 8 seconds), 147 feet (45 m.) above the water, and visible 18 miles. The fog signal is an air siren, blast 2 seconds, silent 13 seconds.

There is a **Navy radiocompass station,** call letters NOJ, on Destruction Island.

An indifferent **anchorage,** affording shelter from northwest winds, may be had off the southeast face of the island in 12 fathoms (21.9 m.), 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 (30.5 m.) 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 (14.0 m.) 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 (24.4 to 30.5 m.) 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 (61 m.) 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 (30.5 m.) high, black with nearly vertical sides, lies a little over 1 mile southward from Hoh Head.

Middle Rock, 40 feet (12.2 m.) 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 (30.5 to 37 m.) 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 (7.6 to 35 m.) 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 (37 m.) 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 (7.6 m.) high, lies halfway between them. Between the rock awash and the beach are two small rocks 44 and 74 feet (13.4 and 22.6 m.) 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 (39 m.) 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 (26.8 to 65 m.). 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 (30.5 m.) 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 (41 m.) 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 (59 m.) high and another 223 feet (68 m.) high, the latter being wooded. One sunken and five low, black rocks extend northward for ¼ mile from Huntington Rock.

Quillayute Needle, 83 feet (25.3 m.) high, a little over ¼ mile southeastward from Huntington Rock, is 35 feet (10.7 m.) in diameter and nearly vertical; it is the southeasternmost of a line of rocks from Huntington Rock, one of which is 47 feet (14.3 m.) high and another 73 feet (22.2 m.) high.

James Island, 125 feet (38 m.) 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 (9.1 to 11 m.), sandy bottom, about 600 yards from the beach. Any swell makes it unsafe.

A fixed white light is located on the southern side of James Island. The light is shown during the fishing season only.

A whistling buoy is placed in 15 fathoms (27.4 m.) 1¼ miles 241° true (SW. ¾ S. mag.) from the light.

Lapush is a village situated abreast James Island at the entrance to the river. There are stores, a hotel, and a post office here and daily communication with Port Angeles. The flagpole in the village is a good mark for making the entrance.

Quillayute River enters at the northern end of the sand beach, expanding into a basin inside the entrance. Some improvements have been carried on by local interests, and the river is now used by fishing boats and light-draft towboats in towing out logs for a paper pulp mill at Port Angeles.

The entrance channel passes close to the southeastern shore of James Island, and there is a least depth of 5 feet (1.5 m.) to the basin inside the mouth.

Mora is a village with a post office situated at the mouth of Dickey Creek. There is a store here and communication by stage to Port Angeles. Gasoline and oils may be obtained.

The entrance to the Quillayute River is well protected for the prevailing northwest weather, but is open to winds from west-southwest. It is reported that fishing boats can enter and leave the river at any time during the year.

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 (35 m.) 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 (6.1 m.) high. Halfway between Cake Rock and the beach is a jagged rock 131 feet (40 m.) 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 (30.5 m.) 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 (31 and 39 m.).

Three high, rocky pillars lie from ½ to 1 mile south-southeastward from the cape and reach elevations of 117, 207, and 125 feet (36, 63, and 38 m.).

From Cape Johnson to Cape Alava the coast extends in a general north-northwest direction for 12½ miles. The cliffs are not continu-

ous 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 (20.7 m.) 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 (61 m.) 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 (38 m.) 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 (75 m.) high, with steep sides; the smaller one is 175 feet (53 m.) 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 islets and the beach, and several low, black rocks lie about 1 mile northwestward. .

Hand Rock, 27 feet (8.2 m.) 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 (14 m.) high, lies halfway between it and the beach, and several low rocks inside the latter.

White Rock, 162 feet (49.4 m.) 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 (36 m.) 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. Cape Alava is the westernmost point in the continental United States.

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 (73 m.) 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 (76 m.) high, lies 1⅛ miles westward from Cape Alava; the inner one, 220 feet (67 m.) 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 (53 m.) 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 34° true (N. ¾ 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 Lightship is moored in 25 fathoms (46 m.) 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 (11.9) 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 4 strokes every 20 seconds. In very heavy weather the light vessel is sometimes obliged to leave her station. A radiobeacon will be established in June, 1926.

The radio station, call letters WWBP, receives and transmits messages.

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 (30.5 to 61 m.) 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 (50 m.) high and the inner one 66 feet (20.1 m.). A rock 40 feet (12.2 m.) 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 (12.8 m.) high, sharp and bare, lies ⅞ 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 (46 to 52 m.); there are three arches in these rocks. A rock awash lies ⅜ mile 245° true (SW. ⅜ S. mag.) from Spike Rock; it is inside the usual course of vessels.

Portage Head, 7⅔ miles northward from the outer Flattery Rock, has a seaward face about 1 mile in length of bold, rocky, irregular cliffs over 100 feet (30.5 m.) high. A reef extends from the point toward Cape Flattery for 1½ miles, showing several low, black rocks awash at low water and one small rock 44 feet (13.4 m.) 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 1½ 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 2¼ 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 ⅜ mile offshore, range in height from 44 to 88 feet (13.4 to 26.8 m.).

Fucas Pillar stands ¼ mile 181° true (SSE. mag.) from the western point of Cape Flattery. It is a rocky column, 140 feet (43 m.) high and 60 feet (18.3 m.) 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 (37 m.) high, rising to an elevation of 1,500 feet (457 m.) 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 ⅜ mile northwestward from Cape Flattery. The main island is about ¼ mile in diameter, with three smaller ones and several reefs awash close-to on its northwestern face. It is 108 feet (33 m.) high, flat-topped, and bare; a reef, the outer rock of which is usually awash, extends ¼ 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 (50 m.) 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 naval **radiocompass station,** call letters NPD, is located on the island, and day and night 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 (12.8 m.), 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 (7.3 m.) 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 (5.8 m.) 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), formerly known as **Shoalwater Bay,** has its entrance 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 (30.5 to 61 m.) 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 lies about 3 miles outside of the line joining the lighthouse and Leadbetter Point. It has never been improved, and the channel over it is continually shifting. In 1925 the channel broke through at a point southwest of the lighthouse, but was gradually working to the southward. Experience shows that this channel works to the southward until it is parallel with the shore, then breaks out to the westward, the cycle consuming 20 to 30 years.

The depth on the bar varies from season to season, ranging from 20 to 27 feet (6.1 to 8.2 m.), with a usual depth of 23 feet (7 m.) at mean lower low water. In September, 1925, the latter was the controlling depth. An examination of shipping records shows the maximum drafts using the harbor to vary from 17 feet (5.2 m.) to 24 feet (7.3 m.). Vessels loaded deeply must await a favorable bar before passing out.

Due to the changeable character of this entrance, vessels should employ a pilot. There is no entering range established.

Long Island, 5½ miles long northwest and southeast and of irregular width, wooded and rising to over 200 feet (61 m.) 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 has been improved by dredging. In 1925, there was a controlling depth of 24 feet (7.3 m.) at mean lower low water to the forks at Raymond.

At high tide, vessels drawing 12 feet (3.7 m.) can ascend to Willapa, 11 miles above the mouth.

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 20 feet (4.6 to 6.1 m.), 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 20 to 25 feet (6.1 to 7.6 m.) The south fork of the river is crossed by a railway bridge with a 125-foot horizontal clearance in the draw span.

Tokeland, on **Toke Point,** about 2 miles eastward from Cape Shoalwater is a summer resort. There is a ferry service from Toke Point to South Bend, and it is connected by highway to points on Grays Harbor.

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 channel leading into North Cove, formerly used as an anchorage by towboats, has shoaled, and this portion of the bay is nearly bare at low water.

The channel leading to Nahcotta has sufficient depth for any vessel that can cross the bar, but it is poorly marked and care is necessary to avoid the shoals on either side. The southern portion of the bay has not been surveyed recently, and the chart can not be relied upon as showing the hydrography correctly. This section of the bay is used by local light-draft craft only.

The channel to Bay Center is marked by aids, but must be followed with caution.

The main channel to South Bend and Raymond is well marked, and vessels once inside the bay should have no difficulty in reaching those ports which are the only ones of commercial importance on the bay.

Aids to Navigation.—Willapa Lighthouse is described on page 177. Willapa Bay Outside Bar gas and whistling buoy is situated 5 miles west-southwestward from the lighthouse. This buoy is moved occasionally to follow changes in the channel over the bar. The channel across the bar is 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.

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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.—Pilots may be obtained from South Bend. Vessels desiring a pilot should call the Grays Harbor Stevedoring Co., at Aberdeen (call letters KZE), and state time of arrival off the bar, or notify Willapa Pilots Association by telegraph at South Bend.

The pilot charges are $2 per foot (0.3 m.) draft and 2 cents per net ton each way, in or out. Deep-draft vessels should not attempt to enter without a pilot.

Towboats.—No towboats are available in Willapa Bay, but they may be had from Grays Harbor. Sailing vessels desiring a towboat should make Grays Harbor, signal the Coast Guard station there, and await the towboat.

Quarantine.—Quarantine regulations are enforced by an officer stationed at South Bend. Vessels subject to quarantine must not pass beyond the first dock at South Bend until pratique has been granted. There are arrangements for fumigation by sulphur only.

A **Coast Guard station** is located at North Cove, 1 mile eastward of the lighthouse. There is a telephone line to South Bend, and vessels off the bar are reported.

Marine hospital.—There is a marine hospital station in charge of a public health officer at South Bend.

Supplies.—Provisions and water may be obtained at South Bend and Raymond. Fuel oil may be had via tank cars from Tacoma, and coal may be arranged for.

Repairs.—Repairs to wooden vessels may be made, but there are no dry docks. There are machine shops and foundries.

Communication may be had by rail and motor stage. There is a regular ferry service to Tokeland. Telegraph and telephone facilities are available.

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. On the bar, the current changes at about the time of high and low waters.

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 25.

Under such conditions vessels should not shoal the water to less than 20 fathoms (37 m.) 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 vessels of 20 feet (6.1 m.) 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. Grays Harbor is probably the leading lumber port in the United States, and its shipments include both coastwise and foreign. 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 178 and 177.

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. It has been improved for a distance of 2 miles above the entrance by dredging a channel 100 feet wide and 18 feet (5.5 m.) deep at mean lower low water.

Westport is a village on Point Chehalis in South Bay just inside the entrance to Grays Harbor; it is a summer resort principally,

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 (3.0 m.). 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 (3.7 to 7.6 m.) 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 25 feet (3.7 to 7.6 m.), 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 north and south jetties, and by dredging the bar during the summer seasons. In June 1925, there was a least depth of 30 feet (9.1 m.) at mean lower low water on the bar, but the experience has been that the bar shoals considerably during the winter months. Prior to the dredging season in 1925, the bar had shoaled to 23 feet (7.0 m.). An examination of shipping records show that in 1924 the monthly maximum draft of vessels departing from Grays Harbor varied from 28 feet (8.5 m.) at the close of the dredging season, to 23½ feet (7.2 m.) during the winter months. Deep-draft vessels must wait favorable bar condition before passing out, and are subject to delay on this account.

The entrance is marked by lighted ranges and by buoys which are shifted to mark the best water as shown by frequent surveys of the bar. Due to the changeable conditions here, vessels should not attempt the entrance without a pilot or local knowledge.

In January, 1926, a steamer was wrecked on the bar, and the wreck lies on the entering range. Pending the removal of this wreck, the bar range lights have been discontinued, and the position of the hulk has been marked by lighted buoys. Special caution should be exercised here until this obstruction is removed.

Channels.—The main channel through the bay to Aberdeen, and through the Chehalis River to Cosmopolis, has been improved by the construction of dikes, the removal of snags, and by dredging.

In 1925 there was a controlling depth of 20 feet (6.1 m.) at mean lower low water to Cosmopolis. The river between Cosmopolis and Montesano has also been improved, and there is a least depth of about 6 feet (1.8 m.) at mean lower low water to the latter point, but at the upper end the channel is very narrow. By using the tide, vessels drawing 14½ feet (4.4 m.) can reach Montesano.

The **Port of Grays Harbor** is under agreement with the Government to maintain a channel to Aberdeen with a depth commensurate to the depth of water on the bar, and in 1925 this project depth was set at 26 feet (7.9 m.), but the full project depth is seldom available.

Prominent features.—The country about Grays Harbor is flat and featureless, with few conspicuous objects.

Saddle Hill, about 400 feet (122 m.) 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. 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 (24.4 m.). 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.

Port Terminals.—Midway between Hoquiam and Aberdeen, the Port of Grays Harbor has constructed and operates a modern freight terminal with two slips, which are maintained by dredging to 30 feet (9.1 m.) at mean lower low water. The terminal has rail connection and is equipped with modern improvements for handling lumber and other cargo.

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 (10.7 to 12.2 m.). 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.—Pilots may be had from Aberdeen. Vessels desiring a pilot should radio the Grays Harbor Stevedoring Co. (call letters KZE) and state time of arrival off bar.

The pilot tug is equipped with radio, call letters KFWG.

Pilotage charges are $1.50 per foot (0.3 m.) draft and 2 cents per net ton, each way, in or out. Minimum pilotage charge, in and out, $125.

Towboats are available for use over the bar and inside the harbor. The rate for towing (in and out included) between the bar and Hoquiam to Cosmopolis is 40 cents per net registered ton. Vessels desiring a towboat should signal the lookout station at Point Chehalis or call KZE by radio.

Customs.—The customhouse is located in Aberdeen.

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 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: [*See preceding table.*]

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 several yards devoted to building steam schooners where repairs can be made to wooden and steel vessels. There are no dry-docking facilities, the marine railways being capable of taking vessels under 130 feet in length. There are machine shops and foundries capable of making ordinary repairs.

Communication.—Grays Harbor is served by three lines of transcontinental railroads, and a large number of ships operating in foreign, intercoastal, and coastwise trade call at the various ports on the bay. There is a good highway to Olympia. Radio, telegraph, and telephone facilities are available.

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. Under normal conditions the current at the bar changes at about the time of high and low water. The master of the dredge working on the bar states that the currents are very erratic. He usually experienced a northerly set close inshore, and a southerly set offshore.

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 25.

Under such conditions vessels should not shoal the depths to less than 20 fathoms (36.6 m.) unless sure of the position.

Strangers are advised to take a pilot, and they should in no case attempt to cross the bar when it is breaking.

At any time when the aids to navigation can be seen vessels of 20 feet (6.1 m.) or less draft, having crossed the bar, should have no difficulty in reaching the wharves at Hoquiam or Aberdeen. The channels should not be attempted in thick weather. Due to the changeable character of the channels and the necessary shifting of the aids to navigation, no directions of a permanent value can be given.

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 employment of pilots in the Strait of Juan de Fuca and Puget Sound is optional and is not required by State law. The masters of towboats are licensed pilots and are the only ones ever found cruising off the entrance. Pilots may be obtained at Port Townsend, Seattle, or Tacoma. There is no statute fixing the rates of pilotage on Puget Sound waters. The following table gives the present schedule of charges. These rates are based on a consideration of the three factors, tonnage, draft, and time.

Flat-rate charge for pilotage (in dollars)

	Anacortes	Bellingham	Blaine	Boundary Line	Bremerton	Dupont	Eagle Harbor	Everett	Mukilteo	Olympia	Port Angeles	Port Blakely	Port Gamble	Port Ludlow	Port Townsend	Point Wells	Seattle
Bellingham	25																
Blaine	50	50															
Boundary Line	50	50															
Bremerton	100	100	115	100													
Dupont	125	125	150	125	65												
Eagle Harbor	75	75	100	75	30	50											
Everett	75	75	100	75	50	75	30										
Mukilteo	75	75	100	75	50	75	30	25									
Olympia	150	150	175	150	90	50	90	90	90								
Port Angeles	75	75	90	60	90	125	75	75	75	150							
Port Blakely	75	75	100	75	30	50	25	30	30	75	75						
Port Gamble	75	75	90	60	65	100	50	50	50	125	75	50					
Port Ludlow	75	75	90	60	65	100	50	50	50	125	75	50	25				
Port Townsend	50	50	75	50	75	100	50	50	50	125	25	50	50	50			
Point Wells	75	75	100	75	50	75	30	25	25	100	75	30	50	50	50		
Seattle	75	75	100	75	25	50	25	25	25	75	75	25	50	50	50	25	
Tacoma	100	100	125	100	50	25	25	50	50	50	100	25	75	75	75	50	25

Miscellaneous charges include the following:

Shifting a vessel, all ports, per shift	$15.00
Swinging a vessel, for compass adjustment	25.00
Piloting vessels, trial trips, 6 hours	50.00
Piloting through locks of Lake Washington Canal	25.00

Rates from Seattle to Victoria are the same as to the boundary line.

Piltoing vessels to or from Port Townsend to the Diamond Point Quarantine Station	$25.00
Allowance for detention at the quarantine station per day	10.00

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 such 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 provisions of this act.

Pilots for British Columbia waters can be obtained from Royal Roads, near Victoria.

Towboats will sometimes be found cruising at the entrance to Juan de Fuca Strait or at anchor in Neah Bay and can be had by signaling 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. The rate for towage from Cape Flattery to Seattle varies from $109 for a vessel of 100 gross tons to $905 for a vessel of 8,000 gross tons.

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 Lightship, and Swiftsure Bank Lightship 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 (91 m.) curve. The outer limit of the 100-fathom (183 m.) 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 Lightship 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 (183 m.) and an average width of 4 miles between the 100-fathom (183 m.) curves. On the east side of this valley the 100-fathom (183 m.) curve lies 20 miles southwestward of Destruction Island and Umatilla Reef Lightship, 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 (183 m.) 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 (183 m.) 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 (183 m.) 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 Lightship; 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 (91 m.) 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 Lightship. 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 Lightship and at Cape Flattery, and thereby verify their position.

Radiocompass stations on Destruction Island (call letters NOJ), Tatoosh Island (call letters NPD), and Pachena Point, Vancouver Island (call letters VAD), afford the navigator an excellent opportunity for frequently fixing his position in approaching the Strait of Juan de Fuca. In addition, the Swiftsure Bank Lightship sends out radio fog signals (groups of 2 dashes for 60 seconds, silent 30 seconds). (See Radio Service on p. 10.)

Swiftsure Bank, about 3½ miles in extent within the 30-fathom (55 m.) 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 (37 m.).

Swiftsure Bank Lightship is placed 13 miles 308° true (WNW. 7/8 W. mag.) from Tatoosh Island Light, and 11 miles 243° true (SW. 5/8 W. mag.) from Carmanah Light. It has a yellow hull with "Swiftsure" on each side, and is two-masted. The mainmast shows a fixed white light, 50 feet (15.2 m.) above the water and visible 11 miles, and the foremast a fixed red light, 50 feet (15.2 m.) above the water, and visible 8 miles. The fog signal is a steam whistle sounding a group of 2 blasts every 30 seconds (blast 2 seconds, silent 2 seconds, blast 2 seconds, silent 24 seconds). A bell is struck if the whistle is disabled.

The submarine bell sounds a group of 6 strokes every 30 seconds. The radio fog signal sounds a group of 2 dashes for 60 seconds, silent 30 seconds.

The radio station, call letters WWBO, receives and transmits messages.

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. 203.)

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, and 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, often make Neah or Clallam Bays and await more favorable weather. The weather off the entrance 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 occurring during December, January, February, and March.

For meteorological data for Tatoosh Island and Neah Bay, see the meteorological tables in the appendix to this volume.

Currents.—The current at Swiftsure Bank Lightship is described on page 287. Off the entrance of Juan de Fuca Strait the coastal current is augmented by the current from the strait. On the flood 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, makes the coast in the vicinity and westward of Carmanah Lighthouse dangerous, especially for small 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 continued 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 maximum 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.

Cape Beale Lighthouse is situated on the Vancouver Island shore about 20 miles westward of the entrance to the strait. The light is flashing white (1 bright flash every 7 seconds), 178 feet (54 m.) 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 (61 m.) 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 **radiocompass station** (call VAD) is situated 33 yards 54° true (NNE. ½ E. mag.) from the light.

Carmanah Lighthouse is situated on the Vancouver Island shore, 15 miles eastward of Pachena Lighthouse. The light is flashing white (3 seconds), 173 feet (53 m.) 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 along the west coast of Vancouver Island. Notice boards have been erected at intervals, 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.

Each rescue hut contains a stove and materials for making fires, instructions in English, French, and German, and a chart indicating the trail or boat track to the nearest habitation; also a store of provisions all hermetically sealed. These huts are connected with the telephone system.

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 25.

From seaward vessels should pick up the 100-fathom (183 m.) curve and be guided by the soundings. The relation between the 100 and the 50 fathom (183 and 91 m.) 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.

Vessels approaching the entrance in thick weather should take advantage of the radiocompass stations located on Destruction Island, Tatoosh Island, and Pachena Point, Vancouver Island. After entering the straits, the radiocompass stations on Cattle Point, Smith Island, and New Dungeness should be utilized during thick weather. (See radio service on p. 10.)

DIRECTIONS, JUAN DE FUCA STRAIT

Follow the directions for the outside coast on page 32 and pass 3 miles northwestward of Cape Flattery Lighthouse, then steer 103° true (E. by N. mag.) for 50 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 Puget Sound on page 213.

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, rising 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 (37 m.) high, or 300 feet (91 m.) 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 p. 198) 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 (9.1 to 11 m.). 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 (3 m.) 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 (27.4 m.) 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 198.

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 (610 m.).

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 (1.8 to 3.7 m.), 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 (1.2 m.) high in its center, lies off this cove. It is marked by a bell and 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 198.

Bonilla Point, about 2 miles east-southeastward from Carmanah Lighthouse, slopes gradually to the sea from hills 100 to 2,000 feet (30.5 to 610 m.) 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 (4.6 m.) 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 (11 to 16.5 m.) all over Port San Juan, the bottom fine muddy sand; when within ¾ mile of the head it shoals to 4 fathoms (7.3 m.), 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 (11 to 14.6 m.).

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 (21.9 m.) 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 (8.5 m.) 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 fixed flashing white (10 seconds) 118 feet (36 m.) 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 (1.5 m.), lies ⅜ mile southeastward from Race Rocks Lighthouse; rocky, uneven bottom, with depths of 5 to 8 fathoms (9.1 to 14.6 m.), extends ½ mile eastward of the rock. A buoy is moored in 10 fathoms (18.3 m.), 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 256.

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 (4.3 m.), 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 (18.3 m.) 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 (37 m.) 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 (16.8 m.) at its western end, terminating in a white perpendicular cliff of sand and gravel. The lighthouse is situated near the western end.

Smith Island Lighthouse is a white conical tower on dwelling. It is flashing white (flash 2 seconds, eclipse 13 seconds), 96 feet (29.3 m.) above high water and visible 16 miles.

A **Navy radiocompass station,** call letters NFH, is located at the light.

Minor Islet, marked by a light (flashing white), 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. An echo board is also maintained here. A field of kelp extends 1½ miles westward of Smith Island, with a width of 1 mile and depths of 4½ to 5 fathoms (8.2 to 9.1 m.). A sunken rock, bare at lowest tides, is reported ⅜ mile 261° true (SW. by W. mag.) from the lighthouse.

Partridge Bank, within the 10-fathom (18.3 m.) 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 (37 and 55 m.). 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 (4.3 m.) 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 22 feet (6.7 m.). Depths of 4 and 5 fathoms (7.3 and 9.1 m.) extends 1 mile west-northwestward of the 14-foot (4.3 m.) 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 (12.8 m.) curve, except toward the eastern end, where the shoal narrows and no kelp exists beyond a depth of 4 fathoms (7.3 m.).

JUAN DE FUCA STRAIT, SOUTH SHORE

Cape Flattery, the south point at the entrance, is described on page 185.

From Cape Flattery the coast trends east-northeastward for 4 miles to Koitlah Point, the west point at the entrance of 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 (30.5 m.) 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 (16.5 to 18.3 m.), 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. A bell buoy is placed off the end of the reef.

Slip Point Lighthouse, a white tower on dwelling, is located on a narrow shelf on the western extremity of the point. It is flashing white (flash 0.2 second, eclipse 4.8 seconds), 48 feet (14.6 m.) above the water and visible 12 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 (4.6 m.) and at West Clallam is also a wharf with 10 feet (3.0 m.) 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.

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, 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 (206 m.) high, wooded to the summit, and with a dark, pillar-shaped rock over 100 feet (30.5 m.) 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 (16.5 to 21.9 m.), 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 (11.0 m.) between the spits and 4 fathoms (7.3 m.) 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. 5/8 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 (7.6 m.) 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 (3.7 m.) 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 submarine cable from Becher Bay, Vancouver Island, is landed in Port Crescent.

Crescent Reef, with 8 feet (2.4 m.) over it lies, 3/8 mile northward of the western point at the entrance. It extends 3/8 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 (18.3 m.) in it. The reef is marked by a gas and 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 (366 m.) 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 (15.2 m.) 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 (11.0 to 18.3 m.). 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 (29.3 m.) 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).

There is a **naval radiocompass station,** call letters NFT, located near the light.

From the end of the spit a shoal extends northward for ¾ mile from the lighthouse. This has been reported as extending farther northward and it should be passed with caution. A buoy marks the shoal and vessels should not pass between the buoy and the lighthouse. The best anchorage is in 5 to 9 fathoms (9.1 to 16.5 m.) 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 (3.7 m.). 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 (3.3 m.) can be taken at low water with local knowledge. Once inside, there is good anchorage anywhere in 6 to 20 fathoms (11 to 37 m.), 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 (5.5 m.) of water. Vessels load shingles and produce.

Port Discovery (chart 6403), where Vancouver anchored and refitted his ships, and from whence he commenced his exploration of these regions in 1792, lies in the eastern part of the bight between New Dungeness and Point Wilson. It is winding and about 8 miles long, with an average 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 (55 m.) at the entrance to 10 and 12 fathoms (18.3 to 21.9 m.) 1½ miles from the head, where good **anchorage** may be had in 8 to 10 fathoms (14.6 to 18.3 m.), muddy bottom. The flats rise abruptly from depths of 3 and 4 fathoms (5.5 and 7.3 m.), 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 appoaching. It is 1½ miles long in a northeast and southwest direction, with an average width of ½ mile, and 200 feet (61 m.) 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 (9.1 m.) are found ½ mile westward of the point. This shoal is marked by a buoy placed in 5½ fathoms (10 m.) about ½ mile west-southwestward from the ends of the point. **Dallas Bank** extends northward from Protection Island, the 10-fathom (18.3 m.) curve lying at a distance of 2½ miles from the northern point. From the 10-fathom (18.3 m.) curve the bank drops off abruptly to depths of over 20 fathoms (37 m.). A wharf is built out from the east side of Kanem Point to 17 feet (5.2 m.), 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 (21.9 m.), 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 (122 m.) near **Middle Point,** and breaking down abruptly a little westward of Point Wilson.

A shoal with 10 feet (3 m.) 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 (7.3 to 11 m.), 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 (37 m.), 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 (6.1 m.) or more, and a clear width of 300 yards between the 3-fathom (5.5 m.) 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 (5.2 m.).

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. Messages signaled by the international code will be transmitted by telegraph from this station. Ships showing their numbers will be reported to Seattle.

A **Coast Guard station** is situated on the shore of the bay ⅜ mile southwestward from Baaddah Point.

Supplies.—Fresh water and a limited amount of provisions 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.

(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 (55 m.) to about 15 fathoms (27.4 m.) in the middle of the harbor; sticky bottom; from the middle the depths decrease regularly to the southern shore, where the 3-fathom (5.5 m.) curve in some places in the eastern part is nearly ¼ mile from the beach. The best anchorage is in 7 to 12 fathoms (12.8 to 21.9 m.), 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 (14.3 m.) above the water, and visible 12 miles. The fog signal is an air siren (blast 5 seconds, silent 40 seconds).

Port Angeles, with a population of about 10,000 is situated on the southern shore, and is a port of entry, a deputy collector being stationed there. Shingles, lumber, paper, fertilizer, fish, and manganese ore are shipped, and general merchandise received. There are two wharves for general freight, and one wharf for loading gravel. The port of Port Angeles, is constructing a modern water terminal with rail connections to have a depth of 34 feet (10.4 m.) alongside. The sawmills have their own exporting docks.

National quarantine regulations govern the port, and there is a national quarantine officer.

Pilots and towboats.—Pilots for the sound may be had in Port Angeles. Small towboats are always available, and others can be obtained on short notice.

Supplies.—Water, provisions, and ship chandlers' stores may be obtained. Coal is not kept on hand, but can be arranged for. A limited amount of fuel oil may be had from the local mills, which have supplies for their own use.

Storm-warning displays (day and night signals) are shown from a steel tower on Laurel Street and are plainly visible to vessels in the harbor and strait.

Communication may be had by rail with Port Townsend and with Puget Sound and British Columbia ports by regular steamer and telegraph. There is a stage service to Seattle, and an automobile ferry to Victoria, British Columbia. There is a cable to Victoria.

Harbor regulations.—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 and the times and velocities of strength of current in Admiralty Inlet together with factors and differences for obtaining the times and velocities of the current for other points in Puget Sound are given in the Pacific Coast Current 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.

Possession Sound.—The tidal currents in the southern entrance of Possession Sound have velocities up 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 velocities up to 1½ knots at strength, and slack water occurs at the time of high and 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 control station, located in mid-channel 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 control station the strongest currents which have been observed are 3.6 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 control station occurs 7.5 hours after the time of low water at Astoria, and the strength of the ebb 8.3 hours afer the time of high water at Astoria.

High-water slack at the control 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 ¼ 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 15 minutes earlier and low-water slack about 25 minutes later than at the control station.

North-northwestward of Orchard Rocks the average velocity of the flood stream is about ½ knot, and the velocity of the ebb about 2 knots.

Observations made at a point midway between Blake Island and Bainbridge Reef indicate that a high-water slack occurs about 50 minutes earlier and the low-water slack about 1 hour later than at the control station.

From points north of Blake Island to the western end of the passage the times of strength are simultaneous with those already given for the control station.

The flood stream through the passage is of a simple and regular character. The stream lines are nearly uniform in trend 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 mid-channel 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 1/5 mile south-southwestward of Point White and a little north of mid-channel 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.

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 199, 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 178° true (SSE. ¼ E. mag.) course for 9⅝ miles will lead to West Point Lighthouse abeam, distant ½ mile. From this position vessels, **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 178° true (SSE. ¼ E. mag.) course for 5 miles beyond West Point Lighthouse to Alki Point Lighthouse abeam, distant 1 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 248.

POINT WILSON TO RESTORATION POINT

EASTERN SHORE

Admiralty Head, with a 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 (91 m.). The light here has been discontinued, but the old tower is still standing. At night many lights of the military post are seen in the vicinity of the tower.

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 (18.3 to 37 m.), which may be used if overtaken by fog.

Double Bluff consists of bare, white cliffs, 300 to 400 feet (91 to 122 m.) 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 Possession Sound and adjoining waters. There is a dock built out to deep water, and a fog signal (electric siren) is maintained on the dock by private interests.

Edmonds is a manufacturing town 1 mile northward from Point Edwards. There is a wharf built out to 12 feet (3.7 m.) 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. It is a water terminal and storage plant for two large oil companies. There is berthing space for several large vessels, and ample depths of water alongside. Southward of the wharf, the shoals extend well offshore, and care should be taken in coming alongside or getting away from this dock to avoid this bank, which is abrupt.

A fog signal consisting of an electric siren (blast 3 seconds, silent 27 seconds) is maintained on the Standard Oil Co. wharf.

Richmond Beach (Richmond post office) is a village ½ mile southward of Point Wells. There is a shingle mill with a 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 (91 m.) 3/8 mile from its extremity, which is marked by a lighthouse and fog signal on a white square tower. 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.

West Point Lighthouse.—The light is alternating flashing red and white every 5 seconds, flash 1 second. The fog signal is a reed horn (blast 5 seconds, silent 25 seconds).

Elliot Bay and Seattle Harbor are described under a separate heading on page 229.

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 1/2 mile northward of Point Wilson to the 5-fathom (9.1 m.) curve, over irregular bottom; these are generally indicated by kelp. The eastern edge of the shoals rises rather abruptly from deep water. A buoy is placed off the foul ground in 7 fathoms (12.8 m.) 3/4 mile 312° true (WNW. 3/8 W. mag.) from Point Wilson Lighthouse. Heavy tide rips extend northward of these shoals, being especially heavy with a westerly wind and ebb current.

The area in the vicinity of the buoy was examined by the wire drag in 1925 and no obstructions were found. The sunken rock formerly shown there was expunged from the chart.

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 (37 m.) high. The eastern extremity of the point is marked by a light. There are landing wharves built out on both sides of Marrowstone Point about 1/2 mile from the light, and submarine telegraph cables are laid northwestward and southeastward from both of them.

Marrowstone Point Lighthouse, a small square structure, shows a group flashing white (flash 2.5 seconds, eclipse 1 second, flash 2.5 seconds, eclipse 4 seconds), 28 feet (8.5 m.) above high water and visible 11 miles. The fog signal is a reed horn sounding a group of 3 blasts every 30 seconds.

Foulweather Bluff is bold and wooded and over 200 feet (61 m.) high; its northern face is a bare bluff and the bottom deepens gradually northward of the head. The 20-fathom (37 m.) curve lies about 3/4 mile, and depths of less than 6 fathoms (11 m.) are nearly 1/2 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 (18.3 m.).

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 (3 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 (9.1 to 18.3 m.) 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 (3 m.).

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 (146 m.) at the entrance to 20 fathoms (37 m.) less than ½ mile from the beach, but the port affords anchorage closer inshore in 15 to 16 fathoms (27.4 to 29.3 m.), 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 (4.3 m.), 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 (2.7 m.), 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 (3 m.) at the end. The old mill wharf is in ruins. There is a shingle mill farther up the inlet.

The approach to Port Madison Harbor has been examined by the wire drag and found free from obstructions.

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 (27.4 m.) on the line of the point. **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 (2.4 m.). The post office is named **Rolling Bay,** and has a landing wharf with 9 feet (2.7 m.) on the on the north side of Skiff Point. On the south side of the cove is a wharf with 6 feet (1.8 m.) at the end, and ¼ mile westward from Yemoalt Point is another wharf with 8 feet (2.4 m.).

Eagle Harbor is described under a separate heading on page 236.

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 (33 m.) at the entrance to 3½ fathoms (6.4 m.) near the head. The usual anchorage is near the entrance in 9 to 16 fathoms (16.5 to 29.3 m.), 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 (4.6 m.) at its highest point. It is 400 yards in extent, with shoal water, well marked by kelp, extending over 250 yards northward.

The rock is marked by a flashing red light.

Directions are not needed for entering Blakely Harbor. Blakely 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 (3 m.) above high water for 300 yards, beyond which it rises abruptly to a wooded knoll about 100 feet (30.5 m.) 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 reef is marked by a gas and bell buoy off its outer end in 10 fathoms (18.3 m.).

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 (27.4 to 14.6 m.) 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 216.

Midchannel Bank extends northwestward from Marrowstone Point about 2 miles toward Point Wilson, with depths varying from 5¾ to 10 fathoms (18.3 m.).

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 (3.4 m.); inside good anchorage is afforded in 4 to 5 fathoms (7.3 to 9.1 m.). 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, is the site of an abandoned iron mill. The wharf is in a dilapidated condition.

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 (4.6 m.) 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. In 1924 there was an effective depth of 12 feet (3.7 m.) in this dredged channel.

Anchorage.—The usual anchorage is 1 to 1½ miles southward of Point Hudson in 8 to 10 fathoms (14.6 to 18.3 m.), muddy bottom. In southerly gales, better anchorage is afforded in the bight northward of Port Townsend, in 8 to 10 fathoms (14.6 to 18.3 m.), 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. Fuel oil may be obtained in limited amounts.

Repairs.—There are no dry docks, and minor repairs only can be made. There are facilities for hauling out launches and fishing boats.

Hospitals.—A marine hospital of the United States Public Health Service is situated at Port Townsend.

Pilots.—Pilots for Puget Sound and Alaska may be had at Port Townsend.

Storm warnings, day and night, are displayed by the Weather Bureau from a steel tower in front of the marine hospital.

Communication with ports in Puget Sound and British Columbia is had by regular steamers, and there is a railway car ferry service to Seattle. There are telegraph and telephone facilities. Port Townsend is connected by rail to Port Angeles. There is a highway to Seattle.

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 (12.8 to 14.6 m.), 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 (76 m.) 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 (7.6 m.) high, of small extent, with deep water around it. From the other two a bank with 8 to 27

feet (2.4 to 8.2 m.) extends to Tala Point. The passage between the rocks and Tala Point is marked by a red buoy placed in 22 feet (6.7 m.) about ½ mile southeastward from Colvos Rocks, and a black buoy placed in 16 feet (4.9 m.) ⅜ mile northward from Tala Point. There is a least depth of 3½ fathoms (6.4 m.) 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 (29.3 m.) 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 (9.1 m.) curves is 600 yards, with depths of 11 to 16 fathoms (20.1 to 29.3 m.) in mid-channel. The channel between Colvos Rocks and Tala Point is marked by buoys, and its depth ranges from 21 to 27 feet (6.4 to 8.2 m.).

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 (7.9 m.). 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.

There is an automobile ferry to Edmonds.

Direction, 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 tug-

boats 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.

A channel 150 feet in width and 28 feet (8.5 m.) deep has been dredged through the narrow entrance to Port Gamble. The outer end of this channel is marked by a fixed white light. Good anchorage is afforded in 4 to 9 fathoms (7.3 to 16.5 m.), 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.

Ferry.—There is an automobile ferry across Hood Canal between Termination and Salsbury Points.

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 23 feet (7 m.). 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 are two docks at Seabeck. The north dock is built out to 18 feet (5.5 m.) and the south dock to 7 feet (2.1 m.) at mean lower low water. 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 (792 m.) 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.

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 (4.3 m.) 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 (7.6 m.) 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 (6.1 m.) 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 (69 m.) high, covered with fir and dense undergrowth. Eastward it slopes to a bluff 40 feet (12.2 m.) 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 (49 m.) 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 ⅜ 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 (2.1 m.) over it is reported to lie about ⅜ mile west-southwestward of the southern Sister and ⅜ mile offshore. Another rock with 15 feet (4.6 m.) over it is reported to lie 1 mile westward of the southern Sister and about ¼ mile offshore.

Case Shoal, partly bare at low water, lies ⅝ mile from and parallel with the western shore of Squamish Harbor. It is 1 mile long and its northern end is ½ 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 1¼ 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 (91 m.) 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 (18.3 to 27.4 m.).

Elliot Point, 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 (3 m.), is on the west side of the sound, 2¼ miles northward from Possession Point.

Muckilteo is a small town eastward of Elliot Point; 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 Elliot Point, is a city of about 35,000 people. Lumber is the principal item of export, while general cargo is imported. There are three docks for general cargo with sufficient depths alongside to accommodate foreign and coastwise shipping.

Supplies.—Water, provisions, and ship chandlery can be obtained. Gasoline and distillate are available but there are no provisions for bunkering large vessels with fuel oil. There are no facilities for coal bunkering.

Communication.—Everett is served by 3 lines of transcontinental railroads and is a port of call for coastwise steamers. Many foreign-bound vessels call to load lumber. There are radio, telegraph, and telephone facilities. The **Everett radio station,** call letters KFT, handles ship's business at 5 cents per word, and private business at 10 cents per word.

Repairs.—There are good machine shops here, but no dry docks except for vessels under 250 tons displacement.

Snohomish River.—The controlling depth over the bar in 1924 was 2 feet (0.6 m.) at mean lower low water. Many sawmills are located on the river and a large amount of lumber is barged out.

Caution.—The flats of the river are reported as extending to the southward to a line joining Pier 1 to the eastern end of Gedney Island. Vessels backing away from Pier 1 are warned to use caution.

Storm warnings are displayed by the Weather Bureau from Pier 2.

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 (9.1 m.) 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 (2.7 m.) 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 (3.4 m.).

Saratoga, 3 miles northwestward of Langley, has 18 feet (5.5 m.) 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 (18.3 m.). 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 (183 m.) at the entrance to 17 and 18 fathoms (31 to 33 m.) 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 (30.5 m.), 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 (55 to 73 m.) at the entrance to 17 and 18 fathoms (31 to 33 m.) 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 (152 m.) 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 (14.6 to 25.6 m.) inside the entrance. **Watsak Point,** the southern point at the entrance, is shoal, a narrow sunken spit extending northward for ½ mile, with depth of about 6 feet (1.8 m.). The spit is marked by a black buoy placed in 24 feet (7.3 m.) 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, the entrance of which is marked by a light. **Maylor Spit** extends northwestward from the eastern shore, and is marked by a light at its 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 (7.3 m.), 150 feet south-southeastward from the rock.

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 (18.3 to 20.1 m.), 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 (12.8 to 42 m.).

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 in 1922 there was a controlling depth at the entrance to the river of 1½ feet (0.4 m.) at mean lower low water.

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. In 1922 the controlling depth from Saratoga Passage to Fort Whitman was 3½ feet (1.1 m.), from Fort Whitman to the Great Northern Bridge 1½ feet (0.4 m.), and in Padilla Bay the channel bares 3 feet (0.9 m.) at mean lower low water.

Padilla Bay is crossed by a railroad bridge and a highway bridge with openings of 94 and 104 feet. The signal for opening either bridge is 4 long blasts. Swinomish Slough is crossed by a bridge with an opening of 100 feet. The signal for opening the bridge is 4 long blasts.

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 (1.2 to 1.8 m.). 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 8 knots at strength, at which times strong eddies will be encountered along the shores. A comparison of 65 observed slacks in Deception Pass with predicted slacks for Admiralty Inlet shows that on the average the slack before flood in Deception Pass occurs 2 hours, and the slack before ebb 2 hours and 10 minutes before the corresponding predicted slacks for Adiralty Inlet. Daily predictions of the times of slack water and the times and velocities of strength of current for Deception Pass will be included in the Pacific Coast Current Tables beginning with the issue for 1927.

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 Passage 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 6449) 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 (91 m.) 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. 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, and grain elevators. Deep-draft vessels can lie at the wharves. It connects with Seattle by rail.

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.

Smith Cove Terminal consists of two piers nearly ½ mile in length and affording 9,000 feet of berthing space. It is well equipped with cargo-handling gear, the largest crane being of 100

tons capacity. Most of the trans-Pacific freight and passenger vessels berth here. The slip is dredged to 35 feet (10.7 m.) at mean lower low water along the fender line, and the largest vessels can be accommodated.

The **Duwamish River** empties into the head of Elliott Bay, and the flats at the mouth of the river have been improved by dredging two waterways, the dredged material being deposited between the two waterways to form a reclaimed area, known as **Harbor Island.** This area is being occupied by industrial concerns.

The river has been improved by dredging, and now empties through a dredged channel into the western waterway. In 1924, the controlling depths in Duwamish River between the head of West Waterway and the Eighth-Avenue Bridge was 20 feet (6.1 m.); to Fourteenth Avenue south, 4 feet (1.2 m.), and at the head of the waterway there is no channel, except at high tide. There are several sawmills on the river, and vessels are often laid up here during the slack season.

East Waterway.—The entrance to East Waterway is marked by an occulting green light placed on the western side of the channel. The spit on the western side of the entrance, with a least depth of 15 feet (4.6 m.), is marked by a red buoy. The waterway serves a number of modern terminals, including grain elevators, cold storage plants, fuel oil storage, and general cargo docks. In 1924, the controlling depth in the waterway was 34 feet (10.4 m.) at mean lower low water. Large vessels in foreign and intercoastal trades berth and load in this waterway.

West Waterway.—The entrance is marked by an occulting light on the extreme northwest corner of the dock on east side of entrance. There are several terminals and docks in West Waterway, but it is not developed to the extent of East Waterway. In 1924, the controlling depth in the waterway was 34 feet (10.4 m.) at mean lower low water. At the northwestern corner of Harbor Island is a large shipyard with two floating dry docks.

Lake Washington and **Lake Union** are connected with the waters of Puget Sound by the **Lake Washington Ship Canal** (chart 6447). In 1925 there was a least depth of 34 feet (10.4 m.) at mean lower low water from Puget Sound waters to the lock; 31 feet (9.4 m.) to Lake Union, and 23 feet (7 m.) at upper pool level from Lake Union to Lake Washington.

Two **locks** are constructed side by side, the larger being 825 feet in length and 80 feet wide. Ocean-going vessels make the passage through the large lock in about 30 minutes, and smaller vessels through the side lock in 5 to 10 minutes. The channels are marked by lighted ranges and buoys, and crossed by several drawbridges, of which the details are given under a separate heading following.

Lake Union.—There are several sawmills and other industries located on Lake Union, but the volume of water-borne commerce on it is light. It is used extensively as an anchorage for laying up vessels.

Lake Washington.—This is a large body of fresh water lying just east of Seattle. There are numerous resorts and small towns around the shores of the lake, but except for logs and some lumber, there is but little water-borne commerce on the lake. There is an avi-

ation field at Sand Point, and near by is a speed-trial course of a measured mile, the ends of which are marked by ranges. The University of Washington is situated north of the channel connecting Lake Union and Lake Washington. Lake Washington has been examined by the wire drag, and is clear of snags except as noted on chart 6449.

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) 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 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 resident owners, or agents, or the master of every vessel entering the harbor between the hours of eight (8) o'clock a. m. and five (5) o'clock p. m. of any day, except Sundays and holidays, shall report to the port warden before five (5) o'clock p. m. of such day, and if entering the harbor between five (5) o'clock p. m. of any day and eight (8) o'clock a. m. of the next day shall report to the port warden before five (5) p. m. of the next day, and if entering the harbor day or night upon any Sunday or legal holiday shall report to the port warden the next legal day, stating name of vessel, master, tonnage, amount, and nature of cargo; and it shall be unlawful to fail, neglect, or refuse so to do: *Provided*, That these provisions shall not apply to vessels plying between Puget Sound ports.

SEC. 6. 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 and Lake Union, 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.

SEC. 7. 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 south side of King Street; thence west on said line to a point intersecting the east line of 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 south side of Dearborn Street; thence in a westerly direction to the southeast corner of 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 two thousand (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.—East and south of a line starting at the southwest corner of Lake Washington Canal and proceeding in a westerly direction in a line with the south bank of the canal 650 feet, approximately; thence southerly on a line which is a continuation of the east side of Fifteenth Avenue North to the south shore line of Lake Union; which is hereby set aside for the use of the Seattle Yacht Club for the anchorage of yachts, boats, or other water craft of said club: *Provided,* That in addition to the above-described 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 waterway 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 or 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. 8. 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.

Anchorage at city buoys.—Every foreign vessel and every American vessel engaged in foreign trade, of 500 tons register or over attached to any city buoy, shall pay as follows: For the first 15 days or any part thereof, $1 per day; for each additional 15 days or part thereof, $10: *Provided,* That a minimum charge of $10 be made for making fast to any city buoy.

The port warden shall have power, and it shall be his duty, to remove any vessel whenever the same is anchored, moored, or landed at any anchorage, buoy, or wharf in violation of this ordinance, or whenever such removal becomes necessary to facilitate navigation or to provide access to such buoy, wharf, or anchorage for another vessel entitled to such access, and the cost of such removal, together with the damage by reason of any accident arising therefrom, or in connection therewith, shall be recoverable by the city of Seattle against such vessel so removed, or the master thereof.

SEC. 11. Every vessel while backing out of any slip shall have at least one member of the crew on the lookout astern on the upper deck, such person to be in full view of the pilot house to warn the master, or the person in charge of such vessel, of the proximity of any obstruction to navigation or of the approach of another vessel. Every vessel shall continue to back a sufficient distance beyond the face of any pier to avoid any danger of accident or collision with any other vessel backing out from the same or any other slip. Every vessel backing out from a slip shall proceed slowly, using extreme care for the prevention of accident.

No lines or cables shall be stretched or maintained across slips without first obtaining a written permit from the port warden so to do.

SEC. 15. It shall be unlawful for the owner or master of any vessel to allow the same to remain anchored or moored or made fast to or lie at any pier unless there shall be on board such vessel at all times a competent watchman.

SEC. 29. Every gangway or other device by means of which passengers pass to or from any vessel shall be provided with a substantial handrail on each side thereof, both sides of which gangway, from the top of the handrail to the floor thereof, shall be inclosed in canvas or some other suitable material, and shall be so constructed as to bend as little as possible when in use by passengers. The top of the handrail shall not be less than thirty-six (36)

inches above the floor of the gangway, and such gangways shall have attached thereto suitable ropes for making the same fast.

The port warden shall have power to forbid the use of any gangway whenever the use of the same shall be dangerous to the public, and it shall be unlawful for any person to again use such gangway until the same shall have been so repaired or reconstructed as to render the same safe for public use, and until the same, as reconstructed or repaired, has been inspected by the port warden and its use again approved by him.

SEC. 35. No vessel containing a cargo or part cargo of explosives shall enter the harbor without a permit from the port warden therefor, and without first complying with all the provisions of this ordinance relating thereto.

No vessel shall be permitted to enter the fairways of the harbor with a quantity of explosives exceeding 20,000 pounds, and then only when such cargo is intended for local consumption within the city or for immediate shipment or transfer to interior points in less than carload lots.

Any vessel entering the harbor carrying a cargo or part cargo of explosives destined for points other than the city of Seattle, as herein specified, or while engaged in the transfer of explosives from one vessel to another, shall remain outside the fairways of the harbor and at least 3,000 feet from any shore line.

Only explosives permitted by the Interstate Commerce Commission regulations for interstate commerce shall be permitted within the harbor.

No vessel having any explosive on board shall remain at any pier between the hours of sunset and sunrise, except by written permission of port warden.

Every vessel at anchor in the harbor which has a cargo or part cargo of explosives shall, between sunset and sunrise, display at some point not exceeding twenty (20) feet above the hull of such vessel one red light in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least 1 mile, and every such vessel lying at any pier or at anchor between sunrise and sunset shall display from a conspicuous hoist and visible all around the horizon a red flag, being the International Code Flag "B."

SEC. 39. 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 five (5) consecutive hours at any one time. After such time the port warden shall collect the sum of twenty-five (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 five (5) dollars for every week or fraction thereof.

No article of any character shall be sold or offered for sale at any city float, or on any float located in any street end, without having first received written permission so to do from the port warden.

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 vessel desiring their opening:

Location	Width of opening	Signal for opening (blast of whistle)
Lake Washington Ship Canal	*Feet*	
Great Northern Ry. at Thirty-sixth Avenue NW.	150	1 long, 1 short.
Ballard Bridge, Fifteenth Avenue NW.	150	Do.
Northern Pacific Ry., above locks	150	1 long, 3 short.
Fremont Avenue Bridge	150	1 long, 1 short.
University Bridge, Tenth Avenue NE.	175	1 long, 3 short.
Montlake Bridge, Montlake Boulevard	150	1 long, 1 short.
West Waterway		
Northern Pacific Ry.	80	1 long, 1 short.
Old City Bridge	115	1 long, 2 short (for 2 bridges).
New City Bridge, Spokane Avenue	150	1 long, 3 short (for all 3 bridges).

The following extracts from the **regulations** for the operation of these bridges are common to all those listed above:

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.

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.

All vessels when passing any bridge shall be moved as expeditiously as is consistent with established rules governing speed.

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.

The draws in each and every bridge named above shall, upon the prescribed signal being given be opened promptly for the passage of any vessel or vessels or other water craft not able to pass underneath it.

Provided, That the Ballard Bridge, Fremont Avenue Bridge, University Bridge, and Montlake Bridge will not be required to open on any day of the week except Sunday between the hours of 6.45 a. m. and 8.45 a. m. and 4.30 p. m. and 6.30 p. m. for vessels or other water craft of less than 175 gross tons; and

Provided further, That the draw in any of the above four city bridges need not be opened at any time for the passage of any vessel of less than 75 gross tons equipped with a movable stack or mast which can readily be lowered so as to permit its passage under the closed draw, unless it has in tow a vessel which is unable to pass under the closed draw. Any vessels of less than 75 gross tons regularly navigating the canal shall be subject to inspection and measurement by the District Engineer, United States Engineer Department at large, in charge of the locality, and said district engineer is hereby empowered to decide in each case whether or not the vessel shall be equipped with hinged or movable stacks, masts, and flagpoles which can be lowered to enable the vessel to pass under the closed draw of any or all the bridges. If the district

engineer decides that such action should be taken, he shall notify the vessel owner and the bridge owner of his decision, specifying a reasonable time for making the alterations; and after the expiration of the time specified the draw need not be opened for the passage of such vessel unless it has in tow a vessel unable to pass under the closed draw.

These regulations, other than the giving of the prescribed signals, shall not apply to vessels owned and operated by the United States. Such vessels shall be passed without delay through the draw of any bridge at any hour of the day or night upon giving the prescribed signal.

These regulations shall take effect and be in force on and after March 1, 1925, and shall supersede on that date the regulations prescribed December 27, 1919, to govern the opening of drawbridges across said waterway.

The following additional **regulations** have been prescribed for the West Waterway bridges:

The draws in each bridge shall, upon the signal prescribed above being given, be opened promptly for the passage of any vessel or vessels or other water craft, not able to pass underneath it, except between the hours of 6.45 a. m. and 8.45 a. m., and 4.30 p. m. and 6.30 p. m. for the old Spokane Avenue Bridge and new Spokane Avenue Bridge:

Provided, That the draws of the two city bridges named in this paragraph shall be promptly opened for the passage of vessels of 50 tons or over, or tugs towing a barge of 100 tons or over, or a raft of four sections of logs or over, or a pile-driver barge of 30 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 any bridge within five minutes before 6.45 a. m. or 4.30 p. m. it shall be passed promptly through all bridges in the direction in which it is moving, and shall not be stopped between bridges.

These regulations shall take effect and be in force on and after March 1, 1925, and shall supersede on that date the regulations prescribed December 27, 1919, to govern the opening of drawbridges across said waterway.

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" on p. 194.)

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 hull and machinery can be made; there are numerous shipbuilding and repair plants with dry docks or marine railways of various sizes. The largest dock available (exclusive of the dry docks at the Bremerton Navy Yard, which are available for private use when not required by the Government) is 520 feet long, 89 feet wide (inside), and has a depth of 26 feet (7.9 m.) over the keel blocks. It is of the floating sectional type and has a lifting capacity of 15,000 tons.

Marine hospital.—There is a relief station (Arcade Building) of the Public Health Service in charge of a service officer. The nearest marine hospital is at Port Townsend, and serious cases are sent there.

Quarantine.—Vessels subject to quarantine are boarded at Port Townsend. Fumigation with cyanide can be arranged for in Seattle.

A commercial **radio station** is located at Seattle.

A **Coast and Geodetic Survey field station** is located in the Burke Building, Second Avenue and Marion Street. Files of charts, coast pilots, and other publications are maintianed for the use of mariners, who are invited to avail themselves of the facilities afforded.

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Charts, coast pilots, current tables, and tide tables are kept for sale. Mariners observing any changes affecting charts or coast pilots are requested to notify the inspector in charge of the field station.

A **branch hydrographic office** is maintained at 408 Lowman Building, Seattle.

Steamboat Inspection Service.—The office of the Steamboat Inspection Service for this district is in the Arcade Building.

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.

Customhouse.—Seattle is the headquarters of the Washington collection district. The customhouse is at Third Avenue and Union Street.

Communication.—Seattle is served by three lines of transcontinental railways, and is the terminus of several lines of freight and passenger steamers to the Orient. It is a port of call of many lines of intercoastal vessels, and has a good coastwise service with points south in California and Oregon, and Alaska in the north. The Harbor Radio, call letters KPE, handles ship's business free, and is intended to facilitate shipping. There are complete telephone, telegraph, and radio facilities.

Currents.—As a rule, the tidal currents in the harbor have little velocity. At times, however, with a falling tide, an appreciable current will be found setting northwestward along the water front.

EAGLE HARBOR

(chart 6444) 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 (9.1 to 11 m.), 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 3,000 tons displacement. The steel cradle is 325 feet long and can take a draft of 17 feet (5.2 m.) forward and 21 feet (6.4 m.) 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 (5.5 m.) 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 (9.1 m.) 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 (3 m.), is marked by a bell 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 (12.2 m.) off its northeast edge. The spit also extends nearly 500 yards northwestward from the point, with depths of 2 feet (0.6 m.) and less, and marked by a black buoy placed in 24 feet (7.3 m.) 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 (4.6 m.) at its highest point. It is 400 yards in extent, with shoal water, well marked by kelp, extending over 250 yards northward. It is marked by a flashing red light.

To enter give Wing Point and buoy a berth of over ½ mile and pass midway between Blakely Rock and Tyee Shoal bell 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 243.

From Restoration Point the main body of the sound extends southeastward for 12½ miles to Robinson Point, then bends southwest-

ward 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 (30.5 m.) 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 (2.4 m.) of water. There is an automobile ferry from Fauntleroy to Manchester.

Point Pully is a sharp, low spit, projecting 300 yards from the high point eastward, which in 1 mile rises to 430 feet (131 m.) elevation. On the low part of the point is a grassy knoll 30 feet (9.1 m.) 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 (6.4 m.) 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 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.

Redondo is a post office and settlement 6½ miles southeastward from Point Pully, and has a landing wharf in 11 feet (3.4 m.) of water.

There is a dock built out to 30 feet (9.1 m.) at mean lower low water, 1½ miles southward 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 (6.1 m.)

Point Brown, the north point at the entrance to Commencement Bay, is marked by a flashing white light (3 flashes every 15 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 (4.6 m.) 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 **Bean Point,** the north point at the en-

trance to Rich Passage. Between the points the shores are thickly settled with summer cottages, which are served by **South Beach Wharf,** built out to 12 feet (3.7 m.), 1¼ miles southwestward from Restoration Point.

Bainbridge Reef, with depths of 4 fathoms (7.3 m.) at the outer end and deeper water inside, extends ⅜ mile southward from the shores between South Beach wharf and Bean Point, and constitutes the principal danger in the approach to Rich Passage. Its outer end is marked by a red buoy.

Rich Passage is described on page 243.

From **Orchard Point,** the south point at the entrance to Rich 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 (49 m.) 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. There is a dock built out to 14 feet (4.3 m.) just southward of the northeastern point of the island.

Yukon Harbor, 2 miles southwestward from Blake Island, affords anchorage in 6 to 10 fathoms (11 to 18.3 m.), with protection from southerly winds.

Point Vashon, the northwest point of Vashon Island, is 280 feet (85 m.) high, steep, and wooded. **Dolphin Landing,** ½ mile eastward of the point, has a wharf built out to 9 feet (2.7 m.).

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 (6.1 m.) of water.

Glen Acres and **Dilworth,** on the north and south shores of **Point Beals,** each has 14 feet (4.3 m.) of water at the wharves.

Vashon is a town with a landing wharf in 16 feet (4.9 m.) 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 (4.9 m.) 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 (4 and 4.9 m.) 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 (2 flashes every 12 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. There is a fixed red light on the south side of the sand spit at the eastern side of the entrance. 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 (3 m.) channel in the middle; the currents in this channel have considerable velocity. Inside the entrance the basin has from 4 to 6 fathoms (7.3 to 11 m.) 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 four 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 Rich Passage. About 2 miles south-southwestward of Rich 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 (11 to 46 m.) with but few dangers, and these as a rule close inshore. The shores are moderately low and wooded.

The country around Port Orchard is rapidly being 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 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 Rich Passage, just inside **Bean Point.** There is a wharf built out to 18 feet (5.5 m.). A rocky patch, with 11 feet (3.4 m.) 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 (3.7 m.), on the north shore of Rich 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.

Dry Dock.—The Government dry dock at the naval station is 827 feet long, and has a width of 145 feet; there is a depth of 35 feet (10.7 m.) on the blocks. The dock will take vessels up to the following dimensions: Length 800 feet, beam 113 feet, and draft 35 feet (10.7 m.).

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 (4.6 m.) 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 (3.7 m.).

Fairview, on the point 1¼ miles northwestward of Tracyton, has a wharf built out to 11 feet (3.4 m.).

Silverdale, on the west side at the head of Dyes Inlet, is a post village with a landing wharf built out to 14 feet (4.3 m.). 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 landing wharf.

Ostrich Bay, in the southwestern portion of Dyes Inlet, is the site of a naval ammunition depot.

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 (3.7 m.)

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 (3.4 m.) of water.

Crystal Springs and **Fletcher 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 Fletcher 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 (1.8 m.) 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 (3.7 m.) at low tide.

A naval torpedo station is located on the west side of the entrance to Liberty Bay. There are two wharves at the Keyport Torpedo Station. No. 1 is built out to 19 feet (5.8 m.) and No. 2 is built out to 26 feet (7.9 m.). The towers of the radio station are prominent, and there are several buildings on the reservation.

Torpedo Warning.—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 sharp lookout for torpedoes and clear of same.

Keyport, a post office on the south side of the passage leading to Liberty Bay, has a wharf with 12 feet (3.7 m.) of water.

Lamola Landing, on the east side of Liberty Bay, has a wharf out to 10 feet (3 m.). A rock with little water over it at low tide lies 150° true (SE. ¾ E. mag.) from the southwest corner of the dock located about midway between Lamola and Poulsbo, on the eastern side of Liberty Bay.

Pearson, a post office on the south side of Liberty Bay, has a landing wharf with 8 feet (2.4 m.), built out from the end of a low point.

Scandia Landing, only ¼ mile westward from Pearson, has a wharf out to 7 feet (2.1 m.). 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 (2.4 to 3.7 m.) 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 (4.3 m.).

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 (1.8 to 2.1 m.), and there are other depths of 14 to 18 feet (4.3 to 5.5 m.) almost in mid-channel. It has been examined by means of a wire drag, and the dangers are shown on the chart.

The northern entrance is marked by a flashing white light on the west side of the channel opposite Agate Point, also a red buoy on the west side of the channel. The southern entrance is marked by a red buoy on the west side of the channel.

Rich 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 239.

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 (13.7 m.) 450 yards southward from the beacon. The reef off **Point Glover** is marked by a gas buoy (flashing white), and **Waterman Point** at the western entrance is marked by an occulting white light. A day range marked by two beacons leads over the best water off Point Glover.

DIRECTIONS, PORT ORCHARD

Strangers should not attempt to navigate Port Orchard, and particularly Rich 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 0° true (NNW. ⅛ W. mag.) until nearly up to red buoy N–6, then haul on to the range. When abeam of Point Glover gas buoy, follow mid-channel courses 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 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 slightly greater. The passage is used prin-

cipally by local passenger steamers and by tugs from upsound 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 several landings on the western shore of Colvos Passage with landing wharves suitable for the local sound steamers, the principal ones being **Fragora, Olalla,** and **Maplewood.**

The principal landings on the eastern side are, **Biloxi, Cedarhurst, Colvos, Cove, Lisabeula,** and **Cross Landing.**

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 (9.1 to 18.3 m.), 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 (14.6 m.). 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 (2.7 to 5.2 m.).

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 (3.7 m.) 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 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 (3.0 m.) draft. There is a blacksmith shop but no machine shop, repairs to machinery being made in Tacoma. There are two wharves, with 12 feet (3.7 m.) 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 (1.8 m.) 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 (2.4 m.) 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 (0.9 m.) 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 (165 m.) at the entrance to 25 and 30 fathoms (46 to 55 m.) 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 most prominent of these is a large ore smelter located 2 miles southeastward of Point Defiance. The remarkably **high chimney** here is the predominating landmark of the vicinity.

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. plants.

The southernmost of these basins is known as the city waterway. There is a channel 500 feet wide with a least depth of 29 feet (8.8 m.) to the first bridge at Eleventh Street, known as the City Bridge. Above the City Bridge there is a controlling depth of 22 feet (6.7 m.) to the Fourteenth Street Bridge, above which the channel has been dredged to 19 feet (5.8 m.) to within 100 yards of the head of the waterway.

City Bridge has a vertical lift span with a 200-foot horizontal clearance, and a vertical clearance of 135 feet (41 m.) above high water when lifted. When in place there is a vertical clearance of 60 feet (18.3 m.) above high water. The signal for opening is 4 long and 2 short blasts of the whistle.

The following **regulations** govern the operation of this bridge:

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 (4) long, and two (2) 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 by 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 8.30 a. m., and between the hours of 3.30 p. m. and 5.30 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 immediately opened during such periods to permit the passage of vessels of 750 gross tons or over.

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.

The Northern Pacific Bridge at South Fifteenth Street is a swing bridge and has two openings of 100 feet. There is a clearance of 17 feet (5.2 m.) above high water when the bridge is closed. The signal for opening is 4 long blasts.

The Oregon-Washington Railroad Bridge has two openings of 100 feet, and a clearance of 3 feet (0.9 m.) above high water with the bridge closed. The signal for opening is 4 long and 1 short blast.

The Middle Waterway is located just north of the City Waterway. It affords a terminal for the Oregon-Washington Railroad, and is used as a lumber dock. The outer end of the wharf is dredged to 30 feet (9.1 m.) on each side.

Puyallup Waterway, through which the Puyallup River discharges, has shoaled to such an extent that it can not be used for commercial purposes.

Milwaukee Waterway is used as a terminal for the Chicago, Milwaukee & Puget Sound Railway and is dredged to depths to accommodate the deepest vessels.

Wapato Waterway.—The port of Tacoma terminal, consisting of two large modern freight piers, is located on the southern side of this waterway. The slip is dredged to 32 feet (9.8 m.). The terminal is equipped with 15-ton cranes, 1 locomotive crane, and 6 monorail hoists.

A narrow channel with 15 feet (4.6 m.) of water is dredged from the head of the slip to the upper end of the waterway to serve a sawmill and boat-building plant there.

Hylebos Waterway, through which the Hylebos River discharges, is the most northerly one of the waterways. The shipyard on this waterway has been dismantled and is no longer in operation. The waterway is used principally for lumber shipments. It is crossed by the Eleventh Street Bridge with two openings of 85 and 82 feet. There is a clearance of 7 feet (2.1 m.) above high water when the bridge is closed. The signal for opening is 4 long blasts.

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 ship chandlers' stores can be had in any quantity.

Repairs.—Only minor repairs can be made. The nearest large dry dock is at Seattle. There are ways for hauling out vessels up to 100 feet in length.

Storm warnings are displayed from the roof of the Fidelity Building in Tacoma.

Marine 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 (4.3 m.) 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 (24.4 m.) 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 the Dofflemyer Point, then follow the directions for Budd Inlet, page 256.

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 (4 m.), and from it a ferry service is maintained to Fox Island and Whollochet Bay. Southward of this wharf there is a large lumber mill, with a wharf in 14 feet (4.3 m.) of water.

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 (12.8 to 14.6 m.) 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, 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 water front 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 (8.5 m.) 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, begins 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 (27.4 m.) 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 (9.1 to 11.0 m.), muddy bottom. A spit makes out about ¼ mile northward from the western point at the entrance.

Itsami Shoal, with 9 feet (2.7 m.) 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 (7.3 m.) 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 (1.8 m.).

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 (3 m.) 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, a rock with 19 feet (5.8 m.) over it lies 150 yards off the eastern shore of Hope Island abreast Steamboat Island. 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 of the northern point of Steamboat Island should be favored to avoid the rock mentioned above. 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 (7.3 to 25.6 m.), 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. It is on a branch of the Northern Pacific Railway, and lumber is shipped by rail only. Railway trestles extend across the flats, which are used as log dumps. There is communication with Olympia by light-draft steamers and telegraph. Launch fuel and some supplies can be obtained.

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 (1.8 m.) 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 (1.8 m.).

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 (20.1 to 21.9 m.), sticky bottom. **Bergs Landing,** with 10 feet (3 m.) at the wharf, is located on the east point at the entrance, and there are farmhouses on both sides of the bay. **Whollochet** landing wharf is built out to 6 feet (1.8 m.) 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 (3.7 m.). **Bee post office,** on the south shore of McNeil Island, 1 mile westward of the penitentiary wharf, has a wharf in 11 feet (3.4 m.) 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 **Johnson Landing,** with 8 feet (2.4 m.) at the wharf.

Eagle Island Shoal, with 5 feet (1.5 m.) 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 (18.3 m.), 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 (12.8 to 14.6 m.), 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 (2.7 m.), 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 (1.2 m.), 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 (85 m.) 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 (11 to 27.4 m.), 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 (2.1 m.) 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 (2.1 m.).

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 **Joe Bay.** The wharf has 7 feet (2.1 m.) at low water at the end. A farming and manufacturing colony occupies the shores 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 Vaughn 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 town site. 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 (2.1 m.). 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 (18.3 to 55 m.), 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 (11 to 27.4 m.), muddy buttom, 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 (0.6 m.), 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 (11.0 to 27.4 m.). 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 (2.4 m.) 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 **Dutcher Cove.**

Vaughn post village, with a wharf in 1 foot (0.3 m.) of water, is on the north side of Vaughn 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 (3.7 to 6.4 m.) 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 Vaughn Bay. It has many settlers about it. A float landing in 10 feet (3.0 m.) of water is established northward of the point dividing the two bays and used at low tide when Vaughn 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 (0.3 m.) 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 (1.8 m.), 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 (8.2 to 11.0 m.), 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 water front, and a shoal with 5 to 12 feet (1.5 to 3.7 m.) 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 (10.0 m.) 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 (3.7 m.) 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 (3.7 m.) 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.

Additional dredging along the city water front has secured a controlling depth of about 22 feet (6.7 m.) at mean lower low water.

The eastern channel is marked by two fixed red lights, one at either end on the eastern side of the cut, and by day beacons placed at intervals between the lights.

It should be remembered that the datum for soundings on the present chart 6462 is 2 feet (0.6 m.) below the plane of mean lower low water; therefore the chart shows 10 feet (3 m.) in these channels.

The "Indian Plane" of 2 feet (0.6 m.) below mean lower low water has been abandoned and as new editions of Puget Sound charts are brought out they will be changed to the datum of mean lower low water.

There is a movement to secure a 28-foot (8.5 m.) channel to Olympia, but to date nothing has been done on the project.

Olympia, the capital of the State of Washington, is situated at the head of the inlet. It has some commerce consisting mostly of lumber and timber products. There are wharves fronting the dredged basin providing ample room to accommodate 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 and **pilots** for the local adjacent waters may be had.

Communication may be had with points on the sound by rail and steamer; there are also telephone and telegraph facilities.

Olympia is on the Pacific Highway, and has stage service north and south. There is also an improved highway to Aberdeen on Grays Harbor.

Directions.—No detailed directions are necessary. A mid-channel course through Budd Inlet clears all dangers until up with the light at the entrance of 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.), being guided by the beacons which mark the eastern side of the channel.

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. 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 provided 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, 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 (122 to 305 m.) 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. 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.

Lime Kiln Light is on a white octagonal tower. It is group flashing white, showing three flashes every 10 seconds. The fog signal is a reed horn sounding a group of two blasts every 20 seconds.

Rocks awash.—A cluster of rocks awash at mean lower low water, lies 1 mile 148° true (SE. by E. mag.) from the lighthouse.

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. The point is marked by a light flashing white every 3 seconds.

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 (9.1 to 14.6 m.). 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 (4 m.). During the summer season, Roche Harbor is extensively used as a yacht anchorage.

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 (1.5 m.) over it and is marked by kelp at slack water. A rock, marked by kelp, with 10 feet (3 m.) over it, lies ⅛ mile northwestward from Barren Island; a black buoy is placed in 6 fathoms (11 m.) about 150 feet northwestward from the rock.

Another rock, marked by kelp, with 4 feet (1.2 m.) over it, lies 350 yards eastward of the one marked by the buoy.

Morse Island, small, 30 feet (9.1 m.) 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 (4.9 to 5.2 m.) 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 a 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 (9.1 to 12.8 m.), 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 (0.9 m.) 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 (198 m.) 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 (7.3 to 8.2 m.), 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 (1.5 m.) at the wharf, is situated on the western shore. **Satellite 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 Satellite Island and anchor in 6 to 7 fathoms (11 to 12.8 m.), 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 (2.4 m.) at low water. Vessels should not pass eastward of Satellite Island.

John Island lies immediately eastward of Stuart Island, separated from it by a narrow channel known as **John 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 Islet 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. There is a naval **radiocompass station** on Cattle Point. The call letters are NFN.

Salmon Bank is an extensive shoal lying southward of Cattle Point, with depths ranging from 9 to 18 feet (2.7 to 5.5 m.); 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 (1.2 or 1.5 m.) 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 (5.5 m.) 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 (3.7 m.). 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 (9.1 to 11 m.), 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 (12.8 to 18.3 m.), 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 (3 m.) 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 (1.8 m.) 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 (3 to 3.7 m.), 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 (3 m.) 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 (4 m.) over it, rising abruptly from deep water. It is marked by a red and black horizontally striped buoy placed in 28 feet (8.5 m.) 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 (4.6 m.) 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 (11 to 12.8 m.). **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 is head. Produce is shipped in scows and motor boats.

Parks Harbor, immediately northward of Point George, on Shaw Island, 2 miles northward to Turn Rock, is ½ mile long and ¼ mile wide. It affords a good anchorage for small vessels in 6 to 8 fathoms (11 to 14.6 m.) 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. At its narrowest point Pole Pass is marked by a fixed red light on the northern side. 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 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 (40 m.) high, flat on top, and sparsely covered with underbrush and trees. **Gull Rock,** 30 feet (9.1 m.) 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 (177 m.), 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 (6.7 to 7.3 m.) being found over ½ mile southward of Sandy Point. **Mouat Reef,** with 9 feet (2.7 m.) 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 (1.5 m.) , is situated on the shore northeastward of Mouat 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 (0.3 m.) over it lies ½ mile northeastward from Point Hammond and is usually marked by kelp.

White Rock, 35 feet (10.7 m.) 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 (0.6 m.) 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,** 2,409 feet (734 m.) high, in the eastern part of the island; **Turtle Back Range,** 1,497 feet (456 m.) high, and **Orcas Knob,** 1,050 feet (320 m.) 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 (1.8 m.).

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.

Parker 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 (18.3 m.) curve, is 1 mile long in a general east and west direction, with an average width of ¼-mile. The shoalest point, 10 feet (3 m.), 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 (6.4 m.) 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 (21.4 m.) 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 (49 m.) 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 (7.3 to 9.1 m.) 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 at its northern end.

Matia Island, 120 feet (37 m.) 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 (11 m.).

The northern side of Puffin Island is marked by a flashing white light.

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 (3.4 m.) 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 (11 to 12.8 m.), 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 (1.2 m.) 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 (5.5 m.) 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 (1.5 m.) over it lies 250 yards off the northern shore ⅜ mile 287° true (W. ¾ S. mag.) from Pole Pass Light.

Bell Island, wooded and of small extent, lies ¼ 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 (10.4 m.) close-to and eastward of the rock. Another rock with 6 feet (1.8 m.) over it lies 400 yards 71° true (NE. ¼ 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 2¾ miles with an average width of ¾ mile. The depths range from over 20 fathoms (37 m.) at the entrance to 7 and 8 fathoms (12.8 and 14.6 m.) 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 ¼ 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 (3.7 m.) 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 (1.2 m.) over it, lies in mid-channel ¾ mile from the head of West Sound; the rock is of small extent and is surrounded by depths of 4 to 10 fathoms (7.3 to 18.3 m.).

Anchorage may be had anywhere in the sound northward of Double Island in 7 to 12 fathoms (12.8 to 21.9 m.), 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 2¼ miles long with an average width of ½ mile; the depths range from 10 to 25 fathoms (18.3 to 46 m.). 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 (3.7 m.). A rock with 15 feet (4.6 m.) 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.

A rock partly bare at low water is reported to lie about 100 yards 132° true (E. by S. ½ S. mag.) from **Blind Island** at entrance to Blind Bay.

Shaw is a post village at the eastern entrance point of the bay. It has a cannery, with wharf built out to 12 feet (3.7 m.).

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 (37 to 64 m.) 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 (11 to 12.8 m.), 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 (27.4 m.) at the entrance to 9 and 10 fathoms (16.5 to 18.3 m.) 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 (27.4 to 31 m.), soft bottom, and at the head in 10 to 12 fathoms (18.3 to 21.9 m.). **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 (3 m.). 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 (3.7 m.). 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 (6.1 m.), 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 (11.3 m.) on a mid-channel course, which can be followed with safety. **Lydia Shoal,** with 3¾ fathoms (6.8 m.) 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 form 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 (3 m.) 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 (5.5 to 9.1 m.), 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 **Swift Bay,** on the northeast side of Lopez Island. It has a landing wharf built out to 12 feet (3.7 m.). **Decatur** post village, with wharf out to 8 feet (2.4 m.), 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 (16.5 to 21.9 m.); 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 (73 m.) high, flat-topped and wooded, rises immediately back of the point and is prominent in approaching from southwestward.

Colville Island, 40 feet (12.2 m.) high, small and bare of trees, lies ½ 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 (7.9 m.) 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 (5.2 m.), and is marked by a red and black horizontally striped bell buoy in 6 fathoms (11.0 m.) 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 (10.7 m.) 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 (27.4 to 29.3 m.), 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 (11.0 to 16.5 m.) over sandy bottom. Eastward of the passage between Allan and Burrows Islands is a middle ground with a least depth of 5¼ fathoms (9.5 m.). 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.

Flounder Bay, a shallow lagoon, has been partially filled in and is now used as a log pond and lumberyard. There is a large sawmill here with a prominent brick stack and burner. There is an exporting dock with 30 feet (9.1 m.) at low tide at its western end. The sawmill is known as the Burrows Bay Mill.

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 and 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 (9.1 m.) high. There is deep water close-to and passage may be made on either side.

Belle Rock, bare at extreme low water, lies ⅓ mile 39° true (N. by E. ¼ E. mag.) from Bird Rocks. It is marked by a day beacon. 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 (4.9 m.) 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 (1.2 m.) 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 (466 m.) 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 (12.8 m.); it is seldom used.

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 (2.7 to 4.6 m.). It is well marked by kelp.

Lydia Shoal, of small extent and with a least depth of 3¾ fathoms (6.8 m.), 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 (6.7 m.), 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 (3.7 m.). 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 (21.9 m.).

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 (530 m.) 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 (11 m.) about ½ mile 313° true (WNW. ⅜ W. 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 (18.3 m.) 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 (4.9 to 5.2 m.), 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 northwestern point of Lummi Island. A red and black horizontally striped buoy is placed near the shoalest point in 21 feet (6.4 m.) 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. ½ 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 1 mile east-northeastward of Belle Rock beacon 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 miles 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 (4 m.) 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 (30.5 m.) 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 light-draft 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 (14.6 to 33 m.). **Shanon 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 (2.7 m.) 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 (chart 6377), 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 glue 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 marine railway for hauling out fishing launches.

Storm warnings, day and night, are displayed by the Weather Bureau from a steel tower.

Communication is by daily steamers or rail and by telegraph and telephone.

Anchorage may be had off the wharves in 6 to 12 fathoms (11 to 21.9 m.).

No **harbor regulations** are prescribed. There is a harbor master in charge.

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 (31 to 110 m.) 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 Viti Rocks and **Carter Point,** the southeastern extremity of Lummi Island. The depths vary from 25 to 50 fathoms (46 to 91 m.), 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 (10.7 m.) 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 (37 m.) near the eastern end to 13 feet (4 m.) on the bar at the western end of the chanenl. **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 (3 m.).

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 (8.2 to 2.4 m.) about midway between the point and the island. The shoalest spot, 8 feet (2.4 m.), 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 (11 to 27.4 m.), mud bottom. 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.

Eliza Rock, off the southern end of Eliza Island, is marked by a flashing white light.

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, lumber mills, and a cement plant. 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 (5.5 m.) and the outer 3,500 feet a depth of 26 feet (7.9 m.) 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. The fog signal is an electric siren sounding a group of 2 blasts every 10 seconds. The light and fog signal are placed on the northwest corner of the municipal dock.

Anchorage.—Bellingham Bay is mostly mud bottom, but there are many slabs from the sawmills on the bottom, and anchors often foul these slabs and will not hold in a blow. Care should be taken here when at anchor during heavy weather.

Starr Rock, with 8 feet (2.4 m.) 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 (37 m.) 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 chandler's 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, except under 140 feet in length.

Communication is by steamer or rail, and by telegraph and telephone. During the summer season there is an automobile ferry service from Bellingham to Sydney on Vancouver Island. Bellingham is on the Pacific Highway.

South Bellingham.—The cannery and exporting dock of the Pacific American Fisheries are located at South Bellingham.

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. ⅞ W. mag.) for 2⅛ miles, passing ¼ mile eastward of Cypress Island Light to a position with the eastern Cone Island abeam, distant ½ mile. From here steer 44° true (N. by E. ¾ E. mag.) for 2⅜ miles to a position ⅜ mile westward of the western end of Vendovi Island and then steer 58° true (NNE. ⅞ E. mag.) for 2⅛ miles to a position ½ mile eastward of the southeast end of Eliza Rock Light.

From here a 16° true (N. ¾ W. mag.) course for 4¾ miles will lead to a position ¼ mile westward of Post Point gas and bell buoy, and a 39° true (N. by E. ¼ E. mag.) course for 2¼ 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 (7.3 to 9.1 m.) 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 (55 m.) 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 flashing white light.

Boundary Bay, from Point Roberts to Kwomais Point, is 6½ 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 (9.1 to 16.5 m.), but it is exposed southward and westward.

Drayton Harbor is a small basin-like 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 (5.5 m.) curve is limited to a small area, less than ⅜ mile square, eastward of the northern end of the spit. The depths range from 4 to 7 fathoms (7.3 to 12.8 m.), with muddy bottom. The shelter is excellent and the tidal currents have little velocity. The entrance is ¾ 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 (8.2 to 21.9 m.). **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.

Danger.—A shoal spot with 16½ feet (5 m.) over it lies 1,030 yards 88° true (NE. by E. ½ E. mag.) from Semiamoo Light. In entering, the southern side of the channel should be favored to avoid this spot, which is of hard material.

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 (3.7 to 5.5 m.), 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.

Storm warnings are displayed by the Weather Bureau from a steel tower near the water front in Blaine.

Communication is had by rail and coasting steamer; there are also telephone and telegraph facilities. The United States-Canadian boundary line passes through the northern edge of Blaine.

Pilots.—Strangers, especially with deep-draft vessels, are advised to employ a pilot. One can usually be obtained from the canneries or sawmills.

CAUTION TO MARINERS

The attention of all mariners, especially those frequenting Puget Sound or Canadian waters, is called to the fact that international rules govern in Canadian waters.

APPENDIX

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 Sandy Hook, 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, Gulf Coast, 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 the Rio Grande	.50
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., 311–312 Maritime Exchange Building, 78 Broad Street.
New Orleans, La., room 314 Customhouse.
San Francisco, Calif., room 305–306 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, Current 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.

NAVIGATIONAL AIDS AND THE USE OF CHARTS

The **U. S. 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 issue the following publications relating to these waters as guides to naviga-

tion: Charts, Coast Pilots, Tide Tables, Current Tables, a catalogue of these publications, and Notices 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; (2) the date of the latest correction to the chart plates, *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. All small but important corrections occurring subsequent to the *date of issue* of the chart are published in Notice 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 which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately 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 1:400,000 and 1:200,000, intended especially for coastwise navigation.

3. Coast charts, on a scale of 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.

NOTE.—General charts of the Philippine Islands are on scales 1:1,600,000, 1:800,000, and 1:400,000; coast charts are on scales 1:100,000 and 1:200,000.

COAST PILOTS, relating to surveyed waters of the United States, Porto Rico, Virgin Islands, Alaska, Hawaiian Islands, and the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. At intervals of about one year, 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., or any of its field stations, 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 times and heights of the tide 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 about 3,500 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.

CURRENT TABLES, which have heretofore been issued as a part of the Tide Tables, are now published separately as Current Tables, Atlantic Coast of the United States, and Current Tables, Pacific Coast of the United States.

AGENCIES for the sale of the Charts, Coast Pilots, Tide Tables, and Current 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 field stations. 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, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Day Marks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses and may be purchased from its sale agencies or from the Superintendent of Documents, Washington, D. C. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey; this publication can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

REMARKS ON THE USE OF CHARTS

ACCURACY OF CHARTS.—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 part 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 that determined on a certain date which is stated in the channel legend. 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. The possibility of shoaling along the edges of the channel should always be considered.

DANGER CURVES.—The depth curves 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 and the largest scale chart available should be 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 directly from copper plates has to be dampened. On drying, distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but usually 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 longer the chart the greater the amount of this distortion. The majority of Coast and Geodetic Survey charts are now printed by lithography on dry paper and have little if any distortion. A lithographed chart may be distinguished from a plate-printed chart by the feel of the surface, the former being smooth while the latter is rough. Lithographed charts also are usually tinted in colors while the others are in black and white.

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 distance given in the light lists, coast pilots, and on the charts for the visibility of lights are computed for a height of 15 feet (4.6 m.) for the observer's eye. The table of distances of visibility due to height, published in the Light List, affords a means 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.

As the range of visibility increases with the elevation of the observer, it is often possible to obtain a bearing before the light is sighted from the bridge by sighting the light from aloft, noting a star in range with it and then obtaining a bearing of the star with compass or pelorus. 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.

In regions where the shores are high and rocky the echo of the whistle frequently gives warning of too close an approach to shore. In narrow passages it is often possible to keep in mid-channel by directing course so that the echoes from both shores are heard at approximately the same time.

SUBMARINE BELLS installed on many lightships and buoys have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving appartus 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 a rising or falling tide. In some localities the tide may be at a high or low water 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 waters 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 one exception noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Wrangel Strait, Alaska, the plane of reference 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, and that the effect of a cross current is greater on a vessel running slowly than when at full speed. 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 time 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, although 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.

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. Counter currents and eddies may occur near the shore 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.

THE CURRENT TABLES published by the Coast and Geodetic Survey give the predicted times of slack water and other current data for a number of places on the Pacific and Atlantic coasts of North America.

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 for 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 bearing 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 3-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 when the position is obtained. By taking the bearing 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 case 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 as 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 astronomic methods of fixing a ship's position the great utility of Sumner's method or one of its many modifications 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.

POSITION LINE BY MEANS OF TABLES.—The Sumner line of position furnished ready to lay down on the chart may be derived from the tables of "Simultaneous Hour Angle and Azimuth of Celestial Bodies," published by the Hydrographic Office as Publication No. 203. By means of these tables all calculations are avoided.

POSITION LINE BY MARC ST. HILAIRE OR CALCULATED ALTITUDE METHOD.—By this method the altitude of the celestial body is calculated for the assumed position, and the difference between the observed and calculated altitudes is laid off toward or away from the assumed position, according to sign, along the azimuth of the observed body. The line of position is then drawn through the new point in a direction normal to the azimuth of the celestial body. This method has certain advantages, the principal one being that the solution is

strong even when the body is near the meridian. Full description of this method will be found in any epitome of navigation.

RADIOCOMPASS BEARINGS and positions are especially valuable at night and during fog or thick weather when other observations are not obtainable. For practical navigating purposes radio vibrations may be regarded as traveling in a straight line from the sending station to the receiving station. Instruments for determining the bearing of this line are now available. The necessary observations may be divided into two general classes: First, where the bearing of the ship's radio call is determined by one, two, or more radio stations on shore and the resulting bearing or position is reported to the vessel (see p. 10, Radio Service); secondly, where the bearing of one or more known radio stations is determined on the vessel itself and plotted as a line of position or as cross bearings. Experiments show that these bearings can be determined with a probable error of less than 2°, and the accuracy of the resulting position is largely dependent on the skill and care of the observer. It must be remembered, however, that these lines are parts of great circles, and if plotted as straight lines on a Mercator chart a considerable error may result when the ship and shore station are a long distance apart. The bearings may be corrected for this distortion as explained on page 12.

Radio bearings may be combined with position lines obtained from astronomic observations and used in ways very similar to the well-known Sumner line when avoiding dangerous shoals or when making the coast.

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 replotted 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 disturbances 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—that is, 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, and generally 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; for example, 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 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.

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 vessels, 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 various commercial tubes for surveying operations, but the results obtained have not been satisfactory. A tube recently designed by the bureau, however, has been tested extensively by field parties and, as it gives results exceeding in accuracy any other type of tube, has been adopted for survey work. Even with this tube great care is necessary in order to obtain satisfactory results. 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 furnished 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. Actual experiments show that errors of 10 to 12 per cent are not uncommon and that considerably greater errors may occur. It is important to note at the amount of these errors depends on the depth; the greater the depth the greater the numerical value of the error.

These errors are due chiefly to uneven bore of tube, variation of barometric pressure from normal, difference in temperature of air and water, uneven thickness of caps used to close one end of the tube, leakage of water, accumulated salt in the tube, and leakage or failure of gaskets and valves used in the construction of some types of tube.

In order to avoid serious errors tubes should, therefore, be used with the greatest care. A type that can be used more than once should be adopted and the tubes to be used for sounding to make a landfall should be tested beforehand by stopping for an up and down cast, sending them down on the sounding wire to any desired depth, and comparing their readings with the actual depth to which they were submerged. Additional tests of this nature from time to time during the sounding operations are also valuable. Special care should be taken to prevent leakage by making sure that the cap fits tightly or that the valve and gaskets are water-tight and are working properly. In using the valve type of tube, it is very important to make sure that the tube does not submerge after it once clears the water.

CURRENTS AT LIGHTSHIPS

For several years current observations have been made at San Francisco, Blunts Reef, Columbia River, Umatilla Reef, and Swiftsure Bank Lightships. A discussion in detail of the observations at each of the lightships will be found in Coast and Geodetic Survey Special Publication No. 121, entitled "Coastal Currents Along the Pacific Coast of the United States." In general it may be said these observations show that winds here bring about a current having a velocity 2 per cent that of the wind, the direction of this wind-driven current being about 20° to the right of the wind with winds from the northeast, southeast, and northwest quadrants, and about 20° to the left of the wind with winds from the southwest quadrant. A summary of the results of these observations at each of the light vessels is given below.

SAN FRANCISCO LIGHTSHIP

Tidal Current.—The tidal current here is rotary, turning clockwise, and is largely diurnal, that is, revolving in a period of about 25 hours. At strength the current has a velocity averaging less than ½ knot, setting southeastward about an hour before higher low water at San Francisco, and northwestward about 2 hours after lower low water.

Nontidal Current.—During the winter months there is a nontidal current with an average velocity of about ¼ knot, setting northwesterly. During the summer months this nontidal current is weaker, averaging about $\frac{1}{10}$ knot, the direction being variable and frequently southerly. The direction and velocity of the average nontidal current is very considerably modified by the current due to the wind.

Wind Current.—In general the wind current here is about 2 per cent that of the wind, but currents coming with winds from the southeast quadrant are stronger than the average, while the currents coming with winds from the northwest quadrant are weaker than the average.

BLUNTS REEF LIGHTSHIP

Tidal Current.—The tidal current at this light vessel is weak, having at strength a velocity of less than ¼ knot. It is therefore completely masked by nontidal currents due chiefly to the wind.

Nontidal Current.—The nontidal current here has a velocity averaging about ¼ knot, setting southwesterly. During the winter months the wind is prevailingly from the southeast and during these months the nontidal current sets northwesterly.

Wind Current.—The observations bring out the fact that here the current, due to a wind of given strength, is practically the same for all directions of the wind, the velocity of the current being about 2 per cent that of the wind. The direction of the wind-driven current obeys the general rule for this coast that winds from the northeast, southeast, and northwest quadrants bring about currents the directions of which are about 20° to the right of the wind, while winds from the southwest quadrant bring about currents setting about 20° to the left of the wind.

COLUMBIA RIVER LIGHTSHIP

Tidal Current.—The tidal current at Columbia River Lightship is of the rotary type with a velocity at strength of flood or ebb of a ¼ knot. This tidal current, however, is completely masked by nontidal currents due to river discharge and winds.

Nontidal Current.—At Columbia River Lightship there is a nontidal current averaging ⅓ knot with a set to the west-southwestward. This nontidal current is due largely to the discharge from the Columbia River and therefore varies with the seasons. It is greatest during the summer months, averaging then more than ½ knot. The direction of the average nontidal current is also subject to a seasonal variation, setting southwesterly in the spring and summer months and northwesterly in the fall and winter months. This variation in direction is due to the winds.

Wind Current.—Along this part of the coast the wind is prevailingly from the northwest in the spring and summer months and from the east and southeast during the fall and winter months. Because of the nontidal current due to river discharge, the direction of which is west-southwest, northerly winds are accompanied by stronger currents than southerly winds. Away from the influence of the river current the general rule holds good that the velocity of the current is about 2 per cent that of the wind and that winds from the northeast, southeast, and northwest quadrants bring about currents that set about 20° to the right of the wind, while the currents accompanying winds from the southwest quadrant set about 20° to the left of the wind.

UMATILLA REEF LIGHTSHIP

Tidal Current.—The tidal current here is only slightly rotary, setting N. 15° W. on the flood and S. 15° E. on the ebb with a velocity at strength of about ⅓ knot.

Nontidal Current.—The nontidal current at Umatilla Reef Lightship shows a very distinct seasonal variation. During the winter months this current sets northerly with a velocity which averages ⅔ knot, while in summer it sets southerly with a velocity of about ⅓ knot.

Wind Current.—Here the prevailing wind is from the east and southeast in winter and from the west and northwest in summer. The southerly winds bring about stronger currents than the northerly winds, the current with the southerly winds being about 3 per cent of the wind, while with the northerly winds the current is about 1½ per cent that of the wind. The general rule for the deviation of the wind-driven current from the direction of the wind, namely, currents brought about by winds from the northeast, southeast, and northwest quadrants set about 20° to the right of the wind, while with winds from the southwest quadrant the current sets about 20° to the left of the wind, is applicable here.

SWIFTSURE BANK LIGHTSHIP

Tidal Current.—At this light vessel the tidal current is distinctly rotary, turning clockwise. At strength of flood or ebb the current has a velocity of ¾ knot on the average. Strength of flood sets southeasterly and comes about 1½ hours after high water at Astoria; strength of ebb sets northwesterly and comes about 1 hour after low water at Astoria.

Nontidal Current.—At Swiftsure Bank Lightship the nontidal current has a velocity averaging ½ knot, setting northwest. This is due largely to the drainage waters flowing seaward through the Strait of Juan de Fuca. The velocity of the nontidal current is greatest during the fall and winter months when it averages somewhat more than ½ knot, this increase being due to the effect of the wind.

Wind Current.—The prevailing wind here is from the east during the fall and winter months and from the west and southwest during spring and summer. Due to the northwesterly setting nontidal current arising from the discharge of the drainage waters through the Strait of Juan de Fuca, the strongest currents at Swiftsure Bank Lightship come with southeasterly winds and the weakest with northwesterly winds. In general it may be said that winds from the southeast quadrant here bring about currents having a velocity about 3 per cent that of the wind while winds from the northwest quadrant bring about currents with a velocity about 1 per cent that of the

wind. The general rule for the deviation of the wind-driven current from the direction of the wind does not hold good here, not only because of the effect of the northwesterly setting nontidal current, but also because of the fact that the coast line here is to the north of the light vessel, while for the other light vessels it is to the east. For an approximate general rule here it may be taken that with winds from the southeast, southwest, and northwest quadrants the current sets about 20° to the right of the wind, while with winds from the northeast quadrant the current sets about 20° to the left of the wind.

INSTRUCTIONS TO MARINERS IN CASE OF SHIPWRECK AS PUBLISHED BY THE UNITED STATES COAST GUARD SERVICE

GENERAL INFORMATION

Life-saving stations and houses of refuge are located upon the Atlantic and Pacific seaboard of the United States, the Gulf of Mexico, and the lake coasts.

All stations on the Atlantic coast are manned annually by crews of experienced surfmen; upon the lake coasts the stations are manned from the opening until the close of navigation, with the exception of the one on Beaver Island, Lake Michigan, which depends on a volunteer crew; and upon the Pacific coast they are open and manned throughout the year.

All life-saving stations are fully supplied with boats, wreck guns, beach apparatus, restoratives, clothing provided by the Women's National Relief Association for the shipwrecked requiring it, etc.

Houses of refuge are supplied with boats, provisions, and restoratives, but not manned by crews; a keeper, however, resides in each, who is required to make extended excursions along the coast after every storm, with a view of ascertaining if any shipwreck has occurred and finding and succoring any persons that may have been cast ashore.

Houses of refuge are located exclusively upon the Florida coast, where the requirements of relief are widely different from those of any other portion of the seaboard.

The life-saving stations are provided with the International Code of Signals, and vessels can, by opening communication, be reported; or obtain the latitude and longitude of the station, where determined; or information as to the weather probabilities in most cases; or, where facilities for the transmission of messages by telephone or telegraph are available, requests for a tug or Coast Guard cutter will be received and promptly forwarded.

All services are performed by the life-saving crews without other compensation than their wages from the Government.

Destitute seafarers are provided with food and lodging at the nearest station by the Government as long as necessarily detained by the circumstances of shipwreck, and, if needed, with clothing provided by the Women's National Relief Association.

The station crews patrol the beach from 2 to 4 miles each side of their stations between sunset and sunrise, and if the weather is foggy the patrol is continued through the day. A continuous lookout is also maintained at every station night and day.

Each patrolman carries Coston signals. Upon discovering a vessel standing into danger he ignites one of these, which emits a brilliant red flame of about two minutes' duration, to warn her off, or, should the vessel be ashore, to let her crew know that they are discovered and assistance is at hand.

If the vessel is not discovered by the patrol immediately after striking, rockets, flare-up lights, or other recognized signals of distress should be used. If the weather be foggy, some recognized sound signal should be made to attract attention, as the patrolman may be some distance away at the other end of his beat.

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 yards 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.

RESCUE WITH THE LIFEBOAT OR SURFBOAT

The patrolman, after discovering your vessel ashore and burning a Coston signal, hastens to his station or the telephone for assistance. If the use of a boat is practicable, either the large lifeboat is launched from its ways in the station and proceeds to the wreck by water or the lighter surfboat is hauled overland to a point opposite the wreck and launched, as circumstances may require.

Upon the boat reaching your vessel, the directions and orders of the keeper (who always commands and steers the boat) should be implicitly obeyed. Any headlong rushing and crowding should be prevented, and the captain of the vessel should remain on board, to preserve order, until every other person has left.

Women, children, helpless persons, and passengers should be passed into the boat first.

Goods or baggage will positively not be taken into the boat until all are landed. If any be passed in against the keeper's remonstrance, he is fully authorized to throw the same overboard.

RESCUE WITH THE BREECHES BUOY OR LIFE CAR

Should it be inexpedient to use either the lifeboat or surfboat, recourse will be had to the wreck gun and beach apparatus for the rescue by the breeches buoy or the life car.

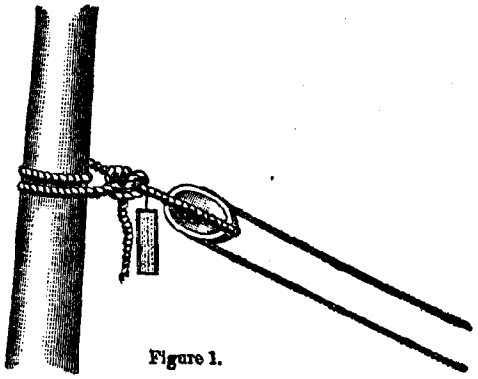

Figure 1.

A shot with a small line attached will be fired across your vessel. Get hold of the line as soon as possible and haul on board until you get a tailblock with a whip or endless line rove through it. This tailblock should be hauled on board as quickly as possible to prevent the whip drifting off with the set or fouling with wreckage, etc. Therefore, if you have been driven into the rigging, where but one or two men can work to advantage, cut the shot line and run it through some available block, such as the throat or peak halyards block, or any block which will afford a clear lead, or even between the ratlines, that as many as possible may assist in hauling.

Attached to the tailblock will be a tally board with the following directions in English on one side and French on the other:

"Make the tail of the block fast to the lower mast, well up. If the masts are gone, then to the best place you can find. *Cast off shot line, see that the rope in the block runs free,* and show signal to the shore."

The above instructions being complied with, the result will be as shown in Figure 1.

As soon as your signal is seen a 3-inch hawser will be bent onto the whip and hauled off to your ship by the life-saving crew.

If circumstances permit, you can assist the life-saving crew by manning that part of the whip to which the hawser is bent and hauling with them.

When the end of the hawser is got on board, a tally board will be found attached, bearing the following directions in English on one side and French on the other:

"Make this hawser fast about 2 feet above the tail block, see all clear and that the rope in the block runs free, and show signal to the shore."

These instructions being obeyed, the result will be as shown in **Figure 2.**

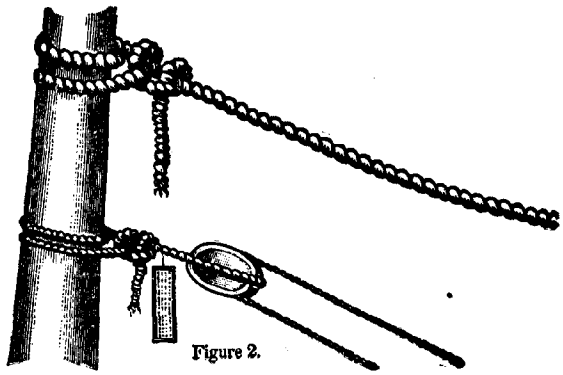

Figure 2.

Take particular care that there are no turns of the whip line round the hawser. To prevent this, take the end of the hawser UP BETWEEN *the parts of the whip before making it fast.*

When the hawser is made fast, the whip cast off from the hawser, and your signal seen by the life-saving crew, they will haul the hawser taut and by means of the whip will haul off to your vessel a breeches buoy suspended from a traveler block, or a life car, from rings running on the hawser.

Figure 3, below, represents the apparatus rigged, with the breeches buoy hauled off to the ship.

If the breeches buoy be sent, let one man immediately get into it, thrusting his legs through the breeches. If the life car, remove the hatch, place as

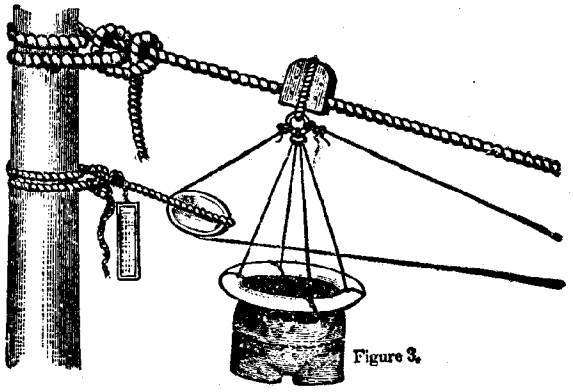

Figure 3.

many persons therein as it will hold (four to six) and secure the hatch on the outside by the hatch bar and hook, signal as before, and the buoy or car will be hauled ashore. This will be repeated until all are landed. On the last trip of the life car the hatch must be secured by the inside hatch bar.

In many instances two men can be landed in the breeches buoy at the same time by each putting a leg through a leg of the breeches and holding onto the lifts of the buoy.

Children, when brought ashore by the buoy, should be in the arms of older persons or securely lashed to the buoy. Women and children should be landed first.

In signaling as directed in the foregoing instructions, if in the daytime, let one man separate himself from the rest and swing his hat, a handkerchief, or his hand; if at night, the showing of a light and concealing it once or twice will be understood; and like signals will be made from the shore. (See, also Signals, below.)

Circumstances may arise, owing to the strength of the current or set, or the danger of the wreck breaking up immediately, when it would be impossible to send off the hawser. In such a case a breeches buoy or life car will be hauled off instead by the whip, or sent off to you by the shot line, and you will be hauled ashore through the surf.

If your vessel is stranded during the night and discovered by the patrolman—which you will know by his burning a brilliant red light—keep a sharp lookout for signs of the arrival of the life-saving crew abreast of your vessel.

From one to four hours may intervene between the burning of the light and their arrival, as the patrolman may have to return to his station, perhaps 3 or 4 miles distant, and the life-saving crew draw the apparatus or surfboat through the sand or over bad roads to where your vessel is stranded.

Lights on the beach will indicate their arrival, and the sound of cannon firing from the shore may be taken as evidence that a line has been fired across your vessel. Therefore, upon hearing the cannon, make strict search aloft, fore and aft, for the shot line, for it is almost certain to be there. Though the movements of the life-saving crew may not be perceptible to you, owing to the darkness, your vessel will be a good mark for the men experienced in the use of the wreck gun, and the first shot seldom fails.

IMPORTANT

Remain by the wreck until assistance arrives from the shore, or as long as possible. If driven aloft, the inshore mast is the safest.

If not discovered immediately by the patrol, burn rockets, flare-up, or other lights, or, if the weather be foggy, fire guns or make other sound signals.

Make the shot line fast on deck or to the rigging to prevent its being washed into the sea and possibly fouling the gear.

Take particular care that there are no turns of the whip line round the hawser before making the hawser fast.

Send the women, children, helpless persons, and passengers ashore first.

Make yourself thoroughly familiar with these instructions, and remember that on your coolness and strict attention to them will greatly depend the chances of success in bringing you and your people safely to land.

WRECK SIGNALS

The following signals, approved by the International Marine Conference convened at Washington in October, 1889, have been adopted by the Coast Guard Service and will be used and recognized by the officers and employees as occasion may require:

"Upon the discovery of a wreck by night, the life-saving 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 vessel 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."

BOUNDARY LINES OF THE HIGH SEAS

The following lines divide the high seas from rivers, harbors, and inland waters described in this volume. Waters inshore of the lines here laid down are "inland waters," and upon them the inland rules and pilot rules given on page 299 apply. Upon the high seas, viz, waters outside of the lines here laid down the international rules given on page 292 apply.

San Diego Harbor.—A line drawn from southerly tower of Coronado Hotel 208° true (S. by W. mag.), 5 miles to Outside Bar whistling buoy, SD (PS); thence 345° true (NNW. ¾ W. mag.), 3⅝ miles, to Point Loma Lighthouse.

San Francisco Harbor.—A line drawn through Mile Rock Lighthouse 326° true (NW. ⅝ W. mag.) to Bonita Point Lighthouse.

Columbia River Entrance.—A line drawn from knuckle of Columbia River south jetty 351° true (NNW. ⅞ W. mag.) to Cape Disappointment Lighthouse.

Juan de Fuca Strait, Washington and Puget Sounds.—A line drawn from New Dungeness Lighthouse 13½° true (N. by W. mag.) 10⅜ miles to Hein Bank gas and bell buoy (HS); thence 337½° true (NW. ¼ W. mag.) 10¾ miles to Lime Kiln Light, on the west side of San Juan Island; from Bellevue Point, San Juan Island, 336½° true (NW. ¼ W. mag.) to Kellett Bluff, Henry Island; thence 347° true (NW. ⅝ N. mag.) to Turn Point Light; thence 71½° true (NE. ⅛ E. mag.), 8¼ miles, to westerly point of Skipjack Island; thence 38½° true (N. by E. ¼ E. mag.), 4⅜ miles, to Patos Islands Light; thence 338° true (NW. ⅛ W. mag.), 12 miles, to Point Roberts Light.

General rule.—At all buoyed entrances from seaward to bays, sounds, rivers, or other estuaries for which specific lines have not been described, Inland Rules shall apply inshore to a line approximately parallel with the general trend of the shore drawn through the outermost buoy or other aid to navigation of any system of aids.

RULES OF THE ROAD—INTERNATIONAL RULES TO PREVENT COLLISIONS OF VESSELS

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collisions at sea shall be followed by all public and private vessels of the United States upon the high seas in all waters connected therewith navigable by seagoing vessels.

PRELIMINARY

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

RULES CONCERNING LIGHTS AND SO FORTH

The word "visible" in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

ARTICLE 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

ART. 2. A steam vessel when under way shall carry—(a) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than forty feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two point abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(b) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(c) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(d) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(e) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

ART. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light six feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a), excepting the additional light, which may be carried at a height of not less than fourteen feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

ART. 4. (a) A vessel which from any accident is not under command shall carry at the same height as a white light mentioned in article two (a), where they can best be seen, and if a steam vessel in lieu of that light two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles; and shall by day carry in a vertical line one over the other, not less than six feet apart, where they can best be seen, two black balls or shapes, each two feet in diameter.

(b) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in article two (a), and if a steam vessel in lieu of that light three lights in a vertical line one over the other not less than six feet apart. The highest and lowest of these lights shall be red, 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 two miles. By day she shall carry in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color, and the middle one diamond in shape and white.

(c) The vessels referred to in this article, when not making way through the water shall not carry the side lights, but when making way shall carry them.

(d) The lights and shapes required to be shown by this article are to be taken by other vessels as signals that the vessel showing them is not under command and can not therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in article thirty-one.

ART. 5. A sailing vessel under way and any vessel being towed shall carry the same lights as are prescribed by article two for a steam vessel under way with the exception of the white lights mentioned therein, which they shall never carry.

ART. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green

light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Steam vessels of less than forty, and vessels under oars or sails of less than twenty tons gross tonnage, respectively, and rowing boats, when under way, shall not be required to carry the lights mentioned in article two (a), (b), and (c), but if they do not carry them they shall be provided with the following lights:

First. Steam vessels of less than forty tons shall carry—

(a) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than nine feet, a bright white light constructed and fixed as prescribed in article two (a), and of such a character as to be visible at a distance of at least two miles.

(b) Green and red side lights constructed and fixed as prescribed in article two (b) and (c), and of such a character as to be visible at a distance of at least one mile, or a combined lantern showing a green light and a red light from right ahead to two points abaft the beam on their respective sides. Such lanterns shall be carried not less than three feet below the white light.

Second. Small steamboats, such as are carried by seagoing vessels, may carry the white light at a less height than nine feet above the gunwale, but it shall be carried above the combined lantern mentioned in subdivision one (b).

Third. Vessels under oars or sails of less than twenty tons shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

Fourth. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this article shall not be obliged to carry the lights prescribed by article four (a) and article eleven, last paragraph.

ART. 8. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with green glass on the one side and red glass on the other, to be used as prescribed above.

Pilot vessels when not engaged on their station on pilotage duty shall carry lights similar to those of other vessels of their tonnage.

A steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights. When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

ART. 9. Fishing vessels and fishing boats, when under way and when not required by this article to carry or show the lights hereinafter specified, shall carry or show the lights prescribed for vessels of their tonnage under way.

(a) Open boats, by which is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night, with outlying tackle extending not more than one hundred and

fifty feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than one hundred and fifty feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least three feet below the first light and at horizontal distance of at least five feet away from it in the direction in which the outlying tackle is attached.

(b) Vessels and boats, except open boats as defined in subdivision (a), when fishing with drift nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than six feet and not more than fifteen feet, and so that the horizontal distance between them, measured in a line with the keel, shall be not less than five feet and not more than ten feet. The lower of these two lights shall be in the direction of the nets, and both of them shall be of such a character as to show all around the horizon, and to be visible at a distance of not less than three miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(c) Vessels and boats, except open boats as defined in subdivision (a), when line fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of subdivision (h), shall carry the same lights as vessels fishing with drift nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way, respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea sailing fishing vessels of less than twenty tons gross tonnage shall not be obliged to carry the lower of these two lights. Should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light visible at a distance of not less than one sea mile on the approach of or to other vessels.

(d) Vessels when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

First. If steam vessels, shall carry in the same position as the white light mentioned in article two (a) a tricolored lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides, respectively; and not less than six nor more than twelve feet below the tricolored lantern a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon.

Second. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform, and unbroken light all around the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in subdivision (d) first and second shall be visible at a distance of at least two miles.

(e) Oyster dredgers and other vessels fishing with dredge nets shall carry and show the same lights as trawlers.

(f) Fishing vessels and fishing boats may at any time use a flare-up light in addition to the lights which they are by this article required to carry and show, and they may also use working lights.

(g) Every fishing vessel and every fishing boat under one hundred and fifty feet in length, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile.

Every fishing vessel of 150 feet in length or upward, when at anchor, shall exhibit a white light visible all around the horizon at a distance of at least 1 mile, and shall exhibit a second light as provided for vessels of such length by article 11.

Should any such vessel, whether under 150 feet in length or of 150 feet in length or upward, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least three feet

below the anchor light, and at a horizontal distance of at least five feet away from it in the direction of the net or gear.

(h) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the dag signal required by subdivision (k); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rain storms make the signal prescribed for a vessel at anchor. (See subdivision (d) and the last paragraph of article 15.)

(i) In fog, mist, falling snow, or heavy rain storms drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of drag net, and vessels line fishing with their lines out, shall, if of twenty tons gross tonnage or upward, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels, with the foghorn, each blast to be followed by ringing the bell. Fishing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(k) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this article to carry or show the lights hereinbefore specified shall not be obliged to carry the lights prescribed by article four (a) and the last paragraph of article eleven.

ART. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon of twelve points of the compass, namely, for six points from right aft on each side of the vessel, so as to be visible at a distance of at least one mile. Such light shall be carried as nearly as practicable on the same level as the side lights.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upwards in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall not be less than fifteen feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescibed by article four (a).

ART. 12. Every vessel may, if necessary in order to attract attention in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, shall carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH

ART. 15. All signals prescribed by this article for vessels under way shall be given.

First. By "steam vessels" on the whistle or siren.

Second. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn, to be sounded by mechanical means, and also with an efficient bell. In all cases when the rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small seagoing vessels. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In a fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(*a*) A steam vessel having way upon her shall sound, at intervals of not more than two minutes, a prolonged blast.

(*b*) A steam vessel under way, but stopped, and having no way upon her shall sound, at intervals of not more than two minutes, two prolonged blasts, with an interval of about one second between.

(*c*) A sailing vessel under way shall sound at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam, three blasts in succession.

(*d*) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e*) A vessel when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to maneuver as required by the rules, shall, instead of the signals prescribed in subdivisions (*a*) and (*c*) of this article, at intervals of not more than two minutes, sound three blasts in succession, namely: One prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing vessels and boats of less than twenty tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

Speed of Ships to be Moderate in Fog, and so Forth

Art. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

Steering and Sailing Rules

Preliminary—Risk of Collision

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

Art. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, namely:

(a) A vessel which is running free shall keep out of the way of a vessel which is closehauled.

(b) A vessel which is closehauled on the port tack shall keep out of the way of a vessel which is closehauled on the starboard tack.

(c) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(d) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(e) A vessel which has the wind aft shall keep out of the way of the other vessel.

ART. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This article also applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are when each of the two vessels is end on, or nearly end on, to the other; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of two vessels is to keep out of the way, the other shall keep her course and speed.

Note.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision can not be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. [See articles twenty-seven and twenty-nine.]

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam—that is, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights—shall be deemed to be an overtaking vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward of or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. The words "short blast" used in this article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam vessel under way, in taking any course authorized or required by these rules, shall indicate that course by the following signals on her whistle or siren, namely:

One short blast to mean, "I am directing my course to starboard."
Two short blasts to mean, "I am directing my course to port."
Three short blasts to mean, "My engines are going at full speed astern."

NO VESSEL, UNDER ANY CIRCUMSTANCES, TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

RESERVATION OF RULES FOR HARBORS AND INLAND NAVIGATION

ART. 30. Nothing in these rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbor, river, or inland waters.

DISTRESS SIGNALS

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: First. A gun or other explosive signal fired at intervals of about a minute.

Second. The international code signal of distress indicated by N C.

Third. The distance signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.

Fourth. A continuous sounding with any fog-signal apparatus.

At night: First. A gun or other explosive signal fired at intervals of about a minute.

Second. Flames on the vessel (as from a burning tar barrel, oil barrel, and so forth).

Third. Rockets or shells throwing stars of any color or description, fired one at a time, at short intervals.

Fourth. A continuous sounding with any fog-signal apparatus.

RULES OF THE ROAD—INLAND RULES TO PREVENT COLLISION OF VESSELS

AN ACT To adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States

Whereas the provisions of chapter eight hundred and two of the laws of eighteen hundred and ninety, and the amendments thereto, adopting regulations for preventing collisions at sea, apply to all waters of the United States connected with the high seas navigable by seagoing vessels, except so far as the navigation of any harbor, river, or inland waters is regulated by special rules duly made by local authority; and

Whereas it is desirable that the regulations relating to the navigation of all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall be stated in one act: Therefore

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following regulations for preventing collision shall be followed by all vessels navigating all harbors, rivers, and inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and are hereby declared special rules duly made by local authority:

PRELIMINARY

In the following rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The words "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way," within the meaning of these rules, when she is not at anchor, or made fast to the shore, or aground.

Rules Concerning Lights, and so Forth

The word "visible" in these rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

Article 1. The rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

Art. 2.[1] A steam vessel when under way shall carry—(*a*) On or in front of the foremast, or, if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such a character as to be visible at a distance of at least five miles.

(*b*) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(*c*) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(*d*) The said green and red side lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(*e*) A seagoing steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision *a*. These two lights shall be so placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

(*f*) All steam vessels (except seagoing vessels and ferryboats) shall carry in addition to green and red lights required by article two (*b*), (*c*), and screens as required by article two (*d*), a central range of two white lights; the after light being carried at an elevation at least fifteen feet above the light at the head of the vessel. The headlight shall be so constructed as to show an unbroken light through twenty points of the compass, namely, from right ahead to two points abaft the beam on either side of the vessel, and the after light so as to show all around the horizon.

Art. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than three feet apart, and when towing more than one vessel shall carry an additional bright white light three feet above or below such lights, if the length of the tow measuring from the stern of the towing vessel to the stern of the last vessel towed exceeds six hundred feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in article two (a) or the after range light mentioned in article two (f).

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Art. 5. A sailing vessel under way or being towed shall carry the same lights as are prescribed by article two for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

Art. 6. Whenever, as in the case of vessels of less than ten gross tons under way during bad weather, the green and red side lights can not be fixed, these lights shall be kept at hand, lighted and ready for use; and shall, on the

[1] Article 2 is amended by act of Congress approved June 9, 1910, effective on and after July 9, 1910, in rules for lights required to be carried by every vessel propelled by machinery and not more than 65 feet in length, except tugboats and towboats propelled by steam. (See p. 309.)

approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted outside with the color of the light they respectively contain, and shall be provided with proper screens.

ART. 7. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light which shall be temporarily exhibited in sufficient time to prevent collision.

ART. 8.[2] Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the masthead, visible all around the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side nor the red light on the starboard side.

A pilot vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board may show the white light instead of carrying it at the masthead, and may, instead of the colored lights above mentioned, have at hand, ready for use, a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

Pilot vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

ART. 9. (*a*) Fishing vessels of less than ten gross tons, when under way and when not having their nets, trawls, dredges, or lines in the water, shall not be obliged to carry the colored side lights; but every such vessel shall, in lieu thereof, have ready at hand a lantern with a green glass on one side and a red glass on the other side, and on approaching to or being approached by another vessel such lantern shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

(*b*) All fishing vessels and fishing boats of ten gross tons or upward, when under way and when not having their nets, trawls, dredges, or lines in the water, shall carry and show the same lights as other vessels under way.

(*c*) All vessels, when trawling, dredging, or fishing with any kind of drag nets or lines, shall exhibit from some part of the vessel where they can be best seen, two lights. One of these lights shall be red and the other shall be white. The red light shall be above the white light, and shall be at a vertical distance from it of not less than six feet and not more than twelve feet; and the horizontal distance between them, if any, shall not be more than ten feet. These two lights shall be of such a character and contained in lanterns of such construction as to be visible all around the horizon, the white light a distance of not less than three miles and a red light of not less than two miles.

(*d*) Rafts, or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the Board of Supervising Inspectors of Steam Vessels.

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[2] AN ACT Relating to lights on steam pilot vessels

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That a steam pilot vessel, when engaged on her station on pilotage duty and in waters of the United States, and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light, visible all around the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the colored side lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and in waters of the United States, and at anchor, she shall carry in addition to the lights required for all pilot boats the red light above mentioned, but not the colored side lights.

When not engaged on her station on pilotage duty, she shall carry the same lights as other steam vessels.

SEC. 2. That this act shall be construed as supplementary to article 8 of the act approved June 7, 1897, entitled "An act to adopt regulations for preventing collisions upon certain harbors, rivers, and inland waters of the United States," and to article 8 of an act approved August 19, 1890, entitled "An act to adopt regulations for preventing collisions at sea."

SEC. 3. That this act shall take effect on June 30, 1900.

Approved, February 19, 1900.

ART. 10. A vessel which is being overtaken by another, except a steam vessel with an after-range light showing all around the horizon, shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

ART. 11. A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform, and unbroken light visible all around the horizon at a distance of at least one mile.

A vessel of one hundred and fifty feet or upward in length when at anchor shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light. The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

ART. 12. Every vessel may, if necessary, in order to attract attention, in addition to the lights which she is by these rules required to carry, show a flare-up light or use any detonating signal that can not be mistaken for a distress signal.

ART. 13. Nothing in these rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorized by their respective Governments and duly registered and published.

ART. 14. A steam vessel proceeding under sail only, but having her funnel up, may carry in daytime, forward, where it can best be seen, one black ball or shape two feet in diameter.

SOUND SIGNALS FOR FOG, AND SO FORTH

ART. 15. All signals prescribed by this article for vessels under way shall be given:

1. By "steam vessels" on the whistle or siren.
2. By "sailing vessels" and "vessels towed" on the foghorn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or by some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn; also with an efficient bell. A sailing vessel of twenty tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In fog, mist, falling snow, or heavy rainstorms, whether by day or night, the signals described in this article shall be used as follows, namely:

(*a*) A steam vessel under way should sound, at intervals of not more than one minute, a prolonged blast.

(*c*) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession, and when with the wind abaft the beam, three blasts in succession.

(*d*) A vessel when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e*) A steam vessel when towing shall, instead of the signals prescribed in subdivision (a) of this article, at intervals of not more than one minute, sound three blasts in succession, namely, one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

(*f*) All rafts or other water craft not herein provided for, navigating by hand power, horsepower, or by the current of the river, shall sound a blast of the foghorn, or equivalent signal, at intervals of not more than one minute.

SPEED OF SHIPS TO BE MODERATE IN FOG, AND SO FORTH

ART. 16. Every vessel shall in a fog, mist, falling snow, or heavy rainstorms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam vessel hearing, apparently forward of her beam, the fog signal of a vessel the position of which is not ascertained shall, so far as the circum-

stances of the case admit, stop her engines and then navigate with caution until danger of collision is over.

STEERING AND SAILING RULES

PRELIMINARY—RISK OF COLLISION

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

ART. 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other as follows, namely:

(*a*) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(*b*) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(*c*) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(*d*) When both are running free, with the wind on the same side, the vessel which is to the windward shall keep out of the way of the vessel which is to the leeward.

(*e*) A vessel with the wind aft shall keep out of the way of the other vessel.

ART. 18. RULE I. When steam vessels are approaching each other head and head, that is, end on, or nearly so, it shall be the duty of each to pass on the port side of the other; and either vessel shall give, as a signal of her intention, one short and distinct blast of her whistle, which the other vessel shall answer promptly by a similar blast of her whistle, and thereupon such vessels shall pass on the port side of each other. But if the course of such vessels are so far on the starboard of each other as not to be considered as meeting head and head, either vessel shall immediately give two short and distinct blasts of her whistle, which the other vessel shall answer promptly by two similar blasts of her whistle, and they shall pass on the starboard side of each other.

The foregoing only applies to cases where vessels are meeting end on or nearly end on, in such a manner as to involve risk of collision; in other words, to cases in which by day each vessel sees the masts of the other in a line, or nearly in a line, with her own and by night to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply by day to cases in which a vessel sees another ahead crossing her own course, or by night to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

RULE III. If, when steam vessels are approaching each other, either vessel fails to understand the course or intention of the other, from any cause, the vessel so in doubt shall immediately signify the same by giving several short and rapid blasts, not less than four, of the steam whistle.

RULE V. Whenever a steam vessel is nearing a short bend or curve in the channel, where, from the height of the banks or other cause, a steam vessel approaching from the opposite direction can not be seen for a distance of half a mile, such steam vessel, when she shall have arrived within half a mile of such curve or bend, shall give a signal by one long blast of the steam whistle, which signal shall be answered by a similar blast, given by any approaching steam vessel that may be within hearing. Should such a signal be so answered by a steam vessel upon the farther side of such bend, then the usual signals for meeting and passing shall immediately be given and answered; but, if the first alarm signal of such vessel be not answered, she is to consider the channel clear, and govern herself accordingly.

When steam vessels are moved from their docks or berths, and other boats are liable to pass from any direction toward them, they shall give the same signal as in the case of vessels meeting at a bend, but immediately after clearing the berths so as to be fully in sight they shall be governed by the steering and sailing rules.

RULE VIII. When steam vessels are running in the same direction, and the vessel which is astern shall desire to pass on the right or starboard hand of the vessel ahead, she shall give one short blast of the steam whistle, as a signal of such desire, and if the vessel ahead answers with one blast, she shall put her helm to port; or if she shall desire to pass on the left or port side of the vessel ahead, she shall give two short blasts of the steam whistle as a signal of such desire, and if the vessel ahead answers with two blasts, shall put her helm to starboard; or if the vessel ahead does not think it safe for the vessel astern to attempt to pass at that point, she shall immediately signify the same by giving several short and rapid blasts of the steam whistle, not less than four, and under no circumstances shall the vessel astern attempt to pass the vessel ahead until such time as they have reached a point where it can be safely done, when said vessel ahead shall signify her willingness by blowing the proper signals. The vessel ahead shall in no case attempt to cross the bow or crowd upon the course of the passing vessel.

RULE IX. The whistle signals provided in the rules under this article, for steam vessels meeting, passing, or overtaking, are never to be used except when steamers are in sight of each other, and the course and position of each can be determined in the daytime by a sight of the vessel itself, or by night by seeing its signal lights. In fog, mist, falling snow, or heavy rainstorms, when vessels can not see each other, fog signals only must be given.

ART. 19. When two steam vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

ART. 20. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

ART. 21. Where, by any of these rules, one of the two vessels is to keep out of the way, the other shall keep her course and speed.

ART. 22. Every vessel which is directed by these rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

ART. 23. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

ART. 24. Notwithstanding anything contained in these rules every vessel, overtaking any other, shall keep out of the way of the overtaken vessel. Every vessel coming up with another vessel from any direction more than two points abaft her beam; that is, in such position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side lights, shall be deemed to be an overtaken vessel; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel can not always know with certainty whether she is forward or abaft this direction from the other vessel she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

ART. 25. In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

ART. 26. Sailing vessels under way shall keep out of the way of sailing vessels or boats fishing with nets, or lines, or trawls. This rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

ART. 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

SOUND SIGNALS FOR VESSELS IN SIGHT OF ONE ANOTHER

ART. 28. When vessels are in sight of one another a steam vessel under way whose engines are going at full speed astern shall indicate that fact by three short blasts on the whistle.

NO VESSEL UNDER ANY CIRCUMSTANCES TO NEGLECT PROPER PRECAUTIONS

ART. 29. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

ART. 30. The exhibition of any light on board of a vessel of war of the United States or a Coast Guard cutter may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

DISTRESS SIGNALS

ART. 31. When a vessel is in distress and requires assistance from other vessels or from the shore, the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime: A continuous sounding with any fog-signal apparatus, or firing a gun.

At night: First. Flames on the vessel as from a burning tar barrel, oil barrel, and so forth.

Second. A continuous sounding with any fog-signal apparatus, or firing a gun.

RULES FOR LIGHTS FOR CERTAIN CLASSES OF VESSELS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

The following rules for lights to be carried by ferryboats, rules for lights for barges and canal boats in tow of steam vessels, rules for lights for rafts and other water craft navigating by hand power, horsepower, or by the current of the river, rule relating to use of searchlights, rule prohibiting unnecessary sounding of the steam whistle, rule prohibiting the carrying of unauthorized lights on steam vessels, and rule relating to drawbridges over navigable waters of the United States were adopted by the Board of Supervising Inspectors, Steamboat Inspection Service, and approved by the Secretary of Commerce.

These rules concerning lights shall be complied with in all weathers from sunset to sunrise.

RULES FOR LIGHTS TO BE CARRIED BY FERRYBOATS NAVIGATING THE HARBORS, RIVERS, AND INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Ferryboats propelled by machinery and navigating the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, shall carry the range lights and the colored side lights required by law to be carried on steam vessels navigating those waters, except that *double-end ferryboats* shall carry a central range of clear, bright, white lights, showing all around the horizon, placed at equal altitudes forward and aft, also on the starboard side a green light and on the port side a red light, of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on their respective sides.

The green and red lights shall be fitted with inboard screens projecting at least 3 feet forward from the lights, so as to prevent them from being seen across the bow.

Local inspectors in districts having ferryboats shall, whenever the safety of navigation may require, designate for each line of such boats a certain light,

white or colored, which shall show all around the horizon, to designate and distinguish such lines from each other, which light shall be carried on a flagstaff amidships, 15 feet above the white range lights.

RULES AND LIGHTS FOR BARGES AND CANAL BOATS IN TOW OF STEAM VESSELS AND FOR LIGHTS AND DAY SIGNALS FOR DREDGES, VESSELS WORKING ON WRECKS, ETC., NAVIGATING THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Lights for barges and canal boats in tow of steam vessels on certain inland waters on the seaboard, except the Hudson River and adjacent waters and Lake Champlain.—On the harbors, rivers, and other inland waters of the United States, except the Great Lakes and their connecting and tributary waters as far east as Montreal and the Red River of the North and rivers emptying into the Gulf of Mexico and their tributaries, and except on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, barges (except scows) and canal boats in tow of steam vessels shall carry lights as follows:

Barges and canal boats towing astern of steam vessels, when towing singly, or what is known as tandem towing, shall each carry a green light on the starboard side and a red light on the port side, and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

When two or more boats are abreast, the colored lights shall be carried at the outer sides of the bows of the outside boats. Each of the outside boats in last tier of a hawser tow shall carry a white light on her stern.

The white light required to be carried on stern of a barge or canal boat carrying red and green side lights shall be carried in a lantern so constructed that it shall show an unbroken light over an arc of the horizon of 12 points of the compass, namely, for 6 points from right aft on each side of the vessel, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 2 miles.

Barges or canal boats towing alongside a steam vessel shall, if the deck, deck houses, or cargo of the barge or canal boat be so high above water as to obscure the side lights of the towing steamer when being towed on the starboard side of the steamer, carry a green light upon the starboard side; and when towed on the port side of the steamer, a red light on the port side of the barge or canal boat; and if there is more than one barge or canal boat abreast, the colored lights shall be displayed from the outer side of the outside barges or canal boats.

The colored side lights referred to in these rules for barges and canal boats in tow shall be fitted with inboard screens, so as to prevent them from being seen across the bow, and of such a character as to be visible on a dark night, with a clear atmosphere, at a distance of at least 2 miles, and so constructed as to show a uniform and unbroken light over an arc of the horizon of 10 points of the compass, and so fixed as to throw the light from right ahead to 2 points abaft the beam on either side. The minimum size of glass globes shall not be less than 6 inches in diameter and 5 inches high in the clear.

Scows when being towed by steam vessels on the waters covered by the first paragraph of these rules shall carry a white light at each end of each scow, except that when such scows are massed in tiers, two or more abreast, each of the outside scows shall carry a white light on its outer bow, and the outside scows in the last tier shall each carry, in addition, a white light on the outer part of the stern. The white light shall be carried not less than 8 feet above the surface of the water and shall be so placed as to show an unbroken light all around the horizon, and shall be of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

Lights for barges and canal boats in tow of steam vessels on the Hudson River and adjacent waters and Lake Champlain.—All nondescript vessels

known as scows, car floats, lighters, and vessels of similar type, navigating the waters referred to in the following rules, shall carry the lights required to be carried by barges and canal boats in tow of steam vessels, as prescribed in such rules.

Barges and canal boats, when being towed by steam vessels on the waters of the Hudson River and its tributaries from Troy to the boundary lines of New York Harbor off Sandy Hook, as defined pursuant to section 2 of the act of Congress of February 19, 1895, the East River, and Long Island Sound (and the waters entering thereon, and to the Atlantic Ocean), to and including Narragansett Bay, R. I., and tributaries, and Lake Champlain, shall carry lights as follows:

Barges and canal boats being towed astern of steam vessels, when towing singly or what is known as tandem towing, shall each carry a white light on the bow and a white light on the stern, except that the last vessel of such tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon: *Provided*, That seagoing barges shall not be required to make any change in their seagoing lights (red and green) on waters coming within the scope of these rules, except that the last vessel of the tow shall carry two white lights on her stern, athwartship, horizontal to each other, not less than 5 feet apart, and not less than 4 feet above the deck house, and so placed as to show all around the horizon.

Barges and canal boats, when towed at a hawser two or more abreast, when in one tier, shall carry a white light on the bow and a white light on the stern of each of the outside boats; when in more than one tier, each of the outside boats shall carry a white light on its bow; and the outside boats in the last tier shall each carry, in addition, a white light on the outer afterpart of the stern.

Barges or canal boats towed alongside a steam vessel, if on the starboard side of said steam vessel, shall display a white light on her own starboard bow; and if on the port side of said steam vessel shall display a white light on her own port bow; and if there is more than one barge or canal boat alongside the white lights shall be displayed from the outboard side of the outside barge or canal boat: *Provided*, That barges known as car floats, when towed alongside, shall have a white light at each outboard corner of said barge.

When barges or canal boats are massed in tiers and towed at a hawser, as is usual on the Hudson River, there shall be carried on the forward port side of the port boat of each tier a white light, and on the forward starboard side of the starboard boat in each tier a white light, and on the after port side of the port boat in the stern tier a white light, and on the afterstarboard side of the starboard boat in the stern tier a white light.

The white bow lights for barges and canal boats referred to in the preceding rules shall be carried at least 10 feet and not more than 30 feet abaft the stem or extreme forward end of the vessel. On barges and canal boats required to carry a white bow light, the white light on bow and the white light on stern shall each be so placed above the hull or deck house as to show an unbroken light all around the horizon, and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least 5 miles.

Provided, That nothing in these rules shall be construed as compelling barges or canal boats in tow of steam vessels, passing through any waters coming within the scope of these rules where lights for barges or canal boats are different from those of the waters whereon such vessels are usually employed, to change their lights from those required on the waters from which their trip begins or terminates; but should such vessels engage in local employment on waters requiring different lights from those where they are customarily employed, they shall comply with the local rules where employed.

RULES FOR LIGHTS AND DAY SIGNALS TO BE CARRIED BY VESSELS, DREDGES OF ALL TYPES, AND VESSELS WORKING ON WRECKS OR OTHER OBSTRUCTIONS TO NAVIGATION, OR MOORED FOR SUBMARINE OPERATIONS OR MADE FAST TO A SUNKEN OBJECT WHICH MAY DRIFT WITH THE TIDE OR BE TOWED

Rule for signals to be displayed by a towing vessel when towing a submerged or partly submerged object upon a hawser when no signals are displayed upon the object which is towed.—The vessel having the submerged object in tow shall display by day, where they can best be seen, two shapes, one above the other, not less than 6 feet apart, the lower shape to be carried

not less than 10 feet above the deck houses. The shapes shall be in the form of a double frustum of a cone, base to base, not less than 2 feet in diameter at the center nor less than 8 inches at the ends of the cones, and to be not less than 4 feet lengthwise from end to end, the upper shape to be painted in alternate horizontal stripes of black and white, 8 inches in width, and the lower shape to be painted a solid bright red.

By night the towing vessel shall display the regular side lights, but in lieu of the regular white towing lights shall display four lights in a vertical position not less than 3 feet nor more than 6 feet apart, the upper and lower of such lights to be white, and the two middle lights to be red, all of such lights to be of the same character as is now prescribed for the regular towing lights.

Rule for steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting.—Steamers, derrick boats, lighters, or other types of vessels made fast alongside a wreck, or moored over a wreck which is on the bottom or partly submerged, or which may be drifting, shall display by day two shapes of the same character and dimensions and displayed in the same manner as required by the foregoing rule, except that both the shapes shall be painted a solid bright red, but where more than one vessel is working under the above conditions, the shapes need be displayed only from one vessel on each side of the wreck from which it can best be seen from all directions.

By night this situation shall be indicated by the display of a white light from the bow and stern of each outside vessel or lighter not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck.

Rule for dredges which are held in stationary position by moorings or spuds.—Dredges which are held in stationary position by moorings or spuds shall display by day two red balls not less than 2 feet in diameter and carried in a vertical line not less than 3 feet nor more than 6 feet apart, and at least 15 feet above the deck house and in such a position where they can best be seen from all directions.

By night they shall display a white light at each corner, not less than 6 feet above the deck, and in addition thereto there shall be displayed in a position where they may best be seen from all directions two red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart, and not less than 15 feet above the deck. When scows are moored alongside a dredge in the foregoing situation they shall display a white light on each outboard corner not less than 6 feet above the deck.

Rule for self-propelling suction dredges under way with their suctions on the bottom.—Self-propelling suction dredges under way with their suction on the bottom shall display by day the same signals as are used to designate any steamer not under control; that is to say, two black balls not less than 2 feet in diameter and carried not less than 15 feet above the deck house, and where they may best be seen from all directions.

By night they shall carry, in addition to the regular running lights, two red lights of the same character as the masthead light, in the same vertical plane and underneath the masthead light, the red lights to be not less than 3 feet nor more than 6 feet apart and the upper red light to be not less than 4 feet and not more than 6 feet below the white masthead light, and on or near the stern two red lights in the same vertical plane not less than 4 feet nor more than 6 feet apart, to show through 4 points of the compass; that is, from right astern to 2 points on each quarter.

Rule for vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation.—Vessels which are moored or anchored and engaged in laying pipe or operating on submarine construction or excavation shall display by day, not less than 15 feet above the deck, where they can best be seen from all directions, two balls not less than 2 feet in diameter, in a vertical line not less than 3 feet and not more than 6 feet apart, the upper ball to be painted in alternate black and white vertical stripes 6 inches wide, and the lower ball to be painted a solid bright red.

By night they shall display three red lights carried in a vertical line not less than 3 feet nor more than 6 feet apart and not less than 15 feet above the deck, and in such position as may best be seen from all directions. All the lights required by these special rules for dredges, wrecking boats, lighters, etc., shall

be of such size and character as to be visible on a dark night with a clear atmosphere for a distance of at least 2 miles.

Rule relating to the use of searchlights.—Any master or pilot of any steam vessel who shall flash or cause to be flashed the rays of the searchlight into the pilot house of a passing vessel shall be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

Rule for vessels which are moored or at anchor.—Vessels of more than 300 gross tons propelled by machinery when moored or anchored in a fairway or channel where traffic is liable to congestion or confusion shall display between sunrise and sunset on the forward part of the vessel where it can best be observed from other vessels one black ball or shape not less than 2 feet in diameter.

Rule prohibiting the carrying of unauthorized lights on steam vessels.—Any master or pilot of any steam vessel who shall authorize or permit the carrying of any light, electric or otherwise, not required by law, on the outside structure of the cabin or hull of the vessel that in any way will interfere with distinguishing the signal lights shall, upon conviction thereof before any board of inspectors having jurisdiction, be deemed guilty of misconduct and shall be liable to have his license suspended or revoked.

REGULATION OF MOTOR BOATS

AN ACT To amend laws for preventing collisions of vessels and to regulate equipment of certain motor boats on the navigable waters of the United States

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "motor boat" where used in this act shall include every vessel propelled by machinery and not more than sixty-five feet in length, except tug boats and tow boats propelled by steam. The length shall be measured from end to end over the deck, excluding sheer: *Provided*, That the engine, boiler, or other operating machinery shall be subject to inspection by the local inspectors of steam vessels, and to their approval of the design thereof, on all said motor boats, which are more than forty feet in length, and which are propelled by machinery driven by steam.

SEC. 2. That motor boats subject to the provisions of this act shall be divided into classes as follows:

Class one. Less than twenty-six feet in length.

Class two. Twenty-six feet or over and less than forty feet in length.

Class three. Forty feet or over and not more than sixty-five feet in length.

SEC. 3. That every motor boat in all weathers from sunset to sunrise shall carry the following lights, and during such time no other lights which may be mistaken for those prescribed shall be exhibited.

(a) Every motor boat of class one shall carry the following lights:

First. A white light aft to show all around the horizon.

Second. A combined lantern in the fore part of the vessel and lower than the white light aft showing green to starboard and red to port, so fixed as to throw the light from right ahead to two points abaft the beam on their respective sides.

(b) Every motor boat of classes two and three shall carry the following lights:

First. A bright white light in the fore part of the vessel as near the stem as practicable, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side. The glass or lens shall be of not less than the following dimensions:

Class two. Nineteen square inches.

Class three. Thirty-one square inches.

Second. A white light aft to show all around the horizon.

Third. On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side. The glasses or lenses in the said side lights shall be of not less than the following dimensions on motor boats of—

Class 2. Sixteen square inches.

Class 3. Twenty-five square inches.

On and after July 1, 1911, all glasses or lenses prescribed by paragraph (b) of section three shall be fresnel or fluted. The said lights shall be fitted with inboard screens of sufficient height and so set as to prevent these lights from being seen across the bow, and shall be of not less than the following dimensions on motor boats of—

Class 2. Eighteen inches long.

Class 3. Twenty-four inches long: *Provided*, That motor boats as defined in this act, when propelled by sail and machinery or under sail alone, shall carry the colored lights suitably screened, but not the white lights prescribed by this section.

SEC. 3. (*a*) Every motor boat under the provisions of this act shall be provided with a whistle or other sound-producing mechanical appliance capable of producing a blast of two seconds or more in duration, and in the case of such boats so provided a blast of at least two seconds shall be deemed a prolonged blast within the meaning of the law.

(*b*) Every motor boat of class two or three shall carry an efficient foghorn

(*c*) Every motor boat of class two or three shall be provided with an efficient bell, which shall be not less than eight inches across the mouth on board of vessels of class three.

SEC. 5. That every motor boat subject to any of the provisions of this act, and also all vessels propelled by machinery other than by steam more than sixty-five feet in length, shall carry either life preservers or life belts or buoyant cushions, or ring buoys or other device, to be prescribed by the Secretary of Commerce, sufficient to sustain afloat every person on board and so placed as to be readily accessible. All motor boats carrying passengers for hire shall carry one life preserver of the sort prescribed by the regulations of the Board of Supervising Inspectors for every passenger carried, and no such boat while so carrying passengers for hire shall be operated or navigated except in charge of a person duly licensed for such service by the local board of inspectors. No examination shall be required as the condition of obtaining such a license, and any such license shall be revoked or suspended by the local board of inspectors for misconduct, gross negligence, recklessness in navigation, intemperance, or violation of law on the part of the holder, and if revoked the person holding such license shall be incapable of obtaining another such license for one year from the date of revocation: *Provided*, That motor boats shall not be required to carry licensed officers, except as required in this act.

SEC. 6. That every motor boat and also every vessel propelled by machinery other than by steam, more than sixty-five feet in length, shall carry ready for immediate use the means of promptly and effectually extinguishing burning gasoline.

SEC. 7. That a fine of not exceeding one hundred dollars may be imposed for any violation of this act. The motor boat shall be liable for the said penalty and may be seized and proceeded against by way of libel, in the district court of the United States for any district within which such vessel may be found.

SEC. 8. That the Secretary of Commerce shall make such regulations as may be necessary to secure the proper execution of this act by collectors of customs and other officers of the Government. And the Secretary of the Department of Commerce may, upon application therefor, remit or mitigate any fine, penalty, or forfeiture relating to motor boats except for failure to observe the provisions of section six of this act.

SEC. 9. That all laws and parts of laws only in so far as they are in conflict herewith are hereby repealed: *Provided*, That nothing in this act shall be deemed to alter or amend acts of Congress embodying or revising international rules for preventing collisions at sea.

RULES FOR LIGHTS FOR RAFTS AND OTHER WATER CRAFT NAVIGATING BY HAND POWER, HORSEPOWER, OR BY THE CURRENT OF THE RIVER, ON THE HARBORS, RIVERS, AND OTHER INLAND WATERS OF THE UNITED STATES, EXCEPT THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL AND THE RED RIVER OF THE NORTH AND RIVERS EMPTYING INTO THE GULF OF MEXICO AND THEIR TRIBUTARIES

Any vessel, except rafts and rowing boats under oars, navigating by ***hand power, horsepower, or by the current of the river,*** shall carry one white light forward, not less than 8 feet above the surface of the water.

Rafts propelled by hand power or by the current of the river, or which shall be anchored or moored in or near a channel or fairway, shall carry white lights, as follows: Rafts of one crib and not more than two in length shall carry one white light. Rafts of three or more cribs in length and one crib in width shall carry one white light at each end of the raft. Rafts of more than one crib abreast shall carry one white light on each outside corner of the raft, making four lights in all.

The *white light* required by these rules for rafts and other water craft shall be carried, from sunset to sunrise, in a lantern so fixed and constructed as to show a clear, uniform, and unbroken light, visible all around the horizon, and of such intensity as to be visible on a dark night with a clear atmosphere at a distance of at least 1 mile. The lights for rafts shall be suspended from poles of such height that the lights shall not be less than 8 feet above the surface of the water.

Meteorological table compiled by the United States Weather Bureau

SAN DIEGO, CALIF.

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 dense fog
	Mean	Extremes		Mean			Extremes						Average fall	Number of days 0.01 inch or more	Maximum fall in 24 hours	Average hourly velocity	Highest velocity	Average number of times (observations at 8 a. m. and 8 p. m.) from—								Number of days with winds of 40 miles or over	
																		N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm	
	For month	Highest	Lowest	For month	Mean max.	Mean min.	Highest	Lowest	Range							Statute miles	Highest velocity										
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	%		*Ins.*		*Ins.*												
January	30.07	30.48	29.48	1.00	54.3	62.2	46.5	15.7	83	25	58	71	4	2.00	7	2.49	5	54	8	12	7	2	5	3	5	20	0	(1)	2
February	30.06	30.53	29.48	1.05	55.1	62.5	47.7	14.8	85	34	51	74	4	1.96	7	2.39	6	45	4	11	7	3	4	5	7	15	0	(1)	2
March	30.02	30.45	29.46	.99	56.7	63.9	49.6	14.3	90	36	63	74	5	1.70	7	2.40	6	46	4	9	8	4	4	5	10	18	0	(1)	1
April	29.99	30.36	29.67	.69	58.5	64.8	52.2	12.6	96	39	57	75	5	0.74	4	1.20	6	46	5	8	6	2	4	7	12	16	0	(1)	2
May	29.95	30.26	29.67	.59	60.8	66.2	55.3	10.9	98	45	53	78	6	0.41	3	1.45	6	33	4	4	5	2	4	11	17	15	0	0	(1)
June	29.92	30.12	29.66	.46	63.9	68.0	58.7	10.3	94	50	44	80	6	0.03	1	.25	6	30	6	3	2	3	6	13	12	15	0	0	1
July	29.92	30.12	29.69	.43	67.2	72.3	62.1	10.2	93	54	39	81	5	0.00	0	.83	6	30	7	3	1	2	3	12	14	19	1	0	1
August	29.89	30.16	29.64	.52	68.7	73.9	63.6	10.3	93	54	39	80	5	0.00	1	1.80	6	25	8	5	1	1	3	10	13	20	1	0	1
September	29.89	30.14	29.59	.55	67.1	72.9	61.3	11.6	110	60	60	79	5	0.06	1	1.50	6	28	8	6	4	1	3	5	8	24	1	0	2
October	29.95	30.24	29.57	.67	63.7	70.6	56.7	13.9	96	44	52	76	4	0.46	3	1.82	5	32	6	9	5	3	4	6	7	22	0	0	4
November	30.02	30.39	29.52	.87	59.7	67.7	51.7	16.0	93	36	57	70	3	0.83	4	2.75	5	34	6	14	8	2	3	4	4	19	0	0	3
December	30.07	30.44	29.56	.88	56.0	64.4	47.7	16.7	84	32	52	68	4	1.82	6	3.00	5	40	5	16	7	3	2	3	4	20	0	(1)	1
Mean	29.98				61.0	67.5	54.4	13.1				76	5				6												
Total														10.01	44			79	100	61	28	45	84	113	228	3	(1)	20

[1] Less than 1.

SAN FRANCISCO, CALIF.

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 Maximum	Mean Minimum	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	30.11	30.62	29.23	1.39	49.9	55.0	44.9	10.1	78	29	49	78	5	4.33	12	4.67	7	57	9	6	3	6	10	7	9	11	1	(1)	2
February	30.10	30.62	29.10	1.52	52.2	57.8	46.6	11.2	80	33	47	77	5	3.70	13	3.60	8	52	6	5	2	4	8	5	16	10	0	(1)	2
March	30.06	30.64	29.23	1.41	54.2	60.3	48.1	12.2	86	33	53	75	5	3.14	10	3.31	9	60	5	4	1	5	6	8	22	11	0	(1)	1
April	30.05	30.48	29.58	.90	55.0	61.2	48.8	12.4	88	40	48	75	4	1.82	6	2.43	10	47	3	1	1	1	5	9	33	7	0	(1)	1
May	29.99	30.35	29.64	.71	56.8	63.0	50.5	12.5	97	42	55	78	4	.81	4	1.42	11	45	1	0	0	1	4	12	38	5	1	(1)	1
June	29.96	30.38	29.61	.77	58.5	65.1	51.9	13.2	100	46	54	80	3	.17	2	1.23	13	48	0	0	0	0	2	14	38	5	1	(1)	1
July	29.95	30.28	29.68	.60	58.5	64.7	52.3	12.4	98	47	51	84	4	.01	0	.23	13	41	0	0	0	0	1	19	41	1	0	(1)	2
August	29.92	30.29	29.56	.73	59.1	65.0	53.3	11.7	92	46	46	85	5	.00	0	.18	12	42	0	0	0	0	1	20	40	1	0	(1)	2
September	29.94	30.26	29.52	.74	60.9	67.7	54.2	13.5	101	47	54	80	4	.29	2	3.56	10	42	1	0	1	1	2	12	37	4	2	(1)	2
October	30.01	30.39	29.54	.85	60.5	67.5	53.5	14.0	96	45	51	76	3	1.29	4	2.03	8	44	4	2	1	1	6	6	32	7	1	(1)	2
November	30.09	30.51	29.44	1.07	56.3	62.1	50.5	11.6	83	38	45	76	4	2.47	6	3.98	7	64	7	5	1	3	6	5	18	13	1	(1)	3
December	30.12	30.60	29.34	1.26	51.3	56.2	46.3	9.9	72	34	38	78	4	4.24	11	3.40	7	60	9	10	3	6	8	4	10	12	0	(1)	2
Mean	30.02				56.1	62.1	50.1	12.0				78	4				10												
Total														22.27	70				45	33	13	28	58	125	334	87	7	(1)	21

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau—Continued

POINT REYES, CALIF.

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					Average fall	Number of days 0.01 inch or more	Maximum fall in 24 hours	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 hourly velocity	Highest velocity	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*												
January	30.11	30.57	28.81	1.76	49.5	54.2	44.6	9.6	78	31	47	84	6	4.54	13	3.10	18	104	2	1	1	4	11	2	1	9	0	13	8
February	30.10	30.57	28.94	1.63	49.8	54.6	45.3	9.3	75	33	42	84	6	3.12	12	2.21	20	101	3	1	0	1	6	3	1	13	0	11	8
March	30.06	30.58	29.24	1.34	50.4	55.5	45.5	10.0	88	30	58	83	6	2.91	11	2.15	21	108	4	1	0	1	6	3	1	15	0	13	7
April	30.05	30.37	29.56	.81	51.1	56.1	46.0	10.1	83	36	47	82	5	1.60	6	1.78	24	110	4	0	0	0	4	2	1	19	0	15	7
May	29.99	30.26	29.56	.70	51.8	57.0	46.5	10.5	85	36	49	85	5	0.93	5	1.80	26	120	3	0	0	0	4	3	1	20	0	16	9
June	29.96	30.18	29.63	.55	52.8	57.9	47.7	10.2	87	38	49	85	6	0.28	2	1.27	27	94	4	0	0	0	2	2	1	21	0	16	12
July	29.95	30.16	29.62	.54	53.5	58.6	48.3	10.3	91	40	51	88	7	0.08	1	0.39	22	90	6	0	0	0	3	2	1	19	0	12	20
August	29.92	30.13	29.61	.52	54.6	59.3	49.8	9.5	90	41	49	89	7	0.05	Φ	0.91	20	76	5	0	0	0	4	3	1	18	0	11	21
September	29.94	30.19	29.59	.60	56.2	61.3	51.0	10.3	98	45	53	85	6	0.62	2	2.52	18	75	7	0	0	0	3	2	1	17	0	8	15
October	30.01	30.34	29.56	.78	55.5	60.9	50.1	10.8	91	40	51	85	5	1.33	5	2.53	17	90	9	1	0	0	5	1	1	14	0	7	13
November	30.09	30.42	29.48	.94	53.9	58.9	48.8	10.1	83	34	49	84	5	2.49	8	2.35	17	82	7	2	1	1	4	2	1	12	0	9	10
December	30.12	30.53	29.01	1.52	50.9	55.8	45.9	9.9	73	34	39	83	5	3.37	11	2.33	16	96	4	1	1	3	7	2	1	12	0	11	7
Mean	30.02				52.5	57.4	47.4	10.0				85	6				20												
Total														21.32	76				58	7	3	10	59	27	12	189	0	142	137

EUREKA, CALIF.

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	49.9	52.8	41.1	11.7	77	20	57	85	7	7.63	17	5.10	7	59	8	3	4	19	13	8	3	3	1	1	4
February	30.11	30.65	28.93	1.72	47.2	52.9	41.4	11.5	72	24	48	84	6	7.03	15	4.91	7	50	11	4	4	13	8	8	4	4	0	(1)	3
March	30.06	30.55	29.05	1.50	48.3	54.0	42.6	11.4	78	29	49	83	6	6.97	16	3.94	8	48	14	3	4	15	7	6	6	7	0	1	3
April	30.11	30.56	29.46	1.10	49.9	55.2	44.4	10.8	79	31	48	83	6	3.93	12	2.87	8	58	17	3	2	9	6	7	5	11	0	(1)	1
May	30.05	30.49	29.38	1.11	52.0	56.9	47.0	9.9	78	35	43	84	6	2.54	10	2.24	8	46	17	3	2	7	7	9	5	12	0	(1)	2
June	30.05	30.37	29.65	.72	54.3	59.1	49.6	9.5	85	40	45	85	5	1.06	6	1.99	8	47	18	2	1	5	4	7	6	16	1	(1)	2
July	30.05	30.28	29.77	.51	55.5	59.8	51.3	8.5	73	43	30	87	6	0.11	2	1.18	7	47	15	2	1	2	6	9	7	19	1	(1)	6
August	30.00	30.26	29.72	.54	56.0	60.3	51.6	8.7	79	45	34	88	6	0.10	2	2.63	5	39	15	2	1	4	7	7	8	17	1	0	7
September	30.01	30.30	29.53	.77	55.9	61.3	50.4	10.9	82	36	46	87	6	1.11	5	2.77	5	46	14	2	3	7	6	8	8	11	1	(1)	9
October	30.06	30.46	29.46	1.00	53.6	59.4	47.8	11.6	84	35	49	87	6	2.65	9	3.61	5	42	13	4	3	12	5	9	7	8	1	(1)	9
November	30.11	30.57	29.24	1.33	51.1	57.2	45.1	12.1	81	27	54	86	6	5.67	13	4.02	6	43	11	4	5	14	9	9	4	3	1	(1)	5
December	30.12	30.71	29.10	1.61	48.2	54.2	42.2	12.0	70	26	44	85	6	7.25	16	3.65	6	50	10	4	6	19	9	7	4	3	0	1	3
Mean	30.07				51.6	56.9	46.2	10.7				85	6				7												
Total														46.05	123				163	36	36	126	87	94	67	114	7	3	54

[1] Less than 1.

Meteorological table compiled by the United States Weather Bureau—Continued

NORTH HEAD, 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.*		[1]											
January	30.05	30.69	28.72	1.97	42.1	46.1	38.1	8.0	65	11	54	89	8	6.68	22	4.29	18	150	3	3	21	13	8	4	5	5	0	12	3
February	30.06	30.63	29.01	1.62	43.0	47.3	38.8	8.5	71	14	57	88	7	5.79	18	3.69	16	90	4	2	16	11	6	5	4	8	0	9	3
March	30.01	30.63	28.78	1.85	45.2	49.7	40.8	8.9	79	22	57	86	7	5.25	20	2.65	16	95	5	2	10	12	8	5	5	15	0	9	2
April	30.05	30.59	29.27	1.32	47.5	51.8	43.2	8.6	88	33	55	86	6	3.22	17	2.74	15	85	5	1	6	7	8	5	6	22	0	7	1
May	30.03	30.58	29.26	1.32	50.9	55.1	46.8	8.3	86	38	48	86	7	2.39	15	1.52	14	78	5	0	4	6	9	5	4	29	0	4	1
June	29.99	30.49	29.29	1.20	54.8	58.7	50.9	7.8	96	44	52	87	6	1.77	13	1.76	13	74	4	1	2	5	5	5	6	32	0	3	2
July	30.08	30.43	29.61	.82	57.2	61.0	53.3	7.7	97	46	51	88	6	0.54	8	0.92	12	62	6	0	1	3	6	3	4	39	0	1	3
August	30.03	30.36	29.49	.87	57.6	61.5	53.6	7.9	90	47	43	90	6	0.56	8	1.78	11	74	8	1	1	5	7	2	3	35	0	1	7
September	30.03	30.44	29.20	1.24	56.5	60.8	52.2	8.6	89	42	47	89	6	1.85	12	2.24	12	92	9	1	4	14	7	3	3	19	0	4	5
October	30.05	30.62	29.03	1.59	52.9	57.0	48.9	8.1	83	36	47	88	7	3.91	16	2.45	13	90	6	2	9	18	7	3	3	14	0	7	6
November	30.05	30.66	28.95	1.71	48.2	52.0	44.3	7.7	72	20	52	88	8	6.33	21	3.00	17	90	4	2	14	15	11	4	3	7	0	11	2
December	30.03	30.76	29.03	1.73	44.1	48.1	40.2	7.9	62	18	44	89	8	7.48	22	3.15	18	104	3	3	24	11	7	4	4	6	0	12	2
Mean	30.04				50.0	54.1	45.9	8.2				88	7				15												
Total														45.77	192				62	18	112	120	89	48	50	231	0	80	37

[1] Approximately.

TATOOSH ISLAND, 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	30.69	28.61	2.08	41.2	44.3	37.6	6.7	60	7	53	85	7	12.16	22	4.56	20	85	1	5	25	8	11	5	5	2	0	15	1
February	30.00	30.64	28.93	1.71	41.0	45.0	38.0	7.0	58	13	45	85	7	8.76	19	3.66	17	85	1	7	21	6	8	6	5	2	0	11	1
March	29.96	30.58	28.75	1.83	42.9	47.6	39.6	8.0	69	24	45	84	7	8.57	20	4.76	16	84	2	10	13	5	12	8	8	4	0	9	1
April	30.00	30.57	29.30	1.27	46.1	50.9	42.3	8.6	74	33	41	84	7	6.31	17	3.77	14	84	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	15	2.22	12	86	1	5	6	3	13	13	18	3	0	3	3
June	30.02	30.52	29.39	1.13	53.0	57.3	48.8	8.5	84	43	41	88	7	4.18	13	2.55	10	88	1	3	4	3	14	19	14	2	0	1	4
July	30.05	30.47	29.57	.90	55.1	59.8	51.3	8.5	82	44	38	88	6	1.78	9	2.35	10	88	1	3	3	1	18	23	11	2	0	1	8
August	30.00	30.41	29.47	.94	55.3	60.1	51.2	8.9	80	43	37	89	5	2.11	9	2.78	10	89	1	4	4	3	21	20	7	2	0	1	11
September	30.01	30.46	29.14	1.32	53.0	58.0	49.3	8.7	76	40	36	89	6	6.14	12	3.40	12	89	1	10	8	4	19	10	7	1	0	2	8
October	30.01	30.65	28.98	1.67	49.9	54.5	46.9	7.6	72	37	35	85	6	8.00	17	4.59	15	85	1	14	15	7	13	4	6	2	0	7	5
November	29.97	30.64	28.95	1.69	45.9	50.1	43.2	6.9	65	25	40	83	8	12.09	22	4.49	19	83	1	9	16	7	13	6	6	2	0	13	1
December	29.96	30.79	28.66	2.13	43.9	46.8	40.3	6.5	60	19	41	86	8	14.59	24	4.28	21	86	1	6	25	8	9	5	6	2	0	14	1
Mean	30.00	------	------	------	48.1	52.4	44.7	7.7	----	----	----	86	7	------	----	------	16	----	----	----	----	----	----	----	----	----	----	----	----
Total	------	------	------	------	------	------	------	------	----	----	----	----	----	88.78	199	------	------	----	13	82	150	59	162	129	107	28	0	82	45

[1] Less than 1.

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	15.90	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.

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 dense fog
	Mean	Extremes			Mean				Extremes								Statute miles		Average number of times (observations at 8 a. m. and 8 p. m.) from—									Number of days with winds of 40 miles or over	
	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	30.05	30.75	28.80	1.95	39.5	43.9	35.2	8.7	63	3	60	84	8	4.84	19	2.47	9	59	10	6	8	16	15	4	1	2	0	1	3
February	30.06	30.67	28.99	1.68	41.1	46.3	35.9	10.4	67	4	63	80	7	3.77	16	1.89	8	54	9	5	8	11	11	5	2	5	0	1	3
March	29.99	30.59	29.22	1.37	44.9	51.3	38.6	12.7	81	20	61	77	7	2.88	16	2.92	9	49	11	7	7	10	10	8	3	6	0	1	3
April	30.03	30.61	29.24	1.37	49.4	57.0	41.9	15.1	85	30	55	74	6	2.38	14	1.74	8	55	8	5	5	10	9	9	5	8	1	1	1
May	30.01	30.52	29.33	1.19	54.5	62.2	46.7	15.5	92	36	56	72	6	1.97	13	1.30	8	44	10	5	4	10	13	7	6	6	1	(1)	(1)
June	30.00	30.48	29.43	1.05	59.0	67.0	51.0	16.0	98	41	57	70	6	1.49	10	1.42	7	47	9	7	3	8	12	7	6	7	1	(1)	(1)
July	30.04	30.43	29.62	.81	63.1	72.2	54.1	18.1	95	46	49	70	4	.67	5	1.00	6	48	13	8	2	6	8	5	7	12	1	(1)	(1)
August	30.00	30.44	29.52	.92	63.1	72.0	54.3	17.7	92	46	46	72	5	.51	4	1.05	6	47	11	7	2	7	9	6	7	11	2	(1)	2
September	30.01	30.46	29.27	1.19	58.1	65.4	50.7	14.7	87	36	51	76	6	1.77	9	1.64	7	48	12	6	4	10	11	5	5	6	1	(1)	5
October	30.05	30.69	29.07	1.62	51.4	57.2	45.6	11.6	81	29	52	82	7	2.67	12	2.22	7	58	14	5	5	14	11	5	3	5	0	1	7
November	30.04	30.69	29.01	1.68	45.6	50.3	40.9	9.4	68	15	53	84	8	5.83	18	2.66	8	64	7	6	7	15	15	7	1	2	0	1	4
December	30.01	30.83	28.91	1.92	41.7	45.9	37.6	8.3	62	12	50	85	8	5.29	19	3.52	8	64	7	6	10	19	12	5	1	2	0	1	3
Mean	30.02				51.0	57.6	44.4	13.2				77	6				7												
Total														34.07	155				121	73	65	136	136	73	47	72	7	7	31

[1] Less than 1.

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