U.S. Army. Signal Corps.

ANNUAL REPORT, 1871/72

OF THE

CHIEF SIGNAL-OFFICER

TO

THE SECRETARY OF WAR

FOR

THE YEAR 1872.

c Oct. 1871 - Sept. 1872

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1872.

National Oceanic and Atmospheric Administration

Annual Report of the Chief Signal Officer, U.S. Army Signal Corps

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REPORT

OF

THE CHIEF SIGNAL-OFFICER.

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL OFFICER,
Washington, D. C., October 1, 1872.

SIR: The instruction of the Army in military signaling and telegraphy during the past year has been limited to that had at the Signal School of Instruction at Fort Whipple, Virginia, the Military Academy at West Point, and in the Department of the Missouri.

Irregular instruction has been given by partially instructed officers at isolated posts in other departments, but it has been of so imperfect a character that it cannot properly be taken into account in summing up the results of the year's labor. In this connection the Chief Signal-Officer desires to reiterate the views expressed in his annual report of last year, of the necessity of providing thoroughly instructed officers in the several military departments, who shall have charge of the duties of instruction connected with the signal-service, in these departments, subject to the direction of the Chief Signal-Officer. Until this plan is adopted the instruction must necessarily be given without thorough system or responsibility.

At Fort Whipple the course of study described in previous reports has been followed by such officers of the Army as have been ordered for instruction during the year. No change has been made in the text-books, except by the addition recently of a work on military telegraphy, prepared under the direction of this Office.

The number of officers instructed and the amount of field-practice had by each are shown in tables 1 and 2 herewith.

The drills of the detachment with arms have been thorough, and have been carefully conducted.

Practice has been had in field telegraphy and in the duties of the detachment, with the field telegraphic train; but it has been quite irregular owing to the want of animals for the train, and until recently of sufficient ground for the train maneuvering. The transfer of a portion of the Arlington reservation to the charge of this office has removed the latter obstacle. It is hoped that the necessary animals will be soon provided in order that this important branch of signal duty may receive the attention it deserves. Additional improvements in the several train-wagons are contemplated, to increase still more their efficiency.

The duties of the signal-service in the branch of military telegraphy have become so recognized in their importance wherever that armies are maintained or serve, that the Chief Signal-Officer does not longer feel it necessary to urge the advantage of a proper organization and practice of this duty. It is by constant effort only the service of the

United States will now be able to keep pace with its rapidly improving progress elsewhere, and, in case of war, to have within itself the nucleus on which to develop a military telegraphy fit for the uses for which it will then be certainly required; that the knowledge and skill had by the enables the service to be employed in many ways for the public benefit, in time of peace, has been sufficiently demonstrated.

A principal duty of the post has been in this year, as in the last, the drill and instruction of the observer-sergeants and the assistant observers, who are here fitted for the intelligent performance of their duties. All candidates for either of these positions are selected from the enlisted men of the signal detachment, for which, after careful examination, they have been first enlisted as privates, and in the duties of which they are regularly drilled. The soldiers seeking the positions of sergeants are required to present satisfactory recommendations as to conduct and general fitness from the officer in charge of the post, and to pass a second preliminary educational examination before they are placed under especial instruction. Classes are formed, and are supplied with the standard text-books on military signaling, telegraphy, and meteorology, and pursue a regular course of study and for recitation as marked out in these books. They are taught the practical use of the various meteorological instruments, forms, &c., in use at the several stations of observation, and station-duties generally, so far as they can be taught with the facilities of the post. They are practiced, at the same time with the rest of the detachment, in the regular drills and duties of the service. When a soldier is considered competent as an assistant, and has been so reported by the instructor at the post, he is ordered, as vacancies occur, as an assistant observer to a station. Here, in addition to perfecting himself in the practical details of the duties at the station, he continues his studies, reciting systematically to the observer-sergeant in charge. A service of six months in this capacity favorably reported upon renders an assistant eligible as a candidate for promotion. He may then be ordered back to the school to review thoroughly the whole course of study and practice, under the direction of the instructor, and to appear for an examination before a board of officers convened for the purpose. Passing this examination, he is considered competent to take charge of a station, and is promoted to the grade of observer-sergeant as vacancies occur. This course has been followed successfully during the past year. The fitness of each man has been clearly determined by this probationary service before his assignment to a responsible position. The total number of assistants instructed since last report is seventy-six (76). Thirty-seven (37) assistants have completed the full course of drills and study, and have passed the required examinations as observer-sergeants. The number of enlisted men examined for the position of assistant has been one hundred and seventy-eight (178). Fifty per cent. of the applicants have failed to come up to the standard of examination. (Tables 3 and 4.)

The instruction at Fort Whipple is under the immediate direction of First Lieutenant C. E. Kilbourne, acting signal-officer and instructor, who has devoted himself assiduously to the discharge of the duty, and by whom it has been well conducted.

Second Lieutenant C. C. Wolcott, acting signal-officer, was in charge until April 11, 1872, at which date he was succeeded by Lieutenant Kilbourne.

The fact that very few men reported for final examination have failed to pass successfully reflects credit upon both officers.

The experience of the Office has confirmed the views hitherto expressed, that the varied subordinate duties in its charge could be rendered by no other class of men so successfully as it is by those who, drilled and practiced as soldiers, continue in its service as non-commissioned officers, habits of fidelity and prompt obedience, with pride in their especial organization. The tests of good qualities, endurance, and capacity given by military discipline are hard ones, and those who have passed them approved rarely evidence that they have been defective. The experience had in the control of themselves and others in the regular and strict discharge of duty becomes invaluable when the charge of stations devolves upon either assistants or sergeants.

The board of examiners for assistant observers has consisted of Brevet Lieutenant Colonel Garrick Mallery and Brevet Captain H. W. Howgate, acting signal-officers. The board of examination for observer-sergeants has been constituted of these officers with the addition of the instructor, now First Lieutenant Charles E. Kilbourne, acting signal-officer. The sessions of both boards are held at this Office, that for assistants meeting weekly; that for observer-sergeants being convened by order whenever necessary.

The condition of Fort Whipple has been materially improved since the date of the last annual report, by the construction of a well appointed hospital, large enough for the present wants of the command.

The Secretary of War having ordered the construction of new quarters and a mess-hall for the men, a guard-house, and a stable at the post, these buildings are well advanced toward completion, and will be ready for occupation before the winter season opens. To obtain suitable space for the erection of these structures it was necessary to demolish a part of the fortifications, and this work has fallen heavily upon the detachment. Buildings are now urgently needed for officers' quarters and for purposes of instruction. Those now occupied are both inconvenient in size and dilapidated beyond repair, and it is recommended that suitable provision be made for the construction of others to replace them. Several changes were made in the immediate charge of the post prior to May 28, on which date First Lieutenant R. P. Strong, Fourth United States Artillery, and acting signal officer, was assigned to this duty. Under his energetic administration several important changes in the management of the post have been made, and the efficiency of the detachment has materially increased. The importance of the proper maintenance of Fort Whipple, well equipped as a post of instruction, can hardly be estimated. It is here alone, in the service of the United States, that either officer or enlisted man can be thoroughly taught the especial duties of the signal-service. At no other post or place is there the time or the facilities for the study and continued practice to properly qualify the officer to be an acting signal officer, nor can enlisted men be elsewhere drilled and practiced in all the branches of the service.

The morning report of Fort Whipple, on September 30, shows thirteen non-commissioned officers and ninety-six privates on duty at that post.

Instructions in military signaling and telegraphy have been given to a limited extent to the first and second classes of cadets at the Military Academy at West Point, but the reports received have not been sufficiently full to render a detailed report practicable. The recommendation made in previous reports, that this duty be made a special branch of instruction, with a merit value given to it affecting the standing of the cadets, is renewed. The fact that during the past year the military representatives of several foreign governments have made the signal-service of the United States Army a matter of especial study shows the importance attached to this branch of military science by those governments, and the necessity of constant work in this country to keep in advance of progress abroad.

The instruction in the Department of the Missouri has been regularly maintained, and the results show a commendable amount of energy on the part of the officers who have been in charge. Second Lieutenant V. A. Goddard, Sixth United States Cavalry, was assigned to duty as acting signal-officer of the department by the general commanding, relieved by the same authority March 27, 1872, and succeeded on that date by Second Lieutenant Philip Reade, Third United States Infantry, who still remains in charge. Neither of these officers has been regularly instructed at the school of instruction. Their labors have, however, been productive of good, by the general dissemination given a knowledge of the elements of signaling. In this department twenty-five officers are reported completely instructed, and eighty-two as partially instructed during the year, and fifty-nine enlisted men are reported as completely, and one hundred and fifty-four as partially instructed during the same period. The reports rendered by Lieutenant Reade are regular in form and promptly rendered, and the work in this department is in marked contrast to that of other military departments.

The purchase and issue of such signal equipments as have been needed in the different military departments have been made.

In connection with the instruction of the Army in the duties of this office, reference is made to papers A and B, herewith annexed, which have been issued in their present form during the year—the former for the first time, and the latter in a corrected and enlarged form.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

In the division of telegrams and reports for the benefit of commerce and agriculture, the service has continued upon the general plans and with the organization minutely explained in the last report. At each of the principal lake, sea-port, and river cities at which there are stations, the stations have been maintained during the year. The display of bulletin reports; of reports at the river stations, giving the rise and fall of the principal rivers; of the large weather maps, showing by changing symbols the meteoric changes at the different reports; and finally, at designated stations, the exhibition of day or night signals on occasions of supposed especial danger, have been regularly made. The reports have been lessened at some points by embarrassments beyond the control of the Office.

The following is a detailed account of the operations of each station from which reports have been had during the year ending September 30, 1872:

ALPENA, MICHIGAN.

The office is on the second floor of a three-story brick building at the corner of Fletcher and Dock streets, and is near the telegraph office from which the reports are sent. The roof of the building occupied is flat and covered with tin, and affords a good exposure for the wind-vane, anemometer, and rain-gauge.

The station was opened on the morning of September 10, 1872, since which date reports have been transmitted to Detroit, from which place they are sent to Washington, and distributed to the principal lake ports. The station is in charge of Sergeant F. P. Bayes, and is supplied with a full set of standard instruments, all of which are in good condition.

Latitude of station.. 45° 05′
Longitude of station.. 83° 30′
Elevation of barometer above sea-level........................ 616 feet.

The instrument shelter is built in accordance with the authorized plan of the Office, and projects from a window on the east side of the room. A northern exposure could not be had.

No reports are received at this station, and consequently no bulletins are issued.

AUGUSTA, GEORGIA.

[Latitude, 33° 28′; longitude, 81° 53′.]

The office at this station was removed, May 1, to the third floor of a large building on the corner of Broad and McIntosh streets. The removal was made upon the recommendation of the meteorological committee of the Board of Trade, to secure more room for the performance of the observer's duties, and to get a better location and exposure for the instruments. The station is provided with a large wind-vane of the standard Signal-Office pattern, and one of Gibbon's self-registering attachment to the Robinson anemometer, in addition to the usual supply of standard instruments. The shelter projects from a window, and is well arranged.

Sergeant James R. Allen was relieved from the charge of the station October 7, 1871, by Sergeant Nathan D. Lane, who still remains, and is assisted by Private Frank Mangels. Both men are favorably mentioned by the officer who inspected the station in March, 1872.

Full reports from all stations were received here, and bulletins issued regularly, until June 30, 1872. Since that date the only reports received have been those from the Western Gulf stations and Shreveport. Copies of these are regularly furnished the local press, and selections from them published. The probabilities issued from the central office in Washington, in the afternoon of each day, are received and published in the morning papers of the day following. During the year ending September 30, 1872, two thousand nine hund·ed and ninety-two bulletins have been issued, and nine hundred and four reports furnished to the press. All station reports have been forwarded with regularity and in satisfactory shape.

The following table shows the meteorological condition of the station during the year:

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October............	30.005	66	1.62	Southeast.
	November........	30.090	54	7.78	West.
	December........	30.230	47	4.98	Northwest.
1872..	January..........	30.160	41	5.20	Northwest.
	February........	30.000	46	5.87	West.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	March	30.090	50	10.88	Northwest.
	April	30.100	66	2.95	South.
	May	30.03	74	5.36	West.
	June	30.04	79	4.77	Southeast.
	July	30.05	81	6.87	South.
	August	30.07	80	4.10	East.
	September	30.08	75	1.33	West.
	Annual mean	30.089	63.3	61.75	West.

BALTIMORE, MARYLAND.

[Latitude, 39° 18′; longitude, 76° 36′.]

The location of the office at this station has remained unchanged since the date of last annual report, nor has any essential change been made in the exposure of instruments, or in instrument shelter. The anemometer has been provided with the standard self registering attachment, and is elevated upon the telescopic rod devised at the central office, to secure a proper exposure of the instrument and to free it from the influence of surrounding objects.

Full reports were received from all stations, and maps and bulletins issued regularly, until June 30, 1872. From that date until August 21 no reports were received, and the only work done at the station was the transmission of the local observations directly to Washington. On August 21 the circuit system was again resumed, and full reports received and published in bulletin form. Maps to the number of thirty daily are sent from the central office, and are distributed at 2 o'clock each afternoon. During the year four thousand one hundred and ninety-nine maps and three thousand one hundred and thirty-five bulletins have been issued, and three thousand two hundred and seventy reports furnished to the press. The papers generally publish the synopses and probabilities as received through the Associated Press, and most of them publish a part, at least, of the tabular report. The weekly summary of the weather, and the monthly statements of the range of instruments, are also published by the leading papers.

The Board of Trade has appointed a meteorological committee, and its secretary, Mr. George U. Porter, has manifested a decided interest in the service. Nine cautionary signals have been displayed at this station during the year, five of which were fully justified.

Sergeant H. J. Penrod has remained in charge during the year, and has performed his duties in a manner satisfactory to this Office. All reports have been forwarded promptly and regularly. Private Wagg, the assistant at the date of last report, was relieved, December 20, 1871, by Private William Theodovius, who remained until ordered in for promotion, July 9, 1872. Private Otto Schutze is now on duty as assistant.

The station was inspected April 3, 1872, and reported in good condition; instruments in fine order, and records neatly kept.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.150	59	3.11	Northwest.
	November	30.08	45	3.24	Northwest.
	December	30.14	33	1.90	Southwest.
1872..	January	30.09	35	.88	Northwest.
	February	30.02	36	1.46	Northwest.
	March	30.06	37	3.06	Northwest.
	April	30.09	56	3.06	West.
	May	30.01	68	1.44	Northwest.
	June	29.97	75	4.16	Southwest.
	July	29.978	81.2	1.58	Southwest.
	August	30.042	79.3	4.59	Southwest.
	September	30.048	69.5	5.06	North.
	Annual mean	30.057	52.2	33.54	Northwest.

BOSTON, MASSACHUSETTS.

[Latitude, 40° 20′; longitude, 71° 03′.]

The office at this station remains at 103 Court street, where it was located at the date of last report. Full reports were received from all stations until June 30, 1872, and bulletins and maps issued regularly. From that date to August 21 the only reports received were those from Burlington, Portland, and Mount Washington, which were here transferred to New York. Since August 21, twenty-two reports have been received and published daily. Other reports will be added from time to time, as the telegraphic facilities increase.

During the year, three thousand one hundred and twelve maps and three thousand eight hundred and eighty bulletins have been issued, and two thousand two hundred and forty-six press reports furnished to the daily newspapers. Tabular reports, monthly statements, and synopses and probabilities have been published regularly by the press, and a general interest manifested in the service.

Mr. Gaffield, chairman of the meteorological committee of the Board of Trade, has displayed marked interest in the condition of the station, and rendered the office valuable assistance.

The anemometer has been supplied with the telescopic rod for additional elevation, and also with the standard self-registering attachment. The other instruments remain as at last report, and are in good condition. Sergeant H. E. Cole is still in charge of the station, and has performed his duties to the satisfaction of this Office, and is favorably mentioned by the meteorological committee of the Board of Trade in their annual report. Private William Black has been on duty as assistant since October 23, 1871, and is reported faithful and intelligent in the performance of his duties. All reports have been forwarded regularly and in proper form. Fourteen cautionary signals have been displayed at this station during the year. In reference to one displayed November 14, 1871, the report of the meteorological committee of the Board of Trade states as follows:

The cautionary flag was displayed at 3.15 p. m., and all vessels regarded the caution and remained safely in port, except the Star of the East, whose captain ventured out and was obliged to put back, the predicted gale coming on with great fury at 12.10 a. m. of the next day. We need not add that one captain certainly will in future bear testimony to the value of the storm-signals, and will respect them implicitly.

In another part of the same report the committee make the following statement:

Captain Nash, commander of the underwriters' relief steamboat, told the chairman of your committee that he would never leave port with a vessel when the signal-officer predicted a coming dangerous storm or gale of wind. On one occasion, when the appearance of the sky to a superficial observer might seem quite threatening, Captain Nash, desiring to take a steamer out of port, applied to the signal-officer at Portland, and was assured that for twenty-four hours he would experience but light breezes, and a flurry of snow during the latter part of the time. Perfectly confiding in the signal-officer, he immediately left the port, proceeded for seventeen hours in almost perfect calm, then experienced the predicted flurry of snow, and reached his destination in safety.

The station was visited by an inspecting officer April 29, 1872, and found in proper condition.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.041	54.2	5.88	Northwest.
	November	29.932	39.8	6.42	Northwest.
	December	30.015	28.39	3.38	Northwest.
1872..	January	29.938	27.53	2.11	Northwest.
	February	29.930	28.55	2.31	Northwest.
	March	29.931	26.40	4.05	Northwest.
	April	29.996	46.31	1.31	Northwest.
	May	29.917	57.17	3.29	East.
	June	29.930	67.61	4.84	East.
	July	29.950	74.45	4.00	Northwest.
	August	30.003	71.8	10.68	West.
	September	30.001	63.8	6.04	Northwest.
	Annual mean	29.964	48.8	54.31	Northwest.

BRECKENRIDGE, MINNESOTA.

This station was opened April 10, 1872, by Sergeant C. A. Shaw, who still remains in charge. Reports are sent to Saint Paul, where they are transferred. No reports are received from other stations, and consequently no bulletins or maps are issued. The town is a small one, and the terminus of a branch of the Northern Pacific Railroad, and the office is located in a small frame building, where the instruments have a fair exposure. The instrument shelter is of the standard pattern, and was made at Saint Paul and shipped to this point.

Latitude of station .... 46° 16′
Longitude of station .... 96° 38′
Elevation of barometer above sea-level .... 1,069 feet.

The station is supplied with one barometer, one thermometer, one hygrometer, one anemometer, one rain-gauge, and one wind-vane, all of the standard pattern.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	April	29.999	41	....	Northwest.
	May	30.004	53	4.05	Southeast.
	June	29.920	65	5.10	Southeast.
	July	29.992	67.1	6.01	Southeast.
	August	30.023	65.1	1.78	Southeast.
	September	29.959	58.3	1.18	Southeast.
	Mean for 6 months.	29.983	58.2	18.12*	Southeast.

* For five months.

BUFFALO, NEW YORK.

[Latitude, 42° 53′; longitude, 78° 55′.]

No change has been made in the location of the office at this station since the date of the last annual report. Full reports from all other stations were received until June 30, 1872, and published in the customary manner in the form of maps, bulletins, and press reports. Owing to the want of telegraphic facilities, the transmission of reports to this station, in common with others on the lakes, was discontinued from July 1 to September 1, 1872. During this period the work of the station was limited to the transmission of the local reports and the transfer of those received from Canada, which are received here from Toronto. On the 1st of September the regular service was again resumed, and fifty reports are now received and published regularly. During the year, five thousand nine hundred and eighty-three bulletins and four thousand two hundred maps have been issued and distributed, and one thousand one hundred and ten reports furnished to the press for publication. The leading newspapers have published regularly the tabular reports, synopses, and probabilities, and weekly and monthly statements, and in other ways shown a desire to assist in the development of the service. The meteorological committee of the Board of Trade has assisted the observer in various ways, and its members manifest a lively interest in the work.

Twenty-five cautionary signals were displayed between October 29, 1871, and September 1, 1872, twenty of which are reported as having been fully justified. Under date of October 30, 1871, the observer reports:

Several vessels held in port during the day, although the wind did not exceed twenty miles per hour. The signal gave entire satisfaction, and may be considered a success.

November 10, 1871.—Signal for November 10, 1871, fully justified, and very generally regarded by mariners. A large number of vessels held in port until signal was lowered; gave entire satisfaction.

November 15, 1871.—An unknown amount of property, and perhaps a great many lives have been saved. The warning was given some fifteen hours before the full violence of the storm was felt at this station. It was heeded by all sailors, and no vessels left this port during its display. The storm was the most violent known on the lakes for years.

November 24, 1871.—Storm unusually severe; signal fully justified. No vessels left this port during its display.

September 25, 1872—This warning was generally observed; no vessels leaving during its display, except one schooner, which left on the morning of the 25th, but returned in a few hours, somewhat damaged. Among the lake men, it was regarded as a very good hit.

September 30, 1872—This cautionary was observed by all classes of mariners. No vessels left the harbor during the time it was displayed, although seven were ready to start on the morning of the 29th of September, and would have done so if the signal had not been hoisted. There is no doubt in the minds of all but that a great many lives and an immense amount of property were saved by this cautionary signal, as the gale was very severe.

In his semi-annual report to this office of January 1, 1872, the observer remarks: "Tug captains probably give the weather-reports more attention than any other class of marine men, and proved very advantageous to them in calculating where to look for vessels which are due or in distress. The press of the city shows every disposition to give the service publicity, and promote its interests;" and on July 1, he reports: "The liveliest interest is now manifested by all classes of citizens in the service, and the office is thronged daily by visitors, commercial men, pleasure-seekers, &c., and the weather reports are relied upon." * * * "The demand for the reports was so great at the opening of navigation that the number used had to be very much increased—the weather maps taking precedence of bulletins." * * * "The display of cautionary signals is lauded in every instance, and no sailor risks his craft on the lakes while the signal is flying."

Sergeant Allen Buell was in charge of the station until relieved July 17, 1872, by Sergeant William McElroy. Both men have shown themselves energetic and well qualified to perform their duties. Private John Clark was on duty as assistant until February 16, 1872, when he was replaced by Private Taylor, who still remains and has given satisfaction. The station was inspected in the latter part of July, and found in good condition.

In addition to the instruments named in last report, the station is provided with a large wind-vane of the standard pattern, and the telescopic rod and self-registering standard attachments to the anemometer

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.014	54.3	1.64	Southwest.
	November	29.997	34.7	3.60	Northwest.
	December	29.945	27.6	2.55	West.
1872..	January	29.965	26.4	1.94	West.
	February	29.940	25.7	2.21	West.
	March	29.968	27.2	1.30	West.
	April	29.950	45.7	1.43	Southwest.
	May	29.905	54.7	2.23	Southwest.
	June	29.894	66.3	3.52	Southwest.
	July	29.884	73.4	1.66	West.
	August	29.942	73.3	1.94	Southwest.
	September	29.921	64.6	4.34	Southwest.
	Annual mean	29.942	47.8	28.36	Southwest.

The winds considered dangerous to navigation at this station are those from the northwest, with a velocity of twenty-five miles per hour and upward, and from the southwest from twenty miles per hour and upward.

BURLINGTON, VERMONT.

[Latitude, 44° 29′; longitude, 73° 11′.]

The location of the office at this station has not been changed since the date of the last report, nor is a change considered desirable at present. Reports have been sent from the station without interruption during the year, but since July 1, 1872, none have been returned. Two thousand and twelve bulletins have been issued. No reports were furnished the press.

The station was inspected in May, 1872, and the instruments and office found in good order. A large wind-vane, of the standard pattern, has been added to the instruments on hand at last report.

Sergeant George H. Ellery has remained in charge during the year, and has forwarded all the reports promptly, and given general satisfaction.

Owing to the fact that this is a station of observation and report only, and does not receive reports from other stations, the citizens feel less interest in its operations than they otherwise would.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.033	47.7	2.75	South.
	November	29.995	26.7	.73	Northwest.
	December	29.972	24.5	.78	South.
1872..	January	29.984	16.3	.42	South.
	February	29.905	19.2	.13	South.
	March	29.840	17.7	.13	South.
	April	29.803	42.7	.73	South.
	May	29.900	54.7	3.59	South.
	June	29.908	66.0	3.66	South.
	July	29.883	71.8	7.27	South.
	August	29.965	70.4	9.70	South.
	September	29.979	60.8	3.38	South.
	Annual mean	29.931	43.2	33.27	South.

CAIRO, ILLINOIS.

[Latitude, 37° 00′; longitude, 89° 00′.]

The location of the office at this station remains unchanged. Previous to July 1, 1872, a sufficient number of reports were received to enable the observer to issue a map each morning, and the bulletins three times daily, but since that date the only reports received have been from the river stations in the afternoon, and but one bulletin is therefore issued. The total number of maps issued during the year is one thousand one hundred and fifty-two; of bulletins, four thousand one hundred and eighty-eight, and three hundred and sixty-six reports furnished the press.

On the 1st of January the observer began to make regular daily observations of the rise and fall of the Ohio River, using for that purpose the gauge constructed by the United States Engineer Corps. These observations have been sent with each regular afternoon telegraphic report, and distributed with that report to all the principal cities on the western rivers.

The station has been inspected twice during the period covered by this report—once in November, 1871, and again in August, 1872. At the first inspection several of the instruments were found improperly located, and suitable changes were made. At the second inspection, the station was found in good working order.

Sergeant Thomas L. Watson has been in charge during the year, assisted by Private James M. Watson. Both men are favorably mentioned for their intelligence by the inspecting officers, and all the telegraphic reports from the station have been regularly transmitted; some delay has occurred in forwarding the mail reports.

The anemometer is provided with the standard self-registering attachment, and the small wind-vane on hand at last report has been replaced by a large one of the standard pattern.

The inspecting officer reports as follows, in reference to the interest taken in the service:

The citizens take a great interest in the weather service, and visit the office and the places where the maps and bulletins are posted daily, when the reports are received. The river reports are particularly valuable, and are studied with as much interest and profit as the market reports.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.122	60.3	3.81	Southeast.
	November	30.130	43.9	2.93	Northeast.
	December	30.230	34.5	4.25	Northwest.
1872..	January	30.270	31.3	1.44	West.
	February	30.063	37.9	2.26	North.
	March	30.150	43.4	2.02	Northwest
	April	30.049	61.4	4.52	Southeast.
	May	30.054	68.7	5.00	Southwest.
	June	30.042	75.7	1.79	Southwest.
	July	30.028	79.8	3.45	South.
	August	30.079	80.2	.19	North.
	September	30.061	70.7	2.56	South.
	Annual mean	30.107	57.3	34.22	Southerly.

Extracts from observer's journal, February 9, 1872.—Slight shock of earthquake between four and five o'clock a. m., lasting about ten seconds; calm nearly all day with the exception of light north and west winds.

March 31, 1872.—The winter just passed is generally conceded to have been the severest in many years at this place, and has been chiefly distinguished by the remarkable and continued low stage of water in the rivers, and the frequency and severity of the "cold snaps" and the backwardness of spring. The blooming of peach-trees, just coming on during the last days of March, took place in the middle of February in the preceding year.

CAPE MAY, NEW JERSEY.

[Latitude, 39°, 00′; longitude, 74° 58′.]

No change has been made in the location of the office at this station, nor is any considered desirable at present. No reports are received here, the station being used for observation and report and the display of cautionary signals only. Of the signals, twenty-two were displayed between October 28, 1871, and September 1, 1872, with satisfactory results. No bulletins, maps, or press reports have been issued. The station was inspected in April, 1872, and some irregularities in the manner of keeping and exposing the instruments corrected.

Sergeant T. F. Townsend remains in charge, and has given satisfaction by the promptness with which his reports have been forwarded and the neatness of his official papers. Since July 1, 1872, the midnight reports have not been forwarded until the succeeding morning, the telegraph office closing before the hour of making the observation. The transmission of the midnight cautionary signal orders is from the same cause rendered impossible.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing winds.
				Inches.	
1871..	October	30.15	59	4.91	South.
	November	30.04	43	6.42	Northwest.
	December	30.12	30	2.90	Northwest.
1872..	January	30.08	31.5	2.99	Northwest.
	February	30.01	31.7	2.99	Northwest.
	March	30.034	36.1	6.61	Northwest.
	April	30.070	48	.92	South.
	May	29.985	59.1	1.50	South.
	June	30.000	66.8	2.15	South.
	July	29.980	75.1	3.27	South.
	August	30.047	73.1	3.09	South.
	September	30.046	67.4	4.51	Northwest.
	Annual mean	30.047	51.8	42.26	Northwest and south.

CHARLESTON, SOUTH CAROLINA.

[Latitude, 32° 45′; longitude, 79° 57′.]

The location of the office at this station remains unchanged. Full reports from all stations were received here until June 30, 1872, when their transmission was discontinued, owing to the want of proper telegraphic facilities. The reports from this station have been sent without interruption to the central office. During the year two thousand seven hundred and ninety-seven bulletins have been issued, and five hundred and eighty-six reports furnished to the press. No maps were printed at this station. The afternoon synopses and probabilities is the only one received here, and is printed in the morning papers of the succeeding day. The monthly summaries are published regularly. During the year four cautionary signals were displayed, two of which were fully justified, and the others partially so.

The station was inspected for the first time in July, and found to be in good general condition. Some slight irregularities in the exposure and care of instruments, and in the manner of keeping official records, were noted and corrected. This station is supplied with the large standard wind-vane, and with the telescopic rod and standard self-registering attachment for the anemometer.

Sergeant J. E. Evans remains in charge and has performed his duties satisfactorily. The inspecting officer remarks in his report upon the station:

The sergeant in charge is a faithful and intelligent man, and very zealous in the performance of his duties, with which he seems thoroughly acquainted. The station generally is in better working order than any I have visited. Both he and his assistant are spoken of in high terms by the presidents of the Board of Trade and Chamber of Commerce, and by the members of the meteorological committees.

Private J. O'Dowd was on duty as assistant until called in for promotion, April 22, 1872. He was succeeded by Private Sidney Powell, who still remains. In reference to the interest felt by the citizens in the service, the inspecting officer says:

The cotton interested portion of the community, perhaps more than any other class, take especial interest in the reports. Mr. Ottin, a leading cotton-broker, states that he has been governed to a great extent in his investments by the weather reports. Mr. Trenholm, ex-president of the Board of Trade, states that there is a general demand among cotton-growers for more stations in their respective districts, to the end that, if possible, the laws which govern the local rain-storms in those parts might be more fully comprehended, and the character and approach of such storms, which greatly influence the season, foretold with more certainty. The agricultural, even more than the mercantile, population in this section is interested in the state of the weather.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.130	69	4.76	Northeast.
	November	30.06	59	4.09	Northeast.
	December	30.19	49	3.67	Southwest.
1872..	January	30.13	45	3.78	Northwest.
	February	29.994	48.5	5.13	Northwest.
	March	30.070	51	9.78	Southwest.
	April	30.111	65.6	2.46	East.
	May	30.023	74.9	6.30	Southwest.
	June	30.045	79.7	1.87	Southwest.
	July	30.056	84.1	2.30	Southwest.
	August	30.055	81.8	7.81	South.
	September	30.053	77.8	7.88	Southwest.
	Annual mean	30.076	65.5	58.83	Southwest.

CHEYENNE, WYOMING TERRITORY.

[Latitude, 41° 12′; longitude, 104° 42′.]

The office at this station was removed February 20, 1872, to the upper story of the building at the corner of Ferguson and Sixteenth streets, where it still remains. The shelter projects from a window, and is of the standard pattern. The exposure of the wind-vane, anemometer, and rain-gauge, on the roof of the building is good. Reports from ten stations were received here, and published in the authorized manner until June 30, 1872, when the failure of the telegraph company to carry out the plan of the Signal-Office caused their suspension. Arrangements were made, however, with another company to transmit the reports, and since September 1, 1872, the same number have been received as before the interruption. Reports from Denver and Santa Fé are received here and transferred to Chicago.

During the year eight hundred and forty-eight bulletins have been issued, and one hundred and sixty-two reports furnished the press.

Since January 1 the Cheyenne Leader has published daily a synopsis of the report immediately preceding the hour of publication. No maps are issued at this station.

The anemometer is provided with the standard self-registering attachment, and a standard wind-vane of the large size is in use. Sergeant A. C. Dobbins is still in charge of the station, and has conducted it since its establishment without an assistant, and without missing a single report. All reports have been forwarded punctually and in creditable form.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.419	46.0	.24	West.
	November	29.384	28.9	.66	Northwest.
	December	29.418	28.0	.16	West.
1872..	January	29.929	26.6	.02	Northwest.
	February	29.859	30.9	.27	West.
	March	29.917	33.0	.38	Northwest.
	April	29.876	38.3	1.61	West.
	May	29.990	52.0	1.99	North.
	June	30.041	61.5	1.84	West.
	July	30.098	64.5	3.90	West.
	August	30.116	65.1	2.05	West.
	September	30.038	55.6	1.03	Northwest.
	Annual mean	29.840	44.2	14.15	West.

CHICAGO, ILLINOIS.

[Latitude, 41° 52′; longitude, 87° 35′.]

The great fire of October 8, 1871, destroyed the office and instruments at this station, and it was not until the 14th that a new location was obtained, with great difficulty, at No. 10 West Randolph street. In regard to the fire the observer, in his journal for October, 1871, says:

October 16, 1871.—Took possession of new office, No. 10 West Randolph street, yesterday. Have been without records from October 8 until to-day, everything official having been destroyed by the great fire, October 8 and 9. The observation at 10.53 p. m., October 8, was taken and transmitted as usual. At half past 9 an alarm of fire was rung. There had been a very large fire the preceding night, which was subdued with difficulty. The weather was intensely dry, and the wind blowing from the south-southwest with a velocity of about twenty miles per hour. Accordingly, when by 10 o'clock p. m. the fire had increased instead of diminishing, many people turned out to see it, not from alarm, but simply for the sake of the spectacle. At 10.30 the fire was still confined to two blocks, with a strong hold of only one. The firemen at this time seemed to have a fair chance of checking it, still the burning was so great as to enable one, by the light of it, to read the time on the city clock, one-and-a-half miles distant. The wind was carrying the sparks right through the center of the city, the line lying only two blocks west of the city hall. Still no one felt alarmed, except those in the immediate vicinity. I myself was present, and had seen the much larger fire of the preceding night checked by the river. By 12 p. m. the fire had increased considerably in area and intensity, but as the wind was south-southwest, and the river ran due north and south, there seemed as yet but little danger for anything beyond the river. Hitherto the fire had been propagated, and with no great velocity, merely by contact with the flames, but toward 1 a. m. the heat of the fire had become so intense as greatly to increase the power of the wind in the immediate neighborhood of the flames. This was especially the case on the east and west of the fire toward the front, the wind blowing straight toward the fire in all directions. Within forty yards of the blaze I estimated the wind blowing from the east toward it at thirty miles per hour. This caused a decided whirling motion in the column of flame and smoke, which was contrary to the hands of a watch.

Blazing pieces of timber of considerable size were now whirled aloft, and carried to the north-northeast, starting new fires as they fell. These new fires being in the line of the smoke were invisible to those at the old fire. One of the fires was on the east side of the river, only a few blocks from the court-house. By 2 o'clock the court-house, with all the beautiful buildings around it, was in flames. The conflagration was now proceeding in the line of the wind as fast as a man could walk. By 3 a. m. the water-works, two miles to the northeast of the court-house, were burned. The city having been thus divided in two by a sheet of flame, the fire continued to work its way more leisurely to the east and west at right angles to the wind, as well as right in the teeth of it. The fire on the night of the 7th alone saved the West Division. It had burned two blocks in breadth down the west side of the river. The fire on the 8th originated only a few blocks further south, hence it could not progress north for want of material. On the east side of the river, in the south division, the fire continued to work toward the east; this it did with the greatest rapidity at the southern limit of the conflagration, because there the unburned houses broke the wind, and caused a back current at the base of the buildings. As soon as the fire had thus got a new swath of houses before it, and the wind behind it, away it went tearing, thus sadly surprising many who were congratulating themselves because the first rush of flame had spared them.

The Tribune people thought the strength of their building had saved them, because it lay at the extremity of one of the swaths. The next one took it. In the north division the first rush of the fire reached the lake, and then worked its way westward to the river. This it did not accomplish before 12 noon on the 9th. The wind had by 9 a. m. increased to perhaps twenty-five miles per hour, at the distance of three miles to the southwest of the fire. In the immediate vicinity of it, and especially in the streets running east and west, it was blowing with the force of a hurricane, lifting up on the north side whole burning wooden buildings and pitching them on the tops of others. The wind, blowing in all directions toward the fire, confused some people in their endeavors to escape. This also caused the fire to progress along the tops of the buildings before the wind, and along the bases against the wind. The heat was intense. The buildings in front and at the sides of the fire began first to smoke from the heat radiating from the burning. Then, in many cases, without waiting for a tongue of flame to touch them, they would all at once burst into a blaze. To talk of fire-proof buildings in the midst of such a furnace is absurd. Steel was melted in innumerable cases, and stones and brick were burned to powder.

The firemen at first endeavored to check the fire in front. As soon as the fire had gathered in force this was not even to be thought of; not a single drop of water could reach the fire. The wind swept it aloft; besides, the firemen had to lookout. Several of the engines which went to the front at first got burnt; others made futile efforts along the side of the fire, playing at right-angles to the wind. The fire ate in behind them, and they had to run. I saw several engines before the water stopped, doing nothing. At length they saw what they could do, and confined themselves to that. Letting the fire have free scope to the north and east, they endeavored to prevent it from spreading south against the wind. In this they succeeded, cutting it off just as it was preparing to lay hold of immense piles of lumber which lay along the river. This was done about 3 a. m. Monday. The efforts of the firemen, lamed for want of water, were ably seconded by gunpowder in the forenoon in the southern division. The same agent had been employed to check the northward progress of the fire, but in vain. Toward noon the further progress of the fire southward was thus checked. In the northern division it had reached its limits about the same time, having burnt everything that would burn, out as far as Lincoln Park, about four miles from the court-house.

The loss of life was greatest along the path of the first rush of fire; it came so sudden and unexpected. Only those who died in the streets have been recovered. The very bones of those who were in the buildings would be burned.

The observation-office lay right in the path along which the conflagration mowed its first swath, from the southwest through the center of the city to the northwest. I went to the scene of the fire between 10 and 11 p. m., and did not think of the danger until too late. Kaufman was on duty, and saved the most valuable of the instruments, but only for a time. He carried them to his lodgings, which lay nearer the lake, and returned to find all the buildings around the office in a blaze. Thinking himself safe, he went back to his lodgings and went to sleep, and awoke in time to find the flames just upon him. Snatching his trunk, he escaped to the lake. Many trunks were lying there in flames, and he pitched his into the water. It might have been possible to have saved everything by procuring a vehicle at first; but vehicles were scarcely to be had. A jeweler, only a block from the observation-office, is said to have offered a thousand dollars for one in vain.

At 10 a. m. Monday I endeavored to find a telegraph-office, but could not; neither could I find a post-office. I wrote a letter and posted it in a letter-box. Early on the 10th I met an operator, who informed me where to find the telegraph-office; sent off a message, and left my address both at the post-office and telegraph-office; everything in confusion, and something like the fabled "state of nature" introduced. Citizens attacked with a supposititious incendiary mania; dangerous to go behind a house for any purpose. Found Kaufman.

On the 11th, waited; Sergeant Downes arrived.

On the 12th, found Sergeant Downes; reports sent in the afternoon.

On the 13th, endeavored to find a room of some sort; found that the price of rooms had trebled and quadrupled, especially in houses of any pretension.

On the 14th, there was a considerable rain-fall, perhaps an inch; still continued in search after an office. An idea of the dearth of rooms may be obtained from the fact that when we sought to rent a room in Briggs' House, which has a very suitable roof, the proprietor informed us that he would be very happy to accommodate us, but that in the smallest of his rooms he had six persons sleeping at four dollars a head. Finally, for lack of a better, rented present office, No. 10 West Randolph street.

To-day, the 16th, the observations have been taken as usual, all except the velocity of the wind. We have no watches, and have sought in vain to procure a sand-glass.

October 17.—The secretary of the board of trade desires that the reports be bulletined as usual in the extemporized hall.

October 18.—Professor Lapham and Colonel Stone to-day visited the office. Colonel Stone, in fleeing from the fire, had his blanket burned on his back. Professor Lapham promised a table of corrections.

October 20.—Obtained a table of barometrical corrections for altitude from Professor Lapham.

October 23.—Commenced bulletining as usual. The Board of Trade meets in a low hall, hastily prepared; it is exceedingly crowded.

Instruments were sent from the central office immediately upon receipt of the telegraphic announcement of the disaster, but did not reach the observer until the 12th, upon which date reports were resumed and continued without further interruption, so far as sending was concerned, although it was some days afterward before full reports were received regularly, owing to the crowded condition of the telegraph lines leading into the city. A flag-staff for the display of cautionary signals was erected with as little delay as practicable, and a new printing-press for the issue of weather-maps sent from New York. The office was removed June 11, 1872, to No. 80 South Market street, where a room was leased for one year, with the privilege of renewal. The location was as good as could be obtained in view of the unsettled condition of affairs in the city at the time of its occupation, but recent changes in the telegraphic arrangements of the office have rendered it unsuitable, and a removal will be necessary at an early date. The present exposure of instruments on the roof is excellent, and the location is a favorable one for the display of signals. The large wind-vane, rain-gauge, and anemometer are on the roof, the latter instrument being elevated on a telescopic rod, and provided with the standard self-registering attachment. The instrument-shelter is of the standard pattern, and projects from a window facing the north, and contains a full supply of instruments. During the year there have been issued four thousand six hundred and five bulletins, and seven thousand eight hundred and fifty-four maps, and five thousand and twenty-three reports have been furnished to the press. Previous to the fire, the leading papers published full tabular reports, but since that time they only appear occasionally.

The probabilities appear regularly when received; but, unfortunately, the midnight ones are sent very irregularly from New York, and the morning papers are compelled to use those issued the previous afternoon. Full reports were received here until June 30, 1872; from that date until July 29, 1872, the only ones received were those from the west, northwest, and southwest, which were collected here and transferred to the central office, *via* New York. From July 29, 1872, until September 1, full reports from all stations were received at midnight, New York sending all not obtained from other sources, and the map was printed during the night, containing, in addition to the reports in full, the afternoon probabilities of the previous day. This map was ready for issue at daylight, and was distributed freely throughout the principal business portions of the city. Since September 1, full reports are received three times each day, but the morning ones come in so late that the publication of the midnight map is continued. As soon as the change to the morning issue can be made without prejudice to the public interests it will be done.

The station was inspected in August, and office and instruments found in good condition. The inspector reports that the observer in charge, Sergeant Theodore Mosher, is "an intelligent man, and a zealous and experienced observer." He took charge of the station July 17, 1872, relieving Sergeant Mackintosh, transferred to Cleveland on that date. At present there are three assistants on duty there, the nature and amount of work done requiring that number. The reports are received at four different telegraph-offices, widely separated from each other, and their collection from these offices is a work of much difficulty, and at night not wholly free from personal risk. Arrangements are in progress for the consolidation of the several telegraph-offices, so far as United States business is concerned, and it is hoped they will prove successful.

Twenty-nine cautionary signals were displayed at this station from October 29, 1871, to September 1, 1872, twenty of which are reported as fully justified. As to known benefits or injury to commercial or other interests resulting from the display of signals, the observer at this point reports as follows:

November 13, 1871.—Several ships staid in harbor and escaped the gale.

November 18, 1871.—Many vessels staid in harbor; even persons delayed visits to distant points.

November 28, 1871.—A large number of vessels remained in port. The signal was justified by the heavy sea and the cold.

April 11, 1872.—A severe storm which wrecked several vessels Chicago-bound; vessels in this port did not put out.

April 29, 1872.—A number of vessels delayed their departure.

September 28, 1872.—This storm is said to have been one of the most severe ever experienced on Lake Michigan. The schooner Francis Bleniman, grain-loaded for the lower lakes, endeavored, while the signal was flying, to clear the harbor, but struck bottom, became unmanageable, and grounded hard on the bar. A tug was sent to her assistance, and had a sailor washed overboard and drowned.

September 30, 1872.—Several vessels delayed their departure on account of the warning given.

The inspecting officer reports that much public interest is manifested in the service, and that the members of the meteorological committee have rendered valuable assistance in various ways, both before and since the fire. A desire is expressed by the president of the Board of Trade to have the office rendered more easily accessible to the general visitor than at present, and substantial assistance to accomplish this is promised at an early date.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	(*)			
	November	30.099	35	3.62	Northwest.
	December	30.099	20	3.44	West-southwest.
1872..	January	30.108	23.2	.68	Southwest.
	February	30.051	25.3	.84	Northeast.
	March	30.107	28.3	3.78	Northwest.
	April	29.983	47.9	3.03	Southwest.
	May	29.978	56.1	2.76	North.
	June	29.951	69.5	3.45	Southwest.
	July	29.969	72.8	3.09	Southwest.
	August	30.030	72.0	2.59	Southwest.
	September	29.912	64.0	6.43	Southwest.
	Mean for 11 months.	30.026	46.7	33.71	Southwest.

* Office destroyed by fire. No records.

CINCINNATI, OHIO.

[Latitude, 39° 06′; longitude, 84° 30′.]

No change has been made in the location of this office during the year, nor is any change considered desirable at present. The station is supplied with a large standard wind-vane and with the telescopic rod and ssandard self-registering attachment for the anemometer, in addition to instruments on hand at last report. A morning edition of the weather-map was printed and issued regularly until June 30, 1872, when the issue was suspended on account of the failure to receive a sufficient number of reports. From that date until August 21, river reports were received from sixteen stations, each afternoon, and published regularly. Since August 21, twenty reports have been received three times each day. During the exposition, which opened September 3, 1872, a full midnight report was received from all stations, and a map issued in time for early distribution each morning. In addition to the detailed reports, the map contained the midnight probabilities, which were sent direct from the central office. Reports from the South are transferred at this station to Chicago and Washington.

Six thousand three hundred and fifty-six bulletins and five thousand eight hundred and ninety-eight maps have been issued, and two thousand and sixty-seven reports furnished the press. The newspapers at this station have taken a lively interest in the service, and have devoted a generous amount of space to the publication of reports. While full reports were received, the Commercial gave each morning a full table containing the reports of the afternoon and midnight previous. It also gave the river reports and probabilites regularly. The Gazette gave the full midnight report, river report, and probabilities; and the Times and Chronicle, the morning report and morning probabilities. Since the interruption of reports in June, these papers have issued the river reports and probabilities and the monthly statements prepared by the observer.

The station was inspected twice during the year, and the office and instruments found in good condition. During the last inspection reports were made by the president of the Board of Trade and the chairman of the meteorological committee affecting the character of the observer, which led to his immediate relief and ultimate discharge from the service.

Sergeant F. B. Lloyd was in charge until relieved April 3, 1872, when his assistant, Private E. F. Maynard, was promoted to the grade of sergeant, and placed in charge. Sergeant Maynard has conducted the station in a satisfactory manner, rendering all reports promptly, and discharging his duties with marked intelligence and zeal. Two assistants have been kept permanently at the station, and during the month of September an additional one was supplied, in view of the increased amount of work required to supply the necessary number of maps and bulletins. All of them are reported as having performed their duties satisfactorily.

The river reports are regularly made, the observations being made from the standard gauge erected by the city at the water-works.

Mr. Davis, the chairman of the meteorological committee of the Chamber of Commerce, is deeply interested in the service, and gives his personal attention to the station, with the view of rendering such assistance as may be necessary from time to time.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.152	60	1.80	East-southeast.
	November	30.135	48	4.18	Southeast.
	December	30.208	33	3.27	South-southwest.
1872..	January	30.218	31	.60	South-southeast.
	February	30.082	36	1.67	East-northeast.
	March	30.149	37.6	1.47	South.
	April	30.080	57.8	5.14	Southeast.
	May	30.048	67	4.70	West.
	June	30.042	75	3.81	Southwest.
	July	30.025	80.1	7.01	Southwest.
	August	30.092	78.6	2.21	South.
	September	30.072	66.1	1.62	South.
	Annual mean	30.109	55.9	37.48	Southeast.

The observer at this station has taken unusual pains in the preparation of his monthly statements for publication, and has thereby made them of special value for future reference.

CLEVELAND, OHIO.

[Latitude, 41° 30′; longitude, 81° 36′.]

No change has been made in the location of the office at this station, nor has it been inspected since the date of last report. The condition of the instruments and office is reported good by the observer. The station is supplied with a large standard wind-vane, and with the telescopic rod and standard self-registering attachment to the anemometer.

Full reports from all stations were received and published until June 30, 1872. From that date until September 1, none were received. Since September 1, fifty-two reports were received, but not with sufficient regularity to make them of value. It is hoped, however, that the telegraphic facilities will be increased in a short time, so as to insure satisfactory work at this station.

During the year, four thousand six hundred and seventy-one bulletins and one thousand five hundred and sixty-five maps have been issued, and three thousand and eighty-three reports furnished the press. But little use was made of the press reports, as the papers only published them at rare intervals. All the principal dailies, however, publish the probabilities when received.

Sergeant Theodore Mosher was in charge of station until transferred to Chicago, July 17, 1872. He was succeeded by Sergeant James Mackintosh. Both men have given entire satisfaction, and have rendered their reports promptly and neatly. Private Craig, the assistant at date of last report, was relieved for misconduct, February 12, 1872, and succeeded by Private E. Moran, who still remains.

Twenty-seven cautionary signals were displayed between October 23, 1871, and September 1, 1872. Upon the result of the several displays, the observer reports as follows:

October 30, 1871.—Steamer Benton, Captain McGregor, and several sailing-vessels remained in port on account of the signal flying.

November 1, 1871.—Steamer Meteor, Captain Wilson, remained in port until 9 a. m., when she went out while the signal was still up, but had to return. A number of sailing-vessels also remained in on account of the warning.

November 16, 1871.—Schooner H. C. Williams, Captain Fuller, saw signal being hoisted, but left port. She was obliged to put back about 7 p. m., and in endeavoring to enter the harbor, struck against the pier and went down, one of the crew being drowned. A number of steamers, schooners, &c., staid in on acccount of the warning given.

November 19, 1871.—Two schooners and one brig remained in port on account of signal flying.

December 4, 1871.—Severe storm; no damage reported.

December 6, 1871.—Very heavy wind, blowing in heavy gusts.

April 4, 1872.—The schooners Wanderer and Traveler, which were just leaving port, returned and staid in on account of the warning, and thus escaped the gale.

The observer reports that he is frequently called upon by sailors and others for information, and that many of them bring aneroid barometers to his office for adjustment and comparison.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.04	55.0	.60	Southeast.
	November	30.03	37.0	2.42	Northwest.
	December	30.00	26.3	.84	Southwest.
1872..	January	30.06	25.0	2.00	Southwest.
	February	30.02	25.0	.80	Northeast.
	March	30.074	28.3	1.30	Northwest.
	April	30.018	49.3	2.22	Southeast.
	May	29.966	58.4	3.99	Southeast.
	June	29.953	69.0	2.68	Southwest.
	July	29.968	73.9	6.19	Northwest.
	August	30.029	73.7	4.53	Northwest.
	September	29.984	64.9	3.47	Southeast.
	Annual mean	30.012	48.8	31.04	Southerly.

The winds considered dangerous at this station, by sailors, are those from the northeast, north, and northwest, especially the latter, with a velocity of twenty miles and upward per hour. Southeasterly winds are not considered dangerous, unless accompanied by snow and fog.

CORINNE, UTAH.

[Latitude, 41° 30′; longitude, 112° 18′.]

No change has been made in the location of the office at this station. Reports from ten stations have been received here, except during the period from June 30 to September 1, 1872, when the only ones received were those from Fort Benton and Virginia City, which are regularly transferred here to Chicago.

Six hundred and twenty-three bulletins have been issued during the year, and two hundred and thirty-one reports furnished the local paper. A large wind-vane has been erected on a substantial platform since last report; but other than this, the instruments remain the same, and are reported in good condition.

Sergeant William McElroy was in charge of station until July 17, 1872, when he was transferred to Buffalo, and was succeeded by Sergeant S. W. Beall. All reports have been forwarded promptly and in proper form, and the duties of the station performed satisfactorily.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.936	44.0	.35	North.
	November	29.859	34.4	3.22	Northeast.
	December	29.944	30.4	4.04	Southwest.
1872..	January	30.183	26.6	.70	North.
	February	30.031	34.5	2.42	North-northeast.
	March	30.033	40.5	.55	Northwest.
	April	29.945	45.6	1.43	North.
	May	29.985	58.4	2.66	Northwest.
	June	29.993	69.0	.47	South.
	July	30.012	75.0	.11	North.
	August	30.039	72.3	1.04	North-northwest.
	September	30.073	59.9	.14	North.
	Annual mean	30.003	49.2	17.13	North.

DAVENPORT, IOWA.

[Latitude, 41° 30′; longitude, 90° 36′.

The location of the office has not been changed during the year, nor is a change considered desirable, as it is in the business center of the city. Reports from twenty-five stations were received daily until July 1, 1872. From that date nothing was received except the river reports from sixteen stations each afternoon, until August 21, when a circuit was arranged from Chicago to Saint Louis, passing through this station, by which means it was to be supplied regularly with twenty-five reports. Up to the present date the telegraphic service at the station has been very unreliable, but there is a reasonable prospect of speedy improvement in this respect.

During the year two thousand six hundred and five bulletins have been issued, and six hundred and seventy-five reports furnished the press. The leading papers publish the river reports, the probabilities, and the monthly statements regularly, and the tabular reports occasionally. No maps have been issued.

The station has been twice inspected since the date of last annual report, once in December, 1871, and again in August, 1872. At the first inspection the office, instruments, and records were found in excellent condition. At the second one numerous irregularities were discovered and corrected.

Sergeant George H. Richmond was in charge of station until relieved on account of ill-health, February 3, 1872. He was succeeded by Sergeant D. S. Pullen, who remained until relieved for misconduct, June 8, 1872, and since that date Sergeant Max Marix has been in charge. Reports are now forwarded promptly and neatly. In reference to the character of the observer, the inspecting officer remarks:

> The sergeant in charge of this station is an industrious and steady man, and is well spoken of by the secretary of the Board of Trade. He has had much to contend with on account of the bad name the office had obtained from his immediate predecessor, and also much back work to do chargeable to the same account.

Private E. Lloyd was the assistant until called in for promotion, February 10, 1872. Two other men were sent and relieved in rapid succession, on account of ill-health. The present assistant, Private W. D. Wright, has been on duty since June 1, and gives satisfaction.

River reports are made from this station, the gauge used being one constructed by the United States Engineer Corps. The anemometer is provided with the standard self-registering attachment. All instruments are reported to be in good condition. A large wind-vane has been erected since last report, which indicates the direction of the wind upon the ceiling of the office-room, in the authorized manner.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.050	54.4	3.19	Southwest.
	November	30.132	33.6	3.33	East-northeast.
	December	30.173	20.5	1.61	West-southwest.
1872..	January	30.176	23.0	.13	West-southwest.
	February	30.070	27.8	.10	Northeast.
	March	30.120	33.3	1.82	Northwest.
	April	29.967	50.9	5.06	Southwest.
	May	29.978	61.5	4.46	Northwest.
	June	29.966	73.2	3.78	Southwest.
	July	29.982	76.3	3.80	Northwest.
	August	30.051	74.6	8.91	Southwest.
	September	29.978	64.6	5.30	Southwest.
	Annual mean	30.054	49.5	41.49	Southwest.

DENVER, COLORADO.

The office is located on G street, near Larimer, in the business part of the city, but, as the rent is high, the observer has been ordered to remove as soon as a more suitable location can be obtained. The wind-vane, (small pattern,) anemometer, and rain-gauge are well-exposed on the roof of building, and the shelter is of the authorized form. The station has not been visited by an inspecting officer. It was established by Sergeant Henry Fenton, and reports commenced November 20, 1871, and have been sent regularly since that date, with the exception of the midnight and morning reports since July 1, 1872, delayed on account of telegraph office being closed.

The station is supplied with one barometer, (Green's standard,) one thermometer, one hygrometer, one Robinson anemometer, one wind-vane, one rain-gauge, one maximum and one minimum thermometer, all in good condition, except the last-named, which is broken.

During the year one thousand and twenty-six bulletins have been issued, and one hundred and thirty-five reports furnished the press.

Latitude of station .... 39° 44′
Longitude .... 104° 58′
Elevation of barometer above sea-level .... 5, 267 feet.

There is no assistant at the station, and no reports are received from other stations.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rain-fall.	Prevailing wind.
				Inches.	
1871..	October	....	....	....	
	November	29.706	23.4	....	South.
	December	29.788	29.2	....	South.
1872..	January	30.027	23.8	.55	South.
	February	29.891	33.7	.22	South.
	March	29.959	36.2	1.71	South.
	April	29.889	46.1	2.09	North.
	May	30.009	57.7	3.74	North.
	June	30.049	67.2	2.07	South.
	July	30.101	69.3	2.69	South.
	August	30.124	69.8	1.65	South.
	September	30.066	60.1	1.57	South.
	Mean for 11 months	29.964	47.0	16.29*	South.

* Amount for nine months.

DETROIT, MICHIGAN.

[Latitude, 42° 18′; longitude, 83° 00′.]

No change has been made in the location of the office at this station, nor is any considered necessary at present. Full reports were received until June 30, 1872, and published in the usual manner. From that date until September 1 the only reports received were those from Grand Haven. Since September 1 fifty-two reports have been received three times each day when the telegraph-line over which they are transmitted is in good order. Some irregularities in this respect have occurred which, it is hoped, time will correct.

During the year seven thousand two hundred and three bulletins and three thousand two hundred and six maps have been issued, and one thousand three hundred and sixty-eight reports furnished the press. The leading daily papers publish the tabular reports, probabilities, and monthly statements regularly, and manifest a gratifying interest in the development of the service.

The station is provided with a large wind-vane and with the telescopic rod and the standard self-registering attachment to the anemometer. The station has not been regularly inspected during the year, but was visited by an officer and found in excellent condition, with the records neatly kept and up to date, and instruments well exposed and cared for.

Twenty-five cautionary signals have been displayed here since the date of the last annual report.

Sergeant Allen Buell was relieved October 16, 1871, by Sergeant F. Mann, who still remains in charge, and has given full satisfaction, by the manner in which his duties have been performed. Private McGovern was relieved as assistant April 15, 1872, by Private Stromberger. The report of the number of maps and bulletins issued gives evidence of the amount of work done and of the energy of the observer.

Reports from Grand Haven and Alpena are transferred here to the New York circuit.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.997	55	.69	Southwest.
	November	30.040	33	2.76	Northwest.
	December	29.990	23	1.88	West.
1872..	January	30.040	23	1.05	Southwest.
	February	30.020	23	.69	Northwest.
	March	30.054	25.6	1.22	West.
	April	29.976	46.8	2.15	East.
	May	29.936	56.8	5.64	West.
	June	29.923	68.3	2.85	Southwest.
	July	29.920	72.8	2.63	Southwest.
	August	29.990	71.6	2.60	Southwest.
	September	29.944	62.6	3.84	Southwest.
	Annual mean	29.986	46.8	28.00	Southwest.

DU LUTH, MINNESOTA.

[Latitude, 46° 48′; longitude, 92° 06′.]

The office remains, as at last report, in Edmund's Block. The only reports received are those from Saint Paul. Eight hundred and fifteen bulletins have been issued and seven hundred and fifty-five reports furnished the press.

The station is supplied with a large standard wind-vane and with the telescopic rod and the standard self-registering attachment to the anemometer. The necessary apparatus for displaying cautionary signals was furnished the station in May, 1872, but up to this date only two signals have been ordered.

Sergeant A. B. Williams was in charge of station until June 1, 1872, when he was relieved by Sergeant John Dascomb.

From July 1 to September 16, 1872, morning and midnight reports were sent very irregularly, as the telegraph-office was seldom open at the hours for reporting. Since September 16, arrangements have been made by which this difficulty is removed, and these important reports will be received hereafter with greater regularity, it is hoped.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.990	45.0	4.19	Northwest.
	November	30.113	28.0	1.47	Northwest.
	December	30.069	7.7	2.05	Southwest.
1872..	January	30.061	13.4	.86	Southwest.
	February	29.989	18.2	.46	Northeast.
	March	30.117	18.7	.85	Northwest.
	April	29.916	37.0	1.80	Northeast.
	May	29.947	46.4	4.62	Northwest.
	June	29.858	59.6	4.46	North-northeast.
	July	29.891	66.8	5.83	North-northeast.
	August	29.932	68.1	2.84	North-northeast.
	September	29.849	55.7	5.01	North-northwest.
	Annual mean	29.978	38.7	34.44	Northeasterly.

The observer, in his semi-annual report of January 1, 1872, says:

Toward the last four months before the close of navigation, very few captains left the harbor without calling at this office for information. They all have perfect confidence in our weather reports and consider them a great benefit to lake navigation.

ESCANABA, MICHIGAN.

[Latitude, 46° 36′; longitude, 87° 06′.]

No change has been made in the location of the office at this station since last report, nor is any considered desirable. Up to January 1, 1872, reports from ten stations were sent to this station, but, owing to the irregularity with which they were received, their transmission was discontinued on the date named. Three hundred and one bulletins have been issued during the year. No cautionary signals have been displayed, nor press report published, except the monthly statements occasionally. The station is supplied with a large standard wind-vane and the telescopic rod and the standard self-registering anemometer attachment. All the instruments are reported in good condition.

From July 1 until September 16, 1872, the morning and midnight reports were delayed on account of the telegraph-office being closed at the hours of report, but since that date this difficulty has been removed.

Sergeant J. N. Martin was in charge of the station until September 4, 1872, when he was relieved by Sergeant Robert J. Bell. Sergeant Martin performed his duties in a manner satisfactory to his superiors, and was relieved at his own request.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.93	47.0	2.94	South.
	November	30.09	32.0	1.94	Northwest.
	December	30.04	11.3	1.41	West.
1872..	January	30.02	17.0	.90	West.
	February	30.00	20.0	1.19	South.
	March	30.077	16.2	1.24	West.
	April	29.937	36.5	1.50	South.
	May	29.921	49.8	7.21	Northeast.
	June	29.864	63.0	2.45	South.
	July	29.918	67.0	7.11	South.
	August	29.977	66.7	2.87	South.
	September	29.868	57.5	3.97	North.
	Annual mean	29.970	40.3	34.73	South.

FORT BENTON, MONTANA TERRITORY.

This station was established by Sergeant William F. Slater, and reports were first made November 25, 1871. Owing to the uncertainty of telegraphic communication with a location so far removed from the settled portion of the country, there has been much irregularity in the transmission of reports, especially since July 1, 1872, as the telegraph-office has been closed at the hours for sending the morning and midnight reports, and they have been sent at such times as the operator found it convenient to be at his post. This difficulty has rendered the position of the observer an uncomfortable one, by cutting him off from regular correspondence with his associates, which was possible so long as he was free to file his reports at the same hours with his widely-scattered comrades. The office was first located outside of the fort, but that position being unsafe, the observer moved within the fort, and still remains there. All mail-reports have been forwarded regularly and in proper shape, and the attention to duty of the observer has been unremitting. No reports were received here and no bulletins issued or published, the station being one of observation and report only.

It is provided with a complete set of standard instruments, the wind-vane used being of the small model. All instruments are reported in good order. The station has not been inspected since its establishment, but an officer is now on his way to visit it.

Latitude of station	47° 52′
Longitude of station	110° 40′
Elevation of barometer above sea-level	2,674 feet.

No description of office has been furnished. The thanks of the office are due to the commanding officer and to the post quartermaster for valuable assistance in fitting up the station.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	December	30.22	7.6	1.30	Southwest.
1872..	January	30.09	18.5	.27	Southwest.
	February	29.83	26.0	.34	Southwest.
	March	29.99	36.7	.82	Southwest.
	April	29.92	43.6	.67	Southwest.
	May	29.98	55.1	.64	Southwest.
	June	29.96	63.7	1.14	Southwest.
	July	30.024	61.4	4.62	Southwest.
	August	30.013	65.5	.61	Southwest.
	September	29.923	55.1	1.82	Southwest.
	Mean for ten mont's	29.995	43.3	12.23	Southwest.

FORT SULLY, DAKOTA TERRITORY.

The office at this station is in the same room as the telegraph-office, and within the walls of the fort. The shelter is a modification of the standard form, and the best that could be constructed under the circumstances. The anemometer and wind-vane (small pattern) are well exposed on a strong platform on the roof of the office-building, and are reached by means of a rude stairway or ladder from one window of the room. The rain-gauge is well exposed on the parade-ground. The station is supplied with one barometer, one thermometer, one hygrometer, one maximum and one minimum thermometer, in addition to the instruments mentioned above, and all are reported in good condition.

The station was established by Sergeant George Prender, who still remains in charge, and who has performed his duties in a satisfactory manner. Reports commenced May 1, 1872, and have been sent as regularly since that time as telegraphic facilities would permit. Owing to the isolated and unprotected condition of the line from Yankton to the Fort—a distance of two hundred and thirty miles—frequent accidents occur to interrupt communication, which render the transmission of the reports unreliable. From July 1 to September 16, 1872, the telegraph-office was closed at the hours for sending the morning and midnight reports, which of course increased the difficulty of getting them off. Since the latter date arrangements have been made to keep the office open; but little improvement has yet been made in the work of getting the reports to Omaha, where they are transferred eastward.

Latitude of station	44° 39′
Longitude of station	100° 40′
Elevation of barometer above sea-level	1,491 feet.

No bulletins have been issued at this station, as no reports from other stations have been received.

General D. S. Stanley, United States Army, whose headquarters are at this fort, has rendered valuable assistance to the office, in providing shelter for the observer, and has manifested his constant interest in the service.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	May	29.749	58.3	2.98	Northwest.
	June	29.646	70.3	2.34	Southeast.
	July	29.702	73.5	6.48	Southeast.
	August	29.734	72.2	1.53	Southeast.
	September	29.714	62.4	.21	Northwest.
	Mean for five months.	29.709	67.3	13.54	Southeast.

GALVESTON, TEXAS.

[Latitude, 29° 19′; longitude, 94° 46′.]

No change has been made in the location of the office since last report. Reports from eighteen stations were received here, until July 1, 1872, when the telegraph company discontinued their transmission, and has not yet resumed. The reports from the station have been forwarded as regularly as the telegraphic facilities would permit. Since July 1, the morning and midnight reports have been delayed by the closing of the telegraph-office at the proper hours for their transmission.

During the year, two thousand seven hundred and seventeen bulletins have been issued and four hundred and forty reports furnished the press. The leading papers have published the tabular reports, the probabilities, when received, and the regular monthly statements furnished by the observer. The station has been twice inspected during the year, once in October, 1871, and again in July, 1872. At the time of the first inspection, the instruments were found badly placed and the shelter for them poorly constructed. These errors were corrected at once, and at the time of the second inspection office and instruments were found in good order, and the latter well exposed and cared for. The anemometer is provided with the standard self-registering attachment, and the direction of the wind is indicated by a large wind-vane of the standard pattern.

Sergeant William Von Hake, who was in charge of the station at the date of last report, was relieved on account of ill-health, October 2, 1871, and was succeeded by Sergeant George S. Rowley, who was in turn relieved and transferred to another station, February 27, 1872. Private McInerney, the assistant at the station, was promoted to the grade of sergeant, and placed in charge on the date last named, and still remains, having given full satisfaction by his management of the station and prompt rendition of all reports. He worked the station alone for some weeks, when the labor became too arduous for one man, and an assistant was sent from the central office.

Sergeant Von Hake died within a few hours after his return to Washington, and was buried in the National Cemetery, on Arlington Heights, with appropriate military honors. He was a hard-working, intelligent man, and performed his duty zealously and well.

The station is prepared for the display of cautionary signals, but none have yet been ordered, owing to the want of a sufficient number of reports from points in the northern and western parts of Texas to afford a reasonable basis of observation.

The members of the meteorological committee have shown a marked interest in the station during the year and have frequently pointed out the necessity for a greater number of stations in the State.

The station has been furnished with an enlarged rain-gauge, to provide for the heavy rains which prevail at certain seasons of the year.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.059	72.0	17.81	East.
	November	30.074	60.0	5.67	North.
	December	30.200	56.0	2.40	North.
1872..	January	30.230	50.0	4.61	North.
	February	30.002	55.0	2.27	Southeast.
	March	30.082	61.4	2.77	Southeast.
	April	30.002	71.7	5.96	Southeast.
	May	30.023	78.1	2.21	Southeast.
	June	30.033	83.0	3.39	South.
	July	30.039	85.6	.34	South.
	August	30.043	84.9	2.63	Southeast.
	September	30.024	82.1	2.33	Southeast.
	Annual mean	30.068	70.0	52.39	Southeast.

GRAND HAVEN, MICHIGAN.

[Latitude, 43° 05′; longitude, 86° 13′.]

The office was removed August 17, 1872, to the Cutler House, at the corner of Washington and Fourth streets, to get a better exposure of the instruments than could be obtained on the building first selected. The present exposure of the wind-vane, anemometer, and rain-gauge is reported by the inspecting officer as excellent. The instrument-shelter was reported defective in size and position, and a change has been ordered so as to make it conform to the standard. The new shelter will have a double wall of lattice-work, with a clear space of ten inches between the walls. The station is provided with a large wind-vane and with the standard telescopic rod and self-registering anemometer attachments.

During the year, two thousand six hundred and fourteen bulletins have been issued and three hundred and five reports furnished the press, but very few of which have been published. Since July 1, 1872, no reports have been received at this station, and the transmission of the midnight reports from the station has been delayed on account of the telegraph-office being closed at that hour. All other reports have been sent with a fair degree of regularity, except on Sundays, when the telegraph-office is usually closed. The station has been in charge of Sergeant Frank F. Wood since its establishment. It was inspected in September, 1871, and several irregularities in the manner of keeping the records discovered and corrected, but the main part of the work is reported to have been satisfactorily performed.

Twenty-five cautionary signals have been displayed during the year. The winds considered dangerous to navigation at this station are reported to be those from the southwest.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.995	52.4	1.75	Southwest.
	November	30.074	33.2	2.33	East.
	December	30.020	22.7	1.38	West.
1872..	January	30.012	24.4	1.54	West.
	February	29.981	21.6	.64	West.
	March	30.035	24.3	1.64	West.
	April	29.933	43.6	2.31	Southwest.
	May	29.921	52.9	2.94	West.
	June	29.900	64.6	2.27	West.
	July	29.911	69.5	1.46	South.
	August	29.972	69.5	6.31	Southwest.
	September	29.890	60.8	9.37	West.
	Annual mean	29.970	45.0	33.94	West.

INDIANAPOLIS, INDIANA.

[Latitude, 39° 42′; longitude, 86° 06′.]

No change has been made in the location of the office at this station since the date of the last annual report. Reports from thirty stations were received and published here until the suspension of the circuit system, June 30. Since the resumption of the system, on August 21, 1872, twenty-five reports have been regularly received, but during the interval between these dates the station-work was limited to the transmission and record of the local reports alone.

Six thousand and ninety-three bulletins have been issued during the year and three thousand and twelve reports furnished the press. The leading newspapers publish either the whole or a synopsis of the tabular reports, as they have space, the local reports in full, and the probabilities and monthly statements regularly. Maps have not been issued. The station is provided with a large standard wind-vane and with the standard self-registering anemometer attachment.

It has been twice inspected during the year, once in December, 1871, and again in September, 1872, and the office and instruments found in good condition on both occasions. Sergeant C. F. R. Wappenhans remains in charge, and has given full satisfaction by the regularity and promptness with which he has rendered all reports. Both inspecting officers commend his attention to duty. The assistant, Private D. C. Murphy, is also favorably mentioned.

In reference to the interest manifested in the service at this station, the observer reports as follows, in his monthly journal abstracts:

January 2, 1872.—A practical use of the tabulated report is also made by the agent of the Western Union Railroad and Transportation Company, and by other freight agents in settling claims of damage to merchandise by rain, &c., during its transit over their railroads.

July 2, 1872.—Several physicians have carefully noted daily, morning and evening, the readings of the barometer, and one assured me that he altered his prescriptions accordingly, as he believes that changes in atmospheric pressure have a corresponding effect on the state of health of his patients.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.053	58.0	1.54	South.
	November	30.065	39.0	3.52	Northwest.
	December	30.111	28.0	2.39	Southwest.
1872..	January	30.130	26.0	1.17	Southwest.
	February	30.008	30.0	1.41	Northeast.
	March	30.043	35.0	1.31	Northwest.
	April	29.960	55.0	3.26	Southeast.
	May	29.988	64.0	3.22	West.
	June	29.976	74.0	3.28	Southwest.
	July	29.964	78.0	10.95	Southwest.
	August	30.032	76.0	2.69	Southwest.
	September	29.997	67.0	2.81	South.
	Annual mean	30.027	52.5	37.55	Southwest.

INDIANOLA, TEXAS.

The office is located in Schultz's Building, on Main street, the principal business street of the town, within convenient distance of the post and telegraph offices. The roof of the building commands the entire bay and roadstead and the greater part of the town; and the wind-vane (small pattern,) anemometer, and rain-gauge, being firmly placed upon an elevated platform on the roof, have an excellent exposure. The shelter is of the standard pattern, and projects from a window having a northeastern exposure.

The station was established by Sergeant Edward Lloyd, and began reporting May 1, 1872. From that date until June 30, 1872, the reports were forwarded with regularity by the telegraph company, but since June 30 the telegraph-office has been closed at the times for sending the morning and midnight reports, and they have been seriously delayed in consequence. Frequent accidents to the line have also caused the loss of afternoon reports since the same date.

The station was inspected in July, and the office and instruments found in good condition. The inspector reports that the observer was highly spoken of by the members of the meteorological committee for his fidelity and close attention to duty. No reports from other stations are received here, and the only bulletins issued are those of the local observations. These have been supplied to the "Bulletin," a weekly paper, and regularly published.

Latitude of station .... 28° 31′
Longitude of station .... 96° 28′
Elevation of barometer above sea-level .... 25 feet

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	May	30.038	77.1	1.08	Southeast.
	June	30.023	83.0	.86	Southeast.
	July	30.037	84.8	1.49	Southeast.
	August	30.043	83.4	2.84	Southeast.
	September	30.032	81.5	.81	Southeast.
	Mean for five mo	30.035	82.0	7.08	Southeast.

JACKSONVILLE, FLORIDA.

[Latitude, 30° 15; longitude, 82° 00′.]

No change in the location of the station has been made during the year. Reports from ten Gulf and Coast stations were received here until July 1, 1872, and since which date from those on the Florida coast alone. Four thousand one hundred and nineteen bulletins have been issued and the press regularly supplied. A meteorological committee has been appointed by the Board of Trade, and its members are unanimous in expressing their desire that the station should receive more reports, especially from points along the coast. The office is much visited by people from the North, temporarily stopping in the city, and who are desirous of knowing the state of the weather at their homes.

The station was inspected in March, and the office and instruments found in good condition. Sergeant D. A. Daboll has remained in charge during the year and given full satisfaction. His conduct and close attention to duty have been commended by the inspecting officer and by the chairman of the meteorological committee. Private J. H. Marsh was on duty as assistant until August 9, when he was ordered in for promotion, and succeeded by Private Simons..

The station is provided with the large standard wind-vane and with the standard telescopic rod and self-registering attachments to the anemometer.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.131	73.5	3.62	Northeast.
	November	30.091	65.4	3.63	Northeast.
	December	30.226	55.4	2.65	Northwest.
1872..	January	30.174	52.7	3.44	Northwest.
	February	29.993	53.9	2.70	Southwest.
	March	30.102	59.1	7.32	Northeast.
	April	30.113	73.5	2.39	Northeast.
	May	30.089	78.3	1.25	Southwest.
	June	30.072	81.0	6.97	Southwest.
	July	30.089	83.4	2.92	Southeast.
	August	30.062	81.4	6.41	Northeast.
	September	30.065	77.7	10.65	Northeast.
	Annual mean	30.101	69.6	53.95	Northeast.

KEOKUK, IOWA.

[Latitude, 40° 18′; longitude, 91° 30′.]

The location of the office remains unchanged since the date of last report. Reports from twenty-six stations were received here from that date until July 1 and since August 21, 1872. During the interval the only reports received were those from sixteen river stations each afternoon, which were sent from Chicago after concentration there.

Three thousand seven hundred and sixty-three bulletins were issued and seven hundred and twenty reports furnished the press. The newspapers publish the river reports and the local observations regularly, and also the probabilities when received. River reports have been made regularly, the gauge used being constructed in accordance with plans furnished from the central office. Owing to its improper location it was injured by floating bodies in the river, and is now out of repair, and a graduated scale on the pier of the railroad-bridge is used for the readings. The station has been twice inspected during the year, once in December, 1871, and again in August, 1872. At the first visit several irregularities were discovered in the location and care of instruments and books; but the office was neatly kept and the observer and his assistant attentive to duty. At the second visit of the inspector the office was found in good condition, but some change was made in the manner of caring for the instruments.

Sergeant A. C. Barclay was relieved from charge of the station for misconduct, November 27, 1871, and was succeeded by Sergeant C. R. Daw, who still remains. Private Warren was on duty as assistant until called in for promotion. His successor was relieved for misconduct, August 31, 1872. Private W. O. Bailey is now on duty as assistant.

In addition to the instruments reported on hand at last report, the station is supplied with the large standard wind-vane and with the standard self-registering attachment to the anemometer.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches	
1871..	October	29.997	57.3	5.22	South.
	November	30.039	30.5	2.89	Northwest.
	December	30.095	25.8	1.46	Northwest.
1872..	January	30.117	25.8	.07	West.
	February	29.964	30.4	.39	Southeast.
	March	30.035	35.0	2.88	Northwest.
	April	29.904	53.9	3.66	Southwest.
	May	29.906	64.5	3.70	West.
	June	29.883	75.2	5.81	South.
	July	29.892	78.6	6.77	Northwest.
	August	29.945	77.3	1.97	South.
	September	29.906	68.2	2.26	South.
	Annual mean	29.972	51.9	37.08	Westerly.

KEY WEST, FLORIDA.

[Latitude, 24° 36′; longitude, 81° 48′.]

The office at this station was removed, March 1st, to the Louvre House, on Front street, and is on the third floor. The cupola of the building is used for the instrument-shelter, and upon its roof the wind-vane, (large pattern,) anemometer, and rain-gauge are exposed. The present location is a good one, and well adapted for the display of cautionary signals, when it is considered advisable to send them to this station.

Three thousand nine hundred and fifty-nine bulletins have been issued during the year, and the local observations have been regularly published by the newspaper at the station. An inspecting officer visited the station in February, 1872, and reported office and instruments in good condition. It was upon his suggestion that the location of the office was changed, and the new one was fitted up under his personal supervision. The anemometer is provided with the standard self-registering attachment. The duties of the station were performed by a citizen from the death of Sergeant John R. Allen, October 12, 1871, until the arrival of his successor, Sergeant M. J. Shanefelter, in November. Of the conduct of Sergeant Shanefelter, the inspecting officer remarks:

The sergeant in charge of this station bears a most excellent character in the community, and from my own observation I perceive that he is both faithful and zealous in the performance of his duties.

Upon the suggestion of an inspector, an assistant was sent to the station March 7, 1872. He was relieved for misconduct May 28, 1872, and was succeeded by Private W. A. Chapman, who still remains. Much valuable assistance to the observer has been rendered by General R. B. Ayres, commanding, and Lieutenant C. W. Hobbes, quartermaster of the post at Key West.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.980	81.0	3.25	East.
	November	30.010	76.0	1.90	Northeast.
	December	30.160	71.0	3.32	Northeast.
1872..	January	30.120	68.0	1.60	North.
	February	30.028	68.0	7.19	Northeast.
	March	30.070	73.0	1.04	East.
	April	30.056	79.0	.08	East.
	May	30.065	79.8	1.01	East.
	June	30.063	83.4	2.14	East.
	July	30.081	83.5	6.92	East.
	August	30.025	84.3	4.89	East.
	September	29.987	84.1	3.15	East.
	Annual mean	30.054	77.6	36.49	East.

KNOXVILLE, TENNESSEE.

[Latitude, 35° 56′; longitude, 83° 58′.]

No change has been made either in the location of the office at this station or in the observer in charge. No reports have been received from other stations since July 1, 1872, previous to which date those from Lynchburgh were regularly received. No bulletins have been issued, but one thousand one hundred and forty-eight reports of local observations have been furnished to the local press and published regularly.

The station has been inspected twice during the year, once in November, 1871, and again in July, 1872, and on both occasions the office and instruments were found in good condition. The station is provided with the standard self-registering attachment to the anemometer. Sergeant John K. Payne, professor of mathematics at the East Tennessee University, remains in charge, and has rendered all his reports regularly and in excellent condition.

Upon the interest manifested by the public in reference to the weather reports, the observer says:

A very general interest has been and is manifested in the weather reports by almost all classes of citizens—*e. g.*, contractors in charge of unfinished buildings which are endangered by wind and rain; people contemplating trips to the country; men in charge of brick-yards, when the hack is without roof, (as it usually is;) jobbers sending goods to country merchants by wagons; farmers with some sort of exposed harvests; road-builders with loose earth dumped, and liable to be cut away by water unless protected by ditches; "committee of arrangement" on pic-nics; political meetings, camp-meetings, &c.; ladies who "think of paying calls to-morrow," &c. All these classes, and many more, have been "observed" to examine the probabilities, and derive benefit therefrom.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.155	58.0	4.28	Northwest.
	November	30.100	46.5	2.61	Northwest.
	December	30.190	37.0	3.27	Southwest.
1872..	January	30.183	32.2	2.99	Northwest.
	February	30.007	39.0	2.24	Northwest.
	March	30.080	43.5	3.04	Northwest.
	April	30.055	59.5	3.61	Northwest.
	May	30.029	68.0	2.86	West.
	June	30.020	73.0	6.68	Southwest.
	July	30.010	78.0	2.29	West-NW.
	August	30.050	76.2	6.27	Northeast.
	September	30.060	67.7	3.89	Northwest.
	Annual mean	30.078	56.6	44.03	Northwest.

LAKE CITY, FLORIDA.

[Latitude, 30° 06′; longitude, 82° 42′.]

The location of the office has remained unchanged during the year. Until the 1st of July, the reports from ten other stations were received and transferred to Key West and Jacksonville and northward. Since that date the only transfers made have been reports received from Key West, Punta Rassa, and Jacksonville. The failure of the telegraph company, by which communication is effected with Savannah, to keep its office open until the hour for sending the midnight report, has compelled the office to transmit the nine o'clock local observation, and has prevented any attempt to display cautionary signals on the coast of Florida. The telegraphic service of the lines running south and east from Lake City has been performed with regularity, and with as few interruptions as could be expected, considering the nature of the country through which the line passes.

No bulletins have been issued during the year. The principal value of this station consists in the fact of its being the point of transfer between the land and cable telegraph lines. The station is provided with the large wind-vane of the standard pattern, and also with the standard self-registering anemometer attachment. The station was inspected in March, 1872, and the office and instruments found in good condition.

Sergeant J. E. Magruder was in charge until April 15, when he was transferred to another station, and was succeeded by Sergeant George McDonald, who was relieved July 31, 1872, by Sergeant J. O'Dowd, who remains in charge. Private S. W. Beall was on duty as assistant until April 10, when he was ordered in for promotion, and was succeeded by Private Jones.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.044	71.0	5.03	Northeast.
	November	30.015	63.0	3.99	North.
	December	30.172	53.0	2.05	Northwest.
1871..	January	30.115	49.0	2.41	Northwest
	February	29.961	53.5	3.02	West.
	March	30.041	57.6	9.59	Southwest.
	April	30.056	71.6	1.90	East.
	May	30.045	78.1	.20	Southwest.
	June	30.027	79.3	5.29	Southwest.
	July	30.048	81.2	3.86	Southwest.
	August	30.019	79.4	5.25	Northeast.
	September	30.018	76.5	4.53	East.
	Annual mean	30.047	67.8	47.12	Southwest.

LEAVENWORTH, KANSAS.

[Latitude, 39° 21′; longitude, 94° 44′.]

No change has been made in the location of the office at this station since the date of last report. Reports from fourteen stations were received here until July 1, 1872, since which date the reports from the river stations alone have been received each afternoon. During the year four thousand five hundred and ninety-one bulletins have been issued, and one thousand four hundred and ninety-one reports furnished to the press. One paper only, the Commercial, publishes the tabular reports, but all publish the monthly summaries. Previous to July 1, three papers gave the full tabular reports daily.

The station has been twice inspected during the year, once in November, 1871, and again in September, 1872, and on both occasions the office and instruments were found in good condition. The station is provided with a large standard wind-vane and the standard self-registering attachment to the anemometer. River reports have been sent from the station since January 1, 1872, and the observations are made from a gauge constructed in accordance with plans furnished from the central office. This gauge has been broken by drift-wood, and needs repairing.

Sergeant George Boehmer has been in charge of station since its establishment, and has performed his duties with marked intelligence and zeal. Owing to the increased amount of work required by the river observations, he was supplied with an assistant, Private W. S. Jewell, December 6, 1871, who remained until called in for promotion, May 17, 1872. The present assistant, Private E. W. McGann, has been compelled by the sickness of the observer to do all the station-work for some weeks, and has given satisfaction. All mail reports have been promptly and regularly furnished during the year, and some of them have been prepared with unusual care. Since July 1 the morning and midnight reports have been delayed by the failure of the telegraph company to have its office open at the proper hours for sending them.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.110	56.9	4.25	West.
	November	30.146	38.0	3.94	Northwest.
	December	30.250	24.2	0.73	Northwest.
1872..	January	30.240	25.0	0.13	Northwest.
	February	30.020	30.9	0.87	Northwest.
	March	30.093	36.0	1.95	Northwest.
	April	29.910	56.2	2.98	Southwest.
	May	29.943	65.6	7.91	Southwest.
	June	29.910	77.2	4.75	Southwest.
	July	29.972	78.4	9.92	Southeast.
	August	29.990	78.4	6.56	Southeast.
	September	29.937	67.7	4.22	Southwest.
	Annual mean	30.043	53.0	48.21	Southwest.

LOUISVILLE, KENTUCKY.

[Latitude, 38° 00′; longitude, 85° 25′.]

The office was removed February 29, 1872, from the custom-house to the fourth story of the building at the corner of Main and Bullitt streets, in the business center of the city. The room commands a view of the whole city, and affords an excellent exposure for the anemometer, (which has the standard telescopic rod and self-registering attachments,) the wind-vane, (small pattern,) and the rain-gauge, all of which are firmly secured upon an elevated platform. The instrument shelter is of the standard pattern, with double louver boarded sides, and projects from a window with a northern exposure.

During the year six thousand and thirty-three bulletins have been issued, and nine hundred and eighty-six reports furnished the press. Reports from thirty stations were received here until July 1, from which time until August 21 the reports from all river stations were received each afternoon from Chicago as a special message. Since August 21, eighteen reports have been received daily. The leading dailies have published the full tabular reports regularly, and also the river reports, probabilities, and monthly statements, and have shown a gratifying interest in the development of the service. The river reports have also been published by the New Albany papers, being furnished them daily at the request of the editors. The standard city water-gauge, in the Louisville and Portland Canal, is used for the river observations.

The station was inspected in October, 1871, and August, 1872, and the office and instruments found in good condition. Sergeant Thomas J. Brown was in charge of station until transferred to the office of the Chief Signal Officer August 17, 1872, and rendered all reports promptly and in proper form. The wide distribution given to the reports here is due mainly to his personal energy and zeal. Sergeant Robert E. McGrady is at present in charge. The assistant on duty here at last report was relieved for misconduct December 15, 1871, and was succeeded by Private W. T. Boyd, who, being ordered in for promotion, was relieved by Private H. M. Ludwig June 17, 1872, who performs his duties satisfactorily.

The Board of Trade appointed a meteorological committee, the members of which have contributed assistance to the observer whenever necessary.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.106	60.5	1.85	Southeast.
	November	30.057	44.0	2.51	Northeast.
	December	30.145	38.0	3.29	Northwest.
1872..	January	30.161	30.8	(*)	Southwest.
	February	30.013	36.0	(*)	Northeast.
	March	30.087	38.7	1.41	Northwest.
	April	30.018	59.1	8.40	Southeast.
	May	30.009	67.6	4.49	Northwest.
	June	29.996	74.3	6.19	Northwest.
	July	29.979	79.0	3.67	Northwest.
	August	30.031	78.2	2.45	Northwest.
	September	30.009	69.8	4.41	South.
	Annual mean	30.051	56.3	38.67	Northwest.

*Rain-gauge not in position.

LYNCHBURGH, VIRGINIA.

[Latitude, 37° 18'; longitude, 85° 54'.]

Sergeant James B. Murray has been in charge here since the establishment of the station, and has rendered his telegraphic reports with regularity. There is no assistant here, and none is considered necessary at present. Seven hundred and twenty-six bulletins of the local observations have been issued.

The office at this station remains in the building at the corner of Eighth and Court streets; and although somewhat removed from the business center of the town, is sufficiently near it for present purposes. No reports have been received here since July 1, 1872. Previous to that date about twenty reports were sent once daily through the courtesy of Mr. Joseph W. Kates, district superintendent of the Western Union Telegraph Company, and were displayed by him on bulletins furnished by this office. The station has been twice inspected during the year—once in October, 1871, and once in July, 1872. At the last inspection, the instrument-shelter was found defective, and a new one constructed of the standard pattern. The large wind-vane is used here, and also the standard self-registering attachment to the anemometer.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.175	57.5	1.60	Southwest.
	November	30.080	47.1	3.76	Northwest.
	December	30.175	35.0	1.12	Southwest.
1872..	January	30.114	33.1	2.08	Southwest.
	February	30.037	36.2	1.99	Northeast.
	March	30.065	39.6	4.24	Southwest.
	April	30.079	57.5	3.20	Southwest.
	May	30.012	67.7	3.15	Southwest.
	June	30.006	74.1	2.53	Southwest.
	July	29.999	78.0	1.56	Southwest.
	August	30.050	77.1	2.27	Southwest.
	September	30.066	69.5	1.26	Southwest.
	Annual mean	30.072	56.0	28.76	Southwest.

MARQUETTE, MICHIGAN.

[Latitude, 46° 33′; longitude, 87° 23′.]

No change has been made in the location of the office during the year. The reports from fourteen other stations were received here until January 1, when they were discontinued on account of the irregularity with which they were received. Much difficulty has been encountered in transmitting the reports from this station, owing to the unreliable nature of the telegraphic communication with Milwaukee, to which place its reports are sent.

From July 1 to September 16, another difficulty existed in the closing of the telegraph-office at the hours for sending the morning and midnight reports; but this is now removed, and it is hoped that communication will be more regular hereafter. The geographical position of this station renders its reports of special importance to the shipping interests on the lakes. In addition to the instruments on hand at last report, the station has been provided with a large standard wind-vane, and the standard telescopic rod and self-registering attachments to the anemometer.

Previous to the discontinuance of reports in January, one thousand two hundred and fifty-six bulletins were issued. Sergeant William H.

Clendenon, the observer in charge, has performed his duties satisfactorily, and has managed his station without an assistant. Arrangements have been made for the display of cautionary signals whenever necessary.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.890	47.0	2.97	Southwest.
	November	30.060	30.0	.65	Northwest.
	December	29.960	14.0	.33	West.
1872..	January	29.980	18.7	.39	West.
	February	*	18.7	.31	West.
	March	*	15.5	.37	West.
	April	*	37.3	.88	West.
	May	29.930	46.0	6.60	Northwest.
	June	29.850	59.4	3.32	West.
	July	29.890	59.6	4.79	West.
	August	29.930	65.4	2.74	Northwest.
	September	29.860	55.6	8.30	Northwest.
	Annual mean	Blank.	38.9	31.65	West.

* Barometer broken.

MEMPHIS, TENNESSEE.

[Latitude, 35° 08′; longitude, 88° 00′.]

The office is on the third floor of building No. 204 Second street, in the business center of the city, and, in the opinion of the inspecting officers, could not be better located. The station has been twice inspected during the year—once in November, 1871, and once in August, 1872. Alterations in the instrument-shelter were found necessary on both occasions, but in most other respects the office and instruments were found in good condition. This station is on the same circuit as Louisville, and receives the same number of reports. From July 1 to August 21 the only reports received were those of the river stations each afternoon. Regular observations of the stage of water in the river have been made and reported since January 1, 1872, the gauge used being one constructed by the United States Engineer Corps. In the reference to the value of the river reports, the observer remarks:

At this port captains and pilots of boats going up the river generally decide by the river reports whether they can continue up the Mississippi or go up the Ohio, and, if so, how far. Boats arriving here from below at 12 o'clock midnight or later, examine the reports on the board at the levee, and if they have no business here, continue on up the river; otherwise, if it were not for the reports, they would have to wait for the morning papers to learn the stage of the water. Before the signal-service reports were published, from six to ten hours were lost at night by boats waiting for the morning papers, all of which is now obviated. The service is highly spoken of by rivermen as being of immense value to their interests.

Five thousand five hundred and sixty-nine bulletins have been issued, and one thousand five hundred and two reports furnished the press. The leading dailies print the probabilities and river reports regularly, and the monthly statements and selections from the tabular reports occasionally. Sergeant S. W. Rhode has been in charge during the year, and given satisfaction. Two assistants, serving at the station since last report, have been promoted. One has been relieved for misconduct and one deserted. Private Nuzum, the present assistant, has been on duty but a short time, having reported September 9.

The inspecting officer gives the following illustration of the practical value of meterological observations:

During my inspection a gentleman came into the office for information as to the weather on certain days last February, having a law-suit turning on that point. The observer was able to give him all the information needed.

The anemometer here is provided with the standard self-registering attachment, and the direction of the wind is indicated by a large standard vane.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.107	63	4.04	South.
	November	30.085	47	2.23	Northwest.
	December	30.228	39	1.62	South.
1872..	January	30.261	35	2.17	West.
	February	30.037	43	4.24	South.
	March	30.128	47	5.19	East.
	April	30.047	64	6.99	South.
	May	30.058	71	4.16	Southwest.
	June	30.055	76	4.44	Southwest.
	July	30.041	83	4.23	Southwest.
	August	30.087	81	.54	Northeast.
	September	30.071	73	3.62	South.
	Annual mean	30.100	62.2	43.17	South.

MILWAUKEE, WISCONSIN.

[Latitude, 43° 03′; longitude, 87° 57′.]

The office remains in the same building occupied at the date of last report, and is well located with reference to the business interests of the city. It was inspected in September, and several irregularities discovered in the condition of the instruments and of the instrument-shelter, all of which were promptly corrected. Full reports were received here until July 1, 1872, when, in common with the other lake stations, it was deprived of them by the suspension of the circuit system. From that date until September 1, the only reports received were those from the northwestern stations, which were here transferred to New York. Since September 1 an attempt has been made to revive the circuit system, and furnish full reports again. Considerable difficulty was met with in effecting the necessary wire-connections at other points upon the circuit to enable the work to be properly done, and, as a consequence, the service has not been as regular as could be wished.

Three thousand one hundred and sixty bulletins and two thousand two hundred and fifty-one maps have been issued, and nine hundred and ninety-three reports furnished to the press. The leading papers publish the probabilities and monthly statements regularly, and occasionally extracts from the daily reports. In reference to the amount of public interest manifested in the service, the observer remarks as follows:

As a proof that our signal-service is advancing rapidly in favor among the people, I would state that those newspapers which a few months since would have nothing to do with the weather-reports, now publish daily, at least, the probabilities, and even go so far as to attract the attention of their readers by a voluntary and favorable notice of the weather-items. This state of affairs has been largely promoted by the people, who, perceiving the benefits derived by them from the service, as applied to their every-day affairs, have insisted upon the publication of the weather-reports in their respective journals, and a great many have lately expressed their regret at the sudden stoppage of the weather-reports, and their criticisms upon the course of the telegraph company are extremely unfavorable to that corporation.

Twenty-nine cautionary signals were displayed at this port, of which twenty were considered as fully justified. As to the results of these warnings, the observer reports as follows:

November 9, 1871.—Only two vessels disregarded the signal and put out of the harbor, and were overtaken by the storm and were seriously damaged. The remainder of the shipping staid in port.

November 12, 1871.—No damage to vessels, as all remained in harbor.

November 20 *and* 23, 1871.—Vessels remained in harbor; no damage.

November 26 *and* 28, 1871.—Steamers were kept in port; no damage.

April 9, 1872.—Twenty-two vessels remained in port; no damage.

April 11, 1872.—Vessels staid in port; one vessel, Milwaukee bound, was capsized.

Sergeant A. Brimer was in charge of the station until September 6, when he was relieved by Sergeant D. H. Sackett. Sergeant Brimer is favorably mentioned in the report of the inspecting officer, but was relieved on account of ill-health.

Much trouble was experienced with the assistants at this station during the year, two having been relieved in quick succession for misconduct, and one for ill-health. Private T. O'Neill was ordered here for duty February 10, and remained until called in to be examined for promotion, September 13. He was succeeded by Private James Courtney.

The station is supplied with the large standard wind-vane, and the standard telescopic rod and self-registering attachments to the anemometer.

Considerable interest has been manifested in the welfare of the station by the members of the meteorological committee, who state that the suspension of the reports during the harvest season was severely felt by the farming community.

Meterological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.030	51.5	3.37	Southwest.
	November	30.090	33.0	2.54	Northwest.
	December	30.040	17.2	1.55	Northwest.
1872..	January	30.000	21.0	.90	Northwest.
	February	30.000	23.0	.34	Northwest.
	March	30.060	24.5	.53	Northwest.
	April	29.930	40.0	1.84	Southeast.
	May	29.940	52.0	2.92	Southeast.
	June	29.920	67.0	3.67	Southwest.
	July	29.940	70.0	1.98	Southwest.
	August	30.000	71.0	1.89	Southwest.
	September	29.913	62.6	8.72	Southwest.
	Annual mean	29.989	44.4	30.25	S. W. and N. W.

MOBILE, ALABAMA.

[Latitude, 30° 42′; longitude, 87° 59′.]

The office was removed to the third story of the building at the southeast corner of Government and Royal streets, May 1, 1872, and is now well located within easy reach of the post and telegraph offices, and the principal hotels and places of business. The wind-vane, (large,) anemometer, (provided with the standard telescopic rod and self-registering attachments,) and rain-gauge, are well exposed and secured upon the roof of the building. The instrument shelter is of the standard pattern, and projects from a window with a northern exposure. The bottom of the shelter is covered with lattice-work, to guard against the effect of radiation from the roof of a verandah, fourteen feet below.

Two inspections have been made of the station during the year, one in October, 1871, and one in August, 1872. The report of the first inspection led to the relief of the observer, and the subsequent change of the office. At the second inspection, the office and instruments were found in good condition.

The reports from eleven stations were received here until the suspension of the circuit system, July 1, since which date nothing has been received except the probabilities each afternoon. Five thousand two hundred and thirty-one bulletins have been issued. The afternoon issue of bulletins was furnished to the leading papers, and regularly published, as have also been the monthly statements. Considerable interest in the service is manifested by the principal citizens of Mobile, and a general desire expressed to have the station furnished with a greater number of reports, especially from the section of country lying south of the Ohio River. In reference to this subject, the observer remarks:

At present everything connected with this office is held in the highest estimation, especially by the cotton merchants and the general merchants of the city, who place the utmost reliance in the bulletins and probabilities; and they are eagerly read by the numerous persons who remain hovering around the usual places, especially in the morning, where the reports are posted.

Three cautionary signals were displayed at this station during the year, two of which were fully justified by subsequent gales.

Sergeant A. R. Thornett was in charge of the station until November 4, 1871, when he was succeeded by Sergeant D. O'Donoghue, who still remains, and who has given full satisfaction by the prompt manner in which he has discharged his duties. Private William Line was on duty here as assistant until ordered in for promotion June 17, 1872, when Private F. H. Wash was sent to replace him.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.093	68	5.33	Northeast.
	November	30.068	59.9	6.68	North.
	December	30.227	52.0	1.36	South.
1872..	January	30.218	45.1	3.69	North.
	February	30.015	51.7	8.00	Northwest.
	March	30.098	51.4	12.76	North.
	April	30.067	69.2	4.35	South.
	May	30.091	75.7	3.78	South.
	June	30.052	80.6	6.33	Southwest.
	July	30.060	80.7	13.37	Southwest.
	August	30.064	81.2	1.69	Northeast.
	September	30.071	77.6	2.15	North.
	Annual mean	30.094	66.1	69.46	North.

MONTGOMERY, ALABAMA.

Reports were resumed at this station September 5, 1872. The office is located on the third floor of No. 49 Market street, within a short distance of the post and telegraph offices. The wind-vane, (small,) anemometer, and rain-gauge are supported on a platform on the roof, and are well exposed. The instrument-shelter is of the standard pattern, and projects from a window having a northern exposuré. In addition to the instruments named above, the office is supplied with one barometer, one thermometer, one hygrometer, one maximum and one minimum thermometer, all standard instruments, and in good condition.

Sergeant George A. Clum is in charge of the station, and as no reports from other stations are received, he has no assistant.

Latitude of station	32° 22′
Longitude	86° 23′
Elevation of barometer above sea-level	220.5 feet

The transmission of midnight reports from this station at the proper hour is rendered impossible, because the telegraph-office closes early in the evening. They are regularly sent with the morning reports of the succeeding day.

MOUNT WASHINGTON, NEW HAMPSHIRE.

[Latitude, 44° 16′; longitude, 71° 16′.]

The office is located, as at date of last report, in the depot building of the Mount Washington Railroad Company, through the courtesy of the company's officers. All attempts to obtain permission to erect a separate building for Government use have failed through the inability of the office to find any one person possessing an undisputed title to the summit. The reports have been made with as much regularity as the uncertain nature of the telegraphic communication would permit, and have been read with greater interest, perhaps, by the general public than those from any other station. The cable from the summit to the depot, at the base of the mountain, has been put in good repair for the ensuing winter, and the office thoroughly and comfortably fitted up, from the experience gained during the two past winters.

The standard self-registering attachment to the anemometer has been furnished the station with the hope of getting a continuous record of the wind's velocity, but the experiment has so far proved a failure, as no instrument strong enough to resist the force of the wind has yet been found. A new and stronger one has been constructed, and may be found to answer the purpose.

During the month of May a special series of observations was made in connection with a temporary station at the base of the mountain, of which a special report is made elsewhere, (paper H.)

Sergeant M. L. Hearne was in charge of the station until April 3, 1872, when he was relieved on account of ill-health, and was succeeded by Sergeant A. R. Thornett. Sergeant Hearne's health having been apparently restored by a temporary absence from the station, he was reassigned there May 17, but not being strong enough to endure the exposure, he was permanently relieved by Sergeant Thornett. Both men have displayed a marked zeal in the performance of their duties under trying circumstances, and their reports have been promptly and correctly rendered. Private William Stevens, the assistant at date of last report, died on the mountain, February 26, 1872, and was buried at Littleton, New Hampshire. Private R. J. Bell was ordered to the station as soon as the sickness of Private Stevens was reported by telegraph, and remained until called in for promotion, June 17, 1872, when Private William Ramsay was transferred there from Portland, at his own request, and still remains.

To guard against any interruption of reports, and to render duty at the station more desirable because less lonely during the winter months, a second assistant has been ordered there.

The thanks of the Chief Signal-Officer are due to Mr. Walter Aikin and Captain J. W. Dodge, of the railroad company; to Mr. Benjamin Kilbourn, and other citizens of Littleton, for assistance rendered during the year, especially in connection with the illness and burial of Private Stevens.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.995	30.0	6.10	Northwest.
	November	29.962	15.0	3.42	Northwest.
	December	29.620	3.0	.85	West.
1872..	January	29.681	3.0	1.67	Northwest.
	February	29.746	5.0	.29	Northwest.
	March	29.573	— 1.3	.83	West.
	April	29.853	21.3	.07	West.
	May	29.995	33.3	4.62	Northwest.
	June	30.015	44.5	18.46	West.
	July	30.166	47.9	3.59	Northwest.
	August	30.256	50.7	6.33	Northwest.
	September	30.154	41.7	9.56	Northwest.
	Annual mean	29.918	24.6	55.79	Northwest.

NASHVILLE, TENNESSEE.

[Latitude, 36° 10′; longitude, 86° 49′.]

The office at this station still remains at No. 30 College street, in the business center of the city. It was inspected in July, and the office found in good condition, but some slight alterations were found necessary in the location of the instruments. The station is supplied with the large standard wind-vane and with the standard self-registering attachment to the anemometer in addition to the instruments on hand at last report.

Reports from thirty stations were received here until July 1, 1872. From that date to August 21 reports from all river stations were received each afternoon, and since the latter date the station receives the same number of reports as others on the river circuit. During the year three thousand seven hundred and seventy-three bulletins have been issued and two hundred and seventy-four reports furnished the press. The principal papers publish the probabilities and river reports regularly, and occasionally the monthly statements.

River reports are made from this station, the gauge used being attached to the south face of the north draw-pier of the Louisville and

Nashville Railroad bridge, and constructed under the direction of the observer, in accordance with the plans furnished by the central office.

Sergeant J. H. Garrard was in charge of station until February 15, 1872, when he was relieved and reduced to the ranks for failing to render his reports properly. He was succeeded by Sergeant W. S. Kaufman, who still remains, and has given satisfaction. He is favorably mentioned by the chairman of the meteorological committee of the Board of Trade. Private W. C. Shreck is on duty as assistant.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.186	61.0	1.31	Southeast.
	November	30.137	47.7	2.13	West.
	December	30.241	39.0	1.65	South.
1872..	January	30.257	35.0	2.32	West.
	February	30.053	43.0	2.11	West.
	March	30.138	44.2	3.09	Northwest.
	April	30.085	62.1	5.91	Southeast.
	May	30.073	71.8	3.09	West.
	June	30.062	77.4	5.17	West.
	July	30.059	79.6	4.90	West.
	August	30.097	80.5	1.65	North.
	September	30.093	71.7	4.50	North.
	Annual mean	30.123	59.4	37.83	West.

NEW LONDON, CONNECTICUT.

[Latitude, 41° 22′; longitude, 72° 9′.]

No change has been made in the location of the office at this station since the date of the last report, but a removal to the custom-house is recommended by the chairman of the meteorological committee and assented to by the collector. This change will probably be made as soon as the necessary arrangements can be perfected. Full reports from all stations were received here until July 1, when the suspension of the circuit system caused them to be discontinued. Since August 21 arrangements have been made by which this station receives the same number of reports as Boston.

Three thousand seven hundred and eighty-four bulletins have been issued, of which copies have been furnished daily to the press of New London and Norwich, and occasionally published. The probabilities are published regularly, and the monthly statements occasionally. The anemometer at this station is fitted with the standard telescopic rod and self-registering attachments, and the wind-vane is of the large pattern.

The office was inspected in April and found in fair condition, and all records neatly entered up to date.

Nineteen cautionary signals have been displayed during the year, of which thirteen are reported as having been fully justified.

Sergeant C. E. Brinsmade remains in charge of the station, and has rendered his reports regularly and in proper form. Private Mark Foley is on duty as assistant, and gives satisfaction.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.099	54.3	8.35	Southwest.
	November	29.963	37.3	5.50	Northwest.
	December	30.049	28.4	2.78	Northwest.
1872..	January	29.969	27.3	2.46	North.
	February	29.938	27.4	.96	Northwest.
	March	29.952	27.5	2.93	Northwest.
	April	30.004	45.2	2.30	Northwest.
	May	29.927	58.2	3.16	Northwest.
	June	29.939	66.8	2.78	Southwest.
	July	29.937	74.4	5.35	Southwest.
	August	30.017	72.6	6.06	Southwest.
	September	30.031	63.1	6.98	Northwest.
	Annual mean	29.986	48.5	49.61	Northwest.

NEW ORLEANS, LOUISIANA.

[Latitude, 29° 57′; longitude, 90° 00′.]

The office was removed November 1, 1871, to the custom-house, where it still remains. It is on the third floor, and in every respect better located than before. No rent is paid for the use of the room, but the Signal-Office bore the expense of putting it in habitable condition. The wind-vane, (large,) rain-gauge, and anemometer are well exposed upon the roof of the building, and the latter instrument is provided with the standard telescopic rod and self-registering attachments. The instrument-shelter is of the standard pattern. Until July 1, the reports from thirty other stations were received here, but from that date to August 21 the work of the station was limited to making and forwarding the local observations, transferring the reports from Shreveport, Galveston, and Indianola to Augusta, and publishing the river reports received from Chicago each afternoon. Since August 21, reports from twenty stations have been regularly received.

The labor of the station has been increased by the necessity of transferring reports from the office of one telegraph company to that of another since July 1. Previous to that date the work was all done from one office. Three thousand three hundred and three bulletins and five thousand and seventy-one maps have been issued and seven hundred and fifty-eight reports furnished to the press during the year. The maps were printed on a press constructed especially for the office, but none have been issued since the suspension of the reports in July, and the press has been sent to another station. The leading papers have published the river reports, probabilities, and monthly statements regularly, and the tabulated reports occasionally. Considerable interest is manifested in the service by the citizens, especially in reference to that part of it connected with river navigation. The gauge used here for making the river observations is one put up by the city engineer.

Eight cautionary signals have been displayed during the year, of which seven are reported as having been fully justified.

Two inspections have been made during the year, one in October, 1871, and one in July, 1872. At the first inspection it was decided to remove the office, and several irregularities in the work of the station were corrected. The office was found in better condition at the second inspection, but some changes were found necessary in the position and care of the instrument-shelter.

Sergeant D. S. Pullen was transferred to another station February 3, 1872, and succeeded by Sergeant Frank Mansfield, who still remains. During the period that maps were issued, two assistants were found necessary to perform the duties with sufficient promptness. One of these men was transferred to another station August 20, 1872. Private D. C. Ralston is now on duty as assistant.

All mail-reports have been forwarded regularly and promptly, and the telegraphic ones as regularly as the facilities attainable would permit.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October..............	30.069	71.0	9.09	East.
	November..	30.047	61.1	7.14	East.
	December....	30.190	56.6	1.46	North.
1872..	January.	30.195	48.7	5.10	Northwest.
	February	29.987	56.2	4.77	Southeast.
	March..........	30.070	59.2	9.18	Southwest.
	April....	30.039	70.4	5.01	Southeast.
	May.......	30.070	75.8	3.14	Southeast.
	June.....	30.034	80.5	5.34	Southeast.
	July	30.030	82.1	6.43	Southwest.
	August..............	30.032	82.6	3.75	East.
	September....... ..	30.034	79.3	2.10	Southeast.
	Annual mean.....	30.066	68.6	62.51	Southeast.

NEW YORK CITY, NEW YORK.

[Latitude, 40° 42′; longitude, 74° 1′.]

The office still remains in the Equitable Building, at 120 Broadway, but the room occupied at the date of last report proving too small for the proper discharge of the observer's duties, the company placed two desirable rooms on the same floor at his disposal, giving ample space for all necessary work connected with the interior of the office. Full midnight reports from all stations have been received here without interruption during the year, but the morning and afternoon reports from the southern stations were suspended from July 1 to August 21, when the circuit system was resumed and all reports received with regularity. Full reports from the eastern States, the Lake region, and the country west of Chicago were constantly received during the suspension of the circuit system, and after consolidation forwarded to the central office. The publication of the map was suspended from July 1 to July 20, when it was again resumed, and printed from the midnight reports, instead of the morning ones, as previously. The night reports are still used for the map in order to get it out and distributed early in the day. The latest synopsis and probabilities received are printed on the map with the detailed reports. Twenty-three thousand eight hundred and forty maps and seven thousand three hundred and fifty-five bulletins have been issued and distributed from the office during the year, besides ten thousand additional maps printed during the fair of the American Institute, and distributed on the spot. The leading dailies, both morning and evening, publish the probabilities regularly, and occasional summaries of such reports as are of special interest. While the work of setting up the map nightly and the work of correcting it before issue is done under the supervision of the observer in charge, the actual printing is done by the Equitable Insurance Company, which has shown a generous and practical interest in the development of the service. It is expected to largely increase the daily issue of maps during the ensuing year, and also to arrange for their prompt distribution in all parts of the city.

There are three flag-staffs for the display of cautionary signals used, one on either side of the large staff belonging to the building. On the central one a wire cylinder is worked by halyards, and raised when the approach of a storm is expected; while on the smaller ones large signal-flags hoisted by day, and lanterns at night are similarly displayed. The cylinder has not worked satisfactorily, as it throws too much strain upon the staff, and other means are being devised to accomplish the purpose for which it was constructed.

Twenty-four cautionary signals have been displayed during the year, with generally satisfactory results. The signal-lights used have been found too small for display in a city where they are surrounded by numerous other lights, of nearly equal brilliancy, and others of an improved quality and larger size have been ordered and will soon be ready for use. The merchants, underwriters, and business men generally in the city have shown a gratifying appreciation of the aims of the service.

Sergeant C. R. Estabrook remains in charge of the station, and has performed the arduous and responsible duties devolving upon him with promptness, intelligence, and zeal. Sergeant A. W. Eastlake, the assistant at the date of the last report, was relieved April 8, 1872, and transferred to Washington. Two assistants are on duty at present, Privates Tighe and Lamont, both of whom are kept busily employed and give satisfaction.

The station was inspected in April, and the office and instruments found in good condition. The anemometer is provided with the standard self-registering attachment.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.130	54.8	7.07	Southwest.
	November	30.090	39.3	3.76	Northwest.
	December	30.075	30.3	1.19	Southwest.
1872..	January	29.997	29.9	2.34	West.
	February	29.968	31.8	1.44	West.
	March	29.986	30.3	3.93	West.
	April	30.014	49.7	2.49	West.
	May	29.894	61.9	2.25	West.
	June	29.942	72.8	2.93	Southwest.
	July	29.938	76.3	9.36	Southwest.
	August	30.013	75.2	6.08	Southwest.
	September	30.014	65.8	3.44	Northwest.
	Annual mean	30.003	51.5	46.28	Westerly.

NORFOLK, VIRGINIA.

[Latitude, 36° 51′; longitude, 76° 19′.]

No change has been made in the location of the office at this station since the date of last report. Full reports were received here until July 1, when the discontinuance of the circuit system caused a suspension of all service to the station, except that rendered necessary for the display of cautionary signals. Two thousand one hundred and fifty bulletins and two thousand and four maps were issued, and two hundred and fifty-seven reports furnished to the press previous to July 1, 1872.

The leading dailies publish the tabular reports and monthly statements occasionally, and the probabilities regularly. The members of the meteorological committee of the board of trade have displayed considerable interest in the service, and, together with other leading citizens, have urged its extension by the establishment of a station at Cape Hatteras. Efforts were made during the past winter by these citizens to get congressional aid for the construction of a telegraph-line to the cape, but they were unsuccessful, and the project has been temporarily abandoned.

The office was inspected in June, and found in good condition.

Ten cautionary signals have been displayed at this port, eight of which are reported as having been fully justified.

Fortress Monroe has been suggested as a better place for the display of these signals, but the present condition of the telegraph cable across the harbor is not considered reliable enough to justify a change. There is a large standard wind-vane at this station, and the anemometer is provided with the standard self-registering attachment.

Sergeant William E. Smith was in charge until transferred to another station, May 4. He was succeeded by Sergeant James E. Magruder, who still remains, and has given satisfaction. Two assistants have been relieved on account of ill-health since last report. Private E. B. Robbins, at present on duty there, was ordered to the station July 9, 1872.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.159	61.0	4.14	South.
	November	30.050	48.0	5.76	North.
	December	30.150	39.0	2.18	Southwest.
1872..	January	29.080	35.0	2.91	Northwest.
	February	29.980	37.0	7.33	Northeast.
	March	30.040	39.0	4.51	North.
	April	30.070	57.0	3.53	Southeast.
	May	30.001	68.7	5.68	South.
	June	30.008	76.0	5.06	Southwest.
	July	30.004	81.5	3.63	Southwest.
	August	30.058	79.2	3.20	South.
	September	30.050	72.6	2.40	South.
	Annual mean	30.054	57.8	50.33	South.

OMAHA, NEBRASKA.

[Latitude, 41° 16′; longitude, 96° 00′.]

No change has been made in the location of the office at this station since last report. The reports from the stations west to the Pacific coast were received here up to July 1 and since September 1, 1872, and two thousand four hundred and sixty bulletins issued in addition to two hundred and seventy-two reports furnished the press. The daily papers publish the probabilities when received, and the monthly summaries regularly, but the tabular reports only occasionally. River reports are made from this station, the gauge used being one constructed in accordance with plans furnished from the central office. At present this gauge is unserviceable, owing to a change in the channel of the river during the year.

Two inspections have been made since last report, one in December, 1871, and the other in September, 1872. The office, instruments, and records were found in good condition at the time of the first inspection, but at the last their condition was such as to compel the immediate removal of the observer.

Sergeant W. B. Webster was in charge until transferred to another station, March 19. He was succeeded by Sergeant G. A. Dandelet, who was relieved for incompetency, September 13, and was succeeded by Sergeant H. Barton, who is now in charge. When river reports were ordered, the distance of the gauge from the office was so great that the services of an assistant were necessary to the proper performance of this additional labor, and Private D. H. Sackett was accordingly ordered to the station, and remained until ordered in for promotion, June 17. Private George W. McKee is now on duty as assistant. Both observers, who have served during the year, have rendered all reports by mail and telegraph promptly and in proper form. The station is supplied with the large-sized standard wind-vane and with the standard self-registering attachment to the anemometer.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.924	52.4	2.06	Southeast.
	November	29.955	31.0	4.22	Northwest.
	December	30.090	16.0	.91	Northwest.
1872..	January	30.130	19.0	.09	Northwest.
	February	29.940	27.5	.43	Northwest.
	March	30.022	31.0	1.61	Northwest.
	April	29.792	51.0	3.84	Southeast.
	May	29.808	61.0	6.35	South-southeast.
	June	29.794	72.7	3.91	South-southeast.
	July	29.836	77.0	6.36	Southeast.
	August	29.874	75.6	1.78	South-southeast.
	September	29.809	62.8	3.24	Southeast.
	Annual mean	29.915	48.1	34.80	Southeast.

OSWEGO, NEW YORK.

[Latitude, 43° 28′; longitude, 76° 35′.]

The location of the office at this station remains unchanged since last report. In common with the other stations on the lake circuit, Oswego received full reports until July 1, when all reports were suspended until September 1, since which date fifty-two have been received daily with as much regularity as the somewhat uncertain telegraphic communication will permit.

Two thousand five hundred and sixty-six bulletins and two thousand and eighty-six maps have been issued and seven hundred and fifty-two reports furnished the press. Selections from the tabular reports are published in most of the daily papers and the probabilities given regularly. Considerable local interest is felt in the service. The chairman of the meteorological committee of the Board of Trade stated to the inspecting officer that the reports had a great influence upon the price of grain at this port, as well as in their direct application to navigation. Mr. McWhorter, the chairman of the meteorological committee, has kept in constant communication with the central office, and has shown a desire to promote the interests of the service by making such suggestions from time to time as appeared to him necessary to improve its operations.

The office was inspected in June, and found in excellent condition. Sergeant B. F. Hough, who has been in charge since the station was established, is highly commended by the inspector for the neat appearance of his office and the intelligence displayed in the management of the station. The sergeant has constructed a self-registering attachment to the large wind-vane similar in principle to one used in the central office, from which he obtains a continuous record of the wind's movements. The anemometer is provided with both the standard telescopic rod and self-registering attachments. The assistants at this station have been men of unusually good character. Private T. B. Jennings remained until ordered in for promotion, June 17, 1872, when he was succeeded by Private McComas, who has shown commendable zeal in the service, especially in the preparation of tables for the correction of the barometrical readings.

Twenty-one cautionary signals have been displayed at this station, and all but four are reported as fully justified. In reference to the display on November 14, 15, and 16, 1871, the observer reports as follows:

> The warning-signal has been of great benefit, as many vessels were detained on account of the display and thus escaped the storm. Two vessels ventured out, but encountered the gale and were obliged to put back, being considerably damaged. One vessel that went out while the signal was flying ran ashore about one mile above the port, and is now a total wreck.

The winds considered dangerous for navigation at this port are reported to be those from the northwest and west-northwest, and from the northeast when accompanied by snow and fog.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October............	30.000	53.3	1.44	South.
	November..........	29.980	34.6	2.96	Northwest.
	December..........	29.930	26.5	1.30	South.

Meteorological summary—Continued.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	January	29.950	26.0	1.48	West.
	February	29.960	23.8	1.17	Northwest.
	March	29.978	25.8	2.43	Northwest.
	April	29.953	42.7	1.44	West.
	May	29.872	52.7	2.72	West.
	June	29.918	64.2	4.48	West.
	July	29.883	72.2	1.84	West.
	August	29.959	72.8	.71	South.
	September	29.944	62.7	2.44	South.
	Annual mean	29.944	46.4	24.61	West.

PHILADELPHIA, PENNSYLVANIA.

[Latitude, 39° 57′; longitude, 75° 12′.]

The office remains at 133 South Second street, as at the date of the last report. The anemometer and wind-vane are on the top of the cupola above the office, and well exposed. The vane is the large-size standard one and the anemometer is provided with the standard self-registering attachment. The rain-gauge is on the roof of the main building, and is affected to some degree by the proximity of the tower, which rises forty-five feet above it and shelters it partially from northwest storms. Measures have been taken to obtain a better location for it.

Full reports were received here until July 1, when they were wholly suspended until August 9, 1872, when the midnight report in full was received and the publication of the map resumed. On August 21 the circuit system was resumed, and full reports have since that date been received at the three regular reporting hours. The publication of the midnight map continues, in order to get it distributed before the receipt of the morning reports.

Five thousand nine hundred and fifty-nine bulletins and ten thousand five hundred and sixty-five maps have been issued and one thousand three hundred and sixty-one reports furnished the press. Several of the leading papers print the tabular report regularly, and nearly all of them occasionally. All print the probabilities regularly, and most of them the weekly and monthly statements. In reference to this subject the observer remarks, in his semi-annual report of July 1:

The advantages of our service are now attracting the most earnest consideration at this place; the shipper, the manufacturer, the merchant, and, in fact, all business men have accepted and employed the benefits of the system in an endless number of ways in their respective occupations. * * * That the value of the weather reports is realized by business men in their transactions is evidenced by the fact that this office is daily in receipt of letters from parties desiring to be supplied with them, and these requests have, in nearly all cases, been granted. * * * I take pleasure in testifying to the unvarying support and efficient aid the ably conducted press of this city has ever rendered to this office in all its efforts to extend any information relating to the service.

The station was inspected in April, and the observer then in charge relieved upon the report of the inspecting officer, who considered a change necessary for the good of the service. Several changes have been made in the men on duty here during the year, all of them with the view of benefiting the service. Sergeant Daw was transferred to another station on November 27, 1871, and was succeeded by Sergeant S. P. Carusi, who was relieved for reasons above stated April 8, and was succeeded by Sergeant George H. Richmond, who was in turn relieved for alleged improper conduct, September 13, 1872.

Sergeant W. T. Boyd is now in charge, and has two assistants, one of them being a printer, who gets out the map. Notwithstanding these numerous changes, the amount of work done at the station has been creditable to the men engaged upon it, and all reports, telegraphic and mail, have been regularly and promptly forwarded. The demand for maps here, as elsewhere, when they are printed, is steadily on the increase and keeps ahead of the ability to supply.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.140	56.5	....	Southwest.
	November	30.046	40.5	4.09	Northwest.
	December	30.146	32.9	1.57	Northwest.
1872..	January	30.053	29.4	.95	West.
	February	30.011	31.2	1.12	Northwest.
	March	30.054	32.1	3.67	Northwest.
	April	30.063	51.6	2.60	West-northwest.
	May	29.975	61.5	3.15	West-northwest.
	June	29.976	72.7	4.29	West-southwest.
	July	29.970	78.6	9.20	West-southwest.
	August	30.045	75.9	7.81	Southwest.
	September	30.049	67.5	3.66	Northwest.
	Annual mean	30.044	52.5	42.11*	Northwest.

* For eleven months; rain-gauge not in position October, 1871.

PITTSBURGH, PENNSYLVANIA.

[Latitude, 40° 32′; longitude, 80° 2′.]

The office has remained in the First National Bank building, at the corner of Fifth avenue and Wood street, the only change made being the removal from one small room to two others on the same floor, better adapted for the office business.

Four thousand three hundred and fifty-eight bulletins have been issued, some of which were furnished to the press and published in whole or in part.

Fifteen reports were received here until July 1. From that date to August 21 the reports from river stations only were received each afternoon, but since the resumption of the circuit system sixteen reports are received regularly three times each day.

The station has been twice inspected since last report, once in January and again in March. Some slight irregularities were found to exist on both occasions, and immediately corrected. The instrument-shelter is a reduced copy of the observatory pattern, adopted by the central office, and answers the purpose satisfactorily. The wind-vane, (large pattern,) rain-gauge, and anemometer are well exposed on the roof of the building. River reports are made regularly from this station, the gauge used being the standard one constructed by the city authorities, on the banks of the Monongahela a short distance above its junction with the Allegheny. Considerable interest is manifested in the service, especially by members of the press and of the Pilots' Association, and a strong desire expressed for the establishment of additional stations on the upper waters of the two rivers forming the Ohio. The probabilities are published whenever received and the river reports regularly.

Sergeant L. M. Crist was in charge until relieved, December 27, 1871, for failure to forward his mail-reports; Sergeant George N. Sullivan from that date until transferred to the central office, May 4, and Sergeant W. E. Smith, who succeeded him, still remains.

Private H. Barton was on duty as assistant until ordered in for promotion, June 17, when he was relieved by Private William Finn.

Reports have latterly been forwarded regularly and in proper form and the station is reported in good condition.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.955	56.0	2.66	Southwest.
	November	30.130	38.0	3.30	Northwest.
	December	30.130	30.0	2.00	Northwest.
1872..	January	30.180	28.0	1.85	West.
	February	30.102	27.0	.97	West.
	March	30.077	34.0	1.33	West.
	April	29.631	57.0	.88	North.
	May	29.920	63.0	2.61	Northwest.
	June	29.900	71.0	2.35	Northwest.
	July	29.910	75.0	7.70	West.
	August	29.980	74.0	2.81	West.
	September	29.980	66.0	2.54	West.
	Annual mean	29.991	51.6	31.00	West.

PORTLAND, MAINE.

[Latitude, 43° 40′; longitude, 70° 14′.]

No change has been made in the location of the office during the year, nor is any considered necessary at present. Full reports were received here until the suspension of the circuit system, July 1, since which date none have been received, owing to the difficulty of making the necessary telegraphic arrangements.

Two thousand six hundred and six bulletins and one thousand nine hundred and thirteen maps have been issued and seven hundred and fifty reports furnished to the press and published in condensed form. The probabilities and monthly summaries are published regularly and considerable interest manifested in the service by leading citizens, and Mr. Farley, chairman of the meteorological committee of the Board of Trade, has rendered much valuable assistance to the observer in various ways during the year.

Twelve cautionary signals have been displayed at this port during the past year, and seven of this number were fully justified. As to the result of the different warnings the observer reports as follows:

November 1, 1871.—The violence of the gale was not felt at this station, but was reported as being very severe off the coast. On account of the display, many vessels remained in the harbor which otherwise would have put to sea, where they would have encountered the storm.

November 10, 1871.—No injuries to shipping are reported, as timely preparations for the storm had been made.

November 14, 1871.—By the timely display of the signal a number of vessels that were making preparations to leave the harbor during the evening were detained, thereby escaping the gale.

December 4 *and* 5, 1871.—Owing to the display of the signal, the regular steamers to New York and ports east remained in harbor until the violence of the gale subsided.

The office was inspected in May, and numerous irregularities in the management of the station and the location of the instruments and the manner of keeping the records discovered, all of which were corrected. The rain-gauge, wind-vane, (large pattern,) and anemometer are well exposed on a raised platform upon the roof, and the last-named instrument is provided with the standard telescopic rod and self-registering attachments.

Sergeant R. E. McGrady was relieved from charge of the station, August 17, and transferred to Louisville, Kentucky, being succeeded by Sergeant A. B. Williams, who still remains. Private N. Phelps is on duty as assistant, having relieved Private Ramsay, who was transferred to Mount Washington, June 17, 1872. Mail and telegraphic reports have been forwarded promptly and in proper form, so far as the observer is concerned, but the midnight reports have been delayed until the next morning by the closing of the telegraph-office at night since July 1.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871 .	October	30.053	50.0	6.55	Southwest.
	November	29.926	33.0	6.37	Northwest.
	December	30.004	23.0	3.00	Southwest.
1872 .	January	29.910	22.5	.77	Southwest.
	February	29.924	23.0	.35	Northwest.
	March	29.900	23.3	1.44	Northwest.
	April	29.949	41.8	1.60	Northwest.
	May	29.955	52.3	3.23	South.
	June	29.950	62.0	5.95	South.
	July	29.919	68.7	2.97	South.
	August	30.007	67.1	6.97	Southwest.
	September	30.020	59.8	3.12	Southwest.
	Annual mean	29.963	43.9	42.32	Southwest.

PORTLAND, OREGON.

The office is located in Gilman's Building, at the corner of First and Alder streets, in the center of the business part of the city and within easy reach of the telegraph-office. The wind-vane, (large pattern,) rain gauge, and anemometer are well exposed on the roof of the building. The instrument-shelter is of the standard pattern, and projects from a window with a northern exposure. The station was established by Sergeant Edwin Garl, and who began to send reports November 1, 1871. The only reports received at the station were those of San Diego and San Francisco, on the Pacific coast, previous to July 1. Since that date the work of the observer has been limited to making and forwarding the local observations. The telegraphic communication with San Francisco, where the reports are transferred eastward, has been frequently interrupted. In addition to this difficulty, the telegraph-office has been closed at the hour for sending the morning and night reports since July 1, causing great irregularities in their transmission.

Four hundred and eighty bulletins have been issued and two thousand one hundred and eighty-seven reports of the local observations furnished the press and regularly published.

The station is supplied with a full set of standard instruments, all of which are reported in good condition. An officer is now on his way to inspect the station.

All mail-reports have been forwarded promptly and in proper form.

Latitude of station	45° 30′
Longitude of station	122° 27′
Elevation of barometer above sea-level	97 feet.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	....	....	....	....
	November	30.060	45.0	2.77	Southeast.
	December	30.040	38.0	7.62	Southeast.
1872..	January	30.160	36.0	6.56	Southeast.
	February	29.900	44.0	12.13	Southeast.
	March	30.130	48.0	5.28	South.
	April	30.150	47.0	2.96	South.
	May	30.130	57.0	.92	Northwest.
	June	30.090	64.0	1.52	Northwest.
	July	30.040	68.0	.20	Northwest.
	August	30.060	66.0	.13	Northwest.
	September	30.063	59.0	1.26	Northwest.
	Mean for 11 mos	30.075	52.0	41.35	Northwest.

PUNTA RASSA, FLORIDA.

[Latitude, 27° 00′; longitude, 82° 18′.]

The location of the office at this station has not been changed since last report, there being no other building in the place. The room is small and somewhat crowded, but is the best that could be had, and for its use the office is under obligation to the International Ocean Telegraph Company, whose property it is.

The station was inspected in February, and found without a proper shelter for the exposure of instruments. One was ordered by the inspector from Key West, the nearest place where it could be obtained. Other irregularities were corrected, and the office left in as good order as could be expected. No reports are received here for publication and no bulletins issued.

Sergeant C. E. Ingram was relieved from charge of the station, February 27, and his successor, Sergeant George S. Rowley, September 5, both upon the report of the superintendent of the telegraph company that they had been guilty of misconduct. Sergeant William Theodovius was ordered to the station, September 5. Private John Healy was assigned to duty here as an assistant, February 27, and still remains for the purpose of preventing interruption of the reports through sickness of the observer.

All mail-reports have been forwarded with regularity and the duties of the station in relation to office-work discharged satisfactorily. The station is supplied with a medicine-chest, furnished by the Medical Department of the Army, for the observer's use, and is comfortably fitted up with such furniture as could be obtained from Key West. Every effort has been made to render the duty here as pleasant as practicable at such an isolated post.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.035	79.8	1.80	Northeast.
	November	30.040	71.5	.98	Northeast.
	December	30.180	67.0	2.68	Northeast.
1872..	January	30.140	62.5	2.64	Northeast.
	February	30.030	64.0	2.71	Northeast.
	March	30.080	69.0	.69	South.
	April	30.080	77.0	1.54	Northeast.
	May	30.090	78.0	2.88	Northeast.
	June	30.077	80.9	7.16	West.
	July	30.090	81.0	8.68	Northeast.
	August	30.045	81.0	3.97	Northeast.
	September	30.020	80.0	5.14	Northeast.
	Annual mean	30.076	74.3	40.87	Northeast.

ROCHESTER, NEW YORK.

[Latitude, 43° 08′; longitude, 77° 51′.]

The office remains in Power's Block, at the corner of West Main and State streets, in the center of the business part of the city. The building is fire-proof, being built of iron, stone, and brick, and, although the office has been on the eighth floor since September 1, it is reached easily by means of an elevator. Previous to September 1 it was on the sixth floor, but the additional stories being added by the proprietor, it was moved at his request and at his expense.

The anemometer provided with the standard telescopic rod and self-registering attachments, the rain-gauge, and large wind-vane are well exposed on the roof of the building, and the signal-staff is sufficiently elevated to be visible from Charlotte, the port of the city, six miles distant. The instrument-shelter is a modified copy of the observatory adopted at the central office, and is on the roof of the building.

Previous to July 1 full reports, and since September 1, fifty-two reports have been received with as much regularity as at the other lake stations. Three thousand eight hundred and sixty-nine bulletins and one thousand eight hundred and seventy-three maps have been issued and five hundred and eleven reports furnished to the press. The leading papers publish the tabular report, the probabilities, and the weekly and monthly summaries. Mr. Powers, the proprietor of the building, has displayed a lively interest in the service and done all in his power to make the office perfect in its appointments at some personal expense.

The station was inspected on July 1, and the office and instruments found in good condition. Sergeant F. M. M. Beall has been in charge since its establishment and has rendered all reports promptly and in proper form. He is highly commended by the inspecting officer as attentive to his duties and always ready to give information to applicants. The assistant, Private L. M. Crist, is also favorably mentioned.

Thirteen cautionary signals were displayed at this point, and all but three are reported as fully justified. In reference to known benefits or injury to commercial or other interests, resulting from the display of signals, the observer reports as follows:

December 3, 1871.—People look up to the signal with expectation and confidence, on account of the accuracy that marks its predictions.

April 13, 1872.—Signal ordered on the 12th instant was hoisted twenty hours before the gale commenced. This being the first display of the season, many persons called to ascertain the probable time and severity of the expected gale. At 2 p. m., the wind, blowing from the west, reached a velocity of sixty-two miles per hour. Considerable damage was done to property, and from personal inquiry I find many builders governing their operations by it, and gladly acknowledged the benefit of the signal. All the city papers acknowledged its timely warning. The steamer Norseman made her regular trip on the 13th, but encountered very high and dangerous seas.

The winds considered dangerous at this station are those from the northeast to the northwest.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.100	51.0	2.59	West.
	November	30.010	32.0	3.10	Northwest.
	December	29.960	24.0	1.82	West.
1872..	January	29.950	23.5	2.37	West.
	February	29.950	23.0	1.28	Southwest.
	March	29.950	22.0	2.50	Northwest.
	April	29.920	44.0	2.15	Northwest.
	May	29.890	54.0	2.18	West.
	June	29.880	65.0	5.35	West.
	July	29.890	71.0	2.56	West.
	August	29.960	71.0	1.89	Southwest.
	September	29.960	62.0	1.72	Southwest.
	Annual mean	29.952	45.2	29.51	West.

SAN DIEGO, CALIFORNIA.

The office is located in the second and upper story of a building on the south side of Horton Square, within easy reach of the post and telegraph offices, and the roof affords an excellent exposure for the wind-vane and anemometer. The instrument-shelter is of the standard pattern, and projects from a window having a northwestern exposure.

The station was established by Sergeant John B. Wells, who began sending reports November 1, 1871, and has kept them up since that date with as much regularity as the condition of the telegraph-line would permit. Since July 1 the closing of the telegraph-office at the hours for sending the morning and midnight reports has been an additional cause of delay. Previous to July 1 the reports of San Francisco, and Portland, Oregon, were received, but at present the work of the observer is limited to the transmission and publication of the local observations.

Five hundred and ninety-eight bulletins and seventy-two reports have been issued and published regularly. The observer remarks as follows upon the local interest manifested in the service:

Semi-annual report of July 1, 1872.—The importance accredited to this branch of the signal-service by the commercial and agricultural public and the zealous interest manifested by all classes in its wonderful development and success are fully demonstrated by the confidence with which the general public are pleased to receive our official reports and the favorable expressions of numerous persons from all parts of the country, generally here for their health, who take the occasion to visit my office. Among my visitors I take pleasure to mention General Meigs, U. S. A., General Alexander, of the Engineer Corps, and a number of other Army and also Navy officers on different occasions. * * * The wonderful equality of this climate, produced as it is by the almost constant westerly winds, which receive their temperature from their passage over the vast expanse of the Pacific, attracts invalids suffering from pulmonary complaints in great numbers from all parts of the country, where they find relief in the peculiar qualities of this dry, bracing atmosphere, and their lives are often prolonged in this climate, where extremes of heat and cold are unknown. Intelligent physicians, in recommending their patients to an agreeable climate, are guided or influenced in selecting a location by our published reports.

Latitude of station	32° 44′
Longitude of station	117° 06′
Elevation of barometer above sea-level	62 feet.

The station is supplied with a full set of standard instruments, all of which are reported in good condition.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	November	30.011	59.7	1.19	West.
	December	30.133	56.5	1.39	Northwest.
1872..	January	30.091	51.9	.99	East.
	February	30.086	54.7	1.63	West.
	March	30.031	56.2	.46	West.
	April	30.054	56.3	.26	West.
	May	30.004	60.8	.12	West.
	June	29.974	65.2	.00	West.
	July	29.975	66.6	.00	West.
	August	29.955	68.9	.18	West.
	September	29.984	66.4	.00	West.
	Mean for 11 months	30.027	60.3	6.22	West.

SAN FRANCISCO, CALIFORNIA.

[Latitude, 37° 48′; longitude, 122° 26′.]

No change has been made in the location of the office since the date of last report. Previous to July 1 and since September 1, reports from eleven stations have been received here, and reports from San Diego, and Portland, Oregon, regularly transferred to Chicago and eastward.

One thousand nine hundred and twenty-four bulletins and four hundred and four press-reports have been issued. The daily papers occasionally publish the tabular reports and monthly summaries.

The anemometer is supplied with the standard self-registering attachment.

Sergeant S. P. Carusi was relieved from charge of the station, October 16, 1871, and was succeeded by Sergeant F. B. Pilling, who is still at the station, but has been unfit for duty on account of serious illness since March 19, 1872, the work having been ably performed in the mean time by Sergeant W. B. Webster, transferred here from Omaha.

All reports by mail have been sent regularly and in proper form since the latter took charge, and the telegraphic ones as regularly as the condition of the lines permitted. The instruments are all reported in good condition. There is no assistant at this station at present, but one will be sent at an early date to insure the transfer of reports in the event of the observer's sickness.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.990	65.5	.07	Southwest.
	November	30.070	53.0	2.81	West.
	December	30.090	53.0	14.36	Southwest.
1872..	January	30.120	52.0	4.03	North.
	February	30.090	56.0	6.90	Southwest.
	March	30.106	54.2	1.59	West.
	April	30.079	53.7	.81	West.
	May	29.986	56.3	.18	Southwest.
	June	29.991	59.9	.04	Southwest.
	July	29.974	58.0	.01	Southwest.
	August	29.945	56.4	.00	Southwest.
	September	29.984	58.7	.04	Southwest.
	Annual mean	30.035	56.4	*30.84	Southwest.

SANTE FÉ, NEW MEXICO.

The office is on the upper floor of a two-story building known as Johnson's Building, on a street without name or number. The roof is flat and affords a good exposure for the wind-vane, (small pattern,) anemometer and rain-gauge, and also for the instrument-shelter, which is a small structure of lattice-work elevated above the roof.

The station was established by Sergeant John P. Clum, who began sending reports November 20, 1871, and has continued to do so since that date with as much regularity as the condition of the telegraph-line would permit.

Mail communication has also been unreliable, causing frequent delays in the receipt of reports sent by mail. The station has not been inspected, but the observer reports all instruments in good condition. The work of the office has been done without an assistant.

Latitude of station .... 35° 41′
Longitude .... 106° 3′
Elevation of barometer above sea-level .... 6,850 feet.

No bulletins have been issued, as no reports from other stations are received. The monthly summaries have been published by the press with regularity, and some local interest manifested in the service, mainly in the expression of a desire for more reports.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	December	....	34.3	....	North.
1872..	January	29.770	27.0	.34	North.
	February	29.733	34.0	.20	North.
	March	29.735	38.8	.13	North.
	April	29.725	45.8	.14	Southwest.
	May	29.851	58.1	.45	North.
	June	29.883	66.9	2.44	Southwest.
	July	29.925	67.6	2.62	Northeast.
	August	29.970	67.0	2.98	South.
	September	29.910	60.0	.27	Southeast.
	Mean	29.834	49.9	9.57	North.

SAVANNAH, GEORGIA.

[Latitude, 32° 05; longitude, 81° 08′.]

No change in the location of the office has been made during the year, and full reports were received until the suspension of the circuit system, since which date the only ones received are those from the Florida stations.

Two thousand nine hundred and seventy-one bulletins, two hundred and fifty press reports, and one thousand four hundred and sixty-nine maps have been issued and distributed throughout the city. The leading papers publish the probabilities and monthly statements regularly. The station has been twice inspected since last report, once in October, 1871, and again in March, 1872, and found in good condition on both occasions, the slight irregularities discovered in the manner of keeping the records and caring for the instruments being easily corrected.

The large wind-vane is well exposed, and the anemometer is provided with the standard telescopic rod and self-registering attachments.

Leading merchants and shippers have manifested a lively interest in the service and expressed themselves as having derived much practical benefit from observation of the reports. A general desire is also expressed for the resumption of the bulletins.

Four cautionary signals have been displayed at this station, all of which are reported as fully justified. The observer reports upon the result of the several displays as follows:

November 15, 1871.—The display prevented several ships and other craft from going to sea, and from information I learn there was a heavy gale along the immediate coast.

November 30, 1871.—Several vessels were detained from leaving port in the immediate vicinity of Savannah; there was a wind from twelve to twenty miles per hour.

Sergeant C. W. Held was in charge until transferred to a northern station, January 15, 1872, when he was succeeded by Sergeant J. O. Manson, who still remains. Both men have given satisfaction by the promptness and regularity with which they have rendered all reports. Private J. K. P. Purdum is still on duty as assistant, and is highly commended by the inspecting officer for his zeal and intelligence.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.142	68.3	3.55	Northeast.
	November	30.061	59.1	2.22	Southwest.
	December	30.215	51.5	1.59	Southwest.
1872..	January	30.160	46.0	2.09	Northwest.
	February	30.000	50.0	4.65	Northwest.
	March	30.078	53.5	10.18	Northwest.
	April	30.103	67.0	2.75	East.
	May	30.060	76.0	5.22	Southwest.
	June	30.045	80.0	9.52	Southwest.
	July	30.060	83.0	4.36	Southwest.
	August	30.060	84.0	12.31	East.
	September	3 .060	76.0	3.52	Southeast.
	Annual mean	30.087	66.2	61.96	Southwest.

SHREVEPORT, LOUISIANA.

[Latitude, 32° 30; longitude, 93° 45′.]

The office is on the fourth floor of the Southern Hotel, on Milan street, in the business center of the town. The roof affords an excellent exposure for the wind-vane, (large pattern,) anemometer, and rain-gauge, and they are well and firmly set up. The shelter is of the standard pattern, and projects from a window having a northern exposure.

Two inspections have been made during the year, one in November, 1871, and the other in August, 1872, and such slight irregularities as were discovered in the arrangement of the instruments and manner of keeping the records corrected.

River reports are made from this station, the gauge used being one constructed by the observer in accordance with plans furnished from the central office. Owing to the fact that it was put up during high water it has failed to prove seviceable during the summer season, and a new one will be required. The reports from this station are considered of importance by shippers on the Mississippi from New Orleans to Saint Louis, and special pains will be taken to render them accurate and trustworthy.

Seventy bulletins and six hundred and forty-five press reports have been issued. The local observations are published by the principal papers.

Sergeant Hugh Coyle has been in charge of the station since November 6, 1871, and is highly commended by the inspecting officer for his attention to duty. All reports have been sent regularly and in proper form. Some delay in the transmission of the midnight reports has occurred since July 1, by the closing of the telegraph-office at the regular hour for sending them. To guard against any interruption of the reports an assistant was ordered to the station, August 2, 1872.

The observer gives the following illustration of the practical legal value of the reports:

In the month of February last something occurred here which may be stated as an indication of the esteem in which our service is held by the intelligent public.

A man was on trial at the district court for murder. A skiff (boat) was one of the things found upon the scene of the supposed murder. It was alleged upon trial that the boat had drifted with the wind in a certain direction to a certain place. Something was said about freezing water, ice in the river, and evaporation on the day the dead body was found, but these allegations were not generally accepted as facts, and a contradiction ensued. The mind of a wide-awake attorney soon perceived that these questions could be determined with scientific accuracy and reliability by means of the Signal-Service records at this station. On the 19th of February my office was visited by two lawyers in quest of information from said records, and the same day I received a citation from the district court to appear immediately with the records of the weather for November 28 and 29, 1871. I was sworn to give true evidence in the case, which was decided by the information obtained from the daily record of observations.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October*	....	....	....	
	November	30.051	51.1	3.04	East.
	December	30.167	47.7	1.30	South.
1872..	January	30.211	40.7	5.25	East.
	February	29.966	50.6	5.89	West.
	March	30.064	54.4	4.11	South.
	April	29.984	66.5	7.18	Southeast.
	May	30.018	73.5	9.10	Southeast.
	June	30.002	80.4	2.70	South.
	July	29.981	84.0	1.62	South.
	August	30.019	84.5	.40	East.
	September	30.002	78.6	2.91	Southeast.
	Mean for 11 months.	30.043	64.7	43.50	South.

* Records incomplete.

SAINT LOUIS, MISSOURI.

[Latitude, 38° 37′; longitude, 90° 16.′]

No change has been made in the location of the office since last report, but one is contemplated at an early day, to a building much more favorably located for meteorological purposes. The large wind-vane, rain-gauge, and anemometer are elevated above the roof on a strongly-built platform, and are substantially put up. The latter instrument is provided with the standard telescopic rod and self-registering attachments.

The instrument-shelter is of the standard pattern, and projects from a window with a northern exposure. The station was inspected in November, 1871, and in August, 1872, and found in good condition on both occasions.

Fifteen reports were received here tri-daily until July 1, after which the same number of river reports were received each afternoon until August 21, when, the circuit system being resumed, the number of reports was increased to twenty-seven, to be received three times each day.

Reports to and from Leavenworth and Cairo are here transferred under the observer's supervision.

Fourteen thousand and thirty bulletins and river reports have been issued and four thousand five hundred and twenty-four reports furnished to the press. The leading dailies publish the tabular reports in full, and the probabilities, river reports, and monthly summaries regularly and in excellent form.

The inspector reports that the citizens are very desirous of having full reports furnished them and a daily map issued, and in compliance with their wishes and his recommendation arrangements are making for such issue, which will be completed at an early day.

The members of the meteorological committee have taken an active interest in the office and render valuable assistance to the observer in various ways. They urge the extension of the system by the addition of several other stations at the mouths of the principal tributaries of the Missouri and Mississippi Rivers, to give timely notice of the approach of floods from those sources. They also desire more stations to the westward, on account of the large carrying business done over the Pacific Railroad. The river reports are of special importance to this station on account of its large river trade, and special messengers are furnished the observer by the chamber of commerce to assist in their wide and prompt distribution.

The water-gauge is set up at the wharf of the Saint Louis Elevator Company, and was constructed by the observer in accordance with plans furnished from the central office. It agrees with that of the Pilots' Association, and its indications are considered reliable.

Saint Louis was designated as a recruiting station for the signal detachment, and the observer instructed to examine applicants for admission to this service and turn over all candidates accepted to the recruiting officer for enlistment and transfer to Washington. The number of applications was unexpectedly large, and the increased amount of work thus thrown upon the observer necessitated the presence of another assistant to enable him to perform this duty and keep up his regular station-work, and one was, accordingly, ordered here in March, and still remains. The following statement shows how energetically the observer has carried out his duties in this direction:

Number of applicants by mail and in person	1,356
Number of men examined	845
Number of men examined who passed examination and were enlisted	103

Sergeant E. H. Singleton has been in charge of the station, and has displayed in its management, and in his unremitting attention to duty, soldierly qualities of a high order. Referring to him the inspecting officer says:

> He seems to have conducted his station in the best manner possible, and to have given the people every facility to obtain such information as they desired. He enjoys a high character in the community.

Privates P. J. Huneke and Thomas G. White are on duty as assistants, and are both applicants for promotion.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.041	60.5	2.07	South-southwest.
	November	30.065	40.2	1.83	Northwest.
	December	30.090	30.5	1.17	Southwest.
1872..	January	30.160	28.3	.64	Southwest.
	February	30.010	32.4	1.15	East.
	March	30.057	39.1	2.43	Northwest.
	April	29.947	57.5	3.17	Southeast.
	May	29.960	67.4	5.97	South.
	June	29.949	76.9	4.28	South.
	July	29.948	79.0	4.41	Southeast.
	August	30.006	74.9	.93	Southeast.
	September	29.965	69.8	3.45	Southwest.
	Annual mean	30.017	55.1	31.50	Southerly.

SAINT PAUL, MINNESOTA.

[Latitude, 44° 53′; longitude, 93° 05′.]

The office was removed, December 27, 1871, to the third floor of the building at the corner of Third and Market streets. The vane, (large pattern,) rain-gauge, and anemometer are well exposed on the roof of the building, and the latter is provided with the standard self-registering attachment and telescopic rod. The instrument-shelter is of the standard pattern, and projects from a window having a northern exposure.

Ten reports were received here regularly until July 1, since which date those from the river stations alone have been received each afternoon. Some delays in the transmission of the morning and midnight reports have occurred since July, but arrangements have been made which it is hoped will prevent their future recurrence, except from accidental causes.

Eight hundred and thirty-four bulletins and two hundred and thirty-five press reports have been issued. The principal papers publish extracts from the tabular reports, and the probabilities and monthly summaries in full.

Considerable interest is manifested in the service by the citizens, and a strong desire expressed to have the station furnished with full reports for the benefit of the agricultural community.

River reports have been made since January 1, the observation being taken from a gauge constructed in accordance with plans furnished from the central office.

The office has been twice inspected during the year—once in December, 1871, and again in September, 1872. At the first inspection the condition of the office was such as to lead to its removal to a better location and the discharge of the observer. At the second inspection the office and instruments were found in good order, and the conduct of the observer commendable.

Sergeant I. V. Munger was relieved January 15, and was succeeded by Sergeant C. W. Held, the present incumbent. All mail reports have been forwarded promptly and in proper form.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.032	47.3	1.90	Northwest.
	November	30.117	27.8	1.41	North.
	December	30.128	9.9	1.20	Southwest.
1872..	January	30.077	15.1	.28	Northwest.
	February	30.002	20.3	.26	Southeast.
	March	30.121	21.9	1.64	Northwest.
	April	29.876	45.1	1.69	Southeast.
	May	29.922	55.2	5.71	West.
	June	29.849	67.9	3.81	Southeast.
	July	29.919	71.2	4.23	South.
	August	29.974	69.2	3.52	South.
	September	29.889	57.6	5.62	East.
	Annual mean	29.992	42.4	31.27	Southerly.

TOLEDO, OHIO.

[Latitude, 40° 39′; longitude, 83° 32′.]

Full reports from all stations were received until the suspension of the circuit system, July 1. Since September 1 those from fifty-two stations have been received as regularly as the telegraphic facilities at the command of the office would permit.

Three thousand eight hundred and twenty-nine bulletins and one thousand six hundred and sixty-three maps have been issued, and a general interest is manifested in the service by members of the press and leading citizens. The station has not been inspected during the year, and a detailed account of its condition cannot, therefore, be given.

The anemometer is provided with the standard telescopic rod and self-registering attachments, and all instruments are reported by the observer to be in good working order.

Twenty-five cautionary signals have been displayed with good results; fifteen being fully justified, and most of the others partially so.

Sergeant A. C. Ford remains in charge, and has rendered all reports promptly and in proper form.

Private Davis was relieved November 10, 1871, for misconduct, and his successor, Private G. A. Dandelet, promoted and transferred, March 19, 1872.

The present assistant, Private W. H. Colesberry, is reported as efficient and attentive to duty.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.035	55.0	.87	Southwest.
	November	30.077	35.0	1.48	Northwest.
	December	30.062	26.0	1.91	Southwest.
1872..	January	30.056	26.0	1.20	Southwest.

Meteorological summary—Continued.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	February	30.012	24.0	1.10	Northeast.
	March	30.042	30.0	1.68	Northwest.
	April	29.977	49.9	1.87	Northwest.
	May	29.947	60.0	3.97	Southwest.
	June	29.923	71.9	3.96	Southwest.
	July	29.914	76.0	5.76	Southwest.
	August	29.982	75.3	1.16	Southwest.
	September	29.941	64.8	3.38	Southwest.
	Annual mean	29.998	49.5	28.25	Southwest.

VICKSBURGH, MISSISSIPPI.

[Latitude, 32° 24′; longitude, 91° 00′.]

No change has been made in the location of the office since the establishment of the station, but one is proposed, October 1, 1872, to secure a better exposure of the instruments, at a less expense than at present.

The same number of reports are received here as at the other stations on the river circuit, and has varied from time to time as at those stations.

Three thousand five hundred and eighty bulletins have been issued, and seven hundred and thirty-four reports furnished the press. The station was inspected in August, and several changes found necessary in the location of instruments and manner of caring for them. The records have been neatly kept, so well, indeed, as to receive special commendation from the inspecting officer.

The construction of a new and better instrument-shelter has been deferred until the removal of the office to its new location.

River reports have been regularly made since January 1, the gauge used being one constructed by the United States Engineer Corps, and is considered reliable, though badly located.

Considerable interest is manifested by the citizens in the river reports, owing to the fact that the principal business of the city is connected with the river trade.

Sergeant R. R. Martin has remained on duty since the station was established, and has given satisfaction by the prompt and correct rendition of all reports. A special series of observations, made voluntarily by him, have been placed on file in the central office, as evidence of his zeal in the service. Private Max Marix was on duty as assistant until ordered in for promotion, April 10, 1872, when he was succeeded by Private R. McLaughlin, who still remains. Both men are favorably mentioned by the inspector.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.170	67.0	4.13	East.
	November	30.102	54.7	7.03	Northwest.
	December	30.231	50.1	2.05	Southeast.
1872..	January	30.262	42.7	3.24	Northeast.

Meteorological summary—Continued.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1872..	February	30.032	52.6	5.34	Southeast.
	March	30.118	56.0	7.82	North.
	April	30.053	69.2	7.79	Southeast.
	May	30.081	75.2	13.23	Southeast.
	June	30.056	81.6	3.82	Southwest.
	July	30.046	83.5	2.11	Southwest.
	August	30.075	84.6	.49	North.
	September	30.072	79.7	.72	Southeast.
	Annual mean	30.108	66.4	57.77	Southeast.

VIRGINIA CITY, MONTANA.

The office is located in the Cresent Hotel, on Wallack street, and the instruments are reported by the observer as well exposed, but the report of the inspecting officer has not yet been received, so that no detailed description of the office can be given.

The station was established by Sergeant A. B. Knight, who began reporting November 25, 1871, and has continued to do so since, as regularly as the uncertain telegraphic communication would permit. The reports from Fort Benton are received here when the line is in working order.

Three hundred and sixty-four bulletins have been issued, and four hundred and twenty reports of local observations furnished the press, all of which have been published regularly.

The mail reports have been rendered neatly, and in excellent form, but not with sufficient promptness, and the report of the inspecting officer is expected to account for the delay.

There is a full set of standard instruments at this station, all of which are reported in good condition by the observer.

Latitude of station.. 45° 18′
Longitude ....112° 03′
Elevation of barometer above sea-level......................5,510 ft.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	December	29.039	20.2	1.43	West.
1872..	January	29.768	20.3	1.45	Southeast.
	February	29.579	26.6	.79	West.
	March	29.683	31.3	.20	West.
	April	29.627	34.3	.35	Northwest.
	May	29.721	46.6	1.78	West.
	June	29.728	55.6	.74	West.
	July	29.839	58.4	2.73	Southeast.
	August	29.838	61.3	.60	West.
	September	29.880	50.4	.28	West.
	Mean for 10 months.	29.670	40.5	10.35	West.

WASHINGTON, D. C.

[Latitude, 38° 53′; longitude, 77° 01′.]

Several important changes have been made during the year in the arrangement of the central office. The building occupied at the date of the last report proving too small for the rapidly-increasing work of the office, the one immediately adjoining was rented in November, and an additional story put on both buildings. The addition of the new story compelled the removal of the observatory previously used as the instrument-shelter, as the roof was not strong enough to bear its weight with that of the several instruments and apparatus necessarily exposed upon it. A new shelter was, therefore, built, projecting from a window on the northern side of the building. The whole of the upper story is used for the examination, comparison, and adjustment of all instruments purchased by the office, whether for local use or issue to stations. Paper D, herewith, gives a detailed description of the different self-registering instruments not previously described, and the manner of using them. A complete record of each instrument issued is kept, showing its error, date of issue, and all changes made thereafter, as reported by the party receiving it. In the photographic room a series of cloud-views has been made, in addition to the regular work upon the photographic registering-apparatus.

Sergeant George C. Schaeffer still has charge of the immediate comparison of station-instruments, under the supervision of a commissioned officer, who has charge of this department of the office.

The station-work proper is done on the third floor, where all telegraphic reports are translated, bulletins written, and, with the large daily edition of the weather-map, regularly issued. In this room all the reports received by mail from all stations are examined, corrected, and filed for future reference.

Sergeant D. J. Gibbon was in charge of the station until commissioned as second lieutenant, U. S. A., March 4, 1872, when he was succeeded by Sergeant Theodore Smith, who has performed the arduous and responsible duties connected therewith in an able and satisfactory manner.

A large amount of correspondence relating to the management of the distant stations is also done in this room, Sergeant James B. Newlin remaining in charge of this branch of work, as at last report.

During the year sixteen thousand and sixty-four bulletins and one hundred and seven thousand eight hundred and eighty-eight maps have been issued, and two thousand nine hundred and twenty reports furnished to the press.

As the care of the numerous instruments and a proper regard for the safety of the whole building required the constant presence of some responsible man, the working force was divided May 1 into three reliefs of eight hours each, and a sergeant placed in charge of each relief, whose duty is to personally examine the instruments and rooms every hour to see that everything is safe. As a precaution against fire, a "Babcock fire-extinguisher" and water-buckets, kept constantly filled, are placed on each floor of each building. A fire-alarm box is attached to the front of the building.

The map-printing was done on the third floor until May 1, when the room becoming too small for the purpose, the press was moved to a larger room in another building near the main office. In addition to printing the maps, a large amount of other work has been done.

Sergeant John T. Downes remains in charge of this division of the office, and has been faithful and regular in the discharge of his duties.

The work of lithographing the isobars and isotherms upon the tri-daily weather-map is done in the same building with the map-printing, and is under the immediate charge of Private P. F. Nagle, who has shown commendable energy and skill in the performance of this duty.

The last reports in the morning are frequently not received until half-past ten o'clock, and the maps, five hundred and fifteen in number, are required to be ready for delivery by half-past eleven daily. As each map passes twice through the lithographic and once through the printing press, and both are worked by hand, the speed attained is considered very creditable to the men employed.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.143	55.5	1.50	South.
	November	30.068	42.4	4.85	Northwest.
	December	30.142	32.3	1.36	Northwest.
1872..	January	30.147	32.7	.23	Northwest.
	February	30.029	34.0	.93	Northwest.
	March	29.999	36.0	3.22	Northwest.
	April	30.059	56.2	1.74	Northwest.
	May	29.979	67.8	1.43	Northwest.
	June	29.966	76.0	2.78	South.
	July	29.877	81.7	.82	South.
	August	30.025	79.6	5.72	South.
	September	30.075	69.3	3.92	Northwest.
	Annual mean	30.042	55.3	28.50	Northwest.

WILMINGTON, N. C.

[Latitude, 34° 11′; longitude, 78° 10′.]

The location of the office remains unchanged since date of last report. No reports from other stations have been received here since July 1. Previous to that date all were received with regularity.

The station is provided with the large standard wind-vane, and the standard telescopic rod and self-registering attachments to the anemometer.

Two thousand five hundred and forty-five bulletins and one thousand seven hundred and twenty-four maps have been issued, and two hundred and fifty reports furnished the press. The principal papers publish extracts from the tabular reports daily, when they are received, and continue to publish the probabilities and monthly summaries with regularity.

The meteorological committee of the Chamber of Commerce urge the construction of a telegraph line to Smithville, at the mouth of the river, in order that the cautionary signals may be of greater advantage to the shipping than at present, as all large vessels are compelled to anchor in the harbor there, out of sight of the signals as now displayed. Only four signals have been ordered here during the year, of which number three are reported as having been fully justified.

The station has been twice inspected since last report, once in October, 1871, and again in July, 1872, and found in good condition on both occasions.

Sergeant Robert Seyboth remains in charge, and has rendered all reports, both by mail and telegraph, promptly and in proper form.

The office was injured by fire February 9, 1872, but no report was lost in consequence. The instruments were saved through the exertions of the observer, but the furniture and records were partially destroyed. Private H. Dietz has been on duty as assistant since July 17, and performs his duties satisfactorily.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	30.165	65.9	3.02	East.
	November	30.070	55.1	4.46	Northwest.
	December	30.200	46.3	3.90	Southwest.
1872..	January	30.128	43.5	3.62	North-northwest.
	February	29.998	45.9	5.20	North-northeast.
	March	30.072	48.8	6.42	Northwest.
	April	30.108	63.2	.97	Southwest.
	May	30.052	73.2	4.89	Southwest.
	June	30.045	78.3	2.87	Southwest.
	July	30.056	83.6	5.54	Southwest.
	August	30.080	80.8	11.15	Southwest.
	September	30.078	75.7	8.22	Southwest.
	Annual mean	30.087	63.4	60.26	Southwest.

NORTH POLAR EXPEDITION.

No intelligence has been received since the date of last annual report from Sergeant Frederick Meyer, the observer with this expedition.

ISLAND OF SAINT PAUL, ALASKA.

[Latitude, 57° 02′; longitude, 170° 00′.]

Private Charles P. Fish was ordered, March 19, to proceed to San Francisco without delay, and report to Captain Bryant, of the Treasury Department, and accompany him to the island of Saint Paul, in the Aleutian group, for the purpose of making a special series of meteorological observations in that remote locality. Through some misunderstanding on the part of Captain Bryant, that officer left San Francisco before the arrival of the observer, who was compelled to await the departure of the next vessel, sent out by the company having the exclusive control of the trade with the Seal Islands. He left San Francisco April 22, but was unable to get farther than Unalaska, from which island he reports, August 2, that he hopes to complete his journey at an early date.

The following instructions will explain the work to be performed by the observer:

In addition to the ordinary observations taken at every station of the signal service, it is highly important, as also practicable, that at the island of Saint Paul, in Behring's Sea, the following special observations be made:

1. *Tidal observations.*—These may easily be made by use of the permanent self-registering gauges which have long been in use by the Coast Survey. It is desirable to have two or three of them always in use at differently exposed points along the sea-coast. The mean of these registers will give the approximate heights of the tide, full explanations as to the use of the instrument accompanying it.

2. *The phenomena of storm waves and swells.*—These undulations, which precede a severe gale sometimes two or three days, may be detected on the tide-gauge, after its registration becomes tolerably well known.

In the case of severe and very heavy storms, it will, perhaps, be sometimes possible to hear distinctly the noise of an approaching tempest when it is yet several hundred miles distant, as is often done at the Bermudas. In this inquiry it will be desirable to ascertain, if possible, the side of the island on which the swell first makes itself felt and the direction in which it is translated. This will serve to show the general direction of the storm when moving on southerly parallels.

It will also be of great interest to ascertain the muddy appearance of the water in anchoring depths, as preceding the more violent storms, caused by heavy undulations affecting the bottom of the sea.

3. Keep accurate memoranda of the amount in inches of snow-fall. To ascertain this, it is desirable to select some spot, or, better, two spots, not liable to drifts, and yet not exposed to the wind. Take a small cylinder of glass, and dip or thrust it, with open end down, through the snow, to the ground, which should be previously covered with a piece of plank or some non-conducting material. Melt the snow, and measure the height of the melted snow, in the same glass-cylinder, by inches, multiply the number of inches by 10, and you have the snow-fall.

4. If possible, take the temperature of the sea, surface and submarine and deep sea, between the Aleutian Islands; also northeast and south of Saint Paul's.

5. Preserve notes of any icebergs from the Arctic Ocean that may pass through Behring Strait.

6. Especially is exact and reliable information desired as to any obstructions or ice-bridges closing up Behring Strait in winter, and, if so, all information that may show whether, in that event, the winter temperatures are higher in Alaska and the Aleutian Islands; and also whether, when Behring Strait is blocked up, the current of the Kuro Siwo from being arrested is thrown over upon the American coast with increased velocity, humidity, and warmth.

7. It is desirable also to ascertain the appearance and capture of the sperm-whale within Behring Sea.

8. Notes of all auroral displays.

9. The frequency and types of the electric discharges, lightning, &c., in the vicinity of Saint Paul's.

10. The proportion of fogs to clear weather.

11. It is also desirable to preserve specimens of any camphor-woods, vegetables, sea-weed, coral or sponges that may be picked up upon the coast of Saint Paul's or the Aleutians, and also of all such drift-matter from the Japan, Banin, Loochoo, and other islands of the Pacific.

CANADIAN STATIONS.

MONTREAL.

Telegraphic reports have been made regularly by Dr. Charles Smallwood, in accordance with the arrangement referred to in my last annual report. These reports have usually been sent to Portland, where they were transferred by the observer, with those of his own station, to New York. Weekly reports by mail are also made with regularity, and are filed with those received from other stations.

Meteorological summary.

Year.	Month.	Mean barometer.	Mean thermometer.	Total rainfall.	Prevailing wind.
				Inches.	
1871..	October	29.987	50.0	2.443	West.
	November	29.906	31.3	8.668	West.
	December	29.837	19.2	2.790	West.
1872..	January	29.855	19.0	2.136	West.
	February	29.876	20.3	2.669	West.
	March	29.854	21.2	2.245	West.
	April	29.915	44.1	2.440	West.
	May	29.882	58.8	1.922	West.
	June	29.929	68.7	2.449	West.
	July	29.916	71.0	3.182	West.
	August	30.008	72.5	3.314	West.
	September	29.970	62.0	6.374	West.
	Annual mean	29.911	44.8	40.632	West.

TORONTO.

Arrangements were made soon after the date of last report with Professor G. T. Kingston, director of the Magnetic Observatory in Toronto, and head of the Dominion Meteorological Bureau, for an exchange of reports as soon as his plans for their collection were elaborated. In accordance with these arrangements, reports from Toronto have been received regularly since November 13, 1871, and from the following-named stations during the periods stated:

Kingston,	Began reporting January 2, 1872.
Port Dover,	Suspended reporting February 13, 1872.
Port Stanley,	Resumed reporting July 2, 1872.
Saugeen,	Began reports January 2, 1872. Suspended reports February 13, 1872. Resumed reports July 3, 1872.

Quebec began reporting July 2, 1872.

The observations are made synchronous with those of the stations in the United States, and are sent in the same cipher. They are concentrated at Toronto, and forwarded by Professor Kingston to the observer at Buffalo, who transfers them to Washington. The instruments used are the property of the Dominion, and the observers are under the exclusive direction of Professor Kingston.

The reports have been forwarded regularly, and have proved of great value in reference to meteorological changes on the lakes. At the request of the Chief Signal-Officer, mail copies of all observations are forwarded weekly, after revision at the Toronto office.

Return reports are furnished from the Buffalo station, as requested by Professor Kingston.

Several of the papers and charts appended to this, afford illustrations of the studies of the observer sergeants. Papers K and L were prepared by Observer-Sergeant Theodore Smith, signal service, United States Army, and papers M and P by Sergeants Schaeffer and Boehmer respectively.

The total number of observer-sergeants on duty at this date is sixty-seven, and of assistant observers, forty-eight.

The charge of stations and reports has remained under the immediate direction of Brevet-Captain H. W. Howgate, United States Army, acting signal-officer and assistant, by whom, as in preceding years, the diverse duties of such a charge, with other duties on occasions of especial service, have been ably conducted.

Since the date of the last annual report, ten additional stations have been established within the United States, and reports are had by a comity of exchange from the seven stations established within the same period in the Dominion of Canada. The total number of stations at which observations are now made, and from which reports are received, is seventy-two. A comprehensive plan for the study of the meteoric conditions of the country has been kept steadily in view in the location of stations. From the stations on the Aleutian Islands and those contemplated in the Sandwich Islands are to be had, it is hoped, the first intimations of storms or meteoric disturbances having their origin, perhaps, on the coasts of Asia, or in the equatorial regions of the Pacific, and destined to extend to the Pacific coasts of the United States. The Pacific coast stations, though few in number, may recognize and report the first appearance on the Pacific coast of the disturbances thus traced, and may enable a connection to be established between their own reports and the reports of the island stations. Eastward of these, the Rocky Mountain stations and the stations upon the great interior plateau, though separated by intervals far too great, keep up a possible connection between the reports had from the Pacific coasts and those coming from the valleys of the Missouri and Mississippi Rivers. It is on this elevated interior some of the most interesting studies are yet to be made. The meteoric conditions of the Missouri Valley connect closely with those of the Mississippi Valley and the country thereto adjacent. The stations located in the valley of the Missouri, together with the stations of the Northwest, those of the Upper Mississippi Valley, and the stations in the immediate vicinity of the Lakes Superior and Michigan, report the first indications of one class of disturbances extending toward the lake region. The stations on the Gulf of Mexico, the Texan stations, and the stations of the Lower Mississippi and of the Ohio Valleys, are located in part to warn against disturbances arising on or traversing the Gulf of Mexico; exhibiting themselves next, perhaps, in the courses of the valleys named and afterward reaching the lakes or extending themselves over the States east of the Mississippi. The stations lying immediately south and north of the lake regions, and those located at the different lake ports, enable care to be had for the commerce of the lakes. Throughout the interior States the meteoric disturbances occurring may be traced from report to report of the stations located within the boundaries of the different States. Passing farther eastward, the eastern and southern stations on the Mexican Gulf receive and give sometimes the first premonitions of storms, which afterward follow the whole Atlantic coast line northward. The stations located at the Atlantic ports perceive the indications of storms passing eastward of our coasts and at sea, or they are warned, and by their reports warn each other in turn, of the progress of disturbances noted at the stations in the interior or at stations on the Gulf or on the lakes, and which threaten the ports at which they are; and, finally, the Atlantic stations, with the stations of the Saint Lawrence Valley, and those lying within the Northern-Middle, and Eastern States, and upon their coasts, note the last indications of disturbances passing over them, extending yet farther eastward, and out upon the waters of the Atlantic. Sometimes there come afterward reports from the meteoric stations on the coasts of the British Islands, which seem to exhibit the presence there of disturbances thus traced out to sea from our shores. From the first station in the Aleutian Islands, from which reports are considered, to those upon the British coasts, the reports from which are noticed, there intervenes nearly half a circumference of the earth's surface. In all the range of connected and connecting stations, there has not yet been found one the absence of whose reports is not unpleasantly felt. Each accession to their number opens new facts, and brings nearer to certainties the opinions as to the approaching meteoric conditions which those facts indicate.

With the view of diminishing the expenses of the service, and at the same time possessing the power of suddenly increasing the number of stations from which reports are to be had in any section of the country which may at any season of the year be especially threatened by the storms which at the different seasons seem to pass more frequently over particular portions of the territories of the United States, the organization of a mobilized corps of observers has been commenced. This corps, which will consist of picked men, skillful, and chosen for their special fitness for its contemplated duties, will be equipped with portable apparatus, comprising all the instruments they will be required to use at any station to which they may be ordered. The stations to be properly occupied in each section of the country in reference to the storms to which that section is habitually exposed at particular seasons will be designated in advance, and the proper telegraphic connections for these stations will be previously arranged. It will be possible to occupy, in this way, the stations, as stations of report, with very great rapidity. The period of danger for which they may be occupied being passed, they will be abandoned and the force left free to be quickly transferred for the protection of other sections whose seasons of danger may be then approaching.

As the system of life-saving stations extends along the coast, those placed at prominent points will become useful as signal-stations. These stations can be connected by telegraphic wires with this Office, under concurring plans of the Treasury and War Departments, at an expense at most trivial, and with benefits to both services which ought not to be overlooked.

Fifty stations have been thoroughly inspected during the year by officers instructed and detailed for the purpose. The irregularities discovered and corrected demonstrate the necessity of at least two careful inspections of each station in each year. The inspections are yet in progress. (Table 5.) Official applications for the establishment of one hundred and thirteen new stations have been received. (Table 8.) From the detailed report of the operations of each of the established stations, it appears that during the year there have been issued and distributed at the different lake, sea-coast, and river ports, and in the inland cities, a total number of bulletins, maps, &c., as follows:

Total number of bulletins, (tabulated weather reports,) one hundred and eighty-seven thousand six hundred and seventeen; total number of maps, (exhibiting meteoric conditions,) two hundred and three thousand five hundred and thirty-three; total number of press reports, fifty thousand eight hundred and seventy-eight.

The tri-daily synopses and probabilities have been regularly furnished to the several press associations from the central office at Washington, and through these to the newspaper press throughout the country. The synopses set forth the meteoric conditions, with the changes as reported for the twenty-four hours antecedent to the receipt of each report. The probabilities are the deductions of the Office as to the changes probably to occur within the eight hours (in some instances within the twenty-four hours) then next ensuing. (Paper A'.)

In the year past there have been issued from the central office one thousand and ninety-five of these press reports. The preparation of each report requires the study of the station reports at the hours due, the draughting of a map and the consideration of, at least, the reports and maps received and made within the then current twenty-four hours. Each may be held to represent the results had from the study of an average number of one hundred and fifty meteoric reports. A total number of one hundred and thirty-six thousand five hundred reports of observations have been in this way discussed during the year. The wide diffusion given these reports by the relations established by the office with the press is evidenced by the fact that it is estimated, computing the number of copies published at each edition of each newspaper in which reports or bulletins have appeared, that the aggregate number of copies of the reports furnished from this Office which have been laid before the public has reached a total of thirty millions. This extensive publication has been without cost to the United States.

It has been the policy of the Office to enlist, by this wide diffusion of its reports, the services of the thousands having some knowledge of meteorology, and possessing local instruments, in the work of supplementing the Office reports, by their local knowledge and the use of their own observations to the end of correctly interpreting, each for his own location, what the Bureau might be able to foreshadow only for a whole section of territory. To render this practice habitual is of the greatest importance. The usage once established will of itself notably diminish the number of disasters by shipwreck. It will be of important advantage to all interests of agriculture. There is hardly a vocation which will not find in it its uses.

The lateness of the hour at which the night telegraphic reports are received has rendered it sometimes impossible to furnish the official deductions from the reports in time to be telegraphed east and west from New York, to reach the various cities in the northern and western portions of the United States before the morning papers have been sent to press. This difficulty has led to a change in the time of making and transmitting the night report from the hour of 11.35 p. m. to that of 11 p. m., Washington mean time. This change was made on September 1st of this year.

It is for every reason desirable that each publication of reports in any newspaper should be of the report last issued from this Office prior to the time at which the paper goes to press. The mode by which to attain this end is yet a subject for study and experiment.

Professor Cleveland Abbe, assistant, First Lieutenant Robert Craig, acting signal-officer and assistant, and Professor Thompson B. Maury, assistant, have alternated in preparing the official deductions of the Office, besides performing such other duties in connection with the reductions of observations as have been found desirable.

The favorable expression of scientific men, the popular credit given the publications of the Office, and the surprise and almost irritation exhibited if at any time they chance to be in error, as must sometimes happen, have sufficiently evidenced the skill and care these officers have manifested in the discharge of their duties.

A comparison of the tri-daily forecasts, or "probabilities," as they have been styled, with the meteoric condition afterward reported, so far as known, has given an average of 69 per cent., as verified up to November 1, 1871. Since that date to the present time (October 1, 1872) the average of verification has been 76.8 per cent. If regard be had to those predictions verified within a few hours after the time for which they were made, this percentage is considerably increased, there being a total percentage of verifications and partial verifications of 82 per cent. Those predictions considered verified are, however, the only ones to be properly estimated upon. In view of the deficiency of telegraphic facilities during the year, and the great irregularities of the working, it was not anticipated that these predictions, based as they are upon the tri-daily telegraphic reports, would increase in accuracy. Whatever success has been attained must be considered an indication of what success might be with well-organized and full telegraphic facilities. The difficulty of telegraphic communication with the stations was greatest, and was most seriously felt during the months of July and August. It then not unfrequently happened that the most important and wide-spread of the press probabilities—*i. e.*, those drawn at midnight from the midnight reports—were made in the absence of any current telegraphic information at that hour due from the observers west or south of the Alleghanies. It is on this section the Office is most dependent for the intelligence which suggests the meteoric changes impending in the Eastern, Middle, and Southern States, and upon the Lakes.

Three hundred and fifty-four cautionary signal-orders have been issued during the year, each display of the cautionary signal at any station being considered a separate order. This signal was announced as to be shown "whenever the winds are expected to be as strong as twenty-five miles an hour, and to continue so for several hours, within a radius of one hundred miles from the station."

The percentage of cautionary signals, verified by the occurrence of the winds described within a few hours after the display of the signal, either at the port at which the signal was exhibited, or within the radius of one hundred miles from that port, is estimated to have been about 70 per cent. The instances of signals displayed, reported not verified, are those in which they have not been proven necessary at the station where exhibited. The signal is wholly "cautionary," forewarning probable danger. It has been aimed to err on the side of caution. The delays such errors may cause are retrievable, the disasters of shipwreck are not. Since the 1st of July of the present year thirty-two cautionary signals, forewarning the approach of six different storms, have been displayed at different ports. Of these storms five were destructive, justifying the display of twenty-eight signals; one, in advance of which four signals were displayed, was not considered dangerous. It is not yet permitted to hope this accuracy can be maintained.

It must not be imagined that in the review of the year there are not found errors of omission, or that warnings have been given in all instances of danger. Local storms of narrow extent, or making their march in a few hours, may pass between stations or over too few only, and are not easily traceable.

The practical results of this branch of the service, with all its errors and imperfections, can be summed, it is believed, in the statement that since the inauguration of its duties no great and continuous storm has traversed the territory of the United States, or raged along the length of its lakes, its gulf or sea-coast shores, as in their course such storms have sometimes done, without fair and general premonition given at the great majority of the points endangered, to any who cared to seek or heed them.

The storms of October 31 and November 1; 9th, 10th, and 11th; 13th and 14th; 18th and 19th; 24th; 29th and 30th; December 5, 6, 7, and 8; 10th; 15th and 16th; 16th; 20th; 23d; 30th and 31st, 1871; and February 3; 8th and 9th; 13th and 14th; March 1 and 2; 4th; 18th; April 11; 15th; 24th; 30th; September 24th and 25th; 28th and 29th, 1872, are mentioned as instances of those in advance of which notification has been given.

Papers J, K, and L, with the appended charts and descriptions of the storms of November 11 to 16, 1871, March 1 and 2, 1872, and September 28 to 30, 1872, are illustrations of the manner in which storms may be traced from the reports had at the Office.

Improving accuracy in the announcement of the approach and force of storms may be expected to follow longer experience. It will increase with each wise increase in the number of stations and reports. There is essential need of such control of telegraphic facilities as will insure the prompt receipt of these reports at any moment they may be called for.

Soon after the date of the last annual report, arrangements were made with Professor G. T. Kingston, of Toronto, chief of the Dominion meteorological bureau, in compliance with an official request from that bureau, and in view of a considerable appropriation contemplated by the Dominion of Canada for the purpose of a system of observation and report similar to that existing in the United States, for an exchange of reports with his office as rapidly as the system may extend in the Dominion. In accordance with these arrangements telegraphic reports are now received from seven Canadian stations. The observations are made synchronous with those in the United States, and are worded in the same cipher. These reports have been forwarded regularly to this Office after concentration at Toronto, and have proved of value in connection with the lake region. Separate reports are furnished from Montreal by Professor Charles Smallwood, director of the Montreal Observatory. Returned reports are furnished by this Office, as requested, to both Toronto and Montreal. Warnings, announcing probable meteoric changes, and prepared with especial reference to the Canadian ports, are sent to Toronto whenever any serious disturbance is indicated. A notable instance of this co-operation was had in the progress of the great storm of September 28, 29, and 30 of this year. Warnings were given in advance at the lake ports of the United States, and similar warnings were at the same time telegraphed to Canada. The advantages resulting to both states from this arrangement are highly estimated. Aside from the sentiment of international comity and good will, incident to its existence, it is of practical value. To the Dominion, located as it is, the exchanged reports received from the United States are essential to safety. To the United States the reports received from the Dominion are like those of vidette stations against the storms moving upon the lake region from the north, and thence traversing the Northern, Middle, and Eastern States, and the adjacent sea-coast. The appropriation made by each nationality, without in any way lessening its value to the people who make it, is in effect supplemented by the sums similarly devoted by the other, a mutual benefit accruing to both. It is to be hoped the system may be extended in the Canadas, and the co-operation be yet closer, this connection of the services becoming the first link in the grand chain of interchanged international telegraphic reports, destined with a higher civilization to bind together the signal-services of the world.

Arrangements of a similar description are contemplated as to be made for the exchange of observations by telegraph with various points in the West India Islands, as soon as the authorization of the different governments interested can be had. These arrangements will be carried into effect, if possible, before the opening of the stormy spring season.

It is believed that many of the cyclonic storms, the indications of which are first felt by the stations of the United States, as then showing the disturbance upon the Gulf of Mexico or near the Atlantic coast, and which storms are afterward to be traced across the States intervening, to the lakes, or along the Atlantic sea-coast, pass in their course over places in these islands from whence their presence could be pre-announced. The returning reports from the United States to the West India ports might indicate dangers threatening near the sea-coasts of the United States, or disturbances upon the Gulf westward of those islands, of which their commerce should be warned.

A reference to international exchanges of this character was made in the last annual report of this Office. They are entirely practicable, useful, and cannot be too widely extended.

Since January 1, 1872, statements of the changes in the depths of water in the principal western rivers, being in direct relation to the meteoric changes, have been reported daily from all stations established upon those rivers. These reports are carefully prepared, and have been received with a marked degree of interest. Numerous applications for additional reports and stations are under consideration. The importance of the information thus conveyed to the commercial interests of the river and inland cities has been fully recognized by the local presses and the river population. It is hoped that as the number of stations increases, and communication with the proper authorities is organized, a portion of the great problem of the protection of the river commerce from ice and freshets, and of the lower river levees from breakage and overflow, with the consequent disasters, will be solved, as they certainly can be, by timely warnings which will be given.

By the act of Congress approved June 10, 1872, the duty was imposed upon the Secretary of War of providing such stations, signals, and reports as might be found necessary for "the benefit of agricultural and commercial interests" throughout the United States. The service before technically limited to the lakes and sea-coasts was thus extended throughout the interior. The agricultural societies in the United States, the addresses of whose officers could be obtained, were informed in July last of this fact, and each was requested to appoint a permanent committee to confer from time to time with the Chief Signal-Officer, and to take in conjunction with him such steps, or to recommend such action, as might be deemed desirable to accomplish the objects in view. Eighty-nine societies have appointed committees in compliance with this request, and notice has been given by a large number of other societies that similar action will be taken by them at an early date. (Table IX.)

While the agricultural interests have shared with others whatever benefit has followed the daily published reports of the Office, and care has been had for those interests in the preparation of the reports, the plans by which it was contemplated to extend a service especially beneficial to those interests have been in some degree delayed by the want of telegraphic and other facilities by which to reach the interior. There has not yet been time in which to fairly organize the details of operations. The field for duty is a large one, and the service in it must be slowly established. But it is believed that with the daily reports and notice of the signals of the Office, or its connected stations, disseminated as they are by the press and channels now in use or known, some simple instructions as to the general courses or probable sequences of meteoric changes on this continent, and one or two inexpensive instruments and plain directions for using them, alone or in connection with the reports, results of important benefit can be obtained. The apparatus can be so cheaply furnished, and its indications be made so simple, that the whole can be had and used anywhere by any intelligent man.

In addition to the committees of the agricultural associations above referred to, thirty-eight boards of trades and chambers of commerce of principal cities and ports have standing meteorological committees which are in direct communication with the Chief Signal-Officer. (Table X.) To all of these committees printed summaries of the meteoric changes for the week then past are, by direction of the Secretary of War, mailed from the office of the Chief Signal-Officer, upon Saturday of each week, for the use of the associations. (Paper Z.)

This paper is an abstract made from the daily telegraphic reports in the form of a general summary of the synopses for the week. It is improved from time to time by the addition of such data as it may be in the power of the Office to give, and which are suggested as desirable by the associations, or known to be of general utility. In addition to the copies furnished the associations, copies are furnished the presses having the largest interior circulation. This paper has been favorably received.

The great railway enterprises, with their vast extent of roads, have an immediate and daily interest in the meteoric conditions existing in the sections traversed by their tracks, or by those of connecting companies. It is in the contemplation of the Office to furnish, if it is found feasible to do so, by arrangement with the companies, whatever information it may be in its power to give, directly beneficial to their interests

The meteoric conditions throughout the United States for each day of the year past have been traced on one thousand and ninety-five separate maps, one being traced for each interval (average) of eight hours of time. The form of map has been much improved, the base map now exhibiting an orographic representation of the United States and of the adjacent territory from which reports are had. In the preparation of the map the orographic charts prepared by Professor A. Guyot, of Princeton, were used, the information had from them being supplemented by the use of whatever *data* could be elsewhere collected by the Office. Each map exhibits in its meteoric features the results had from a consideration of an average number of three hundred and fifty separate readings of different instruments at seventy-two stations. These readings are of especial value as being made from similar instruments, each of which has been compared with the same standard. (Papers W, X, and Y.)

In March last the Office publication of a collection of the tabulated reports and synopses, together with the official deductions, or forecasts, and a statement of the meteoric conditions occurring after the latter, the whole in book form, was commenced. This paper has been continued up to this date, and is intended to form the basis of a monthly issue to contain, in addition to the above matter, reducedcopies of each of the tri-daily maps above referred to. The record is perhaps not paralleled by that had in any other country.

The courses of the areas of low barometer have been traced on especial maps, by months, from March, 1871, to June, 1872, inclusive, and tables are prepared giving the minimum readings, with latitude and longitude, at intervals of eight hours during the movement of any area within the scope of the stations of observation. Illustrations of these maps are given in Plates U and V, herewith. Some of the areas of low barometer have apparently traversed the entire continent, from the Pacific to the Atlantic; some have passed over a portion of the States, while others have made their first appearance in the Gulf of Mexico, moving thence over Eastern Texas, and following the river valleys to the lower lakes. A great number of these storm-centers have passed over the lake region.

The following gives the lowest observed readings of the low barometers, with the number of areas traced for each month, from March, 1871, to June, 1872, inclusive:

March,	1871,	twelve areas of low barometer, varying from	29.80	to	29.00.
April,	1871,	nine areas of low barometer, varying from	29.80	to	29.44.
May,	1871,	six areas of low barometer, varying from	29.60	to	29.30.
June,	1871,	twelve areas of low barometer, varying from	29.70	to	29.40.
July,	1871,	twelve areas of low barometer, varying from	29.85	to	29.50.
Aug.,	1871,	twelve areas of low barometer, varying from	29.79	to	28.20.
Sept.,	1871,	thirteen areas of low barometer, varying from	29.80	to	29.45.
Oct.,	1871,	thirteen areas of low barometer, varying from	29.69	to	29.20.
Nov.,	1871,	twelve areas of low barometer, varying from	29.85	to	29.10.
Dec.,	1871,	thirteen areas of low barometer, varying from	29.70	to	29.10.
Jan.,	1872,	nine areas of low barometer, varying from	29.85	to	29.26.
Feb.,	1872,	thirteen areas of low barometer, varying from	29.70	to	29.40.
March,	1872,	eighteen areas of low barometer, varying from	29.87	to	29.15.
April,	1872,	ten areas of low barometer, varying from	29.80	to	29.00.
May,	1872,	nine areas of low barometer, varying from	22.84	to	29.26.
June,	1872,	six areas of low barometer, varying from	29.79	to	29.20.

The locations of the areas of high barometer have also been mapped for the same period of time, but while a few are traced directly across the continent, the majority give tracings without apparent regularity.

A large amount of office-work has been devoted to collating and discussing the observations received from all stations and collected from other sources, public and private, with a view to their ultimate publication in permanent form. The Office has received many very courteous tenders from public institutions and from private individuals offering the use of material collected by them or in their charge.

Attention has continued to be given to the subject of the reduction of the barometric readings (observations) had at great altitudes to the hypothetical readings at sea-level. A series of tables for this purpose, in course of preparation by Assistant Abbe, has been delayed by the illness of that officer.

A serious obstacle to the accurate reduction of meteorological observations has been found in the want of the proper information in regard to the elevations above sea-level of the different instruments at the several stations. To remove this difficulty, the work of collecting reliable *data* from surveys and other official sources was commenced in February last, and has been vigorously prosecuted since by Lieutenant Henry Jackson, acting signal-officer and assistant. This collection is still in progress. The following statement exhibits the material collected up to this time, and which has been carefully tabulated and corrected for future publication as well as for immediate use.

Number of levels of railroad lines collected from records in the topographical office of the Post-Office Department, 308.

Number of levels of canals collected from records in the same office, 14.

Number of levels of railroad lines collected in the office of the Chief Signal-Officer from railroad companies, 256.

Number of levels of western surveys collected from the records of the Interior Department, 12.

Number of levels of railroad surveys collected from the records of the Interior Department, 7.

Number of levels received from city engineers, being connections between different railroads in the respective cities, 46.

Number of complete lists of State surveys received from State engineers, 43.

Number of surveys of rivers and lakes received from United States Engineer Department, 7.

In addition to the above the United States Coast Survey has furnished a table showing the height and range of the tide at all important ports on the coast of the United States. For assistance rendered in this connection the Office is under obligations to Professor W. L. Nicholson, topographer of the Post-Office Department; to Professor C. S. Peirce, assistant in charge of the United States Coast Survey Office; to the Commissioner of the Land-Office in the Interior Department; to the Chief of Engineers, United States Army; to the officers of the various railroad companies throughout the United States, and to the city engineers of most of our important cities.

Some attention has been given to the investigation of the meteoric conditions at different elevations. A series of especial observations were made simultaneously on the summit and at the base of Mount Washington, in May last, for this purpose.

The experiment of a balloon ascension has been tried with fair results. The ascension was made by contract had with a professional aeronaut, and had in view the determination of the question whether the proper instruments could be carried and used with needful accuracy, an observer-sergeant being charged with the duty. One hundred and fifty-six readings were made during the ascension. This experiment is thought to have established that very delicate instruments may be employed hereafter, if it is considered desirable.

Reference was made in the last annual report to the utility of observations had in the upper aerial currents, in relation to some of the *data* of practical meteorology. The station at the summit of Mount Washington, at an elevation of 6,290 feet above the sea, has been maintained since December 15, 1870. From that date tri-daily telegraphic reports have been had from the party there stationed. It is desirable that new mountain-stations should be established and suitably provided along the Apalachian chain and in the Rocky Mountains. These, together with certain special stations on the western plains, should be provided with self-registering apparatus.

To extend the system of synchronal observations, blanks have been furnished to such ship-captains and others making voyages to sea as have signified their willingness to make the necessary observations at the stated times. Facilities are given for comparing the instruments used upon the vessels with the standard at Washington. Fifty-two records have been received from the Pacific Mail Steamship Company.

These records have been valuable in tracing the courses of atmospheric disturbances before they reach the coasts of the United States, or after they have passed from the coasts seaward. Similar assistance is invited from all ship-owners and those interested in commerce.

The study and comparison of the best known meteoric instruments, for the purpose of ultimately securing the greatest advantages in the standard instruments to be constructed for the United States, has continued since the date of last report. The collection already in possession of this Office has become interesting and valuable. The equipment of the stations throughout the country with reliable apparatus is of the first importance. An electric attachment to the Robinson anemometer, furnishing a continuous record of the velocity of the wind, devised for the office by Lieutenant D. J. Gibbon, acting signal-officer, has been tested and adopted for all the stations. Experiments are in progress to determine the structures of a water-gauge, wind-vane, and of other instruments, to be also self-registering by electricity. It is requisite that they be strong, reliable, and inexpensive. The electric record permits the working portion of the apparatus to be exposed wherever may be best for its uses. The record alone is had in the office of the observer. The self-registering instruments to which reference has been made in previous reports, are now more favorably placed in a room especially fitted for them.

The Department has been again indebted to the Post-Office Department, which, under the especial order of the Postmaster General, has continued the service of transporting, in care of its mail-agents, the barometers and other delicate instruments needed to supply the places of those rendered useless by accident at the stations.

The library of the Office has been increased from six hundred volumes to one thousand three hundred and forty. These books have been catalogued and arranged conveniently for reference, and form the nucleus of a valuable meteorological library, to which additions may be made from time to time.

A system of exchanges with foreign societies has been instituted during the year, and on the part of this Office over five hundred sets of the tri-daily weather maps and bulletins have been sent abroad.

The full daily issue has been sent regularly to the following parties, and has been suitably acknowledged: Robert Scott, esq., director of the London Meteorological Society; Professor Buys Ballot, director of the Royal Meteorological Institute of the Netherlands; Professor H. Mohn, director of the Meteorological Institute of Norway; Captain N. Hoffmeyer, director of the Danish Meteorological Institute; Professor Dr. Prestel, Emden, East Friesland, Germany; Imperial Naval School, Kiel, Germany, furnished through the German legation in this city.

Some idea of the extensive labor devolving upon the Office from its now wide-spread connections may be had from the consideration of the number of papers requiring its action, the record showing thirty-five thousand nine hundred and ninety letters sent, and one hundred and seventy-three thousand three hundred and six letters received during the year. Three thousand one hundred and sixty-five accounts have been examined and settled in the property division. (Table 6.)

Brevet Lieutenant-Colonel Garrick Mallery, acting signal-officer and assistant has had charge of the records, general correspondence, and orders; Lieutenant Henry Jackson, acting signal-officer and assistant, has been in charge of the property division. The untiring zeal of these officers has entitled them to especial commendation.

The office sustained a serious loss by the death, on December 24, 1871, of Brevet Major L. B. Norton, assistant signal-officer, for many years property and disbursing officer of the signal-service. He served with gallantry during the war, and zealously, until the time of his death, a continuous service on signal duty of more than ten years' duration.

The telegraphic transmission of reports of observations was had over the lines of the Western Union Telegraph Company, in accordance with the plans and working forms of circuit of this Office, substantially as exhibited in the last annual report, until June 30 of the present year, when that company declined to continue the service on terms considered satisfactory by the officers of the United States. From June 30 to July 21 it was attempted to conduct the service upon plans differing from the systems of working forms of circuits originally devised for it. The delays, however, proved to be so great, even in what were recognized as the business hours of the companies, and, despite the orders of the presidents of the several companies that the reports should be given priority over all other business, that very many of the reports, when received, were useless. The Office was compelled to resume the form of systematized working circuits as soon as it became practicable to do so. Since July 21 the reports have been had over the wires of the Franklin, Atlantic and Pacific, Southern and Atlantic, Pacific and Atlantic, Great Western, and Northwestern and International Ocean Telegraph Companies, which have consented to transmit the official dispatches to the extent their combined facilities permitted, and in accordance with the working forms of circuits furnished by this Office. Papers T^1 to T^{13} exhibit the working forms of circuits adopted. Some difficulty was experienced in making the proper connections of these circuits, involving, as they did, the wires of so many distinct companies, and the service suffered from serious delays in consequence. The difficulties in the way of successful working are being gradually removed. The subject of its telegraphic communications has been one of the most delicate with which the Office has had to do—duties wholly dependent for their success upon the rapidity and reliability of its telegraphic connections, and with responsibilities involving often the lives, as well as property, of those who might look to it for warnings, there is none which could more properly excite anxiety. Very many questions affecting the relations of the United States and the different telegraph companies have never been settled by precedent or usage. In the correspondence and action which have been had during the year with the different companies upon matters on which there were disagreeing views it has been the aim of this Office, under the direction of the Department, to maintain such a position that each company might feel it had been treated with equal justice, however much the Department might necessarily differ from any of them in its views.

A certain official commendation and good-will seems to be due to those companies which have evidenced their willingness to lend their aid in carrying on the service, trusting all questions to future satisfactory settlement. The rates of compensation the Office has felt empowered to offer being made in some instances a cause of complaint, the Office has stated to any company so complaining that if, upon a just statement of the cost of the service and its proper value to the companies, it cannot be found to be fairly remunerative, the officers of the Department will willingly join the representatives of the companies in the presentation of the facts to Congress or other authority, with the view of securing to the company just compensation.

To secure the discharge of the telegraphic duties of the Office with promptness—with the good will and co-operation of whatever companies might be carrying its service, and with proper remuneration allowed to them for that service—have been the ends to be attained. As the relations of the people of the United States to the telegraphic companies having privileges under the acts of Congress become better determined, and the style of the official communications the Executive Departments may be permitted to have over the wires of the companies, the times at which they are authorized to require the transmission of such communications, and the rates of payment at which the communications transmitted must be paid for, become established, the difficulties which at the outset have hampered this service will disappear.

The Department has been fortunate in the constant advice of the Hon. William Whiting, special assistant of the Attorney-General, in reference to questions of the duties of the telegraphic companies.

The telegraphic service in the Office has been under the immediate charge of Mr. George C. Maynard, electrician, who has rendered important and special service. During the year ended September 30, 1872, seven hundred and sixty-eight thousand and forty-six words of weather reports have been received at, and eighteen thousand seven hundred and forty-two words sent from this Office. One thousand nine hundred and forty-four messages other than reports, but on business connected therewith, were also sent from, and two thousand one hundred and eighty messages received at this office. One hundred and thirty-four thousand three hundred and eight mail reports have been examined and compared with the telegraphic copies and filed for future reference.

The numerical cipher used for the transmission of the reports at date of last report was replaced on the 1st of January by one of a different form. (Paper C.)

By the use of this cipher the number of words have been reduced one third, while the amount of information contained in each report has been increased.

In view of the large and constantly increasing labor of the Office, the compensation of the clerks of class two, employed in it and having general charge of its clerical duties, is considered inadequte. It is recommended that to secure to them a just promotion, the employment of two clerks of class four be authorized.

The propriety of an established organization of the officers of the signal service becomes more apparent as their duties increase in extent and importance. Separated from the commands to which they belong, and on a duty differing from the routine duties of those commands, they lose familiarity with that routine, and by absence from their regiments incur the displeasure of their commanding officers, who do not always reflect that such absence is not voluntary, but in obedience to orders from proper authority. The officers themselves cannot feel while on a detached service that interest in their duties which is felt when promotion and standing is to be obtained by the display of such interest. They are liable to be detached at any time and returned to their regiments. It seems just to both officers and enlisted men that they should be given a recognized organization. The attention of the Secretary of War is especially invited to this subject.

The recommendation that an appointment to a commission be given each year to that observer sergeant who shall in that year be reported as most distinguished for fidelity and ability is renewed.

The promotion to the grade of second lieutenant of Observer Sergeant D. J. Gibbon last year, recommended for his appointment upon such grounds, has been productive of good effects.

At the end of another year of service, during which the active labors of the Office and its connected stations have ceased on no day or night, the annual report, with its record of duty done, is submitted with satisfaction. In no year to come is it likely the service can be more embarrassed than it has been in the year just passed with the difficulties to be encountered by a novel service. It has survived them. The encouragement had in the popular good will and interest in the daily duties, the support of the press and of the different commercial and agricultural associations, has been continued. The public criticism has been considerate. The scientific institutions throughout the United States have received the exchanges of the Office with pleasure and have rendered assistance whenever in their power. From those of almost every foreign country are had expressions of interest and suggestions of co-operation. The field for study and improvement, under a higher guidance, extends with each day's experience. The possible public good to be had, with the service properly conducted and sustained, and with facilities now proved to be attainable on this continent, cannot be estimated.

ALBERT J. MYER,
Brigadier-General and Chief Signal-Officer of the Army.

Hon. W. W. BELKNAP,
Secretary of War.

RECORD OF SIGNAL CAMP OF INSTRUCTION, FORT WHIPPLE, VIRGINIA.

TABLE I.—*Officers instructed during the year ending October 1, 1872.*

Name.	Rank and corps.	Reported for instruction.	Relieved from instruction.	Remarks.
Charles S. Smith	First lieutenant Fourth United States Artillery.	July 15, 1871	Nov. 25, 1871	Completed full course in signaling, telegraphy, and meteorology.
H. H. Humphreys	First lieutenant Fifteenth United States Infantry.	Aug. 18, 1871	Dec. 7, 1871	Do.
Charles E. Kilbourne	First lieutenant Second United States Artillery.	Sept. 19, 1871	Dec. 18, 1871	Do.
Lewis Warrington	First Lieutenant Fourth United States Cavalry.	Feb. 2, 1872	Mar. 9, 1872	Relieved before completing full course of instruction.
H. H. C. Dunwoody	First lieutenant Fourth United States Artillery.	Mar. 4, 1872	Aug. 1, 1872	Reported origin'ly July 10, 1871; granted leave of absence July 12, 1871, to Mar. 3, 1872.
David J. Gibbon	Second lieutenant Ninth United States Cavalry.	....	....	Still under instruction.

TABLE II.—*Amount of field-practice had by each officer.*

Name.	Rank and corps.	No. of days flag-practice was had.	No. of nights torch-practice was had.	Remarks.
Charles S. Smith	First lieutenant Fourth United States Artillery.	12	1	
H. H. Humphreys	First lieutenant Fifteenth United States Infantry.	16	2	
Charles E. Kilbourne	First lieutenant Second United States Artillery.	16	2	
Lewis Warrington	First lieutenant Fourth United States Cavalry.	......	......	Study of manual of signals, wand-practice, &c., for 22 days.
H. H. C. Dunwoody	First lieutenant Fourth United States Artillery.	10	2	
David J. Gibbon	Second lieutenant Ninth United States Cavalry.	......	......	Still under instruction.

TABLE III.—*Number of observer-sergeants instructed from October* 1, 1871, *to September* 30, 1872.

Name.	Instruction commenced.	Date of examination.	Remarks.
Hugh Coyle	June 17, 1871	Nov. 6, 1871	Promoted to rank of sergeant November 6, 1871; in charge of station at Shreveport, La.
N. D. Lane	Aug. 12, 1871	Oct. 6, 1871	In charge of station at Augusta, Ga.
E. O. C. MacInerney	Aug. 18, 1871	Feb. 23, 1872	Promoted to rank of sergeant February 23, 1872; in charge of station at Galveston, Texas.
F. Mansfield	Aug. 18, 1871	Oct. 6, 1871	In charge of station at New Orleans, La.
J. B. Wells	Aug. 18, 1871	Oct. 6, 1871	In charge of station at San Diego, Cal.
George McDonald	Aug. 18, 1871	Oct. 6, 1871	Awaiting orders at Fort Whipple, Va.
A. J. Tilley	Aug. 19, 1871	....	Failed to pass final examination.
F. Mann	Aug. 24, 1871	Oct. 13, 1871	In charge of station at Detroit, Mich.
Charles E. Wheeler	Aug. 25, 1871	Oct. 13, 1871	Dishonorably discharged the service.
M. J. Shanefelter	Sept. 8, 1871	Oct. 20, 1871	In charge of station at Key West, Fla.
A. B. Knight	Sept. 8, 1871	Oct. 20, 1871	In charge of station at Virginia City, M. T.
D. O'Donoghue	Sept. 13, 1871	Oct. 20, 1871	In charge of station at Mobile, Ala.
F. P. Bayes	Sept. 14, 1871	Aug. 20, 1872	In charge of station at Alpena, Mich.
John P. Clum	Sept. 18, 1871	Oct. 20, 1871	In charge of station at Santa Fé, N. M.
Gustave A. Daudelet	Nov. 10, 1871	Mar. 19, 1872	Promoted to rank of sergeant March 19, 1872.
J. O. Manson	Dec. 2, 1871	Jan. 5, 1872	In charge of station at Savannah, Ga.
George Prender	Jan. 15, 1872	Mar. 8, 1872	In charge of station at Fort Sully, D. T.
Charles Lever	Feb. 13, 1872	....	Discharged before passing examination.
E. F. Maynard	Aug. 4, 1871	Apr. 1, 1872	Instructed on station; in charge of station at Cincinnati, Ohio.
Edward Lloyd	Feb. 10, 1872	Apr. 10, 1872	In charge of station at Indianola, Texas.
Charles A. Shaw	Jan. 20, 1872	Mar. 8, 1872	In charge of station at Breckenridge, Minn.
Richard Williams	Mar. 15, 1872	July 11, 1872	Reduced to the ranks for misconduct; now on duty with the detachment at Fort Whipple, Va.
Leslie C. Fletcher	Apr. 1, 1872	May 31, 1872	On duty at the office of the Chief Signal-Officer.
Samuel W. Beall	Apr. 10, 1872	May 31, 1872	In charge of station at Corinne, U. T.
Max Marix	Apr. 10, 1872	May 31, 1872	In charge of station at Davenport, Iowa.
John Dascomb	Apr. 19, 1872	May 31, 1872	In charge of station at Du Luth, Minn.
James O'Dowd	Apr. 22, 1872	July 11, 1872	In charge of station at Lake City, Fla.
W. S. Jewell	May 17, 1872	July 11, 1872	On duty at office of the Chief Signal-Officer.
George A. Clum	May 17, 1872	July 11, 1872	In charge of station at Montgomery, Ala.
William T. Boyd	June 17, 1872	Aug. 21, 1872	In charge of station at Philadelphia, Pa.
Harry Barton	June 17, 1872	Aug. 21, 1872	In charge of station at Omaha, Neb.
Thorp B. Jennings	June 17, 1872	Aug. 23, 1872	On duty at the office of the Chief Signal-Officer.
David H. Sackett	June 17, 1872	Aug. 23, 1872	In charge of station at Milwaukee, Wis.
William Line	June 17, 1872	Aug. 23, 1872	On station at Mount Washington, N. H.
Robert J. Bell	June 17, 1872	Aug. 23, 1872	In charge of station at Escanawba, Mich.
William Theodovius	July 9, 1872	Aug. 23, 1872	In charge of station at Punta Rassa, Fla.
Nelson Gorom	Aug. 21, 1872	....	Still under instruction.

TABLE IV.—*Number of enlisted men instructed for the position of assistant to observer-sergeants from October 1, 1871, to September 30, 1872.*

Name.	Placed under instruction for assistant.	Reported qualified as assistant.	Ordered on station.	Remarks.
William Black	Oct. 23, 1871	....	Oct. 23, 1871	Ordered to Fort Whipple, Virginia, for promotion.
E. S. Martin	Jan. 22, 1872	....	Feb. 1, 1872	At Fort Whipple, Virginia, awaiting orders.
Otto Schütze	June 10, 1872	June 27, 1872	July 9, 1872	On duty as assistant at Baltimore, Maryland.
Thomas A. Taylor	Jan. 22, 1872	Feb. 10, 1872	Feb. 16, 1872	On duty as assistant at Buffalo, New York.
Timothy O'Neil	Jan. 25, 1872	Feb. 10, 1872	Feb. 10, 1872	Ordered to Fort Whipple, Virginia, for promotion.
James H. Marsh	Nov. 3, 1871	....	Nov. 3, 1871	Do. do.
Daniel Murphy	Feb. 6, 1871	....	Feb. 6, 1871	On duty as assistant at Indianapolis, Indiana.
William Stein	Jan. 3, 1872	....	Jan. 3, 1872	Ordered to Fort Whipple, Virginia, under arrest.
C. A. Brogan	Feb. 10, 1872	....	Feb. 10, 1872	Ordered to Fort Whipple, Virginia, for misconduct.
Charles P. Fish	Feb. 12, 1872	Feb. 12, 1872	Feb. 12, 1872	In charge of station at Island of Saint Paul, Alaska.
A. F. McDermott	Mar. 4, 1872	....	Mar. 15, 1872	On duty at office of the Chief Signal-Officer.
Edward Moran	Mar. 4, 1872	Mar. 15, 1872	Mar. 15, 1872	On duty as assistant at Cleveland, Ohio.
Thomas G. White	Mar. 4, 1872	Mar. 15, 1872	Mar. 26, 1872	Ordered to Fort Whipple, Virginia, for promotion.
W. H. Colesberry	Mar. 5, 1872	Mar. 16, 1872	Mar. 19, 1872	On duty as assistant at Toledo, Ohio.
Joseph E. Cook	Mar. 9, 1872	....	Mar. 26, 1872	On duty as assistant at Galveston, Texas.
W. C. W. Shreck	Mar. 15, 1872	Mar. 27, 1872	April 1, 1872	On duty as assistant at Nashville, Tennessee.
L. E. Sebree	Mar. 15, 1872	Mar. 27, 1872	May 20, 1872	On station-duty at office of the Chief Signal-Officer.
F. Z. Gosewisch	Mar. 15, 1872	Mar. 27, 1872	April 8, 1872	On duty as assistant at Chicago, Illinois.
Henry U. Jones	Mar. 20, 1872	April 1, 1872	Apr. 10, 1872	On duty as assistant at Lake City, Florida.
R. McLaughlin	Mar. 22, 1872	April 6, 1872	Apr. 10, 1872	On duty as assistant at Vicksburgh, Mississippi.
William C. Keech	Mar. 25, 1872	....	Apr. 8, 1872	On duty at office of the Chief Signal-Officer.
W. Stromberger	Mar. 29, 1872	Apr. 13, 1872	Apr. 15, 1872	On duty as assistant at Detroit, Michigan.
Sidney Powell	Mar. 29, 1872	Apr. 13, 1872	Apr. 22, 1872	On duty as assistant at Charleston, South Carolina.
A. D. Wolcott	Mar. 29, 1872	Apr. 13, 1872	May 2, 1872	Ordered to Fort Whipple, Virginia, awaiting orders.
W. A. Chapman	Apr. 6, 1872	Apr. 26, 1872	May 7, 1872	On duty as assistant at Key West, Florida.
Arthur W. Hart	Apr. 6, 1872	Apr. 26, 1872	May 2, 1872	Ordered to Fort Whipple, Virginia, for misconduct.
James H. Stockwell	Apr. 6, 1872	Apr. 26, 1872	May 17, 1872	Do.
John Laurens	Apr. 5, 1872	....	....	On duty at office of the Chief Signal-Officer.
E. W. McGann	Apr. 19, 1872	May 17, 1872	May 17, 1872	On duty as assistant at Leavenworth, Kansas.
John W. Everly	Apr. 26, 1872	May 28, 1872	....	Awaiting orders at Fort Whipple, Virginia.
Edward A. Lewis	Apr. 26, 1872	....	May 20, 1872	On duty as assistant at Cincinnati, Ohio.
W. O. Bailey	May 3, 1872	May 28, 1872	Aug. 31, 1872	On duty as assistant at Keokuk, Iowa.
William Finn	May 3, 1872	May 28, 1872	June 17, 1872	On duty as assistant at Pittsburgh, Pennsylvania.
Frank H. Wash	May 3, 1872	May 28, 1872	June 17, 1872	On duty as assistant at Mobile, Alabama.
William D. Wright	May 3, 1872	May 28, 1872	June 1, 1872	On duty as assistant at Davenport, Iowa.
John D. M. Fee	May 10, 1872	June 8, 1872	July 27, 1872	On duty as assistant at Chicago, Illinois.
George W. McKee	May 11, 1872	....	June 17, 1872	On duty as assistant at Omaha, Nebraska.
P. G. Deitz	May 11, 1872	June 8, 1872	June 17, 1872	On duty as assistant at Wilmington, North Carolina.
E. B. Robbins	May 17, 1872	June 17, 1872	July 9, 1872	On duty as assistant at Norfolk, Virginia.
S. P. Ruthven	May 17, 1872	....	....	On station-duty at office of the Chief Signal-Officer.
H. M. Ludwig	May 24, 1872	June 15, 1872	June 17, 1872	On duty as assistant at Louisville, Kentucky.

TABLE IV.—*Number of enlisted men instructed, &c.*—Continued.

Name.	Placed under instruction for assistant.	Reported qualified as assistant.	Ordered on station.	Remarks.
E. F. McComas	May 24, 1872	June 15, 1872	June 17, 1872	On duty as assistant at Oswego, New York.
W. U. Simons	June 7, 1872	June 27, 1872	Aug. 9, 1872	On duty as assistant at Jacksonville, Florida.
James Brown	June 7, 1872	June 27, 1872	June 27, 1872	Ordered to Fort Whipple, Virginia, for misconduct; deserted.
D. C. Ralston	June 27, 1872	July 27, 1872	Aug. 20, 1872	On duty as assistant at New Orleans, Louisiana.
Mark Downing	July 19, 1872	Aug. 19, 1872	....	Awaiting orders at Fort Whipple, Virginia.
A. G. Tassin	July 19, 1872	Aug. 26, 1872	Sept. 3, 1872	On duty as assistant at Cincinnati, Ohio.
W. R. Nuzum	July 19, 1872	....	Sept. 9, 1872	Ordered to Fort Whipple, Virginia, for misconduct.
James Courtney	Aug. 16, 1872	Sept. 10, 1872	Sept. 13, 1872	On duty as assistant at Milwaukee, Wisconsin.
H. R. Stockman	Aug. 16, 1872	Sept. 10, 1872	Sept. 13, 1872	On duty as assistant at Philadelphia, Pennsylvania.
J. B. Campbell	Aug. 23, 1872	Sept. 21, 1872	....	Awaiting orders at Fort Whipple, Virginia.
Lawrence Dunne	Aug. 23, 1872	Sept. 21, 1872	Sept. 24, 1872	On duty as assistant at Boston, Massachusetts.
John McGuire	Aug. 17, 1872	Sept. 10, 1872	....	Awaiting orders at Fort Whipple, Virginia.
B. C. Anderson	Aug. 30, 1872	....	....	Still under instruction.
George Onslow	Aug. 30, 1872	....	....	Do.
Edgar Green	Aug. 30, 1872	Sept. 23, 1872	Sept. 24, 1872	On duty as assistant at Saint Louis, Missouri.
William McGillivray	Aug. 30, 1872	Sept. 23, 1872	Sept. 24, 1872	On duty as assistant at Savannah, Georgia.
John H. Baer	Sept. 6, 1872	....	....	Still under instruction.
Newton Phelps	May 11, 1872	June 8, 1872	June 17, 1872	On duty as assistant at Portland, Maine.
Thomas Cleary	Sept. 12, 1872	....	....	Still under instruction.
E. F. Maynard	Aug. 4, 1871	....	Aug. 4, 1871	Promoted to rank of sergeant; in charge of station at Cincinnati, Ohio.
Edward Lloyd	July 24, 1871	....	July 24, 1871	Promoted to rank of sergeant; in charge of station at Indianola, Texas.
Samuel W. Beall	Sept. 25, 1871	....	Sept. 25, 1871	Promoted to rank of sergeant; in charge of station at Corinne, Utah Territory.
Max Marix	Sept. 11, 1871	....	Sept. 11, 1871	Promoted to rank of sergeant; in charge of station at Davenport, Iowa.
W. S. Jewell	Dec. 6, 1871	....	Dec. 6, 1871	On station-duty at office of the Chief Signal-Officer.
George A. Clum	Oct. 23, 1871	....	Oct. 23, 1871	Promoted to rank of sergeant; in charge of station at Montgomery, Alabama.
James O'Dowd	June 12, 1871	....	June 12, 1871	Promoted to rank of sergeant; in charge of station at Lake City, Florida.
William T. Boyd	Dec. 11, 1871	....	Dec. 11, 1871	Promoted to rank of sergeant; in charge of station at Philadelphia, Pennsylvania.
Harry Barton	Aug. 28, 1871	....	Aug. 28, 1871	Promoted to rank of sergeant; in charge of station at Omaha, Nebraska.
T. B. Jennings	Nov. 3, 1871	....	Nov. 3, 1871	Promoted to rank of sergeant; on station duty at office of the Chief Signal-Officer.
William Theodovius	Dec. 20, 1871	....	Dec. 20, 1871	Promoted to rank of sergeant; in charge of station at Punta Rassa, Florida.
David H. Sackett	Dec. 11, 1871	....	Dec. 11, 1871	Promoted to rank of sergeant; in charge of station at Milwaukee, Wisconsin.
William Line	May 18, 1871	....	May 18, 1871	Promoted to rank of sergeant; on duty on station at Mount Washington, New Hampshire.
R. J. Bell	May 23, 1871	....	May 23, 1871	Promoted to rank of sergeant; in charge of station at Esconawba, Michigan.
J. K. P. Purdum	June 12, 1871	....	June 12, 1871	Ordered to Fort Whipple, Virginia, for promotion.
J. F. Tenney	Jan. 1, 1872	....	....	Still under instruction.

TABLE V.—*Showing stations inspected, by whom, and when inspected.*

Stations.	Name of inspector.	Date.
Augusta, Georgia	First Lieut. H. Jackson, acting signal-officer	October 7, 1871
	First Lieut. C. S. Smith, acting signal-officer	March 23, 1872
Baltimore, Maryland	First Lieut. L. B. Norton, acting signal-officer	June 23–24, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 3, 1872
Boston, Massachusetts	First Lieut. L. B. Norton, acting signal-officer	August 8, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 29, 1872
Breckenridge, Minnesota	First Lieut. Charles S. Smith, acting signal-officer	Sept. 15, 1872
Buffalo, New York	First Lieut. L. B. Norton, acting signal-officer	August 24, 1871
	First Lieut. Robert Craig, acting signal-officer	July 23–26, 1872
Burlington, Vermont	Second Lieut. A. W. Greely, acting signal-officer	May 7, 1872
	First Lieut. H. Jackson, acting signal-officer	November 9, 1871
Cairo, Illinois	First Lieut. Charles S. Smith, acting signal-officer	August 9, 1872
Cape May, New Jersey	First Lieut. L. B. Norton, acting signal-officer	July 6–8, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 13, 1872
Corinne, Utah Territory	Second Lieut. A. W. Greely, acting signal-officer	Sept. 18–20, 1872
Charleston, South Carolina	First Lieut. Charles S. Smith, acting signal-officer	July 9, 1872
Chicago, Illinois	First Lieut. T. R. Adams, acting signal-officer	Sept. 9–11, 1871
	First Lieut. C. S. Smith, acting signal-officer	August 26, 1872
Cincinnati, Ohio	First Lieut. T. R. Adams, acting signal-officer	Oct. 10–14, 1871
	Second Lieut. H. W. Howgate, acting signal-officer	March 22–23, 1872
Cheyenne, Wyoming Territory	Second Lieut. A. W. Greely, acting signal-officer	Sept. 15–17, 1872
Davenport, Iowa	First Lieut. H. Jackson, acting signal-officer	Dec. 14, 1871
	First Lieut. Charles S. Smith, acting signal-officer	August 21, 1872
Detroit, Michigan	First Lieut. T. R. Adams, acting signal-officer	Sept. 4–6, 1872
Du Luth, Minnesota	First Lieut. T. R. Adams, acting signal-officer	Sept. 1–3, 1871
	First Lieut. C. S. Smith, acting signal-officer	Sept. 18, 1872
Escanaba, Michigan	First Lieut. T. R. Adams, acting signal-officer	Sept. 16–17, 1871
Fort Benton, Montana Ter	Second Lieut. A. W. Greely, acting signal-officer	Sept. 28, 1872
Grand Haven, Michigan	First Lieut. T. R. Adams, acting signal-officer	Sept. 7–8, 1871
	First Lieut. Charles S. Smith, acting signal-officer	Sept. 7, 1872
Galveston, Texas	First Lieut. H. Jackson, acting signal-officer	October 24, 1871
	Second Lieut. A. W. Greely, acting signal-officer	July 22–28, 1872
Indianapolis, Indiana	Second Lieut. A. W. Greely, acting signal-officer	Sept. 3, 1872
	First Lieut. H. Jackson, acting signal-officer	Dec. 30, 1871
Indianola, Texas	Second Lieut. A. W. Greely, acting signal-officer	July 23–24, 1872
Jacksonville, Florida	First Lieut. C. S. Smith, acting signal-officer	March 4, 1872
Keokuk, Iowa	First Lieut. H. Jackson, acting signal-officer	Dec. 18, 1871
	First Lieut. C. S. Smith, acting signal-officer	August 17, 1872
Key West, Florida	First Lieut. Charles S. Smith, acting signal-officer	February 12, 1872
Knoxville, Tennessee	First Lieut. T. R. Adams, acting signal-officer	Nov. 7–9, 1871
	First Lieut. C. S. Smith, acting signal-officer	July 22, 1872
Leavenworth, Kansas	First Lieut. H. Jackson, acting signal-officer	Nov. 29, 1871
	Second Lieut. A. W. Greely, acting signal-officer	Sept. 5–6, 1872
Lake City, Florida	First Lieut. H. Jackson, acting signal-officer	October 12, 1871
	First Lieut. C. S. Smith, acting signal-officer	March 9, 1872
Louisville, Kentucky	First Lieut. T. R. Adams, acting signal-officer	Oct. 14–18, 1871
	Second Lieut. A. W. Greely, acting signal-officer	Aug. 26–30, 1872
Lynchburgh, Virginia	First Lieut. T. R. Adams, acting signal-officer	Nov. 11–12, 1871
	First Lieut. C. S. Smith, acting signal-officer	July 18, 1872
Mt. Washington, N. Hampshire	Second Lieut. A. W. Greely, acting signal-officer	May 22–23, 1872
Marquette, Michigan	First Lieut. T. R. Adams, acting signal-officer	Sept. 18–20, 1871
	First Lieut. C. S. Smith, acting signal-officer	Sept. 27, 1872
Memphis, Tennessee	First Lieut. H. Jackson, acting signal-officer	November 6, 1871
	Second Lieut. A. W. Greely, acting signal-officer	Aug. 23–25, 1872
Milwaukee, Wisconsin	First Lieut. T. R. Adams, acting signal-officer	Sept. 13–15, 1871
	First Lieut. C. S. Smith, acting signal-officer	September 4, 1872
Mobile, Alabama	First Lieut. H. Jackson, acting signal-officer	October 17, 1871
	Second Lieut. A. W. Greely, acting signal-officer	August 2–6, 1872
Nashville, Tennessee	First Lieut. T. R. Adams, acting signal-officer	Oct. 19–23, 1871
	First Lieut. C. S. Smith, acting signal-officer	July 26, 1872
New London, Connecticut	First Lieut. L. B. Norton, acting signal-officer	August 1, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 23, 1872
New Orleans, Louisiana	First Lieut. H. Jackson, acting signal-officer	October 21, 1871
	Second Lieut. A. W. Greely, acting signal-officer	August 1, 1872
New York City, New York	First Lieut. L. B. Norton, acting signal-officer	July 17, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 16, 1872
Norfolk, Virginia	First Lieut. H. Jackson, acting signal-officer	Sept. 29, 1871
	First Lieut. C. E. Kilbourne, acting signal-officer	June 29, 1872
Oswego, New York	First Lieut. L. B. Norton, acting signal-officer	August 14, 1871
	Second Lieut. A. W. Greely, acting signal-officer	June 3–5, 1872
Omaha, Nebraska	First Lieut. H. Jackson, acting signal-officer	December 4, 1871
	Second Lieut. A. W. Greely, acting signal-officer	Sept. 8–14, 1872
Philadelphia, Pennsylvania	First Lieut. L. B. Norton, acting signal-officer	July 1, 1871
	Second Lieut. A. W. Greely, acting signal-officer	April 7, 1872
Pittsburgh, Pennsylvania	First Lieut. L. B. Norton, acting signal-officer	July 25, 1871
	First Lieut. H. Jackson, acting signal-officer	January 1, 1872
	Second Lieut. H. W. Howgate, acting signal-officer	March 20–21, 1872
Portland, Maine	Second Lieut. A. W. Greely, acting signal-officer	May 15, 1872
Punta Rassa, Florida	First Lieut. C. S. Smith, acting signal-officer	February 20, 1872
Rochester, New York	First Lieut. L. B. Norton, acting signal-officer	August 17, 1871
	First Lieut. R. Craig, acting signal-officer	July 18–21, 1872

TABLE V.—*Showing stations inspected, by whom, and when inspected*—Continued.

Stations.	Name of inspector.	Date.
Savannah, Georgia	First Lieut. H. Jackson, acting signal-officer	October 10, 1871
	First Lieut. C. S. Smith, acting signal-officer	March 13, 1872
Shreveport, Louisiana	First Lieut. H. Jackson, acting signal-officer	November 2, 1871
	Second Lieut. A. W. Greely, acting signal-officer	Aug. 12–13, 1872
Saint Louis, Missouri	First Lieut. H. Jackson, acting signal-officer	Nov. 11, 1871
	First Lieut. C. S. Smith, acting signal-officer	August 13, 1872
Saint Paul, Minnesota	First Lieut. H. Jackson, acting signal-officer	Dec. 11, 1871
	First Lieut. C. S. Smith, acting signal-officer	Sept. 11, 1872
Toledo, Ohio	First Lieut. T. R. Adams, acting signal-officer	Sept. 1–2, 1871
Vicksburgh, Mississippi	Second Lieut. A. W. Greely, acting signal-officer	Aug. 17–20, 1872
Virginia City, Montana Ter.	Second Lieut. A. W. Greely, acting signal-officer	Sept. 23, 1872
Wilmington, North Carolina	First Lieut. H. Jackson, acting signal-officer	October 4, 1871
	First Lieut. C. S. Smith, acting signal-officer	July 12, 1872

TABLE VI.—*Exhibiting the communications sent from and received at the office of the Chief Signal-Officer (exclusive of telegrams) from November 1, 1871, to September 30, 1872.*

SENT.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

To heads of Departments and Bureaus	92	
To observer-sergeants in reference to their duties	7,215	
In reply to applications for stations and others similar	94	
To telegraph companies in reference to transmission of weather-reports	614	
To boards of trade, chambers of commerce, agricultural societies, &c	4,988	
To foreign correspondents relating to this division	3,202	
General and special orders with reference to this division	1,866	
Miscellaneous	1,136	
Total		19,207

SIGNAL DIVISION.

To heads of Departments and Bureaus	241	
Relating to duties and discipline at Signal-Service School of Instruction and post of Fort Whipple, Virginia	718	
Relating to recruiting and enlistment	48	
Answers to applications for appointment in the signal service, United States Army	315	
General and special orders with reference to this division	376	
Miscellaneous	107	
Total		1,705

PROPERTY DIVISION.

To heads of Departments and Bureaus	288	
To manufacturers and others in reference to instruments, equipments, &c.	546	
To observer-sergeants and other enlisted men in reference to property and money accounts	6,188	
In reference to quarterly returns of officers	52	
Miscellaneous	8,004	
Total		15,078
Aggregate		35,990

RECEIVED.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

From heads of Departments and Bureaus	109	
Applications for establishment of new stations	147	
From telegraph companies in reference to transmission of weather-reports	310	
From observer-sergeants in reference to their duties	5,112	
From boards of trade, chambers of commerce, and agricultural societies	317	
From foreign correspondents relating to this division	83	
Special applications for suggestions for practical use of weather-maps, &c.	125	
Reports relative to instruction of observer-sergeants and assistants	929	
Mailed reports of observer-sergeants on station	153,582	
Miscellaneous	1,202	
Total		161,916

SIGNAL DIVISION.

From heads of Departments and Bureaus	163	
Relating to duties and discipline at Signal-Service School of Instruction and post of Fort Whipple, Virginia	671	
Relating to instruction in signaling at Fort Whipple, Virginia, and in different military departments	684	
Relating to recruiting and enlistment	85	
Applications for appointment in the signal service, United States Army	310	
Miscellaneous	301	
Total		2,214

PROPERTY DIVISION.

From head of Departments and Bureaus	167	
From manufacturers and others relating to instruments, equipments, &c.	539	
From officers concerning property, quarterly returns, &c	983	
From observer-sergeants and other enlisted men relating to property and money accounts	4,049	
Regarding property transferred to stations	3,128	
Miscellaneous	310	
Total		9,176
Aggregate		173,306
Aggregate sent		35,990
Aggregate received		173,306
Total		209,296

TABLE VII.—*Showing the number of meteorological instruments purchased and issued from November 1, 1871, to September 30, 1872.*

Instruments.	Barometers.	Thermometers.	Hygrometers.	Anemometers.	Anemoscopes.	Maximum thermometers.	Minimum thermometers.	Aneroid barometers.	Thermometer tubes.
Issued to stations	19	28	46	24	35	26	26	......	......
Issued for special uses	11	8	3	6	1	2	2	......	......
Issued at last report	57	53	69	61	81	3	3	......	......
Returned for repairs, &c	3	9	12	15	3	2	3	......	......
Total number now on station	73	79	103	70	113	27	26	......	......
Total number purchased	40	56	50	75	37	16	38	7	7

TABLE VIII.—*List of places for which stations have been requested but not established on September 30, 1872.*

Place.	Applicant.	Date.
Muskegon, Michigan	Hon. H. H. Holt, Michigan legislature, inclosing petition of 99 citizens.	Jan. 21, 1871
	Board of Trade, Toledo	Jan. 27, 1871
	Board of Trade, Chicago	Feb. 10, 1871
	Hon. T. W. Ferry, United States Senate.	March 3, 1871
Manitowoc, Wisconsin	Hon. P. Sawyer, M. C	Jan. 25, 1871
Dubuque, Iowa	Doctor A. Munsell	Jan. 26, 1871
Huron City, Michigan	Board of Trade, Toledo	Jan. 27, 1871
	Board of Trade, Cleveland	Feb. 19, 1871
	Board of Trade, Detroit	Feb. 19, 1871
Mackinac	Board of Trade, Chicago	Feb. 10, 1871
Richmond, Virginia	W. G. Turpin	April 3, 1871
Cape Henry, Virginia Body Island Cape Hatteras, North Carolina.	Board of Trade, Norfolk, Virginia, and resolution of the general assembly of Virginia.	April 17, 1871
Lewes, Delaware	Board of Trade, Philadelphia	May 25, 1871
Park's, Colorado	E. J. Mallett, late consul-general	May 24, 1871
Staten Island	C. Keutgen, jr	June 9, 1871
Chambersburgh, Pennsylvania	Hon. John Scott, United States Senate	June 12, 1871
	Hon. Simon Cameron, United States Senate.	June 12, 1871
Watertown, New York	L. L. Pratt	June 21, 1871
Xenia, Ohio	C. E. Case	June 30, 1871
Port Hope	Board of Trade, Detroit, Michigan	July 22, 1871
Illinois Industrial University, Champaign, Illinois.	Hon. W. C. Flagg, secretary	July 21, 1871
	Hon. J. M. Gregory, president	Feb. 21, 1872
Little Rock, Arkansas	Hon. J. M. Hanks, M. C	July 26, 1871
	Albert Cohen	July 1, 1872
Sacramento, California	J. N. Hoag, secretary California State Board of Agriculture.	July 26, 1871 Jan. 10, 1872
	Concurrent resolution of the legislature of California, presented by Dr. T. M. Logan, secretary State Board of Health.	May 15, 1872
Niles, Michigan	J. B. Fitzgerald, secretary Berrien County Agricultural Society.	July 27, 1871
Hot Springs, Arkansas	J. H. Morton, M. D	Aug. 2, 1871
Louisiana, Missouri	William Stark	Aug. 3, 1871
	R. E. Pleasants	
Janesville, Wisconsin	J. B. Whiting, M. D	Aug. 7, 1871
	Rock County Agricultural Society	
Hillsdale, Michigan	Professor George M. Millen, secretary Hillsdale College.	Aug. 6, 1871
	Hillsdale County Agricultural Society	Aug. 6, 1871
Metamora, Illinois	Edward Kipp, secretary Woodford County Agricultural Society.	Aug. 8, 1871
Marietta, Ohio	J. W. Andrews, president Marietta College.	Aug. 10, 1871
	Washington County Agricultural Society.	Aug. 10, 1871
Mount Pleasant Academy, Pennsylvania.	W. H. McCrery, Mount Pleasant Academy and Normal School.	Aug. 11, 1871
Nebraska City	H. K. Raymond, secretary Otoe County Farmers' Club.	Aug. 14, 1871
Mount Moosilauke	Professor C. H. Hitchcock	Aug. 16, 1871
	A. F. Clough	Aug. 16, 1871
Catasauqua, Pennsylvania	Hon. E. McPherson, Clerk of United States House of Representatives.	Sept. 11, 1871
Galena, Illinois	D. Wilmot Scott, editor Galena Commercial Advertiser.	Sept. 14, 1871
Columbus, Nebraska	J. O. Shannon, secretary Platte County Agricultural Society.	Sept. 5, 1871

TABLE VIII.—*List of places for which stations have been requested, &c.*—Continued.

Place.	Applicant.	Date.
Canada—Farther Point Coburg Collingwood	Oswego Board of Trade, by J. L. McWhorter.	Aug. 30, 1871
Springfield, Missouri	John E. Worth, for Greene County Agricultural and Mechanical Society.	Sept. 18, 1871
Port Huron	Board of Trade, Buffalo	Sept. 22, 1871
Yankton, Dakota Territory	Hon. M. K. Armstrong, Delegate House of Representatives. S. V. Clevenger	Oct. 5, 1871 April 26, 1872
Mason City, Iowa	T. G. Emsley, secretary Cerro Gordo County Agricultural Society.	Oct. 6, 1871
Orono, Maine	M. C. Fernald, Maine State College of Agriculture.	Oct. 19, 1871
Belize, Louisiana Fort Morgan, Alabama Waco, Texas	Agent and captains of Morgan Steamship Company.	Oct. 31, 1871
Fort Randall, Dakota Territory	R. J. Percy, for Missouri Valley Telegraph Company.	Nov. 9, 1871
Pike's Peak	W. W. Allen, Colorado Springs colony	Nov. 15, 1871
Univer'ty of Michigan, Ann Arbor	Professor G. B. Merriman	Nov. 28, 1871
Canada—Fort Garry	N. McDougall	Dec. 2, 1871
Fountain, Colorado Territory	R. F. Song, editor El Paso Ranchman	Dec. 4, 1871
Erie, Pennsylvania	Hon. G. W. Scofield, M. C	Jan. 11, 1872
Bangor, Maine	C. A. Boutelle, editor Whig and Courier	Dec. 14, 1871
Vineyard Haven, Massachusetts.	Professor J. E. Hilgard, United States Coast Survey. Daniel W. Stevens Rev. Thomas Hill	 Dec. 18, 1871
Newport, Rhode Island	Hon. H. B. Anthony, United States Senate, forwarding memorial of 29 citizens. Captain S. A. Day, United States Army	Dec. 8, 1871 July 26, 1872
Cape Ann, Massachusetts	Hon. B. F. Butler, M. C	Dec. 19, 1871
Wytheville, Virginia	Hon. W. Terry, M. C	Dec. 20, 1871
Iowa City	John P. Irish	Dec. 14, 1871
Manassas, Virginia	George C. Round	Dec. 27, 1871
Quincy, Illinois	H. A. Hill, secretary National Board of Trade	Jan. 4, 1872
Dover Point, New Hampshire	John B. Stivens, mayor	Jan. 13, 1872
Wilmington, Delaware	Board of Trade	Jan. 24, 1872
New Haven, Connecticut	Hon. S. W. Kellogg, M. C., inclosing petition of citizens Thomas Trowbridge, president Chamber of Commerce Faculty Sheffield Scientific School, Yale College	Jan. 13, 1872
Additional stations on eastern shore of Lake Michigan.	Hon. H. H. Holt, Michigan legislature.	Feb. 11, 1871
Additional stations on mountains of Virginia.	G. C. Wedderburn, secretary Virginia Telegraph Company. L. A. Gobright, Associated Press	May 7, 1871
Additional stations on western slope of Mississippi Valley.	George P. Plant W. H. Scudder R. P. Fansey, committee of Merchants' Exchange, Saint Louis, Missouri.	July 16, 1871
Nobscoe Light, Monomdy Point, Cape Cod, Massachusetts.	B. B. Forbes, recommended by Hon. James Buffinton, M. C.	Nov. 29, 1871
Southwest Pass, Pass à l'outre	Thornton A. Jenkins, rear-admiral, United States Navy.	March 20, 1871
Staunton, Virginia; Christianburgh, Virginia; Bristol, Tennessee; Easton, Pennsylvania; Harrisburgh, Pennsylvania; Winchester, Virginia.	Jed. Hotchkiss	Aug. 15, 1871

TABLE VIII.—*List of places for which stations have been requested, &c.*—Continued.

Place.	Applicant.	Date.
Towanda, Kansas	M. D. Ellis	Feb. 12, 1872
Black Dome, Black Mountain, North Carolina.	William Cain	Feb. 12, 1872
Charlotte, New York	J. Eaton and thirty-five others	Feb. 14, 1872
Gallitzin, Altoona, on Pennsylvania Central Railroad.	David Peelor	Feb. 17, 1872
University of Minnesota, Minneapolis.	William W. Folwell, president	Feb. 21, 1872
Morgantown, West Virginia	Hon. A. J. Boreman, United States Senate	Feb. 28, 1872
	Alexander Martin, president West Virginia University	Feb. 28, 1872
	Hon. J. C. McGrew, M. C	Feb. 28, 1872
	Hon. Frank Hereford, M. C	Feb. 28, 1872
	U. E. Davis	Feb. 28, 1872
	George C. Sturgiss	July 22, 1872
Each of the State Agricultural Colleges.	J. B. Bowman, regent Kentucky University, and others.	Feb. 29, 1872
Columbus, Ohio	J. H. Klippart, secretary of Ohio State Board of Agriculture.	March 5, 1872
Norwich University, Northfield, Vermont.	Captain C. A. Curtis	March 15, 1872
Grand Tower, Illinois	A. R. Harris	March 21, 1872
Iuka, Mississippi	Rev. J. T. Freeman, through Hon. George E. Harris, M. C.	March 25, 1872
Great Natihalee, Bald Mountain, North Carolina.	Charles W. Jenks	April 1, 1872
Deposit, New York	G. W. Hanford	April 1, 1872
Heilman Dale	S. P. Heilman	April 1, 1872
Colorado Springs, Colorado	Robert H. Lamborn	April 5, 1872
Booneville, Missouri	J. L. Stephens	April 11, 1872
Fort Wayne, Indiana	F. C. Johnson, Indiana State Board of Agriculture.	April 12, 1872
New Albany, Indiana	F. C. Johnson, Indiana State Board of Agriculture.	April 12, 1872
Maryland Agricultural College	A. R. Davis, president board of trustees.	April 19, 1872
San Antonio, Texas	Thomas G. Williams	May 10, 1872
Atlanta, Georgia	Hon. John H. James, mayor	May 10, 1872
Auburn, Alabama; Agricultural and Mechanical College of Alabama.	William C. Stubbs	May 14, 1872
	John B. Read	May 14, 1872
	W. H. Jenison	May 14, 1872
Racine, Wisconsin	Mayor and council	May 18, 1872
Ogdensburgh, N. Y	Hon. W. A. Wheeler, M. C	May 25, 1872
Plattsburgh, New York	Hon. John Rogers, M. C	May 28, 1872
Sewanee, Tennessee	John L. Cooper, through Professor Joseph Henry, Smithsonian Institution.	June 10, 1872
Newark College, Delaware	William D. Mackey, secretary	June 11, 1872
Green Bay, Wisconsin	Hon. P. Sawyer, M. C	June 13, 1872
Kenosha, Wisconsin	Wallace Mygatt	June 20, 1872
Warsaw, Indiana	Marshall H. Parks	June 24, 1872
Beaver City, Utah Territory	Daniel Tyler	July 8, 1872
New Ulm, Minnesota	Dr. Alfred Müller	July 10, 1872
Evansville, Indiana	F. C. Johnson	July 13, 1872
	P. Hornbrook, surveyor of customs	July 13, 1872
	Thomas P. Britton, president Vanderburgh County Agricultural Society	July 13, 1872
	John Ingle, secretary Vanderburgh County Agricultural Society.	July 13, 1872
	Charles H. Butterfield, mayor	July 13, 1872
Aiken, South Carolina	Hon. F. A. Sawyer, United States Senate, and sixteen citizens.	July 16, 1872
	J. C. Derby	Sept. 2, 1872

TABLE VIII.—*List of places for which stations have been requested, &c.*—Continued.

Place.	Applicant.	Date.
Winona, Mississippi	A. M. Rafter	July 20, 1872
Eutaw, Alabama	W. S. Bird	July 20, 1872
Belfast, Maine	George E. Brackett	Aug. 6, 1872
Ithaca, New York, Cornell University.	A. D. White, president; petition of seventy-five citizens.	Aug. 8, 1872
Straits of Mackinac	Roys I. Cram	Aug. 7, 1872
Carthage, Illinois	L. F. M. Easterday; petition of one hundred and five citizens.	Sept. 2, 1872
Kutztown, Pennsylvania	A. R. Hornel, principal Keystone State Normal School.	Sept. 13, 1872

TABLE IX.—*List of agricultural societies which on September 30, 1872, had appointed permanent committees to confer with the Chief Signal-Officer of the Army.*

Name of organization.	State.	Committee.	Post-office address.
Monroe County Agricultural Society.	Indiana	T. H. Mallow	Bloomington, Ind.
Muskingum County Agricultural Society.	Ohio	R. S. Mershon	Zanesville, O.
Louisville and Jefferson Counties Agricultural Society.	Kentucky	L. Young	Louisville, Ky.
Schuyler County Agricultural and Mechanical Society.	Missouri	John B. Glaze	Glenwood, Mo.
Highland County Agricultural Society.	Ohio	J. S. Bell	Hillsborough, O.
		J. W. Ellis	
Arkansas State Agricultural and Mechanical Society.	Arkansas	Albert Cohen	Little Rock, Ark.
Bertie County Agricultural Society.	North Carolina	S. J. Wheeler	Windsor, N. C.
		J. B. Cheney	
		D. E. Tayloe	
Geauga County Agricultural Society.	Ohio	Dexter Witter	Burton, O.
		Geo. H. Ford	Do.
		Luther Russell	Do.
Otsego County Agricultural Society.	New York	G. Pomeroy Keese	Cooperstown, N. Y.
		H. M. Hooker	Do.
		Elisha Finney	Do.
Crawford County Agricultural Society.	Pennsylvania	A. P. Foster	Conneautsville, Pa.
		Col. F. Manton	Do.
		Prof. W. H. Armstrong	Do.
Berrien County Agricultural Society.	Michigan	J. B. Fitzgerald	Niles, Mich.
		D. O. Woodruff	Do.
		Wm. Bort	Do.
Greene County Agricultural Society.	Missouri	Dr. J. E. Tafft	Springfield, Mo.
		A. W. McPherson	Do.
		Rev. John E. Werth	Do.
Tolland County Agricultural Society.	Connecticut	Geo. H. Kingsbury	Rockville, Conn.
		J. C. Hammond, jr.	Do.
Burlington County Agricultural Society.	New Jersey	G. C. Brown	Mount Holly, N. J.
		M. S. Pancoast	Do.
		Jas. Lippincott	Do.
Agricultural and Mechanical Society of Western Alabama.	Alabama	W. S. Bird	Eutaw, Ala.
		H. G. Webb	Do.
		A. T. Lupton	Tuscaloosa, Ala.
Crawford County Agricultural Society.	Ohio	G. Keller	Bucyrus, O.
		E. R. Reamley	
		H. M. Scroggs	
		Josiah Koller	
Saratoga County Agricultural Society.	New York	B. S. Robinson	Greenfield Centre, N. Y.
Martin County Agricultural Society.	Minnesota	H. A. Munger	Fairmount, Minn.
California State Board of Agriculture.	California	J. N. Hoag	Sacramento, Cal.
		C. F. Reed	Do.
		F. M. Logan	Do.
Macon County Fruit Growers' Association.	Illinois	Prof. E. A. Gastman	Decatur, Ill.
		Theo. Hildebrandt	
		J. B. R. Sherrick	
Missouri State Board of Agriculture.	Missouri	John H. Tice	Saint Louis, Mo.
		Rev. Chas. Peabody	Do.
		Hon. G. W. Kinney	Snow Hill, Mo.
Jackson County Agricultural Society.	Ohio	Davis Mackley	Jackson C. H., O.
		J. E. Ferree	Do.
		Jacob Dungan	Do.

TABLE IX.—*List of agricultural societies, &c.*—Continued.

Name of organization.	State.	Committee.	Post-office address.
Pike County Agricultural Society..	Georgia.........	J. S. Pope	Zebulon, Ga.
		J. H. Mitchell	Do.
		H. Green..............	Do.
Greene County Agricultural Society.	New York	A. P. Jones...........	Catskill, N. Y.
		G. C. Mott	Do.
York County Agricultural Society.	Pennsylvania ...	John Evans...........	York, Pa.
		G. A. Heckert..........	Do.
		W. S. Roland..........	Do.
Allamakee County Agricultural County.	Iowa............	C. D. Beeman	Waukon, Iowa.
Bay District Horticultural Society of California.	California.......	F. A Miller	San Francisco, Cal.
		Prof. H. N. Bolender ..	Do.
Maine Board of Agriculture	Maine	M. C. Fernald	Orono, Me.
		Prof. G. L. Goodale....	Bowdoin Coll'ge, Brunswick, Me.
		Prof. C. E. Hamlin	Colby Univ'y, Waterville, Me.
		C. F. Brackett.........	Bowdoin Coll'ge, Brunswick, Me.
		Hon. S. F. Perley	Naples, Me.
Tuscola County Agricultural Society.	Michigan	C. C. Stoddard.........	Fair Grove, Mich.
		Townsend North......	Do.
		Dr. Wm. Johnson	Do.
Central Iowa District Agricultural Association.	Iowa............	P. F. Bartle	Des Moines, Iowa.
		M. W. Robinson.......	Do.
		D. V. Cate	Do.
South Carolina Agricultural and Mechanical Society.	South Carolina..	Dr. F. P. Porcher......	Charleston, S. C.
		Dr. T. T. Robertson ...	Winnsborough, S. C.
		Col. J. P. Thomas	Columbia, S. C.
Connecticut State Board of Agriculture.	Connecticut	Hon. E. H. Hyde	Stafford, Conn.
		Hon. Thos. H. Butler ..	Norwalk, Conn.
		H. S. Collins...........	Collinsville, Conn.
Terre Haute Horticultural Society.	Indiana.........	J. D. Foote............	Terre Haute, Ind.
		J. F. Saule	Do.
		John Weir............	Do.
		Rev. — Stimson........	Do.
		Jos. Gilbert...........	Do.
Pope County Agricultural Association.	Arkansas	John B. Bezzo	Moreland, Ark.
		W. W. Brasher........	Do.
		W. A. Stuart..........	Russellville, Ark.
Midddlesex County Farmers' Club	New Jersey.....	G. W. Thompson......	New Brunswick, N. J.
Farmers' Club	Utah............	D. Tyler	Beaver City, Utah Ter.
		Wm. Fotheringham...	Do.
		J. L. Smith...........	Do.
Indiana State Board of Agriculture.	Indiana.........	T. C. Johnson	New Albany, Ind.
		Thos. Dowling	Terre Haute, Ind.
		J. D. G. Nelson	Fort Wayne, Ind.
Rhode Island Society for the Encouragement of Domestic Industry.	Rhode Island ...	Dr. J. W. Sawyer......	Providence, R. I.
		J. T. Smith...........	Do.
		Dr. W. F. Channing ...	Do.
Washington County Agricultural Society.	New York	M. Ingalsbe..........	South Hartford, N. Y.
		R. W. Pratt	Do.
Farmers' and Fruit Growers' Association of Illinois.	Illinois..........	Dr. W. West	Belleville, Ill.
		F. H. Pieper	Do.
		E. W. West	Do.
Iowa State Horticultural Society..	Iowa............	Prof. Chas. E. Bessey..	State Agricul. College, Ames, Iowa.
		Hon. John Scott	Nevada, Iowa.
		G. B. Brackett	Denmark, Iowa.
Addison County Agricultural Society.	Vermont........	Prof. W. H. Parker....	Middlebury College, Middlebury, Vt.
		Prof. H. M. Seeley.....	Middlebury College, Middlebury, Vt.
		Prof. E. Brainerd......	Middlebury College, Middlebury, Vt.
Orleans County Agricultural Society.	Vermont........	D. M. Camp	Newport, Vt.
		T. H. Haskins.........	Do.
		Z. E. Jameson.........	Irasburgh, Vt.
Bradley County Agricultural and Mechanical Society.	Tennessee	T. L. Cate	Cleveland, Tenn.
		J. C. Morgan	Do.
		Dr. G. A. Long	Do.
Iowa State Agricultural Society ...	Iowa............	Peter Melendy........	Cedar Falls, Iowa.
		S. B. Hewitt, jr.......	Eagle Grove, Iowa.
		J. M. Shaffer	Fairfield, Iowa.
Carroll and Choctaw Counties Agricultural Society.	Mississippi	A. M. Rafter	Winona, Miss.
		T. J. Blackmore.......	Do.
		O. J. Moore	Do.
Belmont Farmers' Club	Mississippi	A. M. Rafter	Winona, Miss.
		W. W. Dabney........	Do.
		Jas. Thompson........	Do.

TABLE IX.—*List of agricultural societies, &c.*—Continued.

Name of organization.	State.	Committee.	Post-office address.
Broome County Agricultural Society.	New York	E. G. Crafts	Binghamton, N. Y.
		T. S. Roberts	Do.
		Arch. Stone	Do.
		P. Van Vredenberg	Do.
Bureau County Agricultural Society.	Illinois	Geo. W. Stone	Princeton, Ill.
		A. Bryant, jr	Do.
		H. L. Baltwood	Do.
Essex County Agricultural Society.	Massachusetts	Charles P. Preston	Danvers, Mass.
		William Sutton	Salem, Mass.
		A. W. Dodge	Do.
Kokomo Horticultural Society	Indiana	L. J. Templin	Kokomo, Ind.
		L. W. Leach	Do.
		C. S. Boggs	Do.
Jo Daviess, La Fayette, and Stephenson Union Agricultural Society.	Illinois	A. M. Jones	Warren, Ill.
Marshall County Agricultural Society.	Iowa	Byron Webster	Marshalltown, Iowa.
		John Turner	Do.
		S. P. Kinsley	Do.
Coles County Agricultural Society.	Illinois	D. C. M. Evans	Charleston, Ill.
		Charles Penatol	Do.
Rock County Agricultural Society.	Wisconsin	Dr. J. B. Whiting	Janesville, Wis.
Waupaca Agricultural and Mechanical Association.	do	H. C. Mead	Waupaca, Wis.
		W. Scott	Do.
		E. Cooledge	Do.
Ingham County Agricultural Society.	Michigan	Allen Rowe	Mason, Mich.
		A. M. Chapin	Eden, Mich.
		William Rayner	Mason, Mich.
Fillmore and Mower Counties Agricultural Society.	Minnesota	Dr. A. F. Whitman	Spring Valley, Minn.
		H. S. Hart	Do.
		W. L. Kellogg	Do.
		B. F. Farmer	Do.
		William McNee	Do.
		E. S. Bumstead	Do.
		George W. Farmer	Do.
		W. Allen	Do.
		D. Rathbun	Do.
Marion County Agricultural Society.	Ohio	H. M. Ault	Marion, Ohio.
		H. A. True	Do.
		J. K. Newcomer	Do.
Humphreys County Farmer's Club.	Tennessee	Rev. A. A. Wilson	Waverly, Tenn.
		T. U. Harris	Do.
		W. H. Hollinger	Do.
		A. R. Lankford	Johnsonville, Tenn.
Luzerne County Agricultural Society.	Pennsylvania	Steuben Jenkins	Wyoming, Pa.
		Rev. Abel Barker	Do.
		Dr. J. M. Lewis	Do.
		Dr. J. B. Crawford	Wilkesbarre, Pa.
		Dr. C. R. Gorman	Pittston, Pa.
		Dr. B. H. Throop	Scranton, Pa.
		Dr. R. H. Tubbs	Kingston, Pa.
Atlanta Union Central Agricultural Society.	Illinois	S. D. Fisher	Atlanta, Ill.
		William P. Hunt	Do.
		Daniel McFarland	McLean, Ill.
Howard County Agricultural Society.	Iowa	H. D. Noble	Cresco, Iowa.
		Stephen Rodford	Chester, Iowa.
		C. S. Thurber	Cresco, Iowa.
Outagamie County Agricultural Society.	Wisconsin	W. H. P. Bogan	Appleton, Wis.
		Edwin Nye	Freedom, Wis.
		N. B. Clark	Ellington, Wis.
		Louis Perrot	Greenville, Wis.
Lawrence County Agricultural and Industrial Association.	Ohio	Dr. G. S. B. Hempstead	Hanging Rock, Ohio.
		Cyrus Ellison	Ironton, Ohio.
		Hiram Campbell	Do.
		H. W. Gillett	Quaker Bottom, Ohio.
		Samuel Burke	Arabia, Ohio.
Miami County Agricultural Society.	Ohio	W. W. Crane	Tippecanoe City, Ohio.
Michigan State Pomological Society	Michigan	A. T. Linderman	Grand Rapids, Mich.
		C. L. Whitney	Muskegon, Mich.
		Edward Bradfield	Ada, Mich.
Lamoille County Agricultural Society.	Vermont	George Wilkins	Stowe, Vt.
		H. H. Powers	Morrisville, Vt.
		G. L. Waterman	Hyde Park, Vt.
Sheboygan County German Agricultural and Trades Association.	Wisconsin	Ferd. Stoesser	Sheboygan, Wis.
		Frederick Must	Do.
		Frederick Zimmerman	Do.
		Albert Mohlendorf	Do.
		Thomas Blackstock	Do.
Walworth County Agricultural Society.	Wisconsin	Peter Golder	Elk Horn, Wis.
		David Williams	Darien, Wis.
		Charles E. Buhre	Geneva, Wis.

TABLE IX.—*List of agricultural societies, &c.*—Continued.

Name of organization.	State.	Committee.	Post-office address.
Floyd County Agricultural Society.	Iowa	E. C. Chapin	Charles City, Iowa.
Edgar County Agricultural Society.	Illinois	Walter Booth	Paris, Ill.
		B. Holcomb	Do.
		D. B. Elliott	Do.
Perry County Agricultural and Mechanical Association.	Indiana	I. T. Patterson	Rome, Ind.
		I. I. Wheeler	Do.
		Ad. Ackerman	Do.
Davis County Agricultural Society.	Iowa	Howard Willey	Bloomfield, Iowa.
		William J. Hamilton	Do.
		T. A. Walker	Do.
		A. Rankin	Belknap, Iowa.
		William Hill	Bloomfield, Iowa.
Utah County Agricultural and Home Manufacturing Society.	Utah	Hon. George Bean	Provo, U. T.
		C. D. Evans	Springville, U. T.
		Daniel Graves	Provo, U. T.
Ontario County Agricultural Society.	New York	Cooper Sayre	Oaks Corners, N. Y.
		John S. Coe	Canandaigua, N. Y.
Washington County Agricultural and Mechanical Association.	Virginia	Rev. George R. Barr	Abingdon, Va.
		J. L. White	Do.
		Thomas Cosby	Do.
Otoe County Horticultural Society.	Nebraska	J. W. Pearman	Nebraska City, Neb.
		W. W. Wardell	Do.
Lake County Agricultural Society		D. W. Mead	Painesville, Ohio.
		C. C. Jennings	Do.
		George Blish	Do.
Page County Agricultural Society.	Iowa	S. H. Kiddlebaugh	Clorinda, Iowa.
		S. W. Peterson	Do.
		J. L. Barrett	Do.
King's Creek Valley Farmers' Club.	Ohio	Thomas Cowgill	Kennard, Ohio.
Cerro Gordo County Agricultural Society.	Iowa	George R. Miller	Mason City, Iowa.
		T. G. Emsley	Do.
		A. Wilson	Owens Grove, Iowa.
		Henry Martin	Mason City, Iowa.
		C. W. Tenney	Plymouth, Iowa.
Northumberland County Agricultural Society.	Pennsylvania	Dr. E. H. Horner	Turbotville, Pa.
		William A. Dean	Do.
		Thomas Barr	Do.
Johnson County Agricultural and Mechanical Association.	Kansas	John M. Giffen	Olathe, Kan.
		Harry McBride	Do.
		J. M. Hadley	Do.
Albany County Agricultural and Industrial Society.	New York	Hon. Geo. H. Tweddle.	Albany, N. Y.
		J. Winne	Bethlehem Centre, N.Y.
		J. H. Farrell	Albany, N. Y.
Pike County Agricultural Society.	Mississippi	D. M. Pound	Magnolia, Miss.
Warren County Agricultural Society.	New York	Charles W. Osborn	Warrensburgh, N. Y.
Shenandoah Valley Agricultural Society.	Virginia	Edmund Pendleton	Winchester, Va.
		Dr. W. J. Best	Brucetown, Va.
		J. C. Baker	Winchester, Va.
		Jarvis Jennings	Millwood, Va.
		Edwin S. Baker	Winchester, Va.
Wabaunsee County Central Agricultural and Horticultural Society.	Kansas	William Coleman	Eskridge, Kans.
		William Rinehart	Do.
		George Reynolds	Do.
Oswego County Agricultural Society.	New York	Henry L. Davis	Oswego, N. Y.
		P. M. Newton	Sandy Creek, N. Y.
		Hiram Walker	Union Square, N. Y.
		Thomas H. Austin	New Haven, N. Y.
		Harry Palmer	Parish, N. Y.
Tennessee Central Fair Association.	Tennessee	W. P. Henderson	Murfreesboro, Tenn.
Jersey County Agricultural Society.	Illinois	Dr. J. O. Hamilton	Jerseyville, Illinois.
		George H. Jackson	Do.
		William Shephard	Do.
Steuben County Agricultural Society.	New York	R. E. Robie	Bath, N. Y.
Watonwan County Agricultural Society	Minnesota	W. W. Murphy	Madelia, Minn.
Moultrie County Agricultural and Horticultural Society.	Illinois	G. W. Vaughan	Sullivan, Illinois.
		E. W. Mills	Do.

TABLE X.—*List of boards of trade, chambers of commerce, and other organizations, apart from those directly connected with agriculture, which had on September 30, 1872, appointed permanent committees to confer with the Chief Signal-Officer of the Army.*

Name of organization.	State.	Committee.
Chamber of Commerce of New York	New York	George W. Dow. M. Maury. J. D. Jones. Charles G. Curtis.
Board of Trade of Buffalo	New York	Alonzo Richmond. George S. Hazard. John H. Vought.
Board of Underwriters of New York	New York	Ellwood Walter, secretary.
Board of Trade of Toledo	Ohio	W. T. Walker. M. D. Carrington. A. W. Colton. C. A. King.
Board of Trade of Washington	District of Columbia	J. W. Thompson. A. S. Solomons. R. M. Hall.
Board of Trade of Detroit	Michigan	J. Aspinwall. G. U. Bissell. E. W. Hudson.
Board of Trade of Chicago	Illinois	C. Randolph. D. H. Denton. E T. Lawrence.
Board of Trade of Boston	Massachusetts	Thomas Gaffield. M. D. Ross. John Cummings. E. H. Sampson. Robert S. Perkins.
Chamber of Commerce of Milwaukee	Wisconsin	John L. Hathaway. J. B. Merrill. L. R. Durand.
Board of Trade of Nashville	Tennessee	James Whitworth. R. T. Kirkpatrick. Doctor W. W. Berry. E. D. Hicks. M. S. Cochrill.
Chamber of Commerce of Du Luth	Minnesota	Charles M. Cushman.
Board of Trade of Baltimore	Maryland	H. L. Whitridge. R. R. Kirkland. Benjamin M. Hodges, jr. J. Hall Pleasants.
Board of Trade of New London	Connecticut	R. S. Raymond. James T. Skinner. George P. Rogers.
Board of Trade of San Francisco	California	R. R. Swain. J. De Freney. R. G. Sneath. C. A. Low.
Board of Trade of Cleveland	Ohio	R. K. Winslow. R. F. Lyon. J. C. Sage.
Chamber of Commerce of Charleston	South Carolina	E. H. Frost. W. P. Hall. T. W. Dawson.
Board of Trade of Charleston	South Carolina	Hon. George A. Trenholm. Professor F. S. Holme. E. Lafitte.
Chamber of Commerce of Memphis	Tennessee	Hon. J. Thompson. Colonel Dupree.
Board of Trade of Oswego	New York	J. L. McWhorter. A. H. Failing. W. J. Malcolm.

TABLE X.—*List of boards of trade, chambers of commerce, &c.*—Continued.

Name of organization.	State.	Committee.
Board of Trade of Omaha	Nebraska	A. D. Jones. G. H. Collins. M. Stephens. Colonel J. Patrick. O. O. Housel.
Committee appointed by mayor of Rochester.	New York	Joshua A. Eaton. Charles A. Poole. George Schofield.
Board of Trade of Portland	Maine	C. H. Farley. J. S. Bedlow. M. N. Rich.
Board of Trade of Philadelphia	Pennsylvania	Henry Winsor. Thomas C. Hand. Thomas L. Gillespie. George N. Taltham. George N. Allen. James Hand.
Board of Trade of Mobile	Alabama	C. Forsyth, secretary.
Chamber of Commerce of Savannah	Georgia	Charles Green, president. Robert N. Gourdon, vice-president.
Chamber of Commerce of Wilmington	North Carolina	A. H. Van Bokkelen. George Harriss. W. L. De Rossett.
Board of Trade of Norfolk	Virginia	Dr. S. K. Jackson. W. A. Graves. E. C. Lindsey.
Board of Trade of Indianapolis	Indiana	D. M. Berry. E. F. Cox. John E. Wright. W. R. Nofsinger. S. T. Bowen.
Chamber of Commerce of Saint Paul	Minnesota	R. Ormsby Sweeney. Rev. John Mattocks. J. Fletcher Williams.
Board of Trade of Burlington	Vermont	G. G. Benedict. Professor Peter Collier. Professor McK. Petty.
Merchants' Union Exchange of Saint Louis.	Missouri	George D. Plant. R. P. Taney.
Chamber of Commerce of Galveston	Texas	W. H. Scudder, J. S. Thrasher. W. Richardson. C. G. Forshey.
Board of Trade of Shreveport	Louisiana	George Williams. R. D. Sale. George A. Pike.
Chamber of Commerce of San Diego	California	Douglass Gunn. C. A. Jones. J. S. Gordon.
Philadelphia County Medical Society	Pennsylvania	Lawrence Turnbull.
Board of Trade of Davenport	Iowa	James M. Dalzell.
Board of Trade of Jacksonville	Florida	A. S. Baldwin.
Committee appointed by mayor of Indianola.	Texas	William P. Milby. Robert J. Clark. W. H. Woodward. F. E. Hughes.

PAPER A.

A MANUAL OF MILITARY TELEGRAPHY FOR THE SIGNAL SERVICE. UNITED STATES ARMY, EMBRACING PERMANENT AND FIELD LINES; PREPARED UNDER THE DIRECTION OF THE CHIEF SIGNAL-OFFICER OF THE ARMY.

INTRODUCTION.

This work is, as its title indicates, a manual of military telegraphy, and is intended merely to furnish to officers of the United States Army such information as will enable them to establish and maintain telegraphic communication between forces in the field or points covered by military operations, as between the center and wings of an army, or an army and its base of operations, including, of course, intermediate points in either case.

The Morse or American system of telegraphy is the one proposed, and no attention is paid to others. Two kinds of lines are described, but they differ merely in weight and size of material and equipment: one intended for continued use upon fixed routes, being the ordinary American line, and herein called permanent, and the other intended for use with moving columns, being composed of lighter materials, more simply equipped, portable, capable of being rapidly erected and as rapidly taken down, and provided with means of transportation, and a drilled force to handle it, denominated field-lines.

Sufficient elementary information is given to enable the student to understand the principles which underlie the work he has to perform, without attempting a scientific treatise, and technicalities have been avoided as far as seemed practicable. Reference is made to works on electrics and telegraphy for information of a character too purely scientific to be embraced in this manual, chiefly to the Modern Practice of Telegraphy, by F. L. Pope, esq.

The two varieties of lines are treated of separately, and each in the same manner: materials of line, method of preparation, tools for and method of erection, equipment, method of working, and, in case of field-lines, drill of the force.

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PART I.—PERMANENT LINES.

CHAPTER I.

Materials for permanent lines are:

First, supports; which may be considered as of three kinds only, viz, posts or poles, growing trees, and buildings; the first-named to be used whenever practicable, the second to expedite matters in building a line, or upon a route where timber of the proper size for posts is difficult to procure or transport, (as in forests where are no roads or bad ones,) and the third in cities or towns where it is not desirable to set posts in the streets.

Posts should be of such timber as is best able to resist decay, such as red cedar or black locust, either of which, if of proper size and well seasoned, can be expected to last from thirty to fifty years; and, failing these, of white cedar, spruce, white oak, chestnut, sassafras, yellow pine, or cypress, all of which may be made to last well, say from ten to fifteen years. In emergency, and for lines not expected to last for more than two years, almost any timber will answer; even cottonwood can be used for one year. White cedar, spruce, and sassafras are desirable material, being, when seasoned, extremely light and enduring well.

Posts should be the bolls or stems of young trees, straight, free from large limbs, at least 25 feet in length, and not less than 5 inches in diameter at the top, or small end. They should, when practicable, be cut and the bark be removed six months or more before they are used, to allow them to season, and this is urged for the double reason that such preparation adds greatly to their endurance when in position in line and reduces the labor and cost of transportation and erection. They might be still further guarded against decay by injecting their substance with any of the substances which have the property of coagulating the albumen of the wood, such as carbolic acid, the solution of the sulphate of copper, or others, but the exigencies of military service will seldom permit the delay necessary for these processes.*

Where posts such as have been described cannot be had, others may be sawed from large timber, and in this case, the sap-wood being removed, the posts will not decay so rapidly during the first year or two, and may be made somewhat smaller. For sawed posts, 25 feet long, 6 inches square at the butt, and 6 by 3 inches at the top, is a good size.

When trees are to be used as supports, care should be taken to select, if possible, such as have but few limbs, and those at a height from the ground exceeding that to which it is desired to raise the line, and sparse foliage or small tops, such being less liable to be moved or thrown down by high winds. In open country, where trees are used, it will be well to trim them very closely, for the purpose of reducing the surface exposed to the wind. A tree-insulator should always be used upon trees, which will be described in its place.

When it is necessary or desirable to use buildings as supports, the line should be run over their tops, resting upon as few supports as possible, and great care must be taken to attach firmly and insulate well. These are the least desirable of all supports, and rules can scarcely be laid down for their use. The builder must apply general rules, and exercise great care, as lightning-rods, metallic roofs, gutters, water-conductors, and many other such dangers are in his route, and must be avoided or guarded against.

Secondly, insulators; and upon the quality of these depends the working of the line. By insulation is to be understood the severing in any manner the electric connection between the wire of the line and the earth, except at points where such connection is purposely made, in order that the current be compelled to flow in the wire. This end is to be attained by attaching to the support some non-conducting body, to which the line-wire may be attached.

Strictly speaking, there are no non-conductors, but those substances which are enumerated as such are the worst conductors, and are usually spoken of as non-conductors. (See Pope's Modern Practice, page 10.) Such non-conducting bodies are in number many—glass, and all vitrified substances, the resins, dry woods, oils, and all cereous substances, silk, cotton, &c—but from the list we may select two classes, vitreous substances and resins, as applicable to the purpose, the others, either from their becoming partial conductors when wet, as wood, flax, silk, &c., or from their fluidity at ordinary temperatures, as oils, &c., being valueless, or nearly so. Glass is the substance usually depended on, and its almost universal adoption by telegraph-builders is evidence of its superior practical value. Either simple, or as covering earthenware or porcelain, it is the substance in common use wherever telegraphs have been built, except in subterranean or submarine lines.

One form of insulator is shown by fig. 1. It consists of a glass cap 4 inches in height, $1\frac{1}{2}$ inches in diameter at and for $2\frac{1}{2}$ inches from the top, and of a bell-shape below, so that the diameter at the bottom is 3 inches. The glass is one-fourth of an inch in thickness. A bead or projection, one-eighth of an inch wide and high, at about one-fourth of an inch above the swell of the bell, forms a seat for the wire and prevents it from being slipped over the top of the insulator.

This may be attached to the posts by a pin in the top of the post, as shown in Fig. 2, or to

* For description of the processes for injecting posts, see Shaffner's Manual, pages 681 and 682; Sabine's Electric Telegraph, page 185; or Prescott, page 258.

the side, as shown by Fig. 3, or by a cross-arm, as shown by Fig. 4. In either case the glass cap should be made to fit the peg or bracket snugly, so as to be not easily removed, and a good plan is to have the peg or bracket made slightly smaller than the cavity in the glass, and make the fit by layers of cloth (old tent-cloth will answer) which have been dipped in white-lead and oil. This preparation, when dry, cements glass and wood so firmly that, when the glass is broken by violence, the fragments are often held in place, and so a partial insulation secured. When the peg is used in the top of the post, it should be secured against decay by the same expedient, or some other which will prevent the water which falls upon the top of the post, or any portion of it, from finding its way into the hole in which the peg is driven. The bracket is secured to the post by nails or spikes of a size sufficient to hold it firmly, and the post should be flattened to make a seat for it. Brackets should be of white ash or oak, one foot long from point to point, cut from 1½-inch plank, wedge-shaped, as shown by the figure, 1 inch wide at the lower point and 2½ inches wide at the shoulder. The peg or stud on which the insulator is placed should be

Fig. 1.

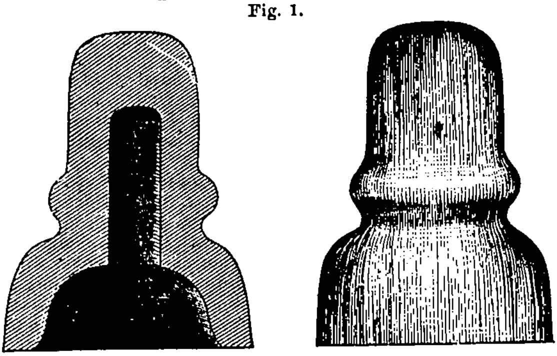


Fig. 2.

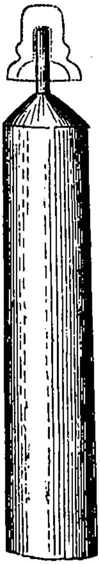


Fig. 3.

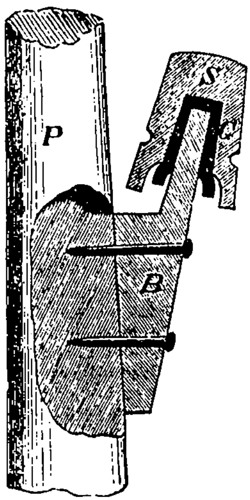
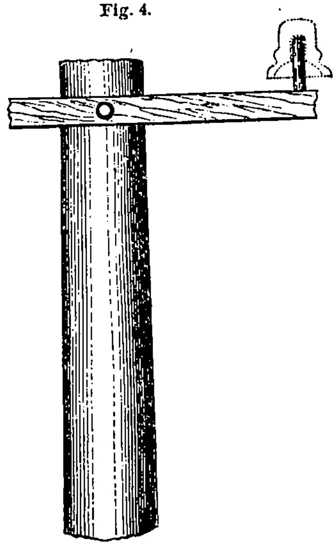


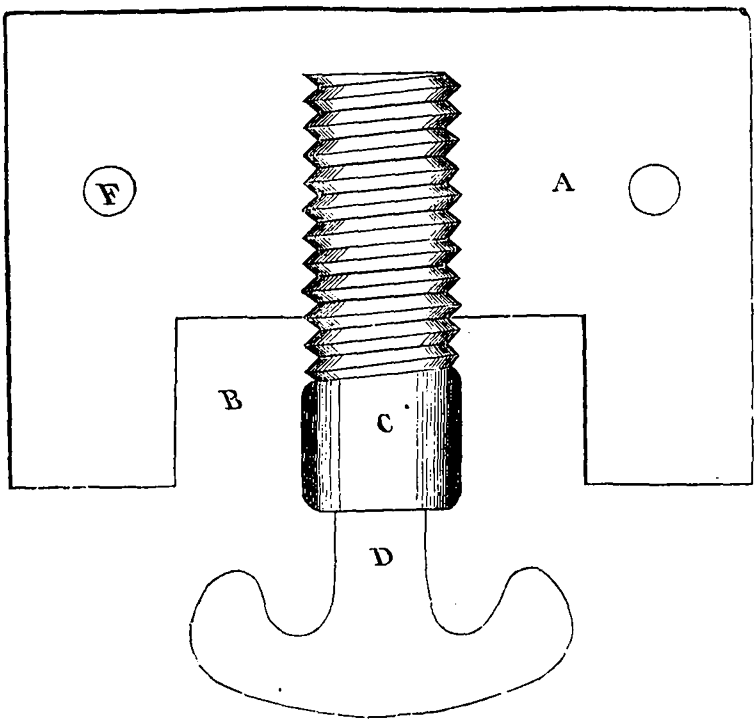
Fig. 4.



turned true, of a size to fit loosely in the insulator, and of a length sufficient to lift the edge of the bell 1 inch above the shoulder of the bracket. Two holes should be bored through the bracket to admit the spike, one at a point two inches below the shoulder, and the other at one inch from lower end, and both should be bored at right angles to the surface of the bracket which is in contact with the post. When cross-arms are to be used, a seat should be cut in the post, a hole bored for the bolt, and the cross-arms secured in position before the post is erected. If bolts and nuts are not at hand, and not easy to procure, cross-arms may be secured to the post by spikes; it is a question of economy, the bolts enduring longer than the spikes.

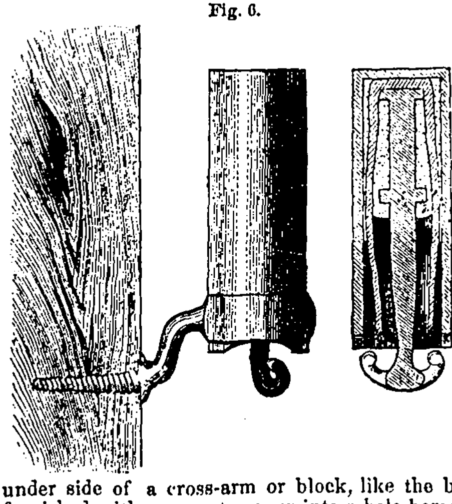
Insulators may be of glazed earthenware or porcelain, made in substantially the same form as those of glass, and such have been extensively used in Europe, but American telegraphers have not found them profitable, and few are now used. A very convenient form of insulator has been and is used, shown at Fig. 5. It consists of an iron stem, terminating in a cross, the extremities of the arms of which are bent at a right-angle with the cross, and parallel with the axis of the stem. The other end of the stem, which is about six inches long, is covered for four inches with hard or bone rubber, (so called,) molded into a cylinder, tapering slightly toward the end of the stem and closely embracing and adhering thereto. On the outer surface of the rubber a screw-thread is cut, and the insulator is screwed into a

Fig. 5.



hole bored in the under side of a cross-arm, or of a pine block, spiked to the side of the post, by which it is intended to protect the rubber from moisture. This insulator is strong, cheap, and durable, but it has not been found practicable to exclude moisture so as to preserve the rubber in its best state, and when its surface has become roughened by exposure its value is much reduced.

Fig. 6.



Paraffine is almost entirely devoid of conducting power or capacity, and is, therefore, in that respect, a desirable substance for use in insulation, but its physical characteristics make the problem difficult of solution. One form of insulator which depends upon this material for its value is shown at Fig. 6. It consists of a hollow cylinder of cast-iron, closed at one end, and having an iron stem, like that described in the preceding paragraph, cemented in its center and projecting beyond its open end. The cement used is composed of non-conductors, one of which is paraffine, and the exposed portion of the stem, the surface of the cement, and the inner surface of the iron cylinder are thickly coated with paraffine. This form is costly, but bears a good reputation, and can but be effective if carefully made and used. It may be attached to the poles by being inserted in a hole on the under side of a cross-arm or block, like the bone-rubber hook, or the iron shell may be furnished with an arm to screw into a hole bored in the pole.

Another form is that of an earthen cup, strong enough for the purpose, shaped so as to be used in the same manner as the glass insulator heretofore described and saturated through its entire substance with paraffine. This form has not yet been proved, but would seem a good one for climates in which the heat of summer is too feeble to melt the insulating material.

To all the forms of insulators heretofore described the line-wire is firmly attached, but, as this is not desirable where trees are used as supports, the motion of the tree endangering the continuity of the wire or the attachment of the insulator, or both, a form has been extensively adopted and used for service upon trees which consists of a block of glass, three inches long by two inches wide and high, having projections at each end on three of its sides, and a groove or slot an inch deep traversing its long diameter on the side on which no projections occur. This insulator is attached to a tree by being fitted into the top of a bracket and the bracket spiked to the tree. When in use it sustains but does not confine the wire, (which merely lies in the groove,) and the glass is protected from wet by a wooden cap nailed upon the bracket. This insulator may also be used on cross-arms by mortising the arm near its end to receive the glass and using the cap. As will be seen, it is not well protected against moisture, and is, in that respect, defective.

As expedients, in the absence of any accepted form of insulator, any non-conductor, so disposed that the line-wire shall come in contact with it and with nothing else, will answer. During dry weather seasoned wood, especially if saturated with resin, may be made to support line-wire, and signals have been successfully transmitted over fifty miles of wire so insulated.

Thirdly. Wire for permanent lines should be of best charcoal-iron, No. 8 standard gauge, though for military uses, having in view saving of weight and facility of putting up, No. 9 or No. 10 may be used for lines of not more than one hundred to two hundred miles in length. It should be annealed, coated with zinc in the manner known as "galvanized," joined up in half-mile lengths, the joints soldered, the lengths run into coils eighteen inches in diameter inside and six inches wide on the face of the coil, and the coils secured by four tie-wires equidistant from each other.

Such wire should show no sign of fracture after being bent, when cold, to a right angle and again straightened, should be free from slivers and splits, and weigh (No. 10) 300, (No. 9,) 340, and (No. 8) 380 pounds to the mile-length.

The following are some of the qualities required by the English postal department for its standard wire:

1st. The wire supplied under this tender must be of the gauge known as No. 8, Birmingham wire-gauge, (diameter .170 of an inch.)

2d. The wire to be highly annealed and very soft and pliable, and to be galvanized. The wire must be capable of elongating 18 per cent. without breaking, after being galvanized.

3d. The wire to be entirely free from scales, inequalities, flaws, splits, and other defects, and to be cylindrical.

4th. No deviation greater than .005 of an inch either way from the prescribed diameter will be allowed.

5th. The whole of the wire to be passed under and over three or more pulleys or fixed studs, placed in such position in the plan indicated as shall, in the opinion of the engineer, admit of the quality of the wire, as regards freedom from splits, being sufficiently tested.

6th. The whole of the wire to be stretched 2 per cent. by machinery, and after being stretched to be coiled carefully, so as to contain no bends or indentations, but in all respects to resemble newly-drawn wire.

The coating with zinc is less important in dry climates than in moist ones, being intended merely as a protection against oxidation, and consequent reduction of the conducting capacity of the wire, but is inexpensive, makes the wire easier to handle, in that it wears the hands of the men who handle it less than the iron, and is of further value, in that it aids in making good connections, when line is broken and rejointed after being erected, by preserving a bright surface. This fact becomes of importance where lines are especially liable to damage, and unsoldered joints (made by repairers or patrols) are frequent, as is likely to be the case with military lines.

For that portion of lines which traverses buildings for the purpose of connecting with instruments located therein, or to reach the main batteries, in short, for all in-doors work, a copper wire should be used of a size sufficient to be equal in conducting capacity to the line-wire—say, for a line of No. 10 iron-wire, a No. 18 copper; No. 9 iron, No. 17 copper; No. 8 iron, No. 16 copper—and such wires always insulated by a covering of silk, cotton, or flax, or of gutta-percha, caoutchouc, or ballata. For ordinary in-doors use the silk, cotton, or flax covering is best, as the other materials named deteriorate rapidly in a dry air, becoming brittle and detached from the wire. For passing into and out of buildings, where the fall of water from the roof endangers the insulation of the line, it may be well to use the gums, or some of them, and renew the wires as often as may be necessary to keep them in a proper state of insulation; though by saturating the fibrous covering with shellac, or other resin, or better still with paraffine,* an equally good result may be obtained.

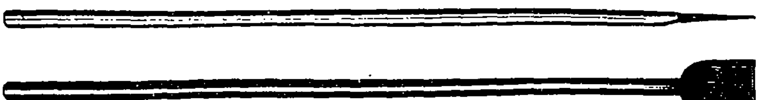
* PARAFFINE.—(*Parvum*, little; *affinis*, affinity.)—There are several substances known in commerce under this name. It is usually applied to a white, solid, translucent substance, free from odor and taste, somewhat

Where copper wire is connected to iron, the joint must be protected by solder, or in some other manner, from moisture, or a local galvanic action will result, which will at the same time reduce the conductivity of the line, by oxidating the surfaces in contact, and impair its strength. If appliances for soldering are not at hand, the joint can be preserved by smearing it with a paste of white-lead and oil, of raw rubber, or by coating it with paraffine, each of which, however, yields to climatic influences, and is inferior to soldering.

CHAPTER II.

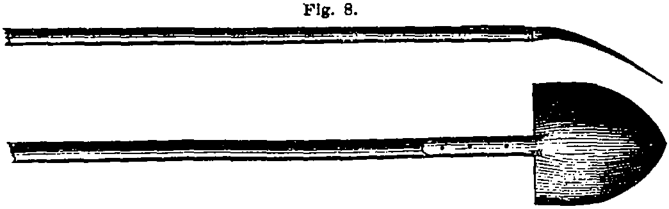
The tools and appliances for building a permanent line are few, and can be procured easily, most of them being found in any ordinary stock of hardware. There are, first: Axes for felling and preparation of posts, and for clearing the way for the line, where such work is required. Hatchets having a bit 4 inches wide, a head or poll with which to drive spikes, (and weight sufficient to make them effective in that respect, say 1½ pounds,) and hickory handles 15 inches long. This tool is of use not only in building but maintaining the line—is in fact one, as the pliers is the other, of the "line-men tools." Diggers, (so called,) which

Fig. 7.



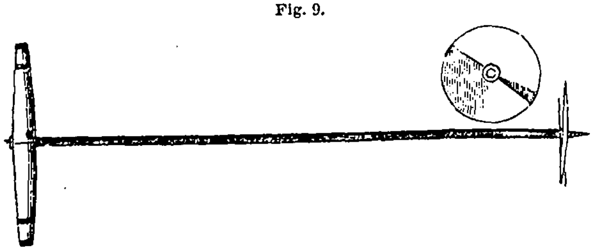
are crowbars of about 15 pounds weight, having a flat cutting point or edge, (Fig. 7,) for loosening the earth, and shovel, (Fig. 8,) for removing it, in digging post-holes, each being

Fig. 8.



of a length of not less than 5 feet, and the point of the diggers and blade of the shovels being steel. In soils where they can be used, post-augers (Fig. 9) should be provided in

Fig. 9.



place of bars and shovels, as on prairies, or alluvial bottoms free from gravel. With this tool one man can do the work of one and a half, using digger and shovel, and the hole may

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crystalline in texture, of specific gravity about 0.87, melting at about 122° Fahrenheit, and volatilizing at a high temperature. It is but slightly acted upon by re-agents, hence its name. Its chemical composition is most probably that of a mixture of several hydrides of the higher alcohols, such as cerotene, or cerotic hydride, ($C_{27}H_{56}$.) melene, or melenic hydride ($C_{30}H_{62}$.) the lowest in this series being marsh-gas, methylic hydride ($C.H_4$.) Alcoholic hydrides, as they get lower in the series, become liquid at the common temperature, and are then known as paraffine oil. Paraffine is obtained in enormous quantities in the dry distillation of wood, coal, bituminous shale, petroleum, peat, and lignite.—*Rodwell's Dictionary of Science.*

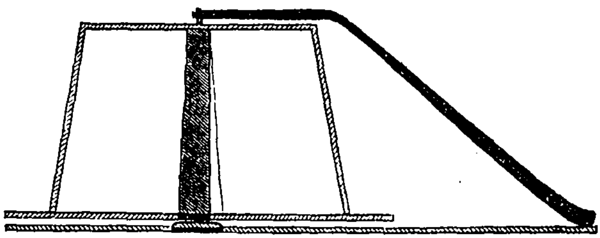
PARAFFINE.—Distill beech-tar to dryness, rectify the heavy oil which collects at the bottom of the receiver, and, when a thick matter begins to rise, set aside what is distilled and urge the heat moderately as long as anything more distills. *Pyrélaine passes over*, containing crystalline scales of paraffine. This mixture, being digested with its own volume of alcohol, of 0.833, forms a limpid solution, which is to be gradually diluted with more alcohol till its bulk becomes six or eight times greater. The alcohol, which at first dissolves the whole, lets the paraffine gradually fall. The precipitate, being washed with cold alcohol till it becomes nearly colorless and then dissolved in boiling alcohol, is deposited, on cooling, in minute spangles and needles of pure paraffine.—*Ure's Dictionary of Arts, &c.*

be made so nearly of the same size as the posts to be set therein as to greatly facilitate the erection of the line, saving labor of tamping, &c. Shears, foot-plates, and pikes for erecting and tamping-bars for setting the posts are also needed. The shears consists of two pieces of timber 6 feet long and 5 inches wide by 2 inches thick, (less will do if posts are not heavy,) crossed near one end, and firmly secured to each other in such a manner as to form a base 3 feet wide to rest upon the ground and a saddle upon which to sustain the weight of the post. The foot-plate is a curved plate of iron or steel, having a handle attached like that of a shovel. Its use is to receive the foot of the post while it is being erected and prevent it from loosening the material of the wall of the hole. The pikes are spruce, pine, or ash poles, 8, 10, and 12 feet in length and 1½ inches in diameter, armed at one end with a spike and ferrule, and are to be used in raising posts. Tamping-bars are rammers of hard wood, 5 or 6 feet long, and of a size to be conveniently grasped. They are used to tamp or ram the earth about the post between it and the walls of the hole, in order that the posts may stand firmly when in place.

Augers for boring the holes in the posts for admitting the peg on which the insulator is set, or those through the post for the admission of the bolts used in attaching cross arms; saws, if the posts are to be prepared for the reception of cross-arms; wide chisels, to cut the seat for the cross-arm, and mallets.

Reels, for laying or delivering the wire from the coil, shown at Fig. 10, consist of a base which may rest on the bottom of a wagon, the deck of a platform-car, (if the car is upon a railroad,) or other means of transportation, and the reel proper, resting upon this base and turning horizontally upon an axis. The base is a piece of timber 6 feet in length and 6 inches wide by 2 thick, having a cross-piece of like width and thickness and 4 feet long, halved on and firmly secured to it at 2 feet from one end. From the center of the point of intersection rises the axis of the reel. This is an iron rod 1½ inches in diameter and 2½ feet long. From the extremity of the long arm of the base an iron stay or brace extends to the top of the axis, hinged to the base, and engaging at the top with the axis of the reel, to prevent it from being bent or thrown out of perpendicular by any strain upon the reel. The reel itself consists of two pieces of oak or other hard wood, 3 feet long, 3 inches wide, and 1½ thick, framed together at right angles to each other at their respective centers, having an iron plate on one side of the intersection, and through the center a hole for the admission of the axis. Secured to this cross, at such a distance from the center that the coils of wire to be used may drop easily over them, and connected at the top by another cross similar to the one described, except that its arms are shorter and do not extend beyond them, are four uprights of the same size and material as the crosses —the outsides of which are curviform—representing segments of the circle formed by the inside of the wire coils, and are 2 feet in length. When complete the reel is a skeleton of a frustum of a cone 2 feet in height, 18 or 20 inches in diameter at its base, and 3 inches less in diameter at its top. When in use it is upon the base described, is retained in position by the axis, and, revolving horizontally, delivers the wire from the coil placed upon and revolving with it straight and free from torsion, and so not liable to run into kinks if slackened or broken.

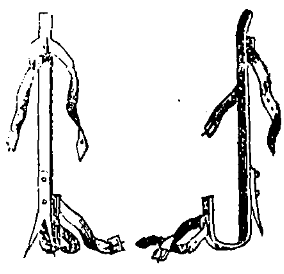
Fig. 10.



Pliers, for making connections in the wire, should be of the kind known as "flat-nosed," with a cutting blade on the side of the jaw, should not be less than 8 inches long, strong, and having well-tempered jaws. Files should be 8-inch triangular saw-files. The tool for making joints (or connections) in the wire should be of steel, 6 or 8 inches long, with one lip recurved. In use the recurved lip embraces the line-wire, while the shoulder rests against the end which is to be wound round and clasp it. By carrying the handle of the tool around the line-wire, the end will be snugly compressed upon and coiled around the line and a smooth joint made.

Tools for soldering joints are an alcohol-lamp of any convenient form, a bottle or other vessel containing muriatic acid in which zinc has been dissolved as long as the acid will take it up, and solder in bars of a foot or so in length and half an inch in width and thickness.

Fig. 11.

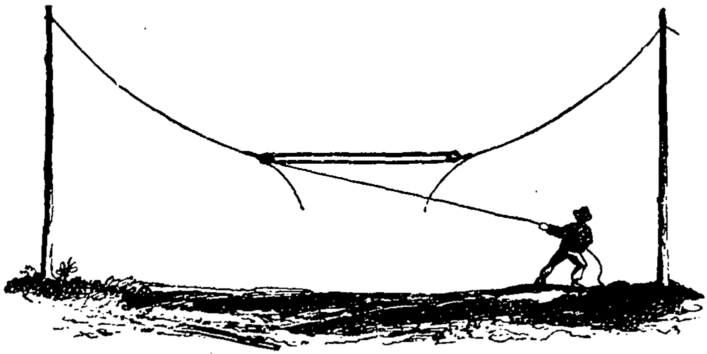


Climbers, to enable the men to reach the top of the posts easily, are of various patterns.

One or two well approved are shown at Fig. 11, as is also the mode of attaching them to the feet of the men.

Pulleys, for bringing together the ends of a broken wire, so that a joint or connection can be made, should be furnished. Two blocks, one single and one double, with not less than

Fig. 12.



50 feet of rope, form the set. Vises, or other devices for grasping the wire, are attached to the block-straps, which, together with the method of reeving, are shown at Fig. 12, and can be better understood by an examination than by the most careful description. In event of vises or other device for holding the wire being wanting, two ends of pliant rope, the bight of which is through the block-strap, can be made to grasp the wire with sufficient tenacity by winding them around it in long spirals in opposite directions and tying the extreme ends together to prevent the unwinding of the spirals. The blocks should be not less than four inches long, the sheaves of *lignum-vitæ*, and bushed with brass, and the rope best half-inch Manila hemp.

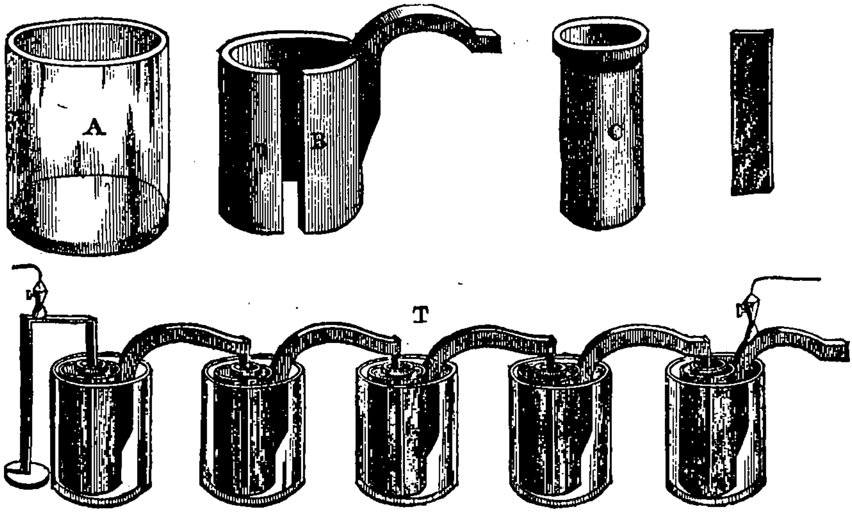
CHAPTER III.

EQUIPMENT OF A LINE.

For the equipment of a line there will be needed batteries, which are to the telegraph what the boiler is to the steam-engine, the source of the motor on which the action of the machinery depends. They are but various forms of the voltaic pile, and the principle upon which all are constructed may be thus stated: When two metals, one more easily oxidized than the other, are subjected to the action of water, a portion of the water is decomposed, the oxygen entering into combination with a portion of the oxidable metal, and a portion of the hydrogen being freed and escaping. At the same time a development of electricity takes place, positive or *plus* electricity being found at the less oxidable of the metals, and negative or *minus* electricity at the other. If the two metals are connected above the water by a metallic conductor, the metals exchange electricities over and along such conductor, and a telegraph-line, in miniature, is at once established. In developing the principle thus laid down it may be further stated that, the greater the difference between the metals and the more active the excitant, the greater will be the result in the development of electricity. Zinc is universally used as the positive element in batteries, being easily oxidable and inexpensive; but copper, silver, platina, and graphite are used as negative elements, and the excitants are almost numberless, varying from pure water to anhydrous acid. For *main batteries*, (*i. e.*, those which supply the current that flows upon the line and serve as the means of communication between distant points,) one of the most approved forms is that shown at Fig. 13, called, from the name of its inventor, "Grove's." Its cell consists of a glass cup or tumbler, 4 inches in height, 4½ inches in external diameter, and of a thickness sufficient to give the requisite strength; a cup of porous earthenware, equal in height to the glass cup, 1¼ inches in outside diameter at the bottom, and for 3 inches of its height having its top funnel-shaped, and 2 inches in diameter, and with its walls one-eighth of an inch thick. The material of this cup must be porous clay, and not vitrified, as it must be traversed freely by the electricity generated in the different cells of the battery or series. The zinc, or positive element, is in the form of a hollow cylinder, divided longitudinally, having projections or feet on which to stand in the cup, and an arm rising from its top above the cup and extending horizontally, so that its end shall be over the porous cup, in the next cell in the battery. The negative element is a strip or ribbon of platinum permanently attached to the projecting arm of the zinc cylinder.

The size of the zinc and platinum may be varied, but a convenient and effective size is 3½ inches for the height of the zinc cylinder, and 3 inches for the horizontal length of the arm, both cylinder and arm being one-half inch in thickness, and the latter three-fourths of an inch in width.

Fig. 13.



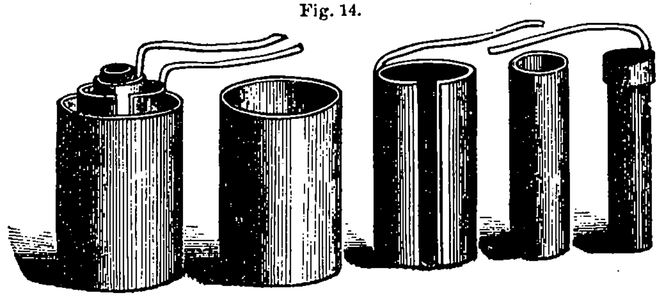
The platinum strip for use with such a zinc should be three-fourths of an inch wide and 4 inches long and soldered firmly upon the end of the zinc arm. The exciting fluids are water and sulphuric acid, twenty parts by weight of the former to one of the latter, surrounding the zinc and filling the glass cup, and nitric acid surrounding the platinum in the porous cup.

The action of this battery may be thus described: The series being connected one with the other and the extremities with the conductors, the oxygen of the acidulated water attacks the zinc, forming sulphate of oxide of zinc, which is dissolved as fast as formed, and thus is continued until the solution becomes saturated, when the oxide is deposited upon the zinc itself, and finally protects it from the action of the oxygen. The flow of electricity then becomes feebler, and finally ceases entirely. The hydrogen freed at the negative (platinum) plate is not permitted to escape or to adhere to the platinum, (by which the conducting power of the battery would be reduced,) but enters into the nitric acid, changing it from nitric to nitrous acid. This battery gives a very steady and powerful current, and is for that reason much used; it is, however, costly, and needs much attention to obtain the best results. The zincs should be amalgamated with mercury by being cleaned in a bath of sulphuric acid and water strong enough to boil them and then dipped in mercury. This preparation preserves the zincs from local oxidation, consequent upon impurities in the metal, and prevents the deposit of sulphate upon their surfaces. Fifteen cells of Grove's in good order are sufficient to work a line of one hundred miles in length, unless there is a large escape or leakage at some point on the line.

The Bunsen battery (Fig. 14) resembles the Grove in all except the negative element, which is of graphite or other form of carbon, instead of platinum. Its power is less than that of the Grove, inasmuch as the carbon is a poorer conductor than the strip of platinum, but it is cheaper, and therefore much used, especially on the continent of Europe.

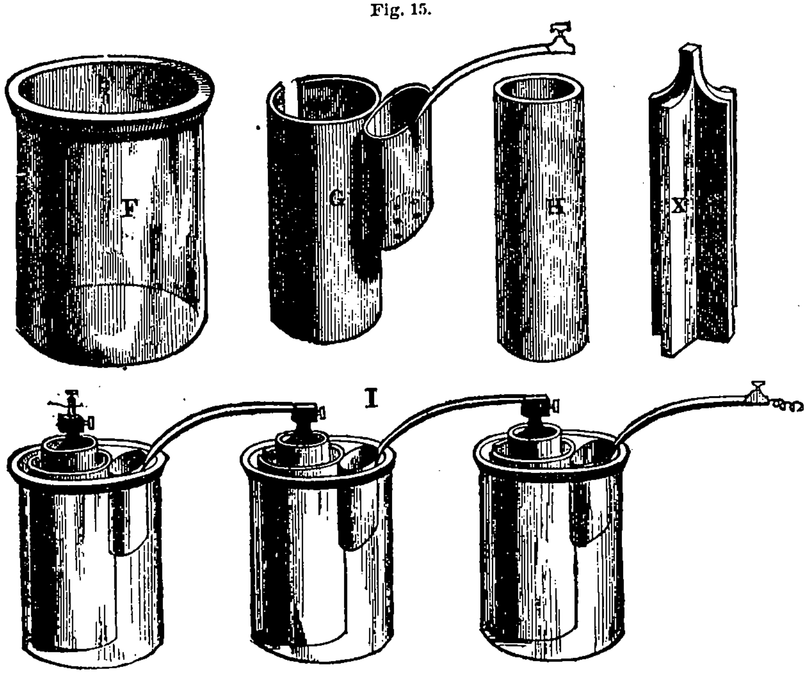
The Daniells battery (Fig. 15) differs from those previously described in everything except the use of zinc as the positive element. It is less powerful than the Grove, and therefore less used in America, where long distances are to be traversed, but is much used in Europe, and is much recommended by its cheapness and the length of time it will remain in action without attention, deriving from this last peculiarity its name of "constant battery." A Daniells cell consists of a copper plate immersed in a solution of sulphate of copper and a zinc plate immersed in a solution (weak) of sulphate of zinc, or in water to which has been added one-twentieth of its weight of sulphuric acid. Its forms are very numerous and need not be described here. If the above-named conditions are maintained, the battery will work, and will give about half the force of the same number of Grove cells, (provided the strength of the solution of sulphate of copper is maintained,) until the precipitation of sulphate of zinc clogs the action upon that metal. A form of this battery, intended for military service, consists of a cylindrical copper vessel, the inner surface of which forms the negative element of the pair, having a diameter of 4 inches and a height of 4 inches, with a perforated copper cup near its top to contain crystals of the salt, a leathern porous cup $2\frac{1}{2}$ inches in diameter, and of the same height as the copper vessel, attached to an insulated cover which fits the top of that vessel, and a prism of zinc 8 inches in height and $1\frac{1}{2}$ in

Fig. 14.



diameter. To place this cell in action, the copper vessel is two-thirds filled with a solution of sulphate of copper, (blue vitriol,) and the perforated chamber filled with crystals of that salt. The porous cup containing the zinc is filled with water slightly acidulated, or with a weak solution of sulphate of zinc, and placed within the copper vessel and the connections made. The solution in the copper vessel should fill it when the porous cup is in position, in order that the crystals in the perforated chamber may be dissolved.

Fig. 15.



When electric communication is established, the acidulated water attacks the zinc, as in other batteries, and the freed hydrogen finds an office in reducing the copper from the solution of its salt. The copper resulting from this action is deposited on the surface of the copper element, keeping it bright and preserving its conducting power. The weakening of the solution is prevented by adding fresh crystals as fast as those in the perforated chamber are dissolved, and the battery works with undiminished energy until the water in the porous cup becomes a supersaturated solution of sulphate of zinc, and a deposition of this salt takes place on the zinc itself. This battery has much to recommend it, its constancy alone making it everywhere preferred for locals. For military lines it has the merits of not requiring the transportation of concentrated acids or such delicate manipulation as the Grove or the Bunsen.*

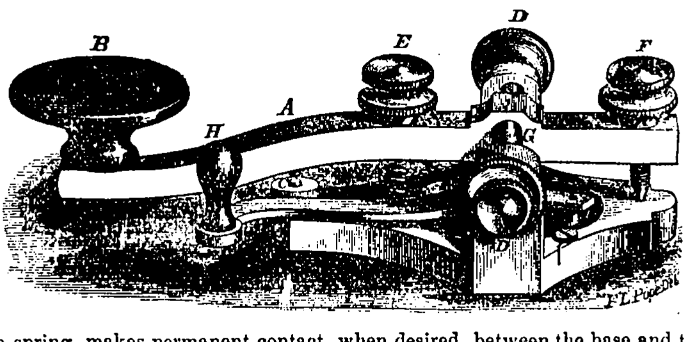
Other batteries might be enumerated and described, but the principles involved in their construction are substantially the same as in those already named. The necessary number of cells for any given line can only be determined when the character of the line as to conductivity and loss of current by defective insulation is known, but fifteen cells of Grove or Bunsen, or twenty-five cells of Daniells, are usually sufficient for a line of one hundred miles in length; and if that number of cells in fair order fails to give good results, the remedy should be applied in labor on the line, trimming, re-insulating, &c. For lines exceeding one hundred miles in length, one cell of Grove or two of Daniells, for each additional ten miles of line, should furnish a current of sufficient intensity. The Daniells cell is especially fitted for use as a local battery, two cells being sufficient for each office, or for each set of instruments where more than one is employed.

Main batteries should be as carefully insulated as any part of the line, the cells not allowed to be in contact with each other, and each one mounted on a dry insulating-stand. In one form of stand used the cell rests on the edge of glass strips so arranged as to shed moisture. The efficiency of this form is much increased by coating both wood and glass with paraffine. Another method is to make a battery stand by using an insulator with a flat top as a seat for each cell and attaching the insulators to a convenient support. The so-called Wade insulator, with wooden shield, is well adapted for this purpose. Local batteries do not need so much care in this respect, as the current generated by them is of low tension and the circuit offers little resistance; they should, however, be kept in a dry place.

INSTRUMENTS.

The instruments for equipping a line are the ordinary Morse key, relay, and sounder; switches, if more than one wire is used, and repeaters if more than one circuit is to be worked. The Morse key is a device for conveniently opening and closing the circuit, and is merely a brass lever of any convenient length, usually about 6 inches, having, about 2 inches from one end, a transverse axis or trunnion; at the end of the shorter arm a screw with a binding-nut for the purpose of regulating the distance through which the lever may move; at the other end a finger-piece, by which it is grasped, of ivory, rubber, or other non-conducting substance, and on the under-side a platinum stud. The lever is mounted by its trunnion on a base so that its set-screw shall be in contact with the base when the front end is raised, and the platinum in stud-contact with an insulated anvil, (also armed with platinum,) to which one end of the wire is attached when pressed down by the finger. The other end of the wire is attached to the metallic base of the key. A lever, held in its

Fig. 16.



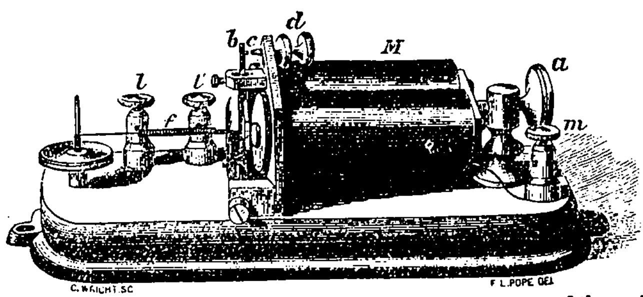
place by a spring, makes permanent contact, when desired, between the base and the anvil, and is called the "circuit-closer."

The key is held open when not in use by a light spring. An examination of Fig. 16 will enable the student to fully understand the apparatus.

Note on the chemical action of the Daniells battery.—"When the current passes, the zinc is dissolved and the copper receives an equivalent increase in weight. In the chamber containing the zinc and acidulated water, the oxygen of each atom of water decomposed unites with an atom of zinc, forming an atom of oxide of zinc, which, in its turn, combines with an atom of sulphuric acid, forming sulphate of zinc, which is dissolved in the water. The atom of hydrogen released is transferred, by means of decompositions and recompositions, toward the copper cylinder. In the interior of the porous cup an equivalent atom of sulphate of copper is decomposed into one atom of copper, one of oxygen, and one of sulphuric acid. The atom of copper is deposited upon the plate by the current; the atom of oxygen, moving toward the zinc plate, meets the atom of hydrogen traveling from the other compartment of the element and combines with it, forming together an atom of water, while the atom of sulphuric acid goes to the zinc compartment to renew the supply there for the formation of sulphate of zinc, as that metal is dissolved."—*Sabine's Electric Telegraph*, page 222.

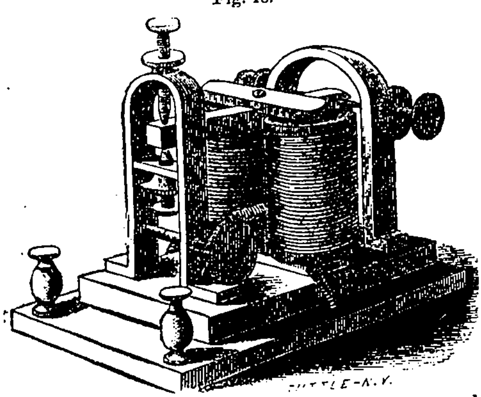
The relay (Fig. 17) is simply an electro-magnet of from five to fifteen miles' resistance, and fitted for use on a circuit of high tension, mounted on a flat base, and provided with convenient posts for the attachment of the main line and local wires, and with an armature so mounted as to be opposite to and within the magnetic field of the poles of the magnet. This armature is provided with a spring, by which it is withdrawn from the poles when the circuit is broken and the attraction ceases. From the bottom of the posts *M* and *m*, connection is made with the wires of the magnet, so that when the line-wires are attached to the posts the magnet is contained in and forms part of the main circuit or route of the current generated by the main batteries. From the posts *l* and *l'* wires are connected with the frame-work that supports the poles of the magnet, and with the armature, which is insulated from the frame-work, so that the electrical connection between the wires can only be made when the platinum points, with which both the armature and the frame-work are armed, are brought into contact, this being part of the local circuit or route of the current generated by the local battery to work the sounder. Relays are of various patterns, but this general description will answer for all, as the principles involved and purpose to be accomplished are the same in all forms.

Fig. 17.



The sounder (Fig. 18) is also an electro-magnet, mounted conveniently, with armature, spring, connecting-posts, &c., like the relay, but differing from that instrument in the character of the magnet and the uses to which it is put. Its magnet is one of very slight resistance, and therefore fitted for use only in a current of low tension, such as that generated by the local battery, (by which its action is controlled,) and repeats its signals so loudly as to render them distinctly audible, and thus reduce the difficulty of receiving or recognizing them.

Fig. 18.

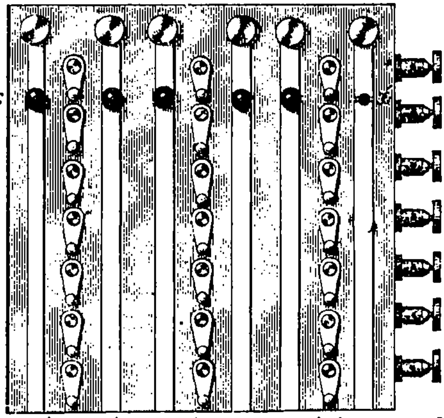


Repeaters are a class of instruments rendered necessary by the difficulty of working circuits of more than two to three hundred miles in length, and are used to repeat automatically in a second circuit the signals made in the first by the manipulation of the key, each repeater performing the work of a receiving and a transmitting operator, thus reducing cost and the chances of error. They are of various kinds, and need not be described in this work, it being sufficient to say that all of them accomplish their purpose by making the armature of a sounder perform the office of a key in a circuit other than that in which the magnets of the sounder are connected.

Instrument-tables may be of any convenient form, and military lines will usually be roughly furnished in this respect, but a good form is 2½ feet in length by 1½ in breadth and 2½ feet high, with a drawer to contain stationery, &c. Such a table is large enough for a set of instruments and gives room for convenient copying of messages.

Switch-boards are needed where several wires enter an office, and are merely devices by which any instrument in the office may be connected with any line-wire, or, in case of an office intermediate between the terminals, by which line-wires on one side can be interchanged with those on the other. They are of various kinds, but the main features of all are similar. A board, having brass strips extending vertically across one surface equal in number to the line-wires to be attached thereto, with screw-posts at the ends of the strips, has also, between the strips, buttons hanging on pivots, (all of brass,) which pivots extend through to the back of the board, and are connected by a wire with one another in horizontal rows, and each row to a screw-post at the side of the board to which the wires which reach the instruments and batteries are attached. It will be seen that, when one of these buttons is turned to right or left, so as to touch a strip, the connection is complete from the line to the instruments and batteries, and that, as each row of buttons crosses all the strips, it is practicable to make any connections desired. Various other convenient arrangements can be made, such as bringing battery and ground wires into switch-boards; arrangements for loops, by which an instrument placed elsewhere than in the office can be, at will, switched into any circuit on the board; tests made of wires, &c. The switch thus briefly described is known by American telegraphers as the "Culgan switch," (Fig. 19.)

Fig. 19.



Lightning-guards are devices by which atmospheric electricity, gathered by the line-wire, is removed therefrom and conducted to earth without injury to the apparatus or operators. They are of various forms, the object in all being to present near the line-wire, and between it and the instrument-tables, a route over which the atmospheric electricity can reach the earth, and this can be done readily, because that electricity will leap over or through short spaces without a conductor. One form brings the line-wire to a plate of metal having a serrated edge and a ground-wire to another such plate, the two plates being secured upon a base of non-conducting material with their points separated by a space not exceeding the one-thirty-second of an inch. Another is to connect the line-wire with a metallic disk and the ground-wire with another, the disks being pressed together by a gripe or clamp, but prevented from coming in contact by a disk of thin paper or of silk. In the one case the atmospheric fluid will leap through the air to the points of the plates attached to the ground-wire, and in the other burn its way through the paper or silk. All devices for this purpose must be carefully watched, as the passage of electricity through them will often melt a portion of the metal and establish a ground-connection, which will prevent the working of the line until removed.

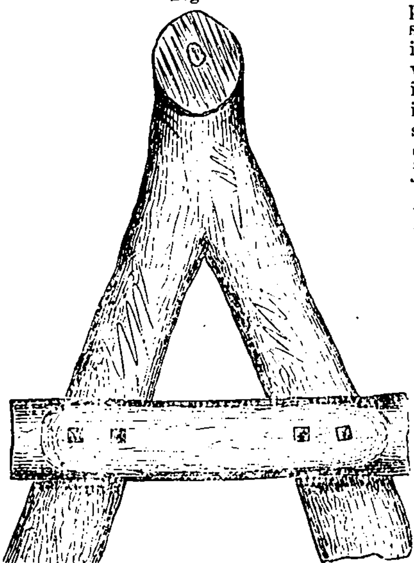
In this connection, though not really part of the equipment of a line, it may be well to describe the manner of making ground-wires or connections. At stations where main batteries are to be kept, a good ground-connection is absolutely necessary to the successful working of the line, and should be made carefully. The ground-wire should be of copper, and should be equal in conducting capacity to all the wires which are to be worked from the battery, or rather should equal the conducting power or capacity of the battery itself. It may be connected by soldering to the water or gas pipes of a city or town; but if none such exist or are to be had conveniently, it should terminate in a copper plate having 6 or 8 square feet of surface, and buried in moist earth, below the reach of frost or drought. If the copper wire or plate cannot be had, iron wire and a plate of zinc may be sustituted, or an iron wire may be led to and connected with a body of charcoal, or other form of carbon, buried as prescribed for the copper plate; but all such substitutes must be watched, especially the iron wire where it enters the earth, it being particularly liable at that point to oxidation.

CHAPTER IV.

The labor necessary to build a line depends, of course, on the country in which it is to be built, the time allowed in which to build it, and, in short, the circumstances of each case, and much must be left to the discretion of the officer or person in charge. But a few suggestions may not be out of place; and first, the order in which the different portions of the work should be carried on. When a line is to be built and the route determined, a party or parties of not less than ten men, each in charge of a non-commissioned officer or foreman, initiate the work by digging the post-holes, the officer or foreman determining the places for the holes and seeing that they are properly made; the men working by twos, equipped with diggers and long-handled shovels or such other tools as the nature of the soil permits. Each of these parties should be accompanied by one or two ax-men to clear the way for the line by cutting shrubs and trimming or felling such trees as would obstruct or impede the work of erecting the line or impair its insulation by contact after its erection. Such a party should dig holes for four or five miles of line daily, making the holes four feet deep and seventy-five yards apart. This estimate supposes clay or loam in which to make the holes, and is, of course, only approximate. For the subsistence of these and all other working parties proper arrangements must be made, but that is a matter which need not be entered upon here, as the same care would have to be taken of working parties at any other duty, and is simply commissary and quartermasters' work.

A party or parties to cut and prepare the poles should follow closely upon the diggers and should be strong enough to supply poles for the line as fast as the holes are dug. No rule can be given, the number of men and amount of transportation depending entirely upon the work to be done, the distance posts have to be transported, &c. Axes are the only tools needed. Wagons can be fitted for transporting poles by removing the bed or box and substituting a long reach for the ordinary one. If the ground be impracticable for wagons, posts may be hauled two or three at a time upon a contrivance shown at Fig. 20, which can be made on the ground by any handy man. When the holes have been dug and the posts delivered for, say, ten miles, the insulators should follow and be attached, one man (or two, if more than one wire is to be put up) doing the work of attaching them, and the party which is to erect the posts should follow closely the insulators, erecting the poles as soon as the insulation is attached, in order that they may be out of the way of such accidents as would injure or destroy them if left upon the ground.

Fig. 20.



The number of men necessary in these parties will depend upon the size and weight of the poles, but cannot be less than five men and a foreman, and only so few when the poles are of very light wood, white-cedar, for instance, and well seasoned. For green posts, of oak, locust, or chestnut, ten men will be needed. In working the foreman or a man places the foot-plate in the hole on the side opposite to that on which the post lies; the men, seizing the post with their hands, raise its top from the ground breast-high and thrust its foot against the foot-plate; the man whose duty it is places the shears so as to support the post in that position, when the men quit their hold, and, taking their pikes, arrange themselves on opposits sides of the post, and, using their pikes, at once raise the post, which slips into the hole. This releases the foot-plate, which is removed; the cant-hook is applied and the post turned, if necessary, to the proper position, *i. e.*, with the insulator on the side next the road, or the cross-arm (if any) at right angles thereto. Two men with shovels and tamping-bars fill the hole with earth and ram it solid; then the post is ready for the wire. In this, as, in fact, in all parts of the work, no pains should be spared to make the work thorough. The foreman must see that the posts are perpendicular; that the insulation is properly attached and in proper position when the posts are erected; that the holes are filled and the earth well rammed, and the surface of earth in contact with the post higher than that surrounding it, so as to turn the water away from it.

The wire-party should consist of foreman and six men, with a wagon (or, on railway, a truck) to carry the wire and wire-reel. The wire being in the wagon and the reel in place, the wire-man places a coil upon the reel, cuts the tie-wires, passes the end (taking care that it be the outside end) of the wire to the follower, who attaches it to the first post or such other starting-point as may be designated, the driver starts his team, and the wire is drawn from the reel, the wire-man applying so much friction to the wire or reel (by a clutch or brake) as may serve to give the wire proper tension; the follower, at from thirty to forty yards in the rear, carries the wire to the foot of the pole, and the climbers, four in number, carry the wire to the top of the post and attach it to the insulator, each man taking the fourth post from the one with which he starts. If more than one wire is to be put up, such a party will be needed for each wire, and the first party will put its wire on the insulator farthest from the route, that is, on the end of the cross-arm away from the road, or the insulator on or nearest the top of the post, so that the work of the first party shall not be in the way of the second. The foreman must see that the wire is delivered with only so much slack as is necessary, and does not hang too low when put up; that the joints or connections are properly made, and generally that the work is well and promptly performed. In putting up two wires on one line, the two parties can be kept within one-fourth of a mile of each other, and under the charge of the same foreman or officer.

Connections, joints, or splices, variously so called, may be made in any manner which will give a contact equal in area to a cross-section of the conducting-wire, so that the conductivity of the line shall not be less at that point than where the wire is continuous. The connection in common use is shown at Fig. 21, and is made by bending the ends of the two lengths to be connected at right angles, and then wrapping each end snugly around the other wire in a close spiral. Another form that has been a favorite with some constructors is made by winding the ends of the two lengths around each other in long spirals which interlock. A third, used in England and the provinces, and called the "Britannia joint," is shown at Fig. 22, and no description is necessary. The joint first shown is, all things considered, the best for military telegraphs The wire of a joint should always be cleaned, and, when practicable, the joint soldered.

Fig. 21.

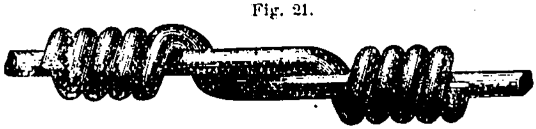
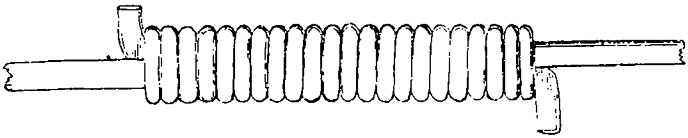


Fig. 22.



Chapter V.

The line being erected, the maintenance thereof must be at once cared for, and the force necessary for this purpose must be determined by the circumstances of the case. No rule can, therefore, be given. Repairmen or patrols must be located at an office in order that their operations may be directed by the officer or person in charge from any point where he may be; must be mounted, or provided with other means of rapid transportation, and be equipped with hatchet, insulators, pulleys, and rope, or other device for bringing together the ends of a broken wire, climbers, file, pliers, and a small quantity of line-wire. Immediately upon the discovery of a fault, the repairman on either side of its supposed location should proceed at once in its direction, and go until he finds and repairs it or meets the man from the opposite side of the fault. In addition to this duty, the repairmen should have charge of a certain length of line, and should go over it often, replacing broken insulators, if any, trimming away branches of trees, shrubs, or climbing-vines, (in short, preserving the wire from any contact except with insulators,) and generally maintaining the line in good condition. On long lines this work should be under the care of a chief, who should be an operator capable of working and testing a line, who should be held responsible for the proper condition of the line at all times and be required to make proper reports of all work done under his direction.

The working of a line should be the duty of a superintendent, with as many assistants as there may be circuits in the line, if more than one, and as many operators as the business to be transmitted renders necessary. At offices that are to be kept open during the day only, and where a small amount of business is to be transacted, a single operator only is needed; but where the labor is continuous, eight hours a day is as much as a man can do and do well, and this should be broken into two watches or tours. Such lines will necessarily be worked by some of the usual modes, and are treated of as worked on the Morse plan, as the most flexible, requiring the least machinery and equipment, and the skilled labor for which is the most easily procurable.

The superintendent is of course responsible for the working and maintenance of the whole, each assistant to him for so much thereof as shall be his charge, and the manager of each office to his immediate superior for his office and subordinates. A system of reports should show monthly the state of the line, condition, property received, expended, and on hand, labor employed, rate paid, work done, and, if money received, its amount, from what sources, how disposed of, and such other information as may be necessary or desirable.

Where military operations are carried on along a line of railway, telegraphs will always be needed to facilitate the operation of the railway as well as to maintain communication between the force and its base, and to render the service effectual a single officer should have control of the movement of trains and charge of the railway wires, if practicable.

On military lines, the communications of the commander, or those addressed to him on military business, must have precedence over all others, those of subordinate officers next, and private or ordinary communications, if transmitted at all, must go only when the line is not otherwise occupied, and should be subjected to rigid scrutiny to prevent the transmission of intelligence of an improper character. When a railway is used, and no wire is set apart for its exclusive use, the messages of the master of trains or transportation concerning the business of his office, affecting, as they do, the movement or supply of the Army, are of great importance, and take precedence of all except those of the commander of the forces.

The alphabet or code to be used on these lines may be that hereafter described; but, as the amount of business to be transacted will always be large, it may be necessary to employ skilled Morse telegraphers and use that code. For information concerning it and the best method of acquiring skill in its use, the student is referred to the work so often referred to already, the Modern Practice of the Electric Telegraph, by F. L. Pope; to Wood's Plan of Telegraphic Instruction, and Smith's Manual of Telegraphy.

PART II.—FIELD-LINES.

CHAPTER VI.

The materials for a line of field-telegraphs (by which is meant a line to be used in the presence of an enemy and for the purpose of placing the commanding officer of a force in constant communication with all parts of his line) differ from those for permanent lines chiefly in point of size and capability of being quickly erected and put into use and as quickly removed when the occasion for the line no longer exists. These materials must be, therefore, such as can be transported with the troops, handled by enlisted men, and when in line worked by enlisted men or officers.

The supports for a field-line may be either natural—such as trees—or artificial poles or lances. The use of the former should be guided by the same rules as for permanent lines, the circumstances being the same. The artificial supports must be of such size and weight as may be transported, and at the same time have length sufficient to carry the wire above the reach of mounted men or wagons and strength enough to endure such handling as under the circumstances they would be likely to receive, as well as to bear the weight and strain of the line-wire. To meet these requirements they must be made of a material at once light and elastic, and the timber best adapted seems to be spruce or cypress, either of which, when well seasoned, fulfills very nearly these conditions. The size may vary within certain limits, but that adopted in the field-telegraph trains of the United States Army is 17 feet long, 2½ inches diameter at the butt, and 1½ inches diameter at top, the butt tapering to a blunt point and the top secured by a sheet-iron ferrule 3 inches in length. Such a lance, of cypress, weighs about eleven pounds, and of spruce a trifle less, and two hundred and fifty of them, together with insulation for ten miles of wire and tools for the erection of a line of that length, can be carried on a truck made for the purpose and readily handled by six mules or four horses. A field-line should be supported by forty such lances to each mile of wire, but in emergency, or upon favorable ground, this number may be reduced to thirty-five or even to thirty without serious difficulty resulting.

In the matter of insulators for field-lines there is small room for choice. Glass and porcelain, the substances in common use for permanent lines, are unfit because of their fragility; the common resins, paraffine, &c., are unfit because of the difficulty of applying them, and there remain only the gums, caoutchouc, gutta-percha, and ballata. Of these gutta-percha becomes friable when long exposed to the sun, rain, and wind, and in such condition loses its good qualities; its use, therefore, is precluded. Ballata is not well proved, and no preparation thereof is yet offered which has consistence enough for the purpose. Caoutchouc when raw becomes viscid and loses form under summer temperatures, but in the prepared form known as vulcanite, ebonite, or, more familiarly, "bone-rubber," resists any heat less than that of boiling water, and has strength and consistence enough for the purpose, at the same time retaining to a great degree the non-conducting power of the raw or unmanufactured gum, making it the most desirable material for insulators for this service.

The form of the insulator is a matter of choice, two conditions only being of importance—that the outer surface shall shed rain and that there shall be an inner surface which shall remain dry, in order that there shall be between the wire of the line and the lance (which, when wetted by rain, becomes a partial conductor) a non-conducting surface. This can be obtained only by protecting a part of the surface of the ebonite from moisture, which, if allowed to reach it, forms a film over its surface and acts as a conductor. The formation of this film may be at least partially prevented by occasionally dipping the ebonite insulator into melted paraffine, the coating of that substance which the ebonite receives acting to prevent the formation of a continuous film of moisture, breaking the water into drops, at the same time that it preserves the surface of the ebonite from "weathering," and so acquiring a spongy character favorable to the formation of the water-film.

Various forms or patterns have been used, one of which was a simple cap of flexible vulcanite to fit over the top of the lance, both lance and cap having a cleft in which the wire rested and was secured by being wound around the outside of the cap; another, which consisted of a wire suspender or "clamp" of ebonite armed with a gimlet-pointed screw, by which it was affixed to the lance or other support; another consists of a spike, which passes through the top of the lance or is driven into a tree, and a suspender formed in part of ebonite. Each has merit, but neither gives entire satisfaction. It would seem evident that the fewer parts the insulator consists of, the better, as less liable to become useless by fracture; that the insulator should be readily attached to and detached from the lances or other supports, and that the device for grasping the wire should be such that the wire could be easily placed therein and not readily displaced, and be held without bending.

Substitutes for any regular form of insulator can be made from many materials, and the ingenuity of the officer must be his reliance. The non-conducting properties of bodies being known, he must make use of the best within his reach, and turn it to such advantage as he may. An insulator of "fat pine," or any wood saturated with resin, may be made to answer a good purpose while the saturation continues. Loops of cotton, linen, or silk fabric suspending the line-wire will insulate it sufficiently during dry weather, and if saturated with oil will prove efficient on a short line even in rain or fog. Saturation with paraffine would be more effective than with oil, and a quantity of this substance might be comprised in the list of supplies for a field-train with much propriety. Wire for field-telegraphs must be light, flexible, and strong enough to bear a tension which will reduce the deflection or "sag" between lances 70 yards apart to 2 feet. Iron is the only material which answers the purpose at moderate cost, and an iron wire, drawn from charcoal rods to No. 15, American gauge, has been adopted for use by the United States. A mile of this wire, joined up and the joints soldered, makes a coil 18 inches in diameter inside, 4 inches in height, and 3 in thickness, and weighing but 75 pounds. The American compound telegraph-wire, a patented article, consists of a steel core, with a coating of copper, and when drawn to No. 18 size has, when new, equal strength and greater conducting capacity than No. 15 iron wire, but is not well adapted for field-use, being less flexible than the iron, breaking more easily if bent, and deteriorating rapidly in consequence of the oxidation of the steel core, wherever moisture reaches it, which it can scarcely fail to do, as the copper coating or envelope opens to the steel whenever the wire is rudely bent or handled.

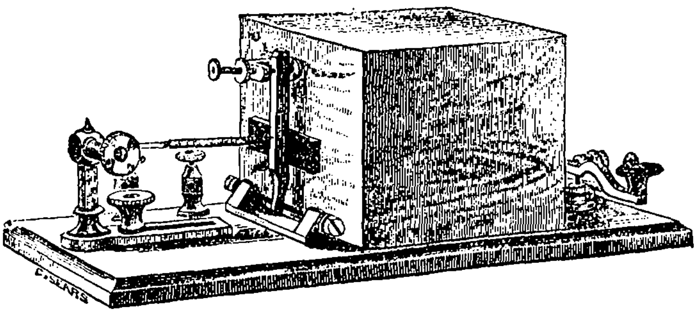
For use where, for any reason, it is impracticable or inexpedient to erect a line upon supports, and therefore necessary to lay it along the ground, conducting wire must be provided which is insulated throughout its entire length. Such a wire has been referred to heretofore as "office-wire," but especial pains needs to be taken to provide for field use, and the various descriptions of such insulated conductors, their characteristics, method of manufacture, strength, flexibility, and conducting capacity understood. Copper, from its high conductivity, is the metal used, and is strengthened in various ways. One device is to form a conducting strand of five wires, the center one of steel, for strength, and the outer ones laid spirally around the center, of copper. Such a strand, made of No. 30 wire, will have the strength of a No. 14 iron wire and the conducting capacity of No. 8, or very nearly, and may be insulated in any manner, like a single wire. Kerite, a preparation of caoutchouc, not yet well known or proved by use, has shown valuable qualities under experimental tests, resisting the action of the atmosphere, which usually destroys such preparations, and is highly recommended by many competent telegraphers and electricians. A single copper wire, covered with a layer of hemp fibers laid parallel to it, and the whole with a spiral covering of cotton, (cotton and hemp being saturated with paraffine,) is light, quite strong, (sufficiently so to sustain itself in spans 200 to 300 feet long,) and sufficiently well insulated for ordinary use. The insulation can be kept up by occasionally passing the wire through a bath of melted paraffine. Another device for retaining the hemp fibers in place has been used by some manufacturers, viz, braiding flax around it, and a preparation of paraffine and coal-tar, known as "Bishop's compound," is used instead of the pure paraffine. For use under water, gutta-percha is the best insulating material known, improving when submerged, instead of deteriorating. For subterranean use the same can be said.

CHAPTER VII.

Instruments for field-lines must be simple, easily placed in position for use or removal, easily adjusted, and strong. Several varieties have been tested by the Signal-Office, but the one from which the best results have been obtained is a form manufactured by Messrs. L. G. Tillotson & Company, in New York, and known as the "box-sounder," shown in Fig. 23. Another form, known as the Caton instrument, shown in Fig. 24, consists merely of an electro-magnet mounted horizontally and provided with an armature, the vibrations of which, when attracted to the poles of the magnet or withdrawn therefrom by the tension-spring, give the sounds by which the signals are recognized; a key by which the circuit is opened and closed in signaling; a device by which the circuit is kept closed, except when the key is in use, and screw-posts by which to attach the line-wires, the whole contained in a case to protect it during transportation. The one shown in the cut is of convenient size, being about 6 inches long and 2½ in width and length.

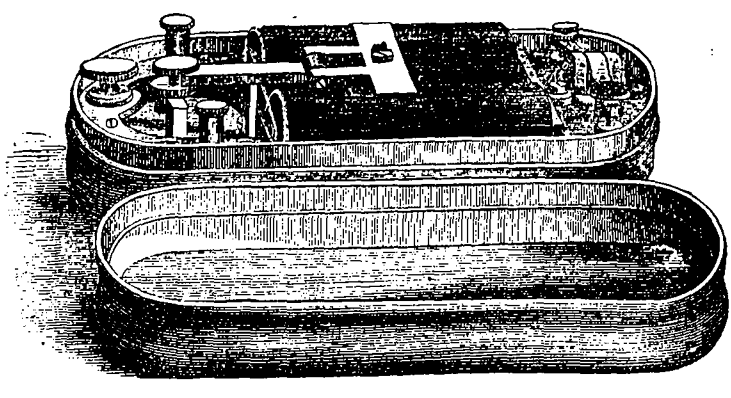
Batteries for field-use need not be so powerful as for permanent lines, and others which require the use of such powerful excitants as sulphuric and nitric acids, and must not be composed of glass or other fragile material. These conditions render the Grove and Bunsen batteries unsuitable and leave the Daniells only for use in some one of its various modifications. The form used at present by the United States Signal Service is an adaptation of the Daniells, and consists of a wooden trough divided into cells by wooden partitions, the whole

Fig. 23.



being rendered non-conducting and impervious to water by saturation with paraffine; a thin copper plate, near the bottom of each cell, having underneath it a layer one-fourth of an inch thick and above it a layer three-fourths of an inch thick of crystals of sulphate of copper; a sponge, saturated with water and filling the cell to within an inch of the top, upon the upper surface of which is sprinkled white vitriol, (sulphate of zinc,) and a zinc plate, which rests upon the sponge. The cells are 5 inches square, being the same in length, breadth, and depth; the top, bottom, and sides of the box or trough containing them, 1 inch

Fig. 24.



and the partitions between the cells one-fourth of an inch in thickness. The copper plates are 4¾ inches square and about one-sixteenth of an inch in thickness, and to each one is attached a copper wire, insulated with gutta-percha or caoutchouc, of sufficient length to reach the zinc of the adjoining cell. The zinc plates are 4½ inches square and 1 inch in thickness, and are furnished with thumb-screws for connecting with the wire from the copper element of the next cell. The cover of the box or trough is hinged, and when closed is secured by hasps and staples. When closed and secured it presses firmly upon the zinc plates and prevents any displacement of the parts of the battery. It will be seen that this is substantially the Daniells copper-zinc pair, the sponge taking the place of the porous earthen cup and the trough or box that of the glass or earthenware containing-vessel. The superposition or the zinc prevents the copper solution from reaching it, and the battery so arranged works with little diminution of force as long as any of the crystals of blue vitriol remain undissolved. It is only necessary to add a little pure water from time to time, to supply the waste by evaporation or leakage. When the cell is filled 1 inch in depth with the crystals, it will work from forty to sixty days without renewal. When necessary to renew the battery, the materials must be removed, the sponges well cleaned, and the whole replaced in proper position. The form of cell and arrangement of the different parts will be understood from Fig. 25.

Fig. 25.

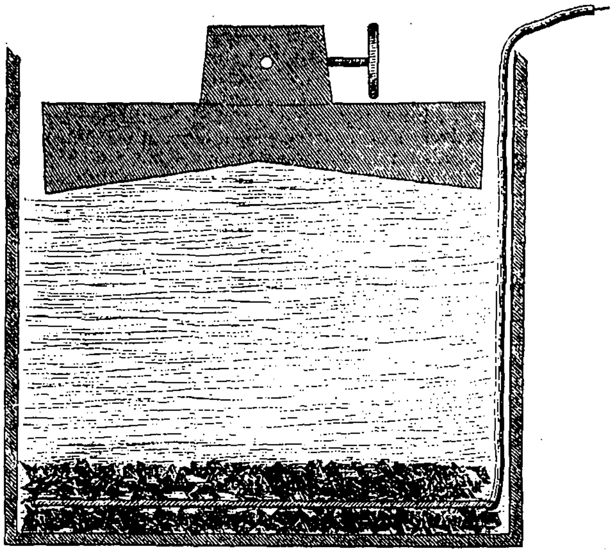
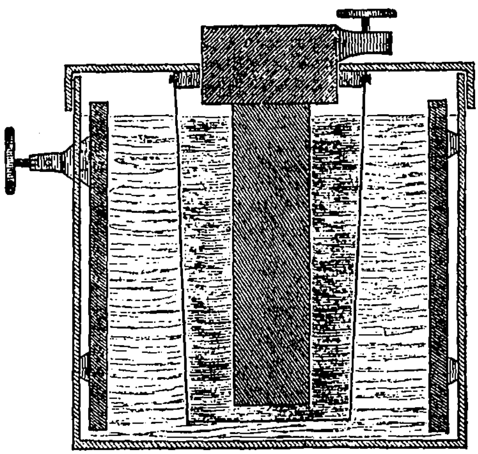


Fig. 26 shows an adaptation of the Marie Davy cell to field-use. The containing-vessel is of ebonite and the cover screws on water-tight. The zinc is kept in place by studs that fit closely into the containing-cell, and into one of which a screw-post passes from the outside. The porous cup is of leather and is fastened to the cover. The negative element is carbon, a plug of which is fitted with a metallic head that screws into the cover within the porous cup. This cell is charged by filling the porous cup with a paste of the bisulphate of mercury and water and the outer cell with the water in which the paste was made. The action is similar to that of the copper-zinc pair, the oxygen of the water attacking the zinc and the freed hydrogen finding its office in reducing the mercury from its crystalline salt. It gives off no gas and works as long as any of the salt remains in the porous cup.

In the absence of any form of battery especially adapted for field use, any of those described herein can of course be used, and the ingenuity of the officer must be his reliance. The principal difficulty will be found in providing transportation for them, and this must be overcome in the best possible manner. The signal-service battery can be made roughly under almost any circumstances—out of a feedtrough, by putting in partitions and coating the inside with wax, tallow, pitch, or other non-conductor; out of a number of buckets, or, in brief, any vessel that will hold the elements. Cotton, tow, sawdust, spent tanbark, sand, or almost any porous substance may be substituted for the sponge, and the battery be made to answer a good purpose until others can be procured. The white vitriol is not indispensable, as the battery will work without it, only requiring a few hours' time to come to its full strength.

Fig. 26.



The ground-connections for a field-line are necessarily such as can be quickly made and easily removed. The most convenient form is that of a cylindrical iron bar, 5 feet long and 1 inch in diameter, pointed at one end and fitted at the other with a binding-screw by which to attach the ground-wire, the whole zinc-coated, (galvanized,) to prevent oxidation and to present always a bright surface to the earth. Such a bar, driven two-thirds of its length into moist earth, is a sufficient ground-connection for field-lines of thirty miles in length.

In cases where the earth at the station is so dry as to render the bar ineffectual, moist earth must be sought at a distance and the ground-wire run to it, or the earth moistened by pouring water into the hole made by the bar, the first-named method being preferable for the reason that the moisture in the second case will scarcely be carried far enough to remedy the defect.

Ground-connections may be made as for permanent lines whenever circumstances (loss of bars, &c.) may render it necessary or convenient to do so. The rule to be followed is the same in one case as in the other—a surface in contact with earth that shall equal in conductivity the battery and line.

The tools for the erection of a field-line (which constitute, with the materials for the line, the outfit of the train) are: marking-pins, by which the points of support are indicated; axes and hatchets, to cut away shrubs or branches of trees or to affix insulators to natural supports; crow-bars, to make holes in the earth in which to set the lances; bars, fitted for cutting through frozen ground; climbers, to enable the men engaged in the work to ascend trees, when necessary, for the purpose of affixing insulators thereto, or to trim away branches; reels, for the delivery and recovery (uncoiling and recoiling) of the wire; pliers, to be used in making connections: files and screw-connectors, which are to be used for making connections between the coils (mile-lengths) of wire in reeling out, and generally where connections are to be frequently made and broken, to avoid loss of time and waste of wire.

The marking-pins are of iron wire, one-eighth inch in diameter and 15 inches long, pointed at one end and having a loop or handle at the other, painted of some bright color, and fitted with a small pennon of bright-colored cloth, so as to be conspicuous objects, and are used to mark the places where lances are to be erected, by being thrust into the earth at such points, or the natural supports to which insulators should be affixed by the same methods.

It is scarcely necessary to describe axes or hatchets, except, perhaps, to say that the latter should have a hammer-poll with which to drive a spike. But the efficiency of the line may depend on their use, which is mainly to cut down all shrubs growing near the line-wire, to trim off such as come, or might be thrown by the wind, in contact with the line-wire.

Crow-bars, with which to make seats for the lances, are cylindrical iron bars 4½ feet long, 1¼ inches in diameter for 2 feet from the point, and 1 inch in diameter for the rest of their length, and pointed so as to penetrate the earth easily. Such a bar weighs fifteen pounds. These (and all the iron used in the work) should be zinc-coated, (galvanized.)

Ice-bars are of the same general form and dimensions as the crow-bars, but have a wide chisel-shaped point or blade, and are used for cutting through frozen ground, to facilitate the work of setting the lances.

Climbers, to enable the men engaged in erecting a line to ascend trees to affix insulators and attach the wire, are of various patterns. A good form is made of steel, with leathern straps for attaching them to the feet, and weigh about four pounds the pair. A strap or sling is carried over the shoulder of the man and used to aid him in maintaining his position without the use of his hands, leaving them free for the work of handling his tools.

Reels for field use are in general form like those for permanent lines, but are lighter, and are provided with arms attached to the uprights, which are laid flush with the face of the uprights when reeling out wire, and secured at right-angles thereto when reeling up, in order to confine the wire and give the coil its proper shape. Each one has a handle affixed to the extremity of one of the upper cross-arms, by which it is turned when reeling up wire.

The reel is seated in the wire-wagon, but may be carried by men over ground impracticable for the wagons in the hand-bearer, one of which should accompany each reel.

Pliers and files are of the same kinds as for permanent lines, but smaller, as the wire is smaller and the work to be done lighter. Connectors are simply brass cylinders, perforated through their length to admit the wires, and fitted with a thumb-screw, the end of which presses upon and holds the wires so inserted.

Chapter VIII.

The vehicles used for the transportation of the materials, tools, and equipments are also used for offices or stations, and are called battery-wagons, wire-wagons, and lance-trucks.

The battery-wagon is the central or headquarters office; is of a size sufficient to contain four instrument tables, the necessary batteries for four lines, each ten miles in length, instruments and table-apparatus for each table, four ground-bars, a supply of battery-material, seats for four operators, and a stove.

It is mounted on platform-springs, and turns in its own length, is covered with canvas, and must not be too heavy to be drawn by two horses over any ground practicable for artillery. The tables are each 2½ feet long by 1 foot or 1 foot 3 three inches wide; are attached to the sides of the wagon at a height from the floor of 2½ feet; one in each corner of the wagon. The batteries, in sections or cases of six cells each, are supported by brackets underneath the tables, each bracket being of a size sufficient to support two such sections. The instruments and table-apparatus are carried, when not in use, in pouches of leather attached to the sides of the wagon between the tables; the supply of battery-material in a box underneath the driver's seat; the ground-bars on the floor, next the sides, (two on each side,) and confined by clamps and keys; and the seats for the operators (camp-stools) in any convenient manner. The stove is placed in the center of the floor and secured against displacement. The wagon is entered by a door at the rear.

The wire-wagon is of the same general form as the battery-wagon, and mounted in the same manner. It is of size and strength to contain an instrument-table, which is attached to the front end; a single section of battery underneath the table; a pouch for instrument and apparatus at its side; a seat (camp-stool) for the operator; a ground-bar, secured as in the battery-wagon; a wire-reel, seated in a socket in the center of the floor near the hind end; a hand-bearer, secured at the top of the wagon by straps; ten coils of wire, (one mile in each,) secured for transportation at the sides of the wagon; and a box, which serves to hold the wireman's tools (pliers, files, and connectors) and as a seat for him when at work reeling out or recovering wire. This wagon must be strong to safely carry its load, but must at the same time be light enough to be handled by two horses on roads or ordinary ground, and by four over any ground at all practicable for wagons.

The lance-truck is a wagon without springs, of length sufficient to carry lances, and of strength sufficient to sustain the weight of 250 lances and all the line-tools and insulators for ten miles of line. The lances are stowed compactly in the middle of the wagon or truck and confined by upright stanchions and end-boards. The insulators and tools are contained in boxes arranged for the purpose on either side of the pile of lances. The weight of the load will be approximately 3,000 pounds, and a good six-mule team will be needed to move it. It carries 250 lances, 400 insulators, 16 crow-bars, 4 ice-bars, 2 axes, 12 hatchets, 12 pairs of climbers, and 80 or more marking-pins.

A full train consists of one battery-wagon, four wire-wagons, and four lance-trucks, and is divided into four sections, each of which consists of a wire-wagon and lance-truck and is capable of acting independently. Thus a full train may erect lines radiating in four directions from the battery-wagon; or the four sections, the second commencing to reel out its wire when the first has finished, may extend a single line forty miles long, having offices at the termini and at three intermediate points equidistant from each other. Additional instruments being furnished, intermediate offices other than the regular ones can be opened whenever necessary.

The train is commanded by a chief of train, whose place is with or near the headquarters of the force with which the train is acting, and with him the battery-wagon with its complement of operators, battery-man, and driver. To work the four lines separately twelve operators will be the ordinary number, three for each of the lines, giving to each eight hours' duty out of each twenty-four; and this should be divided into two tours or watches of four hours each. Should the work to be done by the lines be exceedingly heavy, this force might be increased to advantage, and under other circumstances might perhaps be reduced; but it is false economy to require too much of men, and eight hours of close attention is fully enough. The battery-man will have charge of and be held responsible for the batteries, not only those in the battery-wagon but also those in the wire-wagons; will see that they are at all times in order and ready for work; have the care of the supplies for them, and make regular reports to the chief of train, embracing all necessary information concerning them.

Each section will be commanded by a chief of section and manned by four non-commissioned officers and thirty-six men, whose several duties will be as follows:

One director, (non-commissioned officer,) who, receiving from the chief of section general orders concerning the direction to be taken or point to be reached, will go over the ground and select the route for the line. He will be accompanied by two markers carrying guidons, whom he will station so as to guide the surveyor. The director should be carefully selected, as upon his skill and judgment depends, in a great degree, the promptness with which lines can be erected. He must take the most direct line practicable to the point he has to reach, but, in order to determine what is best, he must examine the character of the ground and know that there are no obstacles insuperable to the train—streams, ravines, bluffs, or marshes; that the soil is such that the line can be erected—not loose sand or rocks; that the route he selects is not made impracticable by the guns of an enemy; and, in short, must bear in mind all the contingencies to which the train or line may be subjected, and be governed by the circumstances of the case. The director and markers must be mounted, and each marker, on being relieved from post by the arrival of the surveyor, will rejoin the director. Over difficult ground it may be necessary to increase the number of markers, and upon a road or over country well known it may be practicable to dispense with them entirely, the director accompanying or slightly preceding the surveyor. For night-work the markers will carry a lantern instead of a guidon.

One surveyor, whose duty it is to move toward the marker in sight, measuring the distance by paces and directing the pin-men where to plant the marking-pins. He will be governed by the general rules for locating lines as laid down herein, in which he should be thoroughly instructed. He is accompanied by three pin-men, two of whom have each forty or more marking-pins, which they plant at points indicated by the surveyor, to indicate the place where lances are to be erected, or insulators attached, if natural supports are used. The first man, when his pins are expended, halts until the third, who follows the lance-men, has gathered the pins and overtaken him, when he rejoins the surveyor, and the second on expending his pins does the same, the first and second relieving each other and the third bringing up the pins when the line is erected.

Thirteen bar-men, twelve of whom are equipped with a crow-bar, with which, at the points indicated by the marking-pins, they make holes for the foot of the lances. This must be carefully done, and that it is so it is the duty of the thirteenth, who is a non-commissioned officer and chief of the detachment, to see. The holes must be fully 2 feet deep, which will be the case if the shoulder of the bar is below the surface when the point is at the bottom of the hole, and large enough to admit the lance easily. As the lance is of twice the diameter of the bar, the hole must be made of the proper size by working the bar around and pressing back the earth, and this should be done as the bar is driven down, for if the bar be driven first to the full depth and then worked, it will be difficult to sufficiently enlarge the hole in ordinary soils, and when done will not be of uniform size, but large at top and bottom, and smaller midway, a point to be avoided, as in such a hole the lance will be easily drawn from a perpendicular even if it can be forced to the bottom. The bar-man, standing erect, should grasp his bar near the top with both hands and drive it into the ground, working with hands close together, as, if he grasps the bar with one hand near the top and the other below, he will not work as easily or direct the blows of the bar so accurately, but will be compelled to bend his body sidewise, his upper hand will throw the top of the bar from him and the lower hand draw the point toward him; the work will be done in a slovenly manner, and the hole when completed not be perpendicular.

Two wire-men, whose duties are to accompany the wire-wagon and attend to the reeling out and reeling up of the wire. They will, in reeling out, place the coils of wire upon the reel, remove the straps or wires by which it is bound, and one of them, seated in the wagon, by the use of the brake so control the motion of the reel that the wire shall be laid straight and without slack, and will make the necessary connections as the coils are one after another paid out. Joints in field-wire should be made in the same manner as in wire for permanent lines, except that to join the end of one coil to that of another it is well to use a wire-connector, as these joints mark off the line into mile-lengths for convenience in recovering the line and recoiling the wire, and time is saved by their use. All joints other than these must be carefully made in the same manner as for permanent lines, and soldered. The second man will follow the wagon and carry the wire to the line of lances, and render such assistance to the first as may be required.

Thirteen lance-men (one of the number being a non-commissioned officer and chief of the detachment) will affix the insulators to the lances and deliver a lance and insulator at each hole, one or two men being mounted upon the lance-truck for that purpose, and the others will place the wire in the insulators, erect the lance, thrust its foot into the hole prepared for it by the bar-men, and stamp the earth solidly around it.

Three operators, to work the station when opened, and drivers for the wire-wagon and lance-truck, complete the force.

CHAPTER IX.

TRAIN DRILL—(ONE SECTION.)

The minimum force for illustrative drills with a section-train is as follows: One (1) lieutenant, one (1) director, one (1) surveyor, two (2) pin-men, seven (7) bar-men, two (2) wire-men, seven (7) lance-men, two (2) operators, and three (3) drivers.

It will be parked in the following order:

Wire-wagon in line with and ten (10) paces on the left of the battery-wagon, and the lance-truck in rear of the center of the wagons, with distance of ten (10) paces, as indicated in Fig. 27.* The figures refer to the illustrations of the train-drill given in the manual.

At the "first call" the drivers, director, and markers will saddle and harness up.

When the "assembly" is sounded the drivers will lead out and hitch up, the director and markers will lead out and take position immediately in front of the train, and with the drivers will stand at "attention" and "dismounted." The drivers, when dismounted, will always stand at their horses' heads.

The men for duty with the section will be formed on the parade in two ranks, the roll called, and the detachments told off, the latter taking position in the following order: The surveyor and pin-men on the right, the bar-men with an interval of two paces, the wire-men with an interval of two paces, the lance-men with an interval of two paces, the operators and battery-men with the same interval.

They will be marched in column of detachments to the ground where the train is parked and wheeled into line by the flank previously designated, facing the train.

The section-train being in park, with the detachments in line near it, the chief of train wishing to form the train in column of route, will command—

1. "Form train front, (right, left, or rear.")
2. "March, (or double time, march.")

The train is always formed on the line of direction of the battery-wagon, whether the train be in disorder or in park.

At the first command the director, markers, and drivers mount, and director and markers

* The figures refer to the illustrations of the train-drill given in the manual of signals.

and battery-wagon move, if necessary, to take the direction indicated. The chiefs of detachments give the cautionary commands to cause their detachments to move toward the proposed front. At the second command the battery-wagon halts, the director and markers take post twenty (20) paces to the front of the battery-wagon. At the same command, which will be repeated by the detachment commanders, the detachments will move off and form in close column in the same relative order as before, behind the director and markers, (Fig. 28.)

The section being formed for the march, the park will be broken, and it will be moved forward by the command—

1. "Forward,"
2. "March,"

when the director and markers will move forward, followed in order by the column of detachments, the battery-wagon, the wire-wagon, and the lance-truck.

On the march the section is formed as shown in Fig. 29.

The direction and swiftness of the march will be regulated by the movements of the director and markers, under the orders of the captain.

The section being on the march, to halt it previous to opening station, the chief of section commands—

1. "Section."
2. "Halt."

To open station the chief of section will command—

1. "Open station, right, (or left.")
2. "March."

At the second command the battery-wagon will move out of the column to the point indicated, and be followed by the battery-man and three (3) operators; at the same time the wire-wagon and lance-truck will close up to the column of his detachment; the driver of the battery-wagon will unhitch his horses and stand at their heads, and the battery-man will make the necessary ground-connection. To open station, the train being in march, the command will be the same, (1. "Open station, right, (or left.") (2. "March.") At the command "march," the detachments *halt* under command of the chiefs of detachments; the battery-wagon wheels out of the column in the direction indicated, and the wire-wagon and and lance-truck close up upon the column of detachments and halt. The command will then be—

1. "Equip."
2. "March, (or double time, march.")

At the first command, the chiefs of detachments will cause them to face about. At the second command, which will be repeated by the chiefs of detachments, the latter will separate, and move in equal divisions on either side of the train, the operators and two wire-men taking position at and to the rear of the wire-wagon, and the lance-men, bar-men, and pin-men on either side of the lance-truck, where they will take equipments, and face toward the front of the train; the lance-men opposite the rear wheels, the bar-men between the wheels, and the pin-men and the two lance-men who are to deliver lances, opposite the front wheels of the lance-truck. (Fig. 30.) The command will then be given—

1. "To your posts."
2. "March, (or double time, march.")

At the first command the director and markers move forward 20 paces, and the bar-men raise the bar to the right shoulder, the two designated lance-men mount the lance-truck.

At the command "march," the surveyor and pin-men move to the front, and immediately behind the director and markers. The bar-men follow the surveyor and pin-men. At the same time the lance-truck will pass the wire-wagon, and close up upon the bar-men. The lance-men are marched to the rear of the wire-wagon.

At the command—

1. "Prepare to reel out,"

the director having been instructed by the lieutenant as to the direction and route of the line, moves forward rapidly with the markers, stationing the first marker at a point about 300 feet from the wire-wagon. One of the wire-men takes the end of the wire from the wire-wagon, and makes it fast to the wheel of the battery-wagon. (Fig. 31.) The first pin-man, under direction of the surveyor, marks the first hole about 30 paces from the battery-wagon, a bar-man falls out to make it, and the first lance is delivered by it. The command is then given—

1. "Reel out."
2. "March."

At this command the director moves forward, taking the second marker, and stationing him at a second point on the route, visible to the first marker. The distances between the markers thus placed will be necessarily regulated by the topography of the country. The lieutenant moves forward; the surveyor follows on the line indicated by the markers, and is accompanied by two pin-men.

The first pin-man, with forty marking-pins (for one mile of line) follows the surveyor, who paces the distance of 55 steps, or 132 feet, the distance between poles, and indicates the points where the pin-man shall place the pins.

The second pin-man, similarly equipped, also accompanies the surveyor, and relieves the first when the pins of the latter are used up.

The third pin-man takes station at the first pin placed.

The bar-men (each with a crow-bar) follow the pin-man, making, by the side of each pin thus placed, a hole large enough to admit the foot of the lance easily, and two feet deep, the length of the bar from point to shoulder being the measure, and the hole being made, leaving the pin beside it to guide the lance-men.

The lance-truck will follow close upon the bar-men, the two lance-men in the truck attaching a spike and insulator to each lance, and delivering a lance so prepared at each hole.

The wire-wagon with operators and two wire-men follows the lance-truck reeling out the wire; the first wire-man in the wagon in charge of reel, and the second wire-man following, carrying wire to the line of poles.

The lance-men, eleven (11) in number, follow the wire-wagon, placing the wire in the insulators and erecting the lances, taking care to force them to the bottoms of the holes, and that the insulator-spikes are at right angles to the line, and the insulator properly adjusted.

The third pin-man now follows the lance-men, and as the line is erected gathers the pins and delivers them to the pin-man, who sets them, and who waits at the point where he placed the last pin, when the latter pin-man moves in double time to the front, and relieves at the proper moment the one who precedes him.

The end of the line having been reached, the command will be given—

1. "Take station, right, (or left.")
2. "March."

At the command "march," the lance-truck halts and is passed by the wire-wagon, which moves to take the position indicated by the chief of section, when ground-connection is made by a wire-man. As they come in, the lance-men take position behind the lance-truck, and the bar-men and pin-men behind the wire-wagon. The drivers will then hitch their horses and stand at their heads. The train is now arranged as in Fig. 32.

Having thus formed, the equipments of bar-men and pin-men are returned under direction of the chief of section, and such disposition made of the men as may be advisable, under his directions.

Details should then be made for patrols to guard the line and make repairs when necessary. Each man is made responsible for a certain portion of the line which is assigned to him.

To recover the line, the command is given—

1. "Close station."
2. "March."

The wire-man removes the ground-connection, the horses are hitched to the wagons, and the drivers mount.

At the command—

1. "Prepare to reel up,"

the wire-wagon and lance-truck wheel about on their own ground, and then stand fast. The laace-men, bar-men, and pin-men are faced about. (Fig. 33.)

At the command—

1. "Reel up,"
2. "March,"

the lance-men, commencing at the wire-wagon, draw the lances, free the wire from the insulators, and pass the lances into the truck. The two men in the truck receive lances, detach insulators, and return parts thereof and lances to their places.

The wire-wagon following, reels up the wire, the pin-men assisting the wire-men, and the bar-men taking care that the wire does not run into kinks or become entangled, so as to prevent it from being readily reeled up. Care should be taken that the lance-truck and wire-wagon are not more than 150 paces apart, and the lance-men not more than three lances in advance of the lance-truck.

Upon reaching the central station, and when the lance-truck reaches the first lance, the lieutenant will command—

1. "Section."
2. "Halt."

At the command from the chief of train—

1. "Close station,"
2. "March,"

the wire-wagon reels up to the end of the line, passing the lance-truck, and moves in rear of the battery-wagon. The detachments retain their relative positions, and the horses are hitched to the battery-wagon; the wire-man detaches the line from the battery-wagon, and the battery-man removes the ground-connection. (Fig. 34.)

The chief of train then commands—

1. "Form train front, (right, left, or rear,)"
2. "March, (or double time, march,")

when the detachments will be promptly placed as directed in the train formed for the march.

The command "form train front, (right, left, or rear,) march," may be given at any time by the chief of train when it is necessary to change his design of reeling out, &c., provided the wagons are near together.

The general rule governing the movement is, that the director and markers shall move, if necessary, 20 paces in front of the battery-wagon (which is turned toward the proposed front of the train) when the command "form train" is given: then, at the command "march," the detachments will take the shortest line to their places in column, in front of the battery-wagon, and the wire-wagon and lance-truck wheel as nearly into their proper places as the nature of the ground will allow, so that they may gain them at once, then the train is moved forward by the usual commands.

The train being in column *en route*, in order to move in a line to right or left, the chief of train will command—

1. "In line, right, (or left.")
2. "March."
3. "Guide left, (or right.")

At the first command the chiefs of detachments caution them to wheel to the right (or left.)

At the second command each detachment and wagon turns to the right (or left) and moves forward in a line, the guide being towards the director and markers.

The drivers must be careful to preserve their intervals, and keep the heads of their lead horses dressed on the line. (Fig. 35.)

The train may be halted by the command—

1. "Train."
2. "Halt."

The train being in line, (either at a march or halt,) it may be formed in order of column to the right or left and moved forward by the commands—

1. "In train, left (or right.")
2. "March."

At the second command each detachment and wagon will be turned in the direction indicated and move forward in column without further command.

The train being in column, in order to change the march directly to the rear, the command will be given—

1. "Countermarch right (or left.")
2. "March."

At the second command the detachments and wagons halt, with the exception of the director and markers, who wheel about to the right (or left) and move toward the rear of the train, followed in succession by the detachments and wagons, which wheel about in turn into their places in the moving column.

When the train is in line or in column, and it is desired to gain distance to the rear without preserving the prescribed formation, the command will be—

1. "Train right (or left) about."
2. "March."

At the second command each detachment will wheel about to the right (or left;) the wagons at a trot will move to the left (or right) and then wheel to the right (or left) about and take walk when they have their proper distance. If this command be given when the train is in line, the guide will be changed when the new direction is taken.

The train being in march, and it is desired to park it in the line of the direction of march, the chief of train will command—

1. "Forward into park."
2. "March."

At the first command the chief of section will command "right oblique."

At the second command, repeated by the chief of section, the director and markers and the detachments oblique ten paces to the right, when he will command—

1. "Left front into line."
2. "March."

At the second command the director and markers halt, and the detachments execute the prescribed movement; the battery-wagon obliques to the right, and moves at the command "march" to take the post ten (10) paces in the rear of the right of the detachment of bar-men; the wire-wagon moves to take post on line with and ten (10) paces to the left of the battery-wagon. The lance-truck moves into position ten (10) paces to the rear, and in the center of the two wagons, and halts.

To go into park on the left of the line of march the command will be given—

1. "Left into park."
2. "March."

At the second command the director and markers and the detachments wheel to the left and, dressing to the right, march thirty paces to the front, when they will be halted by the chief of section and aligned on the director; the wagons continue the march until the battery-wagon is opposite the detachment of bar-men, when it wheels to the left and takes post ten (10) paces in rear of the right of that detachment. The wire-wagon and lance-truck follow, and take their prescribed posts as in the usual formation. (Fig. 36.)

To go into park on the right of the line of march the commands are—

1. "Right into park."
2. "March;"
and they are executed by reverse movements to those prescribed for "left into park;" but in this case the wire-wagon will pass the battery-wagon before turning to the right.

The drill being dismissed, the detachments will be marched by their respective chiefs to the parade, where they will be dismissed.

Fig. 40 shows the position of a full train in park.

GENERAL DIRECTIONS FOR RUNNING AND ERECTING A FIELD-TELEGRAPH LINES.

They should be as nearly straight as the circumstances will allow. When it is impracticable for any reason to follow a straight line, the divergence should be made with a tree, house, or other firm support at the angle, and this especially if the divergence is large, approaching a right angle. Should such support be unavailable, two or three lances should be set close together to divide the strain.

When following a road or highway the line should be placed beyond the ditch, so as to be entirely out of the way of trains. When crossing country the same object should be kept in view, and the line run along the edge of timber, or the brink of ravines, avoiding ground likely to be selected for the parking of trains, or upon or across which artillery is likely to be moved.

In crossing broken country the surveyor should be careful to place lances upon the brink of declivities and on the top of knolls, in order that no ground between lances shall be high enough to endanger the line, should troops or trains pass under it.

Cross roads as seldom as possible, and when necessary to do so, select, if possible, a point where the road is lower than the banks on either side.

Select ground in which the lance-holes can be easily and quickly made, but avoid sand. Lances should be fifty-three (53) steps apart, but this distance may be varied five (5) to ten (10) steps to avoid bad ground, hard clay, rock, or dry sand.

The sergeant in charge must see that the lance-holes are made of proper depth, and large enough to admit the foot of the lance easily.

The lance-men must force the lances down to the bottom of the hole, and stamp the earth about the lance to make it stand firmly; the insulator-spike must stand at right angles with the course of the line, and the insulators be all on one side of the line of poles.

The wire-men will deliver the wire from the reel only as fast as the wagon moves, allowing no slack, in order that when lifted on the lances it shall be tight and not hang in loose curves.

Clamp-hook insulators should be put on every fourth pole, and on the poles next to a telegraphic instrument.

Form for inspection and review for section train.

FORM FOR REVIEW.

The train will be conducted to the ground appointed for the review by the chief of train, and formed "in line right, (or left,)" facing the stand of the reviewing officer, with the director and markers on the right.

The chief of train takes his place twenty (20) paces to the front and center of the train, facing from it; the chief of section six (6) paces to the front and center of the line of detachments. (Fig. 37.)

At the approach of the reviewing officer, he is received by the chief of train by an individual salute, and the latter advances, faces the train, and commands—

1. "Prepare for review."
2. "Detachments to the rear, open order."
3. "March."

At the command "march," the director and markers and drivers dismount and stand at the heads of their horses. The chief of train and chief of section will remain mounted if the inspector is mounted.

The chief of section, after dressing the front and rear ranks of the detachments, returns to his place in line, when the chief of train commands—

1. "Front."

He will then accompany the reviewing officer along the front of the train from right to left, along the rear back again to the right and front, and take his post.

As soon as the reviewing officer takes his stand, the chief of train faces about and mands—

1. "Close order."
2. "March."

At the second command the ranks are closed, and the director and markers mount. The commands will then be given—

1. "To pass in review."

2. "In train, right."
3. "March."

The chief of train then takes his place three (3) paces in front of the director and markers, and conducts the column in review past the reviewing officer, the right guides or chiefs of detachments passing within six (6) paces of the latter. The chief of train leaves the head of column after saluting the reviewing officer, and remains at his side until the train passes, when he will again take charge, and, if required, pass the train again, in double time. When the train passes in double time no salutes will be given.

Having finally arrived upon the ground where the line was first established, it will again form by the command—

1. "In line, left."
2. "March."
3. "Halt."
4. "Right dress."
5. "Front."

The chief of train then takes his post and reports, saluting as before.

The change of direction in passing in review will be indicated by fixed guidons, or use of the mounted markers.

If the ceremony terminates with a review, the train is at once parked and dismissed.

FORM FOR INSPECTION.

If an inspection is to follow the review, the chief of train will command—

1. "Prepare for inspection."
2. "In train, right."
3. "March."
4. "Halt."
5. "Detachments, rear, open order."
6. "March."
7. "Front."

At the third command, the detachments and wagons will be wheeled to the right and move forward in column.

The fourth command will be given as soon as the wagons gain their places in column, covering as little ground as possible, when the lieutenant will take post three (3) paces in front of his section.

The chief of section takes his place six (6) paces from the head of the column. The director, and markers, and drivers dismount. At the sixth command, when the detachments are (Fig. 38) brought to "rear, open order," the chiefs of detachments remain at the right of the front rank of their detachments.

The inspector, commencing at the head of column, regularly inspects the detachments and wagons in succession, and as soon as he has finished the ranks will be closed by the chief of train, and unless a drill is ordered the train will be at once dismissed.

CHAPTER X.

The lines being erected, the offices must be arranged for the transaction of business, and in case of field or flying telegraphs this is a plain matter, the description of the wagons of the train and direction for use already given having covered the ground. At the central station or battery-wagon the ground-bar is connected to the zinc or negative pole of the battery; the copper or positive pole is connected to one of the screw-posts of the instrument and the line wire to the opposite screw-post. At the outer station the connections are the same, except that the zinc pole of the battery is connected to line-wire (through the instrument) and the copper pole to the ground. At an intermediate station, if any exists, there is no ground-connection, the line-wire being cut and the instrument inserted so that it forms part of the circuit.

Upon permanent lines, where the ordinary Morse instruments are used, the combination of the main and local circuits makes the arrangement of the offices somewhat more difficult, and a few plain directions may be needed. In a terminal office the battery having been placed in position and the ground-connection made, a wire, equal in conducting capacity to the ground-wire, runs to the switch-board in the instrument or operating-room. From the switch-board as many wires as there may be lines to be worked, run to the several instrument-tables connecting through the relay and key of each, and return through the switch-board to the line-wires. Under each table, or in some convenient place, is erected a local battery, the wires from which connect through the magnets of the sounder and the "points" of the relay. At intermediate offices the battery and ground-connection are left out, the line-wires connect through relay and key, and the local wires are run as in the terminal offices. At intermediate offices, on both field and permanent lines ground-connections should be prepared and in readiness for use in testing the lines or to enable the office to work to or with that terminal office to which the connection by line-wire is perfect in case of a break in the line. This will be shown in the directions for testing. Ordinarily, on military lines the switch-boards will be unused, the line-wire run directly to the instrument on one side and the wire from the battery to the opposite, the switch-board being a convenience merely and not a necessity. The fundamental conditions are that the line-wires be so connected that the current generated by the main battery, and flowing through them, shall pass through the magnet of the relay and the insulated post and circuit-closer of the key, and that the local wires be so connected that the current of the local battery must pass through the magnet of the sounder and the "points" of the relay. If these are fulfilled the office is ready for business.

The alphabet used is the "General-Service Code" of the Army and Navy, and the signal-numerals thereof are transmitted by blows of the key, like the dots of the Morse alphabet, one blow indicating the numeral 1, and a double blow (two blows made without interval) the numeral 2. It is received by sound, the stroke of the armature of the magnet making the sound.

Written with pen or pencil, the code is this:

Alphabet.	Flag-code.	Telegraph.
A	22	.. ..
B	2112	.. . . ..
C	121	. .. .
D	222	.. .. ..
E	12	. ..
F	2221	.. ..
G	2211	.. .. . .
H	122	. .. ..
I	1	.
J	1122	. . .. ..
K	2121	.. . .. .
L	221	.. .. .
M	1221	. .. .. .
N	11	. .
O	21	.. .
P	1212	. .. . ..
Q	1211	. .. . .
R	211	.. . .
S	212	.. . ..
T	2	..
U	112	. . ..
V	1222	. .. .
W	1121	. . .. .
X	2122	.. . .
Y	111	. . .
Z	2222	.. ..
ing	2212	.. ..
tion	1112	. . . ..
&	1111	. . . .
1	21112	.. . .
2	12221	. .. .
3	22122	.. ..
4	22212	.. ..
5	22221	.. ..
6	12222	. .. .
7	11222	. . ..
8	11112	. . . . ..
9	11211	. . .. . .
0	22222	.. ..

Three blows or strokes, without interval, is full stop, and is the only punctuation-mark used.

The points or dots in the above code represent, as has been said, sounds, the single dots single blows of the key in sending or of the armature in receiving signals, and the double ones double blows. It must be borne in mind that the instrument makes two sounds for each stroke of the key, one by the forward motion of the armature, corresponding to the stroke of the key, and a second by the backward motion of the armature, which occurs when the key is raised or opened. Thus the signal-numeral 1, which is represented in the printed code by one dot, is heard by the operator as the sound of two blows, (differing in tone,) the numeral 2 by four such sounds, (two of each tone,) and the 3 by six. It will be seen that the blows of the forward motion only are significant, those of the backward motion being the result of a "return to position" by the armature. The spaces between them represent intervals of time equal to those occupied in giving the blows. In combining the alphabetic signals to form words this interval must be increased. The rule of practice is this: Whatever the rate of signaling, the time occupied in giving the stroke is the unit of time. Between the signal-numerals of any combination allow one unit of time to intervene. Between letter-combinations (including, of course, abbreviations and numerals) allow two units; between words, four units.

Messages can be sent in this code at from fifteen to eighteen words per minute, but ten words per minute is a good rate of speed, and as much as is safe, if the message is enciphered.

The blows of the key must be firmly and evenly made, especial care being taken to avoid nervousness and haste, which produce uncertain sounds and confuse the receiver. Five words per minute, which the receiver can read without "breaking" or calling for repetitions, is a better rate and will accomplish more in an hour than double or treble that rate interrupted by breaks and frequent repetitions, not to mention the liability to error, which increases rapidly as the rate of transmission is accelerated.

Each office or station will be known by a signal peculiar to itself, which is its "call," and each operator by a personal signal, (usually the initial of the name of the person.)

When a message is received at one station for transmission to another, the operator on duty will "call" the station wanted, by repeating its signal four times, and then that of his own station, and continuing until the signal is perceived and answered. The answer is given by the operator on duty at the called station by opening the circuit, upon which the caller closes, and the called station signals G. A. and the signal of the station. The operator who called then forwards the message, and concludes by sending his own personal signal The operator receiving the message acknowledges the receipt thereof by signaling O K. and his personal signal.

When not in use, that is, when no one is signaling, all the circuit-closers are closed—placed in contact—so that the battery-current finds an uninterrupted path, and flows constantly, keeping all the magnets active. This is necessary in order that the line may be ready for use by any station, whether terminal or intermediate, upon it; and to understand how this necessity arises, it is necessary to comprehend the relation of the parts of the line to each other and the manner in which the sounds are produced.

The batteries furnish the current, which is the power by which the signals are made, the conducting-wires carry this current to the points which it is desired to connect, and the instruments are the devices by which the current is manipulated so as to form signals, and by which these signals are made intelligible to the eye or ear of the receiver.

The key has already been described and its offices indicated, as also the receiving-instrument; but the essential portion of any such instrument, relay, sounder, or field-instrument—the electro-magnet—must be thoroughly understood by the student.

An electro-magnet is composed of a soft iron core, usually, though not necessarily, approaching a horseshoe form, around which is coiled an insulated conductor. When an electric current is transmitted through the conductor the iron core becomes magnetic, and continues magnetic as long as the current continues to flow, losing that property again, quickly, upon the cessation of the current.

The batteries and ground-connections being at either end of the line, all the instruments intervening, it will be seen that when all keys are closed (*i. e.*, circuit-closers in contact) the current is constantly flowing, and the iron cores of all instruments magnetic. It follows that by the opening of any one key (circuit-closer not in contact) the circuit or path of the current is interrupted or broken, the current ceases to flow, and the cores are demagnetized. As it is by the alternate magnetization and demagnetization of these cores, made recognizable by the motion of the armatures, that signals are transmitted, the necessity for placing the circuit-closers in contact (in telegraphic phrase "closing the key") becomes apparent. It may be further seen, that while all the offices on any line may receive at the same time what any one may be transmitting, only one operator can be transmitting, and, therefore, the necessity for a careful adjustment of the instrument by the operator, constant attention thereto at all times, and especially before attempting to transmit signals.

By "adjustment" is meant such a regulation of the distance between the poles of the electro-magnet (*i. e.*, the ends of the iron core) and its armature, and of the tension of the armature-spring, as that the armature shall obey the attraction of the magnet when that force is excited by the flow of the current, and move to the front contact promptly, while the tension of the spring shall be sufficient to overcome the residual magnetism of the iron, and any attraction which may result from the flow of current consequent on defective insulation, and withdraw the armature to the back contact upon the opening of any key.

By the phrase "residual magnetism" allusion is made to the fact that the attractive power of the iron is developed gradually, and gradually lost, so that in ordinary signaling the force of attraction generated by one signal-impulse is not entirely discharged or dissipated before the succeeding impulse is commenced, the result being that the iron is at all times magnetic; strongly so when the current is flowing, and weakly in the intervals. This weak attraction is called "residual magnetism," and must be counterbalanced by the elasticity of the spring. In addition to the residual magnetism, the spring must overcome any attraction of the magnet, resulting from escape. On all lines of any considerable length, a portion of the current passes to the earth through or over the supports, or at points of accidental contact with trees, buildings, &c. This flow develops the magnetism of the iron in proportion to its amount; and this attraction must also (as has been said) be balanced by the tension of the spring.

As these forces are both variable the closest attention is required, and frequent tests must be made by the operator to be certain that the instrument is properly adjusted. On a ine which is well insulated, having little loss by escape, the adjustment will be comparatively easy, the difference to be guarded against being that in the rate of speed by different signalists. If a large intefval is allowed between the signals, giving time for the discharge of the magnetism of the cores, the signals will be clear with a low tension of the spring; if, on the contrary, the signals follow each other rapidly, a higher tension will be necessary to overcome the residual magnetism. A safe rule is to adjust high enough to get the quickest signals distinctly. Upon a badly-insulated line the matter is more difficult. In this case the adjustment necessary to get the signals from the distant station may be so high as to prevent, or render difficult, the reception of the signals made by a nearer station. Suppose a line with two terminal and three intermediate stations, equidistant, which loses by defective insulation three-fourths of the current generated by its batteries, the loss being distributed equally over its whole length. The opening of the key at one terminal leaves the instrument at the other still acted upon by three-fourths of its battery-current, which flows out at the points of escape, and to recognize the signals the adjustment must be high enough to balance three-fourths of the power of the magnet as excited by the battery-current. At the station next nearer, the opening of the key would cut off the one-fourth of the current which goes to ground at the terminus, and in addition thereto one-fourth of the escape, as one-fourth of the line lies beyond it. At the middle station the open key would cut off one-half the escape, and at the third, or nearest intermediate station, three-fourths of the escape, in addition to the one-fourth that would go through; and thus is rendered necessary a different adjustment to enable the operator at the one terminal to work with the other and with each of the intermediate stations. Practice only can give the operator skill in this respect, and too much attention can scarcely be given it, as from want of skill in adjusting arises much of the delay in transmission of messages, interference with each other by operators, misunderstanding of signals, &c.

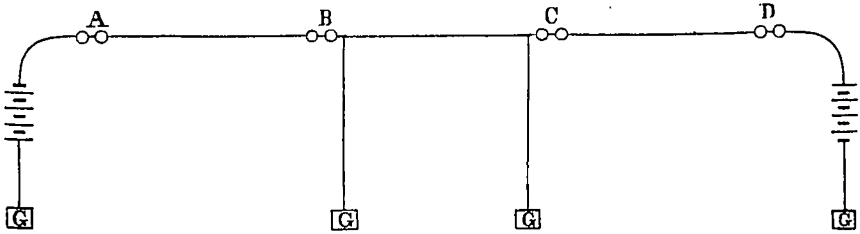
CHAPTER XI.

Telegraph-lines are subject to three contingencies which may impede or prevent the transmission of signals. These are the breaking of the conductor, by which the transmission of the signals will be prevented; the loss of current by contact with the ground, (or with other conducting bodies which connect with the ground,) which will render the transmission of signals difficult in proportion as the loss of current is greater or less; and contact between two wires, by which the signals passing upon either may interfere with and confuse those of the other. The first are known as breaks, the second as grounds, (total or partial,) and the third as crosses.

The operation necessary to determine what the fault is, when one is found to exist, and where it is, in order to direct concerning its removal, or to devise means of avoiding or overcoming the difficulty of signaling, is called testing.

This may be, and on long lines without intermediate stations, whether aerial, subterranean, or submarine, necessarily is, performed by the aid of a galvanometer and artificial resistance. These methods are many, and are capable of locating and defining a fault with great certainty and exactness, by comparing the known resistance with the unknown, but as the delicate instruments and apparatus are unfit for military service, and the conditions-precedent necessary to testing in this manner generally wanting on military lines, the student is referred to more elaborate works for knowledge thereof, and the common methods of testing with the ordinary instruments only will be considered. If a line be broken, and the broken ends of the wire prevented from falling to the ground, or having fallen rest on dry earth or sand, the apparent result will be a stoppage of the battery-current, made appreciable by the non-action of the magnets at the adjustment in use previous to the breaking of the wire. Attempts to adjust the magnets to the new condition will show no current if the accidental connection to earth be very slight, and in any case only such as is due to escape, over-defective insulation, and the imperfect contact at the break. The work of locating such faults lies with the intermediate offices. When the power of the magnet is much reduced or lost at any station intermediate between the termini of a line, the operator should, by placing his ground-wire in connection with the line on one side or the other of his instrument, ascertain in which direction the fault lies. If with the ground-wire on one side he finds the power of the magnet restored, the fault is beyond the ground-wire. If with the ground-wire on the opposite side he receives a feeble current, indicated by a weak action of the magnet, the line is on the earth, but not broken. If no current is received the line-wire is broken. If, after testing on each side, no effect is found, (the magnet remaining inactive,) the probability is that the fault is in the testing-office, and it should be at once cut out, and carefully inspected and tested. Fig. 39 is a diagram of a line with four stations, broken between the intermediate or "way" stations. It will be seen that there are formed by the use of the ground-wires at the way stations two separate circuits, one from A to B, the power furnished by the battery at A, and one from C to D, the battery at D furnishing the power.

Fig. 39.



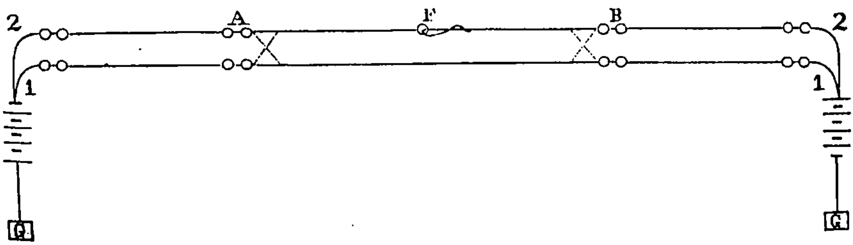
Were the line not broken, but merely thrown upon moist earth at the same point, the result would be the same, practically, without the use of the ground-wire, the earth-contact acting as ground.

Breaks are usually the result of violence to the line-wire, but occur not infrequently in offices by the carelessness of an operator in not closing his circuit after working, or by the loosening of a binding-screw about the instrument or switch. The fine wire of which the coils of the magnets are made is sometimes burned off by atmospheric electricity, with the same result.

When a break has been improperly repaired, as by making a "hook-joint," (so called,) by which the conducting capacity of the line is but partially restored, the result is the same as though additional wire had been attached; the battery-current, encountering more resistance, excites the magnet less powerfully, and the transmission of signals is less prompt and certain. This fault may be found in the same manner, or if there be more than one wire the device of cross-connecting them may be made use of.

Fig. 40 represents a line having two conductors and intermediate stations. A partial disconnection exists at F in No. 2 wire, which, by cross-connection at A and B, is shifted

Fig. 40.



into No. 1 wire at the terminals, showing that it is between the cross-connections. It will be seen that any fault except a cross (which affects both wires alike) can be tested for in the same manner.

Grounds are tested for by a terminal station by calling the most distant station and noting the strength of the current, (by its effect on the magnet,) when the circuit is left open, and the tension of adjustment-spring necessary to get signals clearly from the distant office, and by comparison with the results of the same experiments with the other stations in succession. When the open key shows only the ordinary amount of escape, and the signals come clearly at the ordinary adjustment, the fault is passed. If the change is sudden, the current is escaping principally at one point between the last station which required a "high" adjustment and the first which worked on a lower. If the change is gradual, as station after station is tested with, the fault is a general defect in insulation, broken or faulty insulators, or contact with trees, shrubs, &c.

Crosses may occur between the wires of an intersecting line, in which case they can be tested for by the same methods as those employed to locate grounds; or between parallel wires of the same line. When the latter is the case the terminal station conducting the test should direct the other terminal station to open circuit on one of the wires, and each of the intermediate stations, one after the other, commencing with the most distant, to make signals on the wire which remains closed. As long as the cross is between the operator making the signals and the testing-terminus the signals will come on both wires, but as soon as the cross is more distant than the signaling operator, they will come on the one in which they are made only, the other remaining closed.

If one of the wires only is in the way stations, the testing terminals can made a loop-test by directing the other terminus to open circuit on both wires, and connecting one of them to earth outside the battery. Signals made at the testing-station will then go out on one wire to the cross and back on the other to earth, and the cross will be found beyond the farthest station that hears the signals. All stations beyond the cross will have open circuit, or no current.

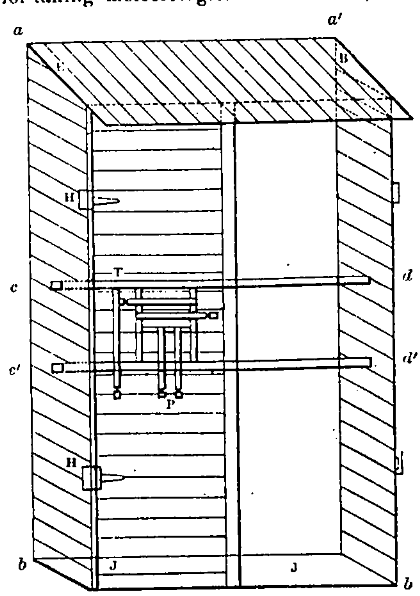
While a cross exists one wire should be kept open in order that the other may work uninterruptedly; or, having located it, let the stations on either side disconnect the line-wire from their instruments on the side next the "cross," and substitute a ground-wire. The terminus can then use one wire "through," and each can reach the way stations between itself and the fault by the ends of the divided wire.

Paper B.

INSTRUCTIONS TO OBSERVER-SERGEANTS, SIGNAL-SERVICE, ON DUTY AT STATIONS OF OBSERVATION, UNITED STATES ARMY, AND REPORT PREPARED UNDER THE DIRECTION OF THE CHIEF SIGNAL-OFFICER OF THE ARMY.

INSTRUCTIONS.

1. Each observer, upon arriving at his station, will immediately proceed to secure a room suitable for office purposes and the storage of instruments and other United States property in his charge. This room must be in the immediate vicinity of the telegraph office charged with the transmission and receipt of the weather reports, and should be in the upper story of a building, and contain at least *one* window facing the north. In all cases he will endeavor to get permission to occupy the roof of this building for the necessary exposure of his instruments, and, at stations specially designated by the Chief Signal-Officer, for the erection of an instrument-room, in accordance with plans furnished by this Office. When such permission cannot be obtained, or a suitable roof found, and at all stations not designated as above, an instrument shelter will be constructed similar to the one described in the Smithsonian directions for taking meteorological observations, as follows:



Select a window fronting the north; remove the lattice-blinds, if there be any, and along the exterior jambs of the window place perpendicularly two pieces of lattice-work (*a b*, *á b'*,) projecting to a distance of from twenty to twenty-four inches from the panes. At half this distance, ten or twelve inches from the panes, and at the height of the eye of the observer, when in the chamber, pass from one end of the shelter to the other two small wooden transverse bars (*c d*, *c' d'*,) each an inch broad, for the purpose of supporting the instruments. Upon the outer edge of the sides fasten, in the usual way, (H H,) the latticed blinds which were removed from the jambs, or two others provided for the purpose. That blind behind which the instruments are to be placed is to serve as a screen, and must be fastened, almost entirely closed, so as to make a little more opening; the other may remain open, to allow a free access of air and light, and need not be closed except in great storms. The whole must be covered with a small inclined roof of boards, (B E.) placed at least fifteen or twenty inches above the instrument. The lower part, (J J,) or the basis, may remain open, unless the shelter is within ten feet of the ground, in which case the bottom will be covered with slats two inches wide, placed one inch apart.

The building selected should be detached from other buildings, and, where this cannot be had, should be higher than those surrounding it.

Too much attention cannot be given to the proper setting up of the instruments and their protection from local influences.

2. An observer, upon arriving at his station, will, as soon as practicable, put himself in communication with the board of trade, chamber of commerce, board of underwriters, and such other bodies as may desire to co-operate with this Office in its efforts to make the service locally, as well as generally, useful. If meteorological committees have not been appointed by any or all of these bodies, their appointment should be urged as a matter of special importance, and the committees requested to place themselves in communication with the Chief Signal Officer. He will also communicate with such colleges, scientific associations, and other institutions of learning as may be located at or near his station, and will explain to their officers and members the nature and object of his duties, and invite their co-operation. He must bear constantly in mind that it is expected he will use every effort in his power to render his office of the greatest public utility.

3. The office-furniture will be of the plainest kind, and consist only of such articles as are absolutely necessary for the proper transaction of business. The room, furniture, and instruments must be kept neat and clean at all times, and always prepared for inspection.

4. The regular reports from station ——— will commence with the morning report of ———, and from and after that date three observations will be made daily, and transmitted by telegraph, to ———, and three observations, at different hours, for transmission by mail weekly to this Office.

5. The observations for telegraphic transmission will be taken daily at —— a. m., —— p. m., and —— p. m., (local time,) and, after the proper corrections are made, will be entered on Form 5, supplied by this Office, and also in the daily record of observations and the record of bulletins, and a weekly record of them on Form 4 will be sent to this Office. The instruments will be read in the following order:

1. Barometer.	2. Thermometer.	3. Hygrometer.
4. Anemometer.	5. Anemoscope.	6. Rain-gauge.

6. The reports will be handed by the observer in person to the operator charged with their transmission, in the order and at the times named below, viz: Report No. 1, at —— a. m.; report No. 2, at —— p. m.; report No. 3, at ——— p. m.

7. Observers must be at the telegraph-office, with the reports carefully and plainly written out *in duplicate*, ten minutes before the hours named above, in order that the operator may be notified in time to prepare for their transmission, and must obtain the signature of the operator to *both* copies *of each report*, with the exact time of receipt by him. They will also furnish the manager of the office with a plainly written or printed list of stations (with their proper telegraphic numbers) from which reports are to be received at, and also of those to be sent from, his office, with the names of the stations to which they are to be sent. If reports are to be transferred or selected for transfer at any station, the observer at that station must personally attend to such transfer or selection, unless prevented by sickness or other extraordinary cause. To provide against such an event, he must so arrange with the manager that the regular transmission of reports will not be interrupted by his absence.

8. The following is a list of stations, with their proper telegraphic numbers. Those to be received at station No. —— are underlined in red ink, and any failure to receive them must be promptly reported to this Office, with a statement of the probable cause of failure:

Station.	No.	Station.	No.
Plaister Cove, Nova Scotia	10	Boston, Massachusetts	13
Saint John, New Brunswick	11	New London, Connecticut	14
Portland, Maine	12	New York City, New York	15

Station.	No.	Station.	No.
Albany, New York	16	Punta Rassa, Florida	59
Philadelphia, Pennsylvania	17		60
Baltimore, Maryland	18	Vicksburgh, Mississippi	61
Washington, District Columbia	19	Memphis, Tennessee	62
Wilmington, North Carolina	20	Nashville, Tennessee	63
Charleston, South Carolina	21	Louisville, Kentucky	64
Savannah, Georgia	22	Cincinnati, Ohio	65
Augusta, Georgia	23	Saint Louis, Missouri	66
Lake City, Florida	24	Omaha, Nebraska	67
Key West, Florida	25	Cheyenne, Wyoming Territory	68
Montgomery, Alabama	26	Santa Fé, New Mexico	69
Mobile, Alabama	27	Corinne, Utah	70
New Orleans, Louisiana	28	Fort Benton, Montana Territory	71
San Francisco, California	29	Shreveport, Louisiana	72
Norfolk, Virginia	30	Jacksonville, Florida	73
Oswego, New York	31	Portland, Oregon	74
Rochester, New York	32	San Diego, California	75
Buffalo, New York	33	Denver, Colorado	76
Cleveland, Ohio	34	Virginia City, Montana Territory	77
Toledo, Ohio	35	Port Stanley, Canada	78
Detroit, Michigan	36	Port Dover, Canada	79
Chicago, Illinois	37	Kingston, Canada	80
Milwaukee, Wisconsin	38	Saugeen, Canada	81
Saint Paul, Minnesota	39	Breckenridge, Minnesota	82
Du Luth, Minnesota	40	Fort Sully, Dakota Territory	83
Pittsburgh, Pennsylvania	41	Indianola, Texas	84
Knoxville, Tennessee	42	Alpena, Michigan	85
Indianapolis, Indiana	43		86
Lynchburgh, Virginia	44	La Crosse, Wisconsin	87
Burlington, Vermont	45		88
Mount Washington, New Hampshire	46		89
Keokuk, Iowa	47		90
Grand Haven, Michigan	48		91
Escanaba, Michigan	49		92
Marquette, Michigan	50		93
Davenport, Iowa	51		94
Leavenworth, Kansas	52		95
Cairo, Illinois	53		96
Cape May, New Jersey	54		97
Galveston, Texas	55		98
Montreal, Canada	56		99
Quebec, Canada	57		100
Toronto, Canada	58		

9. At each station an observation of the barometer will be taken daily at 12 m., Washington mean time, and if a change equal to, or greater than, fifteen-hundredths of an inch has taken place since the regular morning telegraphic observation, the fact will be reported immediately by telegraph to the Chief Signal-Officer, with the direction of wind and state of weather, and the velocity of the wind in miles per hour; the whole being sent in the same order in which they are given here, and in the regular cipher words. A regular weekly report of these mid-day observations will be made out on Form 4 and mailed to the central office with the other reports on this form.

In these special reports the barometer will be corrected, in the usual manner, for temperature, elevation, and instrumental error.

10. In addition to the observations made for telegraphic transmission, three others will be taken daily—at 7 a. m., 2 p. m., and 9 p. m., (local time,) respectively. These will be recorded upon Form 4 in the same manner as the telegraphic observations, but on a separate sheet, and a copy of them will be forwarded weekly by mail to the office of the Chief Signal-Officer.

11. After delivering his own reports to the operator, each observer will remain in the telegraph office until they are sent to their proper destination, and until the reports from other stations intended for use at his station are received, or until assured that their receipt has been prevented by some cause beyond the control of the operator. The reports for Station No. —— should be received by —— a. m., —— p. m., and —— m., respectively; and when

they are delayed beyond these hours, the facts should in all cases be promptly reported to this Office by mail, with a statement of the cause of delay when known.

12. To avoid useless delay in getting out the bulletins, observers should arrange, whenever practicable, to have the use of a desk or table in or near the operating-room of the telegraph-office, in order that the reports could be translated and written out properly as rapidly as received. Where permission to occupy the room for this purpose is granted by the manager, a small table will be furnished by this Office for the use of the observer, whenever necessary.

13. The telegraph-offices at which the reports are received will be kept constantly supplied by the observers with Form 2, and in all cases the receiving operator will be required to fill in the name of station, *date*, and time that reports are received. Observers will in like manner fill up Form 5 before delivery.

14. *Reports must be made on Sundays at the regular hours, and delivered punctually at the telegraph-office.*

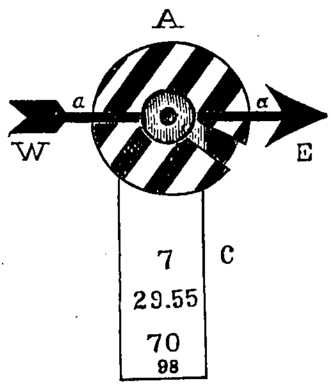
15. Immediately upon the receipt of the morning reports at any station the observer will translate them into ordinary language, and write them out clearly and plainly on the bulletin sheet, (Form 3,) filling in each column with the data named in its heading. The manifold issue of the bulletin will be used, and when completed, copies will be regularly posted in the rooms of the board of trade, chamber of commerce, and such other conspicuous places as may have been officially designated. Copies may also be furnished to private individuals when personal application is made for them at the observer's office, and their preparation does not interfere with the issue of those designed for public use, or with the ordinary and regular duties of the station. A copy will be furnished to each evening newspaper published at the station and its regular publication secured if possible. The local observations will invariably be entered in all bulletins, press reports, and maps. At stations supplied with the manifold maps, their preparation follows the bulletin, and they will be printed as rapidly as practicable, and furnished to such parties as may be designated by this Office, upon the recommendation of the observer in charge. The "War Department Weather Map" will then be changed in accordance with the following key and instructions

The index consists of an arrow, disk, and card, which show the direction and velocity of the wind, state of the weather, height of the barometer, and height of the thermometer, and relative humidity at the place on which they are affixed. The index will be changed once daily, at 10 a. m., or as near that hour as is practicable. The arrow flies with the wind.

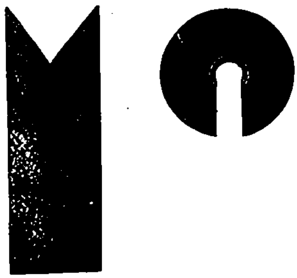
A red disk indicates clear weather.
A blue disk indicates sky covered with clouds.
A ¼-blue disk indicates sky ¼ covered with clouds.
A ½-blue disk indicates sky ½ covered with clouds.
A ¾-blue disk indicates sky ¾ covered with clouds.
A black disk indicates rain.
A white and black barred disk indicates snow.

A yellow card projecting below the disk, and held in position by the same screw that fastens the arrow and disk, shows the velocity of the wind in miles per hour, the height of the barometer in inches and hundredths, and the height of the thermometer in degrees Fahrenheit, and the percentage of humidity.

Example:



The barred disk A indicates snow, and the position of the arrow *a a* that the wind is blowing from the west, the upper figure on the card, *c*, shows that the velocity with which the wind is blowing is seven miles per hour. The height of the barometer, shown by the middle figures, is twenty-nine inches and fifty-five hundredths, the height of the thermometer seventy degrees above zero, and the relative humidity, indicated by the lower figures, is ninety-eight per cent. When the temperature is below zero the minus sign should always be prefixed. To facilitate changing the disks and cards they are cut so as to slip on and off without removing the clamp, as shown in the following figures:



A calm is indicated by the omission of the arrow.

16. The afternoon reports will be received and translated in the same manner as those received in the morning, and will be bulletined at such places as will insure the greatest publicity. At stations where the morning papers go to press too early for the publication of the midnight report, they will be furnished with the afternoon issue.

17. The night reports, after translation, will be carefully and promptly written out on Form 3 and furnished to such morning papers printed at the station as desire them for publication. Observers will endeavor to arrange with the publishers to have the reports taken from the observer's office, but where this arrangement cannot be effected, the observer, or his assistant, will deliver them in person at the different newspaper offices.

18. At stations where the publishers of newspapers desire to have the three reports of the previous day, they will be supplied by the observers on the manifold form issued by this Office for that purpose. In such cases, observers will write up the morning and afternoon reports during the day and evening, so that there will be no delay in getting out the full report at midnight. In filling out the heading of the daily bulletin, for publication, the *time* of the reports will be the exact local time of the place of publication, and will be so stated at all stations. In carrying out that part of their duty which relates to the publication and distribution of reports, observers will be required to act promptly and intelligently, as the usefulness of the reports depends wholly upon the speed and accuracy with which they are laid before the public.

19. *In furnishing weather reports and items for publication, observers must confine themselves strictly to the instructions issued from this Office, and will not, under any circumstances, publish, or cause to be published, forecasts or predictions of the weather not originated by this Office.*

20. At each station a daily record will be kept of missing reports, showing the name and official numbers of stations, with the cause of their non-receipt when known, and also such other telegraphic errors as may come to the observer's knowledge. A copy of this record on Form 19 will be forwarded weekly to this Office in the same package with the originals of Form 2.

21. A copy of the latest synopsis received by the Associated Press at stations where it is regularly received will be posted with each copy of the bulletin that is publicly displayed. These copies will be made in manifold on Form 15 furnished by this Office.

22. Observers will be held directly responsible for the correct publication of all weather reports at their respective stations, and must take every precaution to guard against errors, especially in the newspaper copies, where they are most frequently found. The accuracy of the published reports must be verified by daily personal inspection, and when errors are found they should be traced to their proper sources and measures taken to prevent their reptition as far as it is in the power of the observer. The use of the regular official heading authorized by this Office for all reports must be insisted upon, and care taken that correct time of issue is given to both the bulletin and synopsis.

23. When the wires of the telegraph company by which the reports are regularly transmitted are known to be down or obstructed in such a manner as to prevent their prompt transmission, they will be sent, until such obstruction is removed, over the wires of any other company possessing the necessary facilities.

24. In all reports and bulletins posted or furnished to the press for publication, due credit must be given to the telegraph company over whose wires they were received.

25. At all stations ordered to make river reports, the depth of water above low-water mark will be observed at 3 o'clock (local time) each afternoon.

The sixth space in first line of Form 5 will be used for the depth in feet whenever the number exceeds eight, and the sixth space in second line for the odd inches.

Whenever the depth does not exceed 8 feet, the word "River" will be used to fill the space in the first line, and the whole depth given in the second line in inches. The headline "Change in last 24 hours" will be erased from the cipher manual.

In furnishing the reports to the press, and in filling up the Bulletin, Form 3, both the depth of water and the daily change will be given The change will be obtained by taking the difference between the current report and that of the preceding day.

26. Whenever any sudden or unusual change occurs in the condition of the river between the regular hours of river observations, the observed unusual depth will be reported in the usual manner at the next suceeding telegraphic report, and these special reports will be continued tri-daily (one at each telegraphic report) until the river resumes its normal condition, when the morning and midnight specials will be discontinued.

27. In carrying out these instructions, observers will use the cipher words in the column headed "Rise," when the river is rising at the date of report, and those in the column headed "Fall," when it is falling.

28. The observations for the morning and midnight special river reports will be made within an hour of the time of report if practicable.

Observers must exercise great care in making and recording the river reports, in order that they can be relied upon as accurate by interested parties.

29. The amount of rain-fall (or melted snow) will be measured and reported at each of the three telegraphic reports only.

INSTRUMENTS.

30. Each station will be supplied with the following instruments:

One standard barometer, (Green's.) (Signal-service U. S. A.)
One standard thermometer, (Green's.) (Signal-service U. S. A.)
One standard hygrometer, (Glaisher's model.)
One maximum thermometer. (Signal-service U. S. A.)
One minimum thermometer. (Signal-service U. S. A)
One anemometer, (Robinson's.)
One wind-vane. (Signal-service U. S. A.)
One rain-gauge. (Signal-service U. S. A.)
One clock.

Other instruments may be added from time to time as the necessity for their use becomes apparent.

BAROMETER.

31. The barometers will in all cases be carefully compared with the standard at this Office before issue, and the amount of instrumental error will be sent with each when it leaves this Office.

The barometer should be placed in a room of a temperature as uniform as possible, not heated nor too much exposed to the sun. It should be suspended at the height of the eye, near a window, in such a manner as to be lighted perfectly without exposure either to the direct rays of the sun or to the currents of air which are always found at the window-casings and doors. To protect the instrument from external injuries, from dust, and from the direct radiation of warm bodies or the currents of air from the window, observers will fasten the wooden case in which it is carried firmly against the wall in a vertical position near the window, in such a manner that the cover will open in a direction parallel to the panes. An opening large enough to admit the tube of the barometer will be cut in the upper end of the box; and directly above this, at the distance of one inch, a strong hook will be driven into the wall. This hook should extend two or three inches beyond the box, and upon it the instrument will be suspended. When not in use the cover will be closed; but when an observation is to be taken it will be opened, and the instrument drawn out on the hook, clear of the box, and in the full light of the window. After the observation is made the barometer will be slipped back into the box.

32. All readings of the barometer taken for telegraphic transmission will be corrected by the observer making the observation, for *instrumental* error, for *temperature*, and for *elevation*, before they are sent from his station. In correcting for temperature, the reading of the *attached* thermometer will be used, while in correcting for elevation the temperature used will be that of the exposed or open-air thermometer.

In correcting for elevation, the height of the surface of the mercury in the cistern of the barometer above the ground must be added, in all cases, to the height of the station above sea level, as in the following example, viz: suppose height of station above sea level to be 670 feet; height of mercury (surface) in cistern to be 17 feet above the ground; then the elevation to be corrected for would be 687 feet.

In correcting for temperature, Table XVII, pages 66 to 71, paper C, of Guyot's tables, will be used; and for elevation, Table XIX, page 92, paper D, of the same book, when special tables prepared at this Office are not furnished.

33. In transporting a barometer, even across a room, it should be screwed up, and carried with its cistern uppermost. For traveling, it is provided with a wooden case. On steam-boats or railroads, it should be hung up by a hook in the state-room or car, and the lower end firmly strapped to the side of the room or car to prevent jarring. In wheeled vehicles, it should be carried by hand, supported by a strap over the shoulder, or held upright between the legs; but it should *not* be allowed to rest on the floor of the carriage, for a sudden jolt

might break the tube. If carried on horseback, it should be strapped over the shoulders of the rider, where it is not likely to be injured, unless the animal is subject to a sudden change of gait. When about to be used, it should be taken from its case, and, while screwed up, gently inverted and hung up, when it can be unscrewed. While it has its cistern uppermost, the tube is full—is one solid mass of metal and glass—and not easily injured; but when hung up, a sudden jolt might send a bubble of air into the vacuum at the upper end of the tube, and the instrument would be useless until repaired. Observers must never *swing* the barometer or endeavor to force the mercury against the top of the tube without first screwing up the large adjusting screw at the base of the cistern.

If the cistern should become dirty, it can be cleaned with safety, and without changing, in the slightest degree, the zero of the instrument. Everything used in the operation must be clean and dry. Blowing upon any of the parts must be avoided, as the moisture from the breath is injurious.

The instrument being placed upright, the cistern uppermost, unscrew and take off the brass casing which incloses the wooden and leathern part of the cistern. This wooden part (which has the grain crosswise, and therefore is not air-tight) is made in two pieces, fastened together by four screws and four brass pieces, each in the form of a half of a circular ring. It will be necessary to take out two of these screws and loosen the other two, when the brass pieces can be taken off. The upper wooden piece, to which the bag is attached, can then be lifted off, and the mercury will be exposed. By then inclining the instrument a little, a portion of the mercury in the cistern may be poured out in a clean vessel at hand to receive it, when the end of the tube will be uncovered. This is to be closed by the *gloved hand*, when the instrument can be inverted, the cistern emptied, and the tube brought again to its upright position. Great care must be taken not to permit any mercury to pass out of the tube. The long screws which fasten the glass portion of the cistern to the other parts can then be taken off, the various parts wiped with a clean cloth or handkerchief, and restored to their former positions. The mercury which had been taken out of the cistern must now be cleaned, or it must be replaced by other that is clean and pure. If the old mercury is merely dusty, or dimmed by a film of oxide, the cleaning may be effected by straining it through chamois leather, or through a funnel with a capillary hole at the end, of a size to admit of the passage of but a small thread of the metal. Such a funnel is conveniently made of letter-paper. The dust will adhere to the skin or paper, and the filtered mercury will present a clean and bright appearance. At stations where muriatic acid can be procured, the mercury may be easily and quickly cleaned by mixing about two ounces of the acid with it in a small vessel or cup and then pouring into the vessel clear water until it overflows and carries off all the impurities. When sufficiently pure the water will be poured off and the mercury heated over a gas or lamp-light until all remaining moisture is expelled. If chemically impure, it should be rejected, and fresh, clean mercury used. With such clean mercury, the cistern should be filled as nearly full as possible; the wooden portions put together and securely fastened by the screws and clamps; the brass casing screwed on, and the screw at its end screwed up. The instrument can then be hung up and readjusted. The tube and its contents having been undisturbed, the instrument should read the same as before. If a little mercury has been lost during the operation, and there is none at hand to replace it, no serious harm has been done; but if much is lost, the open end of the tube may become exposed in inverting the instrument, in which case air may enter. To guard against this error, a little fresh mercury will be added if it can be procured.

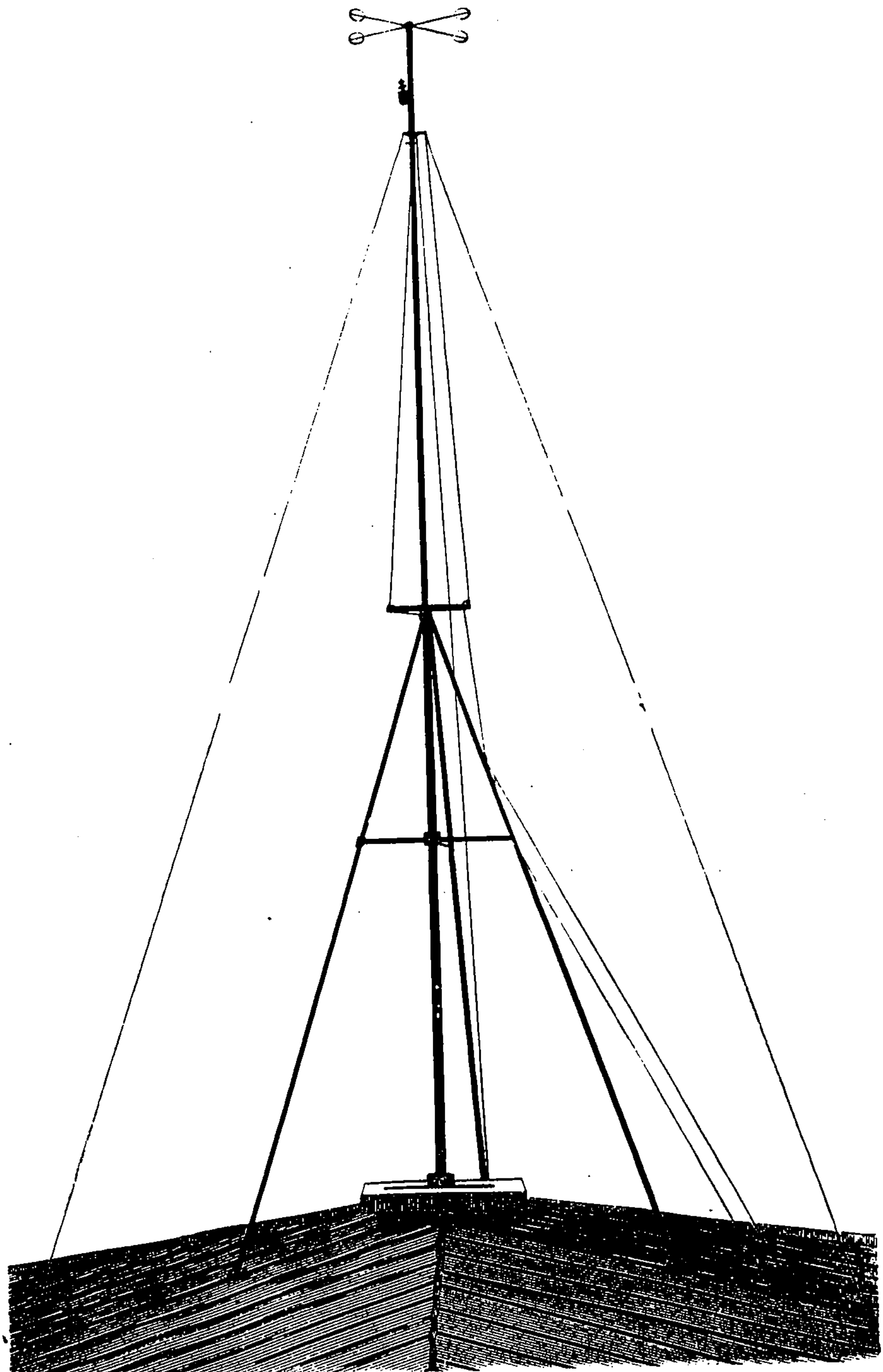
THERMOMETER.

34. The thermometer should be hung in the open air facing the north in such a manner that it will be always in the shade, and at least one foot from the wall or the building to which the shelter is attached, where the Smithsonian form of shelter is used. It must be protected from the light reflected from surrounding objects, and from rain, snow, and hail. The instrument must be placed exactly perpendicular, the middle of the scale being at the height of the eye in order to prevent error in reading. The readings should be made at all times, and, especially in the winter, *through the panes*, without opening the window, when the shelter is built out from a window. When the shelter is built upon a roof, great care must be exercised in making the readings in order to prevent the instrument from being affected by the heat of the body or of the lantern at night. The observations must be made as rapidly as is consistent with accuracy.

HYGROMETER.

35. The hygrometer will be placed in the same shelter as the thermometer, and at a distance of one foot from it. The cistern will be kept supplied with pure water at all times when the temperature of the air is above the freezing point, and the cover of the wet bulb will be changed every month, and the bulb carefully cleaned. The cover may be washed as often as necessary, without removal, by means of a jet of clean water from a small syringe.

When the temperature of the air is below the freezing point, the water will be emptied from



the cistern, and the wet bulb will be moistened with cold water by means of a camel-hair brush fifteen minutes before the observation is made, or long enough to permit the ice to form and *dry* on the bulb. The coating of ice allowed to form should be very thin, otherwise the reading will be inaccurate. Alcohol must not be used to prevent the water from freezing. The reading must be made rapidly, and without opening the window. The relative humidity of the air will be obtained from Table VII, page 46, paper B, of Guyot's tables.

Especial care must be taken to keep the tubes of the hygrometer clean, and the wet bulb properly moistened, and to make the observations and deductions accurately, as the humidity of the air forms an important element in all calculations of atmospheric changes.

Whenever the dry bulb of the hygrometer is observed to show a higher temperature than the exposed thermometer under similar exposure, the observer will cut a circular opening, about three inches in diameter, in the board to which the dry and wet bulbs are attached, and directly behind the bulbs.

MAXIMUM AND MINIMUM THERMOMETERS.

36. A board will accompany these instruments, which will be securely fastened with screws, in a horizontal position, upon the side of the instrument-shelter, or observatory, near the hygrometer and exposed thermometer.

The brass support for the minimum will be screwed into the upper part of the board; the holes being so arranged as to slightly incline the left end of the support.

The top of the thermometer will be fastened by the small brass screw upon the support, while the lower end will be dropped into the notch to the left.

For the support of the maximum thermometer the long brass pin with a nut will be screwed into the board, in the hole to the extreme right. The nut will be taken off and the pin slipped through the hole in the upper end of the instrument, which will be securely fastened by replacing the nut and screwing it tightly. The plain brass pin is then inserted in the hole at the left of the board, and the thermometer placed upon it so as to incline slightly in that direction.

The end of the pin to which the maximum is attached must be occasionally oiled to prevent friction.

After unpacking the minimum it must be carefully compared with the exposed thermometer, and if an air speck is found in the column, the bulb will be immersed in warm water until all the air-bubbles disappear in the space at the top of the tube, *great care being taken not to break the bulb by heating it too suddenly.*

After fastening the top of the minimum upon the support, the lower end of the instrument will be raised until the top of the small index touches the top of the column of spirit.

The instrument is read by observing the number of degrees upon the scale where the top of the index rests. After taking a reading, the bulb or lower end of the thermometer should be elevated until the index comes down to the temperature of the air, at the time of the observation, and the instrument will then be dropped into the notch at the left of the support, as before.

The maximum is read by observing the number of degrees upon the scale at the top of the column of mercury.

After taking a reading the observer will remove the pin to the left, and then take hold of the thermometer, about three inches from the top, and spin it around several times, or until the top of the column is brought down to the temperature of the air at the time of observation. Care must be taken not to touch the bulb, and also that the nut is screwed up sufficiently tight to prevent the instrument from striking against the side of the board to which it is fastened. After adjustment, gradually raise the instrument to a horizontal position, and insert the pin as before.

Care should be taken in elevating the thermometer not to raise the bulb too high, as the column of mercury would then run to the upper end of the tube.

The observations upon these instruments will be made at the 11.35 p. m. report, and recorded upon Form 4, in the proper column.

ANEMOMETER.

37. The anemometer will be fixed in a vertical position upon a post of sufficient height to bring the dial on a level with the eye of the observer, and will be in an exposed situation, so as to receive the full force of the wind; when possible, this post should be framed into the roof, to steady it and prevent the instrument from vibrating; but when this cannot be done, it should be framed at the bottom into two pieces of scantling, not less than three feet in length, that cross each other at right-angles, and which can be nailed fast to the roof or platform upon which the instrument is placed. Short braces can be added when necessary to insure steadiness. The outer dial of the instrument is graduated in miles and tenths of miles—the figures 1, 2, 3, &c., indicating miles, and the subdivisions tenths. One complete revolution of this dial is equivalent to ten miles of wind, and carries the inner dial forward one subdivision. This inner dial registers up to one thousand miles, and will not be used in making ordinary observations, but will be read by observers daily when making

the morning telegraphic observation. To obtain the velocity of the wind for the regular tri-daily telegraphic observations, two readings of the outer dial must be taken, with an interval of five minutes between them, and the *difference* between these readings will be the distance of tenths of miles traveled by the wind in that interval. This, multiplied by twelve and divided by ten, will give the proximate velocity in miles per hour. Example: suppose the index of the outer dial to be at 3 when the first reading is taken, and at 3.6 five minutes after, the difference, 6, is the distance traveled in that time; and this multiplied by twelve and divided by ten, gives a velocity of seven and two-tenths miles per hour. Whole numbers only will be used in expressing the velocity. When the decimal is greater than five-tenths, the unit's figure will be increased by one; when five or less it will be thrown out. The whole distance traveled by the wind in any twenty-four hours, provided it does not exceed one thousand miles, will be obtained from the inner dial by a double observation as above, making the interval twenty-four hours instead of five minutes, and will be entered on both copies of Form 4, opposite the morning observations.

38. The following directions for setting up and the general management of the electric self-recording anemometer attachment adopted by this Office will be observed at all stations supplied with this apparatus.

Near the top of the post on which the anemometer is fixed place two screws "c" and "d," (Fig. I,) to each of these screws fasten the wires separately, (the insulated wire to one, and the naked wire to the other,) leaving just sufficient of the upper end of each wire to reach to the outside ends of the contact bars "a" and "b," to which securly fasten with the binding screws, taking great care not to loosen the insulating attachment "g." Then pass the lower ends of the wire down the post, over the roof and down the side of the house (securing so the wind will not sway them) to the top of the office window, pass them in through two small holes (where the sash and shutters will not injure them) and down the inside. In crossing the roof it is well to fasten them between two wooden strips, one on top of the other. One wire should then go to the screw-cup "h," (Fig. II,) and the other to one pole of the battery at "i," then from the other pole "m" of the battery run a wire to the screw-cup "k," when the circuit is completed and the armature will be closed once for each mile the wind travels.

Particular care must be taken that all the connections are tight.

For putting on the paper.—Place the cylinder "s" on a table in front, with the screw "r" to the left hand, place the paper on the cylinder with the top of it from the screw. Let the line marked 12 m. (noon) come on the line marked on the cylinder, and place a small rubber band on each end. The lines on each end of the paper will then exactly coincide.

Place the cylinder "s" in its position, so that the end on which there is no screw "t" will be close up to the post on which it rests. Slide the small sliding bar "n" on the horizontal bars "o" "o," until it fits on the ends of the screw-axle "r"; then revolve the cylinder until the pencil rests on the end of the upper line marked 12 m., and tighten the thumb screw "n."

To regulate the length of the mark, first move the armature set-screw "p" until the point of the pencil rests on the upper line marked 12 m., then (after loosening the set screw which holds down the coils) move the magnet by means of the set screw "q" until the pencil mark is a little less than one-eighth of an inch long. *The mark should never exceed one-eighth of an inch.*

Care must be taken in adjusting the armature spring, so that it will not be too strong for the magnet, and still strong enough to draw back the pencil in a straight line.

The pencil should be kept pointed enough to give a clear distinct mark.

The clock should be wound every day, when the record is changed.

The record should be changed daily, at 12 o'clock noon.

At stations furnished with this self-recording apparatus, the hourly velocity of the wind or the three telegraphic reports will be deducted from the record of the half hour immediately preceding the time of observation.

LA CLANCHE BATTERY.

39. Place two ounces sal ammoniac in each glass jar, fill in with water to the depth of 1 inch, let the salts dissolve one hour, then set in the porous cups and the zincs. The glass jars should then be JUST HALF FULL, AND NEVER MORE THAN THIS. Then connect the zinc of one cell with the carbon of the next. Connect the zinc of the last with the carbon of the first, and let them stand six hours; then loosen the last connection and attach the wire from screw-cup "k" to one-pole "m" and the wire "d" (from the Robinson anemometer) to the other pole "i."

The battery, after being set, must not be shaken, and moved as little as possible.

The solution should be saturated, *i. e.*, as much sal ammoniac as the water will dissolve. It will probably be necessary to pour in one or two teaspoonfuls of sal ammoniac every four or five months.

Keep the cells from one-third to one-half full of water, by pouring it down the outside of the porous cup. The water must not be allowed to freeze.*

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* This form of battery having proved unsuited in this connection has been replaced by the Daniell's battery.

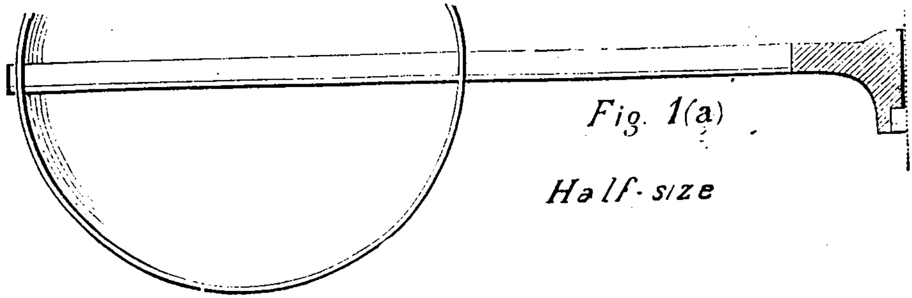


Fig. 1(a)

Half-size

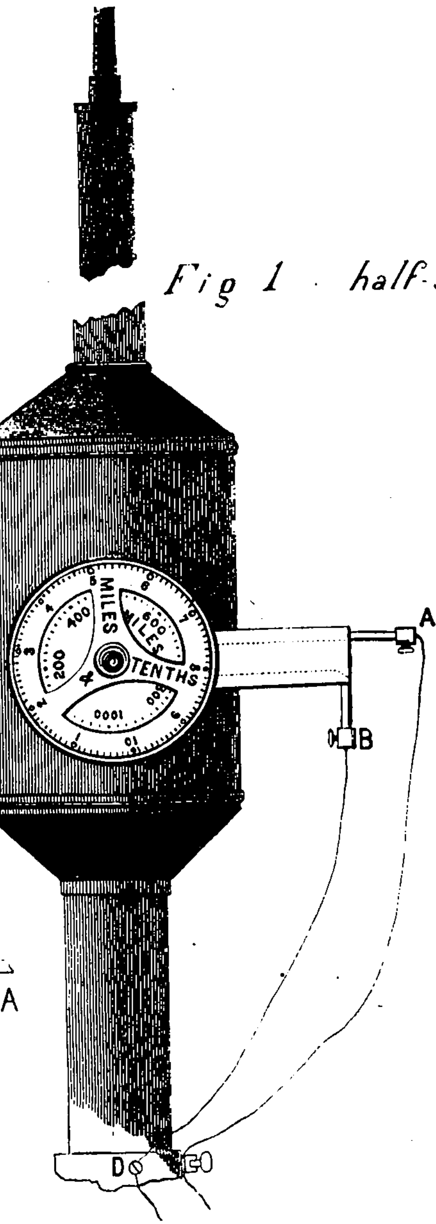
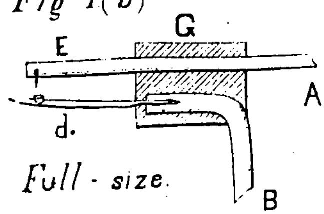


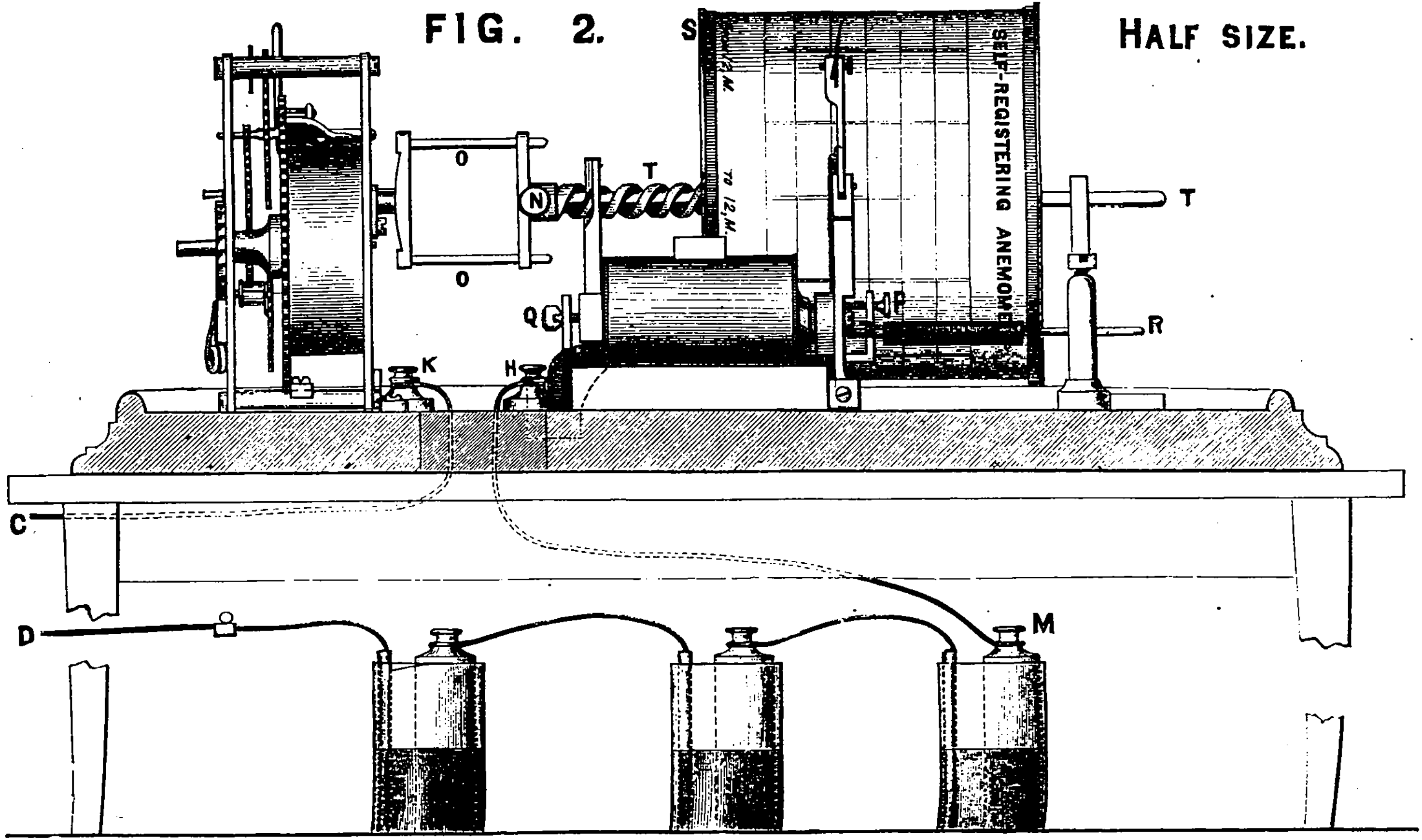
Fig 1 half-size.

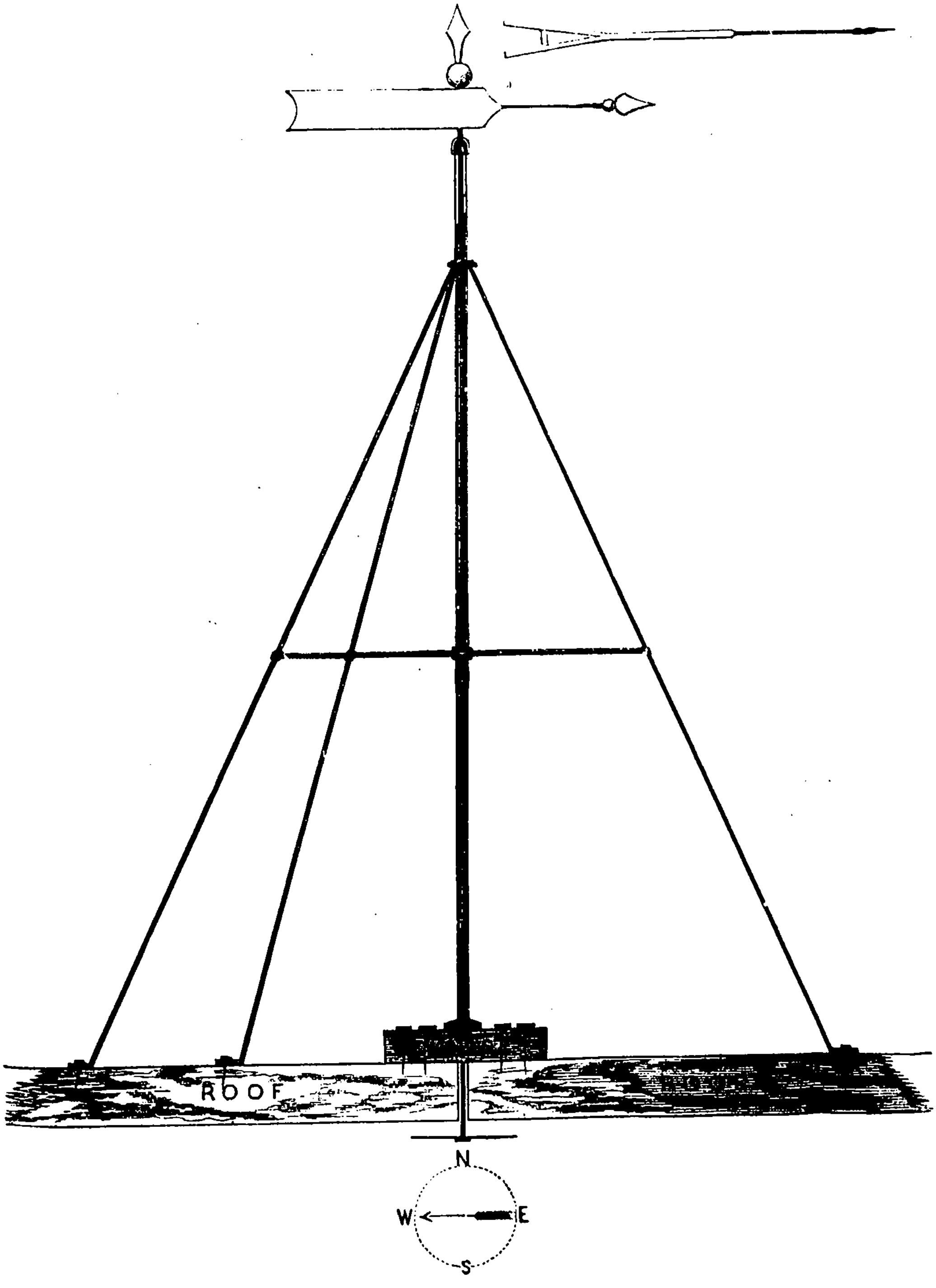
Fig 1(b)



Full-size.

FIG. 2. HALF SIZE.

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WIND-VANE.

40. Two wind-vanes will be furnished at each station; one small one to be sent with the observer for immediate use upon his arrival, and one large one to be sent as soon after the station is opened as practicable. When the latter is received the small one will be removed and carefully stored by the observer for use in cases of emergency.

41. The vane used for getting the direction of the wind must be set in a place as free and open as possible, in order that the wind may act freely upon it, and must never be sheltered by surrounding buildings or other objects. When the small one is used, observers will mark, with the aid of a compass, upon a wooden dial, at the base of the upright which supports the vane, the true meridian of their respective stations. The magnetic variation at Station No. —— is ——— degrees.

42. When the large vane is received at any station it will be immediately erected upon the building in which the observer's office is located, provided the consent of the owner of the building can be obtained, and the roof is strong enough to support its weight.

The general appearance of the vane, and the location of the several parts, are shown in the illustration herewith. The iron straps which unite the two parts of the foot-block will be taken off and the block separated before raising the vane, in order to put the iron socket holding it in proper position. After the vane is up the pieces will be fastened firmly together again by these straps. The central rod can be lengthened whenever necessary by adding a piece of the same diameter and cutting a screw-thread on both ends.

Where the office is not on the upper floor so that the rod can be brought into the room through the roof, the lower half of the rod will not be attached, but must be stored away for future use. When the office is on the upper floor the central rod will be brought into the room and allowed to project about two inches through the ceiling. The gilded arrow will then be screwed on and a circle drawn around it on the ceiling a little greater in diameter than the arrow. This circle will be divided into the eight points of compass used in the weather reports, care being taken to get the true meridian as a starting point.

When permission cannot be obtained to put up the vane the fact will be reported at once to this office.

The services of a skilled mechanic may be employed, whenever necessary, in erecting this vane.

The packing box in which the vane is received will be preserved for use in the event of its removal at any future time.

The observation of the vane requires more care than is usually given. In winds of considerable strength the vane is never at rest, or fixed in the same direction; it oscillates incessantly, and its oscillations increase in extent with certain winds and with the violence of the wind. In such cases observers must *note the mean* direction between the extremes. When the wind is too light to move the vane, and when it is calm, no direction will be given in the report, but the space will be filled with the proper cipher word for "Calm" The attention of observers is called to this matter in order to prevent them from recording the direction of the wind when it is calm. The direction of the wind will be designated by the eight principal points of the compass, beginning with the north and moving around by the eastward, and numbered from one to eight respectively.

The bearings of both vane and anemometer must be kept well and carefully oiled to prevent friction.

RAIN-GAUGE.

43. The rain-gauge will be placed, whenever practicable, with the top of the funnel-shaped collector twelve inches above the surface of the ground, firmly fixed in a vertical position, and protected from the interference of unauthorized persons It will be examined at the time of making each of the three telegraphic observations, the amount of water it contains carefully measured by means of the graduated rod sent with each gauge, and then emptied and returned to its proper position. When a position at the level of the ground cannot be found with a sufficiently clear exposure, the gauge will be placed on the top of the instrument-room, or roof of the building occupied by the observer, who will measure the height above the ground and report it to this Office. The measuring-rod is graduated in inches and tenths of inches, and the proportion between the cylinder and funnel is as ten to one, so that ten inches upon the rod correspond with one inch of actual rain-fall, one inch on the rod to one-tenth of rain, and one-tenth on the rod to one-hundredth of rain. Snow will be melted and then measured and reported in the same manner as rain, but the fact of its being melted snow must be noted under the head of remarks, in the weekly reports, on Form 4.

CLOCK.

44. The clock will be hung upon the interior wall of the room occupied as an office, and at each station will be carefully adjusted to the standard local time.

As it frequently happens that the telegraph time differs slightly from the standard local time, each observer will be careful to note the amount of this difference, in order to avoid confusion in filing his reports. As the time by which the observations are governed must be as nearly accurate as practicable, the observer will endeavor to arrange with the manager of the telegraph to have both clocks run together as a sure means of preventing errors.

45. Immediately after placing his instruments in position, each observer will make out and forward to the Chief Signal-Officer at Washington a full report in writing, stating the kind, size, and position of room selected; the street and number of the building in which the room is situated; the position of each instrument, and height of each above the ground, and also above the bench-mark furnished by this Office. In giving the height of the barometer the measurement will be made from the surface of the mercury in the cistern. Whenever the position of any instrument is changed a record will be made of such change, with date and amount of difference in elevation, and the facts reported at once to this Office.

In addition to this information, such other facts will be stated as will enable the Chief Signal-Officer to judge of the manner in which this part of the observer's duty has been performed.

Observers are cautioned against changing the position of any instrument without good and sufficient cause, and must report every change in elevation of six or more inches.

TOOL-BOX.

46. The following implements for cleaning and repairing instruments will be supplied, neatly packed in a small box, to each station:

Two screw-drivers, one fitting the screws about the cistern, the other those about the scale of the barometer; a small glass funnel; two porcelain cups, from two to four inches in diameter; kid-skin; shoemaker's thread; white wax; chamois leather; a pair of small forceps; a small three-cornered file, and a blow-pipe.

MISCELLANEOUS APPARATUS.

47. *Printing press for weather-map.*—At stations supplied with a press for printing maps the following articles not sent with the press will be found necessary: A set of type-springs (one for each reporting station) for the rapid justification of the figures; one stick; one galley; sponge; brush; lye; sperm-oil, and benzine

When the synopsis and probabilities are printed (and this should be done wherever there is a press) a twenty-five-pound font of pica type will be necessary, in addition to the symbols and figures furnished with the press. The synopsis should be set in a measure of twenty-eight ems wide. At stations supplied with the type-springs, the figures will not be removed from the plate after each issue, as the work can be done much more rapidly and easily by simply taking out the springs and changing only such figures as are necessary.

The figures and symbols should, however, be completely removed twice each month, and, with the plate, thoroughly cleaned. The figures can be cleaned daily in the plate by using a sponge moistened with benzine. The type used for the synopsis should be washed with lye. The ink-roller should be cleaned weekly, or oftener if necessary, and everything pertaining to the press must be kept well cleaned to prevent difficulty.

If stations are added for which the bed-plate has not been pierced, observers will have the necessary work done, being careful to get the new stations in their proper geographical position.

One copy of the map will be kept on file in the observer's office for reference, and on Saturday of each week a copy of the current issue will be mailed to this Office.

48. *Instructions for stamping manifold weather-maps.*—1. Count off from ten to fifteen maps from the top of the book.

2. Place the iron plate under the number counted out, and turn a map down upon it.

3. Place a sheet of carbon paper smoothly upon this map, and then turn down the next map, on which put another sheet of carbon, and so on alternating carbon and maps until the number to be issued is complete, leaving the last map without carbon upon it, taking care to smooth all when down.

In making three or four maps only a sheet of blotting-paper should be placed next to the iron plate and beneath the lower map.

4. Place the box of stamps at the top of the map, with each die in its proper place, and taking especial care not to allow the hands or mallet to rest on the paper, and thus mark and deface the lower maps.

5. First stamp with the symbol dies, the direction of the wind and state of weather, as indicated by the legend on the maps. Hold the die perpendicular to the map and strike it hard enough to make the impression go through all the maps without cutting the upper one. The actual amount of force required can only be learned by practice.

6. After the weather use the figure dies, taking care that the figures for one station do not interfere with those of any other. Stamp the first two figures (Thermometer) close together, the next two (Barometer, 29 or 30) one-eighth of an inch from the first pair, the last two of the barometer following closely. The last of the figures (Velocity of the Wind) are to be separated one-eighth of an inch from those for the barometer. Great care must be taken to

make the figures neat and regular in appearance, and to stamp them so they can be read without difficulty.

7. After the maps are properly stamped write with the stylus in head-line the name of station, day of week, date, and time of report, thus: "Washington, D. C., Saturday, April 20, 1872, 7.35 a. m."

WATER-GAUGE.

49. No definite form of water-gauge has been adopted, owing to the difficulty of getting one at a reasonable cost that would be adapted to the essentially different circumstances under which it must be used at the several river stations. The following description of a simple form of gauge may be useful in localities where it is difficult to get one of more scientific construction, or to be used as a temporary substitute for the latter in cases of emergency:

Take a piece of pine scantling, from 1¼ to 1½ inches in thickness, and from 5 to 6 inches in breadth; the length varying according to the depth of water where it is to be used.

Having planed the scantling smooth, give it a heavy coat of white zinc paint, and after the paint is dry divide the scantling into feet and tenths of feet with a rule and lead pencil.

With a small brush paint the tenths of feet black, except the center and initial ones of each foot, which will be painted red and in heavier lines than the intermediate ones, thus:

Indicate each foot, with its proper number, in plain figures marked on the white surface just above the triangle.

Having thus marked the staff up to a sufficient height to insure getting the maximum high water, select a pile, or other stationary object, in some portion of the levee or wharf where the staff will be secure from being damaged or defaced by coming into contact with vessels, and where it will not be left dry by the tide. Lower the staff into the water, taking care to keep it in a vertical position until it touches the bed of the river, and then secure it to the pile by spikes.

It would be well, in selecting a place for fixing the staff, to take the angle of a pier, and having fastened a smooth piece of scantling, about the size of the staff, on the side of the pile, secure the staff to this.

When the gauge is in an exposed place, liable to be washed by the waves, advantge should be taken of the first low water to secure it from being displaced, by driving in additional spikes, or lashing it with strong cords to the pile.

Care must be taken in reading the staff when the water is rough to get the mean of the rise and fall of the waves. It would be well, after securing the staff, to determine some point of reference, so that in case it should be destroyed another one could be put up at the same height. This may be done by taking and marking some given point in the vicinity, a pile or a rock, at any given height of the water. Thus, by driving a spike or drilling a hole, and recording the height of the water, as read from the staff at the time, you have a "bench-mark," or point of reference, by which to set up another staff. It would be necessary in doing this to make a sketch of the place, giving the location of the staff and the point of reference; noting the local names of the surrounding points so that any other person could find the place from the description.

The record consists of a simple blank-book, with name of town and particular locality, and name of observer at head of each page, ruled in columns, with the headings, date, year, day of month, and the time of observation, hour and minute; the height of the water, expressed in feet and hundredths, state of weather, direction and approximate force of wind.

50. Observers, in publishing their local river reports, will give, in addition to the changes in past twenty-four hours, the height of water above some fixed point known and used by steamboat men and other interested parties.

51. The river observations must be made and reported with as much care, regularity, and accuracy as those of the barometer, and where the observer is compelled by pressure of other duties to intrust this part of his work to an assistant, he must assure himself by frequent personal inspection that it is faithfully and honestly done.

SIGNAL APPARATUS.

52. Stations ordered to display cautionary signals will be supplied with two (or more) red flags, one six feet and the other eight feet square, having square *black* centers one-third the size of the flag; one red signal lantern; one large flag-staff, and two sets of small staffs for use in cases of emergency. The large flag-staff must be from twenty-five to thirty feet in height, and so situated as to be clearly visible from as large a part as possible of the harbor and shipping it is designed to warn of approaching danger. The staff will be provided with halyards for raising and lowering the flags and lantern, and will be erected on the roof of some building, preferably on the one in which the office is located, unless a more desirable position is found near the office.

Everything connected with the signal apparatus must be kept in perfect order; flags mended when torn, ties sewed on, halyards renewed, lanterns constantly filled and trimmed.

and the approaches to the staff convenient so that there may be no delay in obeying all orders to hoist or lower signals.

53. Timely requisition must be made upon this office for new articles of equipment when those in use are likely to become unserviceable.

SIGNAL ORDERS.

54. Signals will be ordered up by telegraph from this Office in the words "Up signals," and will be ordered down in the words "Signals down." Signals will remain displayed until the order to lower them is received from this Office, unless telegraphic communication with the Office is interrupted and continues so for some hours after the storm has passed, in which case the signal will be lowered when the danger is over. Extreme caution must be exercised in this respect, in order not to mistake the customary lull in the center of a storm for an indication that it has passed over.

Observers must not, under any circumstances, hoist or display cautionary signals without authority from this Office.

55. Observers must immediately acknowledge by telegraph the receipt of all signal-orders, giving name of station, nature of order, and time of receipt. These acknowledgments will be addressed to the Chief Signal-Officer, and signed by the observer or assistant receiving the order. The following examples will illustrate the form of message to be used:

1.

CHIEF SIGNAL-OFFICER, *Washington:*

Chicago—Up signals received ten-forty a. m.

MACKINTOSH, *Observer.*

2.

CHIEF SIGNAL-OFFICER, *Washington:*

Detroit—Signals down received six-fifty p. m.

MANN, *Observer.*

56. At the end of each week a report, made out on Form 23, will be forwarded in the same envelope with the other weekly reports. This report will be forwarded regularly, whether orders have been received or not during the week.

The hours of duty will be so arranged at cautionary stations that one man will be in the office constantly, in readiness to obey signal-orders.

RECRUITING FLAG.

57. Each station will be furnished with one United States recruiting flag, for display on special occasions as ordered from this Office. At cautionary stations it will be displayed on the signal flag-staff, and at other stations a cheap staff, twelve or fifteen feet in length, will be procured for this purpose, and so arranged that it can be put up and taken down a pleasure.

MAP AND BULLETIN FRAMES.

58. Frames for the proper display of maps and bulletins will be furnished by this Office, and will not be purchased by the observers without special authority.

FORMS.

59. The following-named forms will be furnished for use at each station:

Form 2—Receiving sheet.
Form 3—Daily bulletin.
Form 4—Weekly report.
Form 5—Telegraphic report.
Form 6—Receipt for property.
Form 8—Weather map.
Form 15—Synopsis.
Form 16—Monthly chart.
Form 19—Error sheet.
Form 20—Barometrical correction.
Form 22—Monthly mean.
Form 24—Records of bulletins.
Form 25—Telegraphic form.

Stations displaying cautionary signals will be furnished, in addition to the above, with Form 23, for reporting receipt of signal orders.

60. Form 2 is for the use of the telegraph operators in receiving the reports from other stations, and will be furnished by the observers in such quantities as may be required, care being taken to guard against wasteful and unnecessary use. The spaces will be filled up in regular order, commencing at the upper left-hand space and filling each space to the right in succession on the first line, and then commencing at the left-hand space of the second line, and so on until each space is filled. Observers will require the receiving operators to sign and date each sheet, and also to note the time the reports upon it were received before taking it from the telegraph office.*

After the reports are transferred to the bulletin the receiving sheets for each full report will be placed together and folded neatly in three folds parallel with the writing.

Each morning the three reports of the preceding day will be secured together so as to form a single package. At the end of each week the seven daily packages of the week will be put up in a neat package and forwarded by mail to this Office, accompanied by the error sheet.

61. Form 3 is the daily bulletin issued for public information. The several columns will be filled up from the receiving-sheet, the words and figures being written plainly and distinctly.

Before making any entries upon the manifold form, the sheets will be carefully smoothed down so that the registered lines of the several stations will fall directly over each other. If more than fifteen bulletins are to be written, it is better to make out the number in two equal parts, than to try and write them all at once, in order that the copies may all be legible.

One copy of the morning issue of the Saturday bulletin will be mailed to this office from each station.

The headings of the different columns indicate with sufficient clearness the matter to be filled in.

When any part of a report is not received, or, if received, is evidently incorrect, the word "blank" will be written in the spaces to be filled by such part.

Absence of wind, pressure of wind, clouds, rain-fall, or change in barometer, thermometer, and river, will be indicated by the figure zero.

New stations, whose names are not in the printed list, will be written in the blank lines at the bottom of the form.

62. Form 4 is the weekly report, and three copies will be forwarded to this Office at the end of each week; one copy containing the full record of the telegraphic series of observations, one the record of the local series, and the third that of the midday observations. This last will be sent in blank, if no changes have been noted of sufficient amount to call for report and record. In addition to the items called for by the headings of the different columns, observers will enter in the column of "Remarks" the weekly mean of the barometer and thermometer for the telegraphic series of observations, giving, firstly, the mean of the morning; secondly, that of the afternoon; and thirdly, that of the midnight observations.

63. Form 5 will be used for all of the telegraphic reports, and will be made out each time in duplicate, one copy for deposit in the telegraph-office, for transmission by telegraph to this Office, and the other for transmission by mail to the same place. Both copies must be filled up and signed in the manner indicated upon the form itself.

Each regular report will consist of *ten* words, arranged in two lines of *five* words each. At all stations designated by this Office as *river* stations, the afternoon report will consist of *twelve* words, arranged in two lines of *six* words each, the last word in first line being "river," and the last word in second line indicating by the proper cipher word the change in past twenty-four hours.

In filling up the form, the first space of the first line will be used for *name of station*, the second for *date* and *time* of report, the third for barometer, the fourth for thermometer, and the fifth for humidity. In the second line the first space will be used for state of weather, the second for velocity of wind, the third for upper clouds, the fourth for lower clouds, and the fifth for rain-fall. The cipher words must in all cases be written plainly and correctly. The word "blank" will be used when from any cause an observation is not taken.

The duplicate copies of the report for each day will be mailed the succeeding day to this Office from all stations having daily mail facilities. Other stations will forward as often as practicable.

64. Form 6 is a memorandum receipt for property, and will be filled up with the number and kind of articles received, signed, dated, and transmitted promptly to this Office.

Detailed instructions in reference to this form will be given under the head of "Property."

65. Form 8 is the weather map, to be printed or made out in manifold, as may be directed from this Office, and shows the direction of the wind, state of weather, height of barometer, height of thermometer, and velocity of wind at each station. The arrow is always to fly *with* the wind, and *not toward* it like a vane. In printing or stamping these maps great care must be exercised to make the figures and different signs correctly and distinctly.

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* When the reports are received in duplicate by the operator, observers will retain the original sheets furnished them by this Office.

Observers must never allow imperfect or illegible maps to leave their offices. To insure accuracy, the printed maps, before being issued, must be carefully compared with the reports received, and if errors are found they will be corrected on the map, if the corrections can be made without disfiguring it and without rendering it illegible. If they cannot be so corrected, the whole edition will be destroyed, as it is better not to issue any map than one which is imperfect.

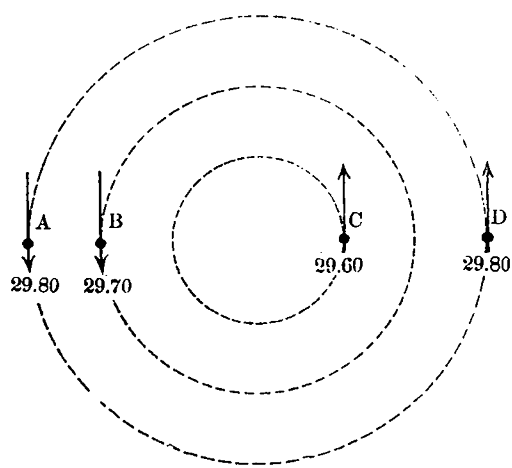
66. Observers are authorized to trace upon these maps *isobars* or lines of equal barometric pressure, in accordance with the following directions:

1st. Ascertain by a general examination of the reports, after they are entered on the map, whether any of the lines of equal pressure will, when drawn, traverse a large portion of the map, and if this is found to be the case these long lines will be drawn first. The lines of 29.90, 30.00, and 30.10, on the map, opposite page 12 of the circular issued by this Office, on the practical use of meteorological reports and weather maps, are illustrations of this principal isobar or *base line*.

2d. If decided differences in barometic readings are observed to exist between neighboring stations, enter upon the map with a red-lead pencil little dots or dashes, intermediate between any two of them, to represent the points at which the barometic reading would be exactly 29.50, 29.60, &c., or 30.00, 30.10, &c., supposing the pressure to change uniformly in the space between the two stations. The precise position of these intermediate points can usually be found with sufficient exactness by estimation with the eye.

The interpolated isobars—that is, those which are drawn between stations, as in the preceding paragraph—cannot be relied upon as perfectly accurate, but the amount of error need not exceed two-hundredths of an inch in the position of any one line, if proper attention is paid to the following points: *First.* The isobars must not be extended west of the one hundredth degree of longitude west of Greenwich, (or the meridian twenty-three degrees west of Washington,) as the barometric readings of very elevated stations cannot at present be combined with those of an altitude of fifteen hundred feet or less. *Second.* The barometrical readings reported from Mount Washington must not be used in drawing the isobars over the New England States. *Third.* Certain allowances or corrections must be made for the readings reported from several stations whose elevation is not yet accurately determined. These corrections will be furnished from this Office upon application.

When a sufficient number of dots or dashes have been made to enable the observer to trace the course of one or two of the principal isobars, they will be joined together by a curved line passing through, or nearly through, all of them, without following any of the minor irregularities that would be possibly caused by slight errors in the interpolations.



Any perplexity that may arise in drawing these lines, as to their proper route, may generally be removed by considering the direction of the wind as reported from each station. Thus, if from stations A, B, C, and D, reports are received as shown in the figure, it would be seen at once that between B and C there was a central area of low pressure around which the wind circulated in the direction indicated by the arrows, and the isobars would therefore be drawn as shown by the dotted lines.

When the lines are very much crowded together, as happens in a few severe storms, the isobars may be drawn for every two-tenths of an inch, instead of every one-tenth.

Each isobar should be plainly marked at its extremities with the figures indicating the corresponding pressure, and the central areas of highest and lowest pressure should be marked "high" and "low," respectively, unless by so doing the appearance of the map would be injured by the complication of the lines.

When the observer has any doubt as to the course of a given isobar, he should omit it entirely or simply indicate its probable position by a broken instead of a full red line. Observers will forward to this Office weekly examples of their isobaric maps, and will not post them in any public place until officially authorized to do so.

66. Form 15 is for the synopsis and probabilities, and a copy properly filled will be posted with each bulletin at all stations where they are received. The midnight synopsis will be used with the morning bulletin, and the morning synopsis with the afternoon bulletin, whenever practicable. At stations where the afternoon and not the midnight synopsis is received, this will be used with the bulletin of the next morning.

In all cases the time and date of issue from Washington must be plainly written upon the form.

67. Form 16 is the blank meteorological chart to be made out monthly at each station, and forwarded by mail to this Office as soon after the close of each month as practicable.

The following instructions, taken in connection with the illustration given in the annual report of the Chief Signal-Officer for 1871, will enable observers to make them out properly:

For the thermometer, take the weekly reports on Form 4, beginning with the morning report of the first day of the month; with a sharp pencil make a dot on the chart at the height at which the dry-bulb thermometer stood at 7 a. m., (or the first observation,) at its 7 a. m. relative distance from the 12 m. line, as shown in the illustration referred to. Do the same with each of the six observations. Join these dots with the pencil and afterward trace with ink.

Continue the same way with the wet-bulb thermometer, barometer, and velocity of the wind, marking the direction of the wind in small letters opposite each observation.

The relative humidity and amount of clouds are given at the 2 o'clock observation—the space between the central horizontal dark lines being 100 per cent. for humidity, and the squares for clouds being 1, 2, 3, and 4-4ths, respectively.

The dark lines for rain are placed with the right edge at the point where the rain ceased.

The scale may be changed for a greater fall of rain than 1¼ inches, or a greater velocity of wind than 35 miles per hour.

Different colored ink may be used for the several lines, if preferred.

In forwarding these charts by mail they should never be folded, but rolled around a central core of paper or wood, the latter being preferable. As they are intended for future reference, care should be taken in making them out accurately and neatly.

68. Form 19 is the error sheet, which accompanies the weekly packages of Form 2 sent by observers to this Office. It will be filled up in the following manner:

In the 3d column will be entered the official numbers of all regular reports missing when the telegraphic circuits are closed. In the 4th, 5th, and 6th columns will be entered, on the same line under appropriate headings, the numbers of all reports of previous dates which may have been received during the time designated at the left hand of the form. In the 7th column the time the last report was received will be noted. Receipt of duplicates, corrections, and reports not in schedules, causes of delay, &c., will be noted in the column headed "Remarks." The number of words must include all reports due at the station which may have been received up to the time the circuits were closed, whether they were of the current or previous dates. Duplicates and corrections are not to be counted. *Each line of the form must contain a complete record of the work for the date and time specified.* The record will be made up from Form 2 immediately after each report.

69. Form 20 is for the weekly example of the manner in which the observer works out the barometrical corrections and deduces the relative humidity from the readings of the wet and dry-bulb thermometer.

70. Form 22 is used for the record of the daily and monthly means of the barometer and thermometer, with the prevailing direction of the wind and amount of rain-fall for the month.

In filling up this form the means of the barometer and thermometer will be obtained by dividing the sum of the 7 a. m., 2 p. m., and *double* the 9 p. m. observations, by four. The telegraphic observations will not be used.

Copies of this form, properly filled up, will, at the end of each month, be furnished by observers to as many of the newspapers and other periodicals, published at their stations, as may desire to make use of it. One copy will also be forwarded to this Office, and one kept on file in the observer's office.

71. The weekly mean of the telegraphic observations of the barometer and thermometer will be obtained in the following manner: Divide the sum of the a. m. telegraphic observations by the number of observations, and the quotient will be the mean of the morning observations; proceed in the same manner for the afternoon and night observations, and enter the quotients separately under the head of "Remarks," on Form 4.

The monthly mean of the telegraphic observations will be obtained in the same manner, and forwarded at the end of each month to this office, on a separate form, which will be ruled by the observers until otherwise supplied.

The local observations made at 7 a. m., 2 p. m., and 9 p. m., will not be used in getting this mean.

ILLUSTRATIONS.

Barometer; telegraphic observations, 7.35 a. m., 4.35 p. m., and 11.35 p. m., Washington mean time.

A. M.	P. M.	Midnight
30.04	30.04	30.08
30.09	30.11	30.06
30.09	30.00	29.89
29.83	29.76	29.70
29.76	29.83	29.96
30.04	29.96	29.89
29.85	29.66	29.60
7)209.70	7)209.36	7)209.18
29.957	29.908	29.883

Mean of a. m. observation 29.957
Mean of p. m. observation 29.908
Mean of midnight observation 29.883

Thermometer; telegraphic observations, 7.35 a. m., 4.35 p. m., and 11.35 p. m., Washington mean time.

A. M.	P. M.	Midnight.
24	37	32
32	42	32
27	47	38
40	46	40
34	32	24
23	42	38
34	61	52
7)214	7)307	7)256
30.6	43.8	36.5

Mean of a. m. observation 30.6
Mean of p. m. observation 43.8
Mean of midnight observation 36.5

72. In calculating the mean of the thermometer-readings at low temperatures, the following rule will be observed:

"When minus-readings occur, the difference between the sum of the positive and the sum of the negative numbers is to be taken. This difference, which is the TOTAL SUM, has the sign of the greater of the two partial sums, and will be divided by the TOTAL number of observations."

The quotient obtained by this division will be the mean sought.

The following are examples:

Example 1

	+ 70
	+ 50
	+ 20
	0
Sum of positive	+ 140
Sum of negative	0
Total sum	+ 140
Number of observations	4
Mean	+ 35

Example 2.

	+ 60
	+ 20
	0
	− 5
Sum of positive	+ 80
Sum of negative	− 5
Total sum	+ 75
Number of observations	4
Mean	+ 18.75

Example 3.

	+ 2
	— 5
	0
	+ 4
	— 7
	+ 5
	— 15
Sum of positive................	+ 11
Sum of negative................	— 27
Total sum.....................	— 16
Number of observations........	7
Mean	— 2.3

Example 4.

	— 5
	0
	0
	0
	0
	0
Sum of positive................	0
Sum of negative................	— 5
Total sum	— 5
Number of observations........	6
Mean	— 0.8

73. Form 23 is for use at stations designated for the display of cautionary signals, and will be filled up and forwarded weekly to this Office during the period signals are ordered. Under the head of "remarks" will be recorded the highest velocity reached by the wind during the time the signals were displayed.

74. Form 24 is the weekly report of the number of bulletins and maps issued at each station, and will be forwarded to this Office in the same envelope with the other regular weekly reports.

75. Form 25 is the one upon which all official telegrams to this Office must be written. As everything transmitted is charged for, unnecessary words must be avoided. The full date and time of filing message will be written *above* the upper heavy line, while only the name of the city and the day of the month will be written below it. The signature must contain only the surname of the sender and the word "observer." Only the matter written between the heavy lines is to be transmitted.

BOOKS OF REFERENCE AND RECORD.

76. The following books of reference and record will be furnished by this Office to each station:

For reference.—Guyot's Meteorological Tables; Buchan's Handy Book of Meteorology; Loomis's Treatise on Meteorology; Myer's Manual of Signals; Piddington's Horn-Book; Pope's Modern Practice of the Electric Telegraph; Annual Report of the Chief Signal-Officer for 1871; Practical Use of Meteorological Reports and Weather-Maps; Instructions to Observer-Sergeants, Signal-Service, United States Army; Smithsonian Directions for Meteorological Observations.

For records.—Journal; Daily Record of Observations; Record of Bulletins; Record of Letters Sent; Record of Letters Received; Original Record of Observations; Weather-Map of the United States.

77. In the journal will be entered, daily, all matters of interest not provided for in the various forms, such as meteoric and auroral displays, earthquakes and unusual atmospheric appearances and disturbances, giving in all cases, when possible, the time of beginning and duration of each. Especially will the observer enter a detailed account of the characteristic phenomena of every serious storm that passes over or near his station. In this book will also be noted the condition of the instruments, and when they are damaged, in any way, the cause will be stated. A monthly abstract of the entries in the journal will be forwarded to the Chief Signal-Officer within five days after the expiration of each month.

78. Observer-sergeants will be particular to note every display of aurora, seeking, by inquiry of others, if necessary, to make their record complete.

If the heavens are obscured by clouds so that the aurora, if present, cannot be observed, the word "obscured" will be entered in that part of the record devoted to auroral displays. If the sky is sufficiently clear for observation, the words "aurora" or "no aurora" will be entered according as one is visible or not. When observed, a full account of the phenomenon will be entered in the journal, showing the exact minute of beginning and ending of the aurora, and the principal phases of changes that it experiences. The following particulars should be especially noted: the azimuth and altitude of each extremity and of the crown of any arch of light and the same data for any corona or glory that may be formed.

When the observer is familiar with the names of the principal fixed stars, he may locate the arch or crown by reference to them; but it is preferable that he should observe directly the altitude and azimuth.

Altitudes are expressed by degrees from the horizon to the zenith. If any circle be divided into 360° parts, and radial lines connect these parts with the center, each pair of lines subtend an angle of one degree; the fourth part of the circle will subtend an angle of ninety degrees, or one right angle, and the corresponding radii are perpendicular to each other. Thus, the zenith (that point in the heavens immediately above the observer) is ninety degrees from the horizon, or, in other words, its altitude is ninety degrees.

A point half way up from the horizon to the zenith has an altitude of forty-five degrees.

Azimuths are also expressed in degrees, but are measured on the horizontal plane, and will be recorded as is done in astronomy, from the south point to the westward, passing successively the west, north, and east points of compass until 360° have been passed over and the south point is again reached.

Observers must be particular as to the date of the aurora, and when it begins in the evening of one day and continues into the early morning of the next day it will be entered as occurring on the *first* day; but its details will be given in the record as occurring between the hours of its actual beginning and ending. Thus, an aurora that began on the evening of the 12th of January, and continued until the early morning of the 13th, would be entered as the aurora of the 12th, but its details would be recorded as occurring, for instance, between the hours of 10 p. m. of January 12 and 2 a. m. of January 13.

All entries in the journal of occurrences and observations of any one day will be made under or opposite to that day, and not be entered as a subsequent date as is frequently done. For example; an auroral display occurring May 23, should be entered opposite that date, and not referred to on the 24th, as having occurred "last evening."

Observers must pay particular attention to accuracy in the use of the terms "morning" and "evening," and will be governed by the following instructions in reference to them:

Midnight is the moment 12h. 00m. 00s., and is the beginning or first moment of the new day, and should receive the date of that day. Thus, whatever happened in the afternoon of June 10, at 11*h*. 59*m*. 59*s*., happened at 11h. 59m. 59s. p. m. June 10; whatever happened one second later was at midnight of June 10 and 11; and at one second later still, at 12*h*. 00*m*. 01*s*. a. m. of June 11; at midday of same date whatever happened at 11*h*. 59*m*. 59*s*., happened at 11h. 59*m*. 59*s*. a. m. June 11; at one second later it was noon June 11; at one second later still it was 12*h*. 00*m*. 01*s*. p. m. June 11.

79. The daily record of observations will be an exact copy of Form 4, and filled up in the same manner. The several series of observations can be entered in the same book, care being taken to date and time them properly. The telegraphic series may be entered in the beginning of the book, and the local series at the end, while the midday reports may follow either of the two.

80. The record of bulletins will be filled up regularly from the daily bulletins, of which it is a copy.

81. In the books of letters sent and letters received will be entered all letters sent, and an abstract of all those received relating to the official business of the station. The original letters received will be properly briefed and numbered, and filed away for reference. The numbers used will correspond with those in the letter-book.

82. The large weather-map of the United States will be hung up in the principal room of the board of trade or chamber of commerce, or both, and the state of the weather throughout the United States will be shown upon it in the manner already described, as soon after the receipt of the morning report as is practicable.

83. All books of reference and record must have the *name* of the station to which they belong plainly written on the fly-leaf.

GENERAL INSTRUCTIONS.

84. Each observer in charge of a station will, as soon as practicable after arriving at his station, make arrangements with some competent person to perform his duties in case of sickness or disability. The person so selected must be carefully instructed in the use and care of the several instruments, in the manner of taking the observations, of making out and forwarding the weather reports sent from the station, and the proper disposition of those received from other stations. His name and regular post-office address will be reported to this Office as soon as the selection is made. The employment of this assistant will be temporary only, and he will be paid at the end of each month in which the services were rendered, at the rate of compensation fixed by the Chief Signal-Officer, on forwarding the proper vouchers to this Office, with a certificate from the observer-sergeant stating the number of days employed, with the dates in each case.

85. In case of sickness or disability rendering an observer or assistant observer incapable of performing his duties, the observer in charge will report the fact by telegraph to the Chief Signal-Officer, and will forward by mail the certificate of his attending physician.

86. At stations where there is no medical officer, a resident practitioner will be employed, whose account, made out in duplicate, on the form given below, together with the prescriptions when medicines have been required, will be transmitted for payment to the Surgeon-General of the Army, through the office of the Chief Signal-Officer, Washington, D. C.

Bills for articles of food, or diet of any kind, liquors, wines, mineral waters, patent or proprietary medicines; instruments or appliances, such as syringes, trusses, or suspensory bandages, will not be allowed by the Medical Department.

When the services of a nurse are necessary, a separate bill for the nursing will be made and certified in the same manner as that for medical attendance.

The UNITED STATES,

To ——— ———, M. D., DR.

For medical attendance furnished to ——— ———, suffering from ——— at ——— from ——— to ———.. $———

For medicines as per accompanying prescriptions .... $———

I certify that the above account is correct and just; that the services were rendered as stated and were necessary; and that the charges do not exceed those customary at this place.

——— ———, *M. D.*

Subscribed and sworn to before me, this ——— day of ———, 187—

——— ———

——— ———

I certify that the above account is correct and just; that the services were rendered as stated, and were necessary; that I was on duty at ———, and could not secure attendance from a medical officer of the Army.

——— ———

Observer-Sergeant, Signal Service, U. S. A.

Sworn to and subscribed before me, this ——— day of ———, 187—

——— ———

——— ———

Approved:

——— ———,

Brigadier-General and Chief Signal-Officer of the Army.

When the attendance has been to an assistant, the form will be altered accordingly, and the account forwarded through the sergeant in charge, who will indorse his remarks upon it, and inclose in letter of transmittal to this Office.

87. At stations where there is a medical officer of the Army on duty, observers will be duly notified, and provided with authority to call on him for medical assistance. When medicines are not furnished directly by the medical department, but through a druggist, on the prescription of a medical officer, and the bill of the druggist is presented to the patient, that bill in duplicate, approved by the medical officer and receipted, will be attached to an account made out in the name of the patient, the above form being altered according to the facts, and the only sworn certificate necessary being that of the patient.

88. At all stations where there is a private soldier on duty as assistant, the observer-sergeant in charge will give especial attention to his instruction in the theory, as well as in the practice, of meteorology, signalling, and telegraphy.

In order that this may be properly done, the sergeant will require his assistant to give a recitation each week from one of the following-named text-books, going through them in the order given: Loomis's Treatise on Meteorology; Myer's Manual of Signals; Pope's Modern Practice of the Electric Telegraph, until satisfied that the subject is thoroughly understood, or that the assistant is wanting in capacity to understand it.

The ordinary station work will be fully explained, and the reasons for each instrumental correction given in detail. A brief weekly report will be made to this Office, showing the nature of the instruction given and progress made during that period.

This duty must be carefully and faithfully performed, in order that worthy men may receive the promotion due them, and unworthy ones be disposed of.

No application from assistant observers for promotion to the grade of sergeant will be favorably considered until this course of instruction has been completed in a satisfactory manner, and is so reported by the observer in charge.

The instruction will extend through the work on meteorology; to page 96 of the Manual of Signals, and to page 72 of the work on telegraphy.

89. In the absence of serious special reasons or exigencies of the service, no applications for examination before the board of examiners at this Office for promotion to the grade of sergeant will be favorably considered, except when made by enlisted men of the Signal-Service Detachment, United States Army, who shall have performed satisfactorily the duty of assistant to an observer-sergeant on station, or similar duty at this Office, for a period of six months. Such applications, by men on duty as assistants, must be made in writing, through the observer-sergeant in charge of station, (who will in all cases indorse his report of the character, habits, and ability of the applicant,) and will be acted upon by the board when vacancies exist in the authorized number of observer-sergeants.

90. The publication of the Government weather-reports by newspapers must be done without expense to the United States.

91. Observers will select such places for posting the daily weather bulletins and maps as will insure their widest publicity at all hours of the day or night, and will report the names and locations of the places thus selected to the Chief Signal-Officer. At the same time, they will report the location of their own offices, giving name of street and number. This information will also be furnished to the manager of the telegraph-office charged with the transmission and receipt of the reports.

92. Observers must not make use of the telegraph in communicating with the central office in Washington, except in cases of the utmost importance. Where the use of the telegraph is considered unnecessary by the Chief Signal-Officer, the cost of the telegram will be charged against the observer sending it.

93. Communications to this Office on official business will be written on the official size of letter-paper, inclosed in an official envelope, and directed to "The Chief Signal-Officer of the Army, Washington, D. C." The words "official business" will be written on the right-hand upper corner of the envelope. Letters thus addressed and indorsed are free of postage.

94. Half sheets of paper will be used in all cases in which letters are completed on the first page. When more than one page is required, a whole sheet will be used.

95. Communications written on letter-paper will be folded in three equal folds; on fools-cap or legal-cap paper, in four equal folds, parallel with the ruling. Observers must not brief any official letter to this Office, and must give the full names of all persons referred to.

96. All official communications received by observers, wherever serving, from parties not connected with the signal-service, will be immediately referred to this Office for such action as may be considered necessary.

97. No reports or letters containing information in reference to the signal-service will be made or sent to any person or persons by observers on station until such reports or letters have been submitted to and approved by the Chief Signal-Officer.

98. Observer-sergeants will comply with the Regulations of the Army, and wear their uniform-coat buttoned up while on duty. They are required to be especially neat and careful in their dress; and any negligence in this particular coming to the knowledge of the Chief Signal-Officer will be considered sufficient cause for the reduction of the offender to the rank of a private soldier.

99. Observer-sergeants will not comprise in the same communication matters relating to their meteorological observations and general details of duty with those relating to property received or disposed of, commutation or pay vouchers, bills, or any other particular involving money or property accountability.

Letters of transmittal, application, or explanation, under these two general heads, must be written on separate sheets of paper, but may be sent in the same envelope as a matter of economy.

100. Observers will give close attention to the observation and record of all local premonitory signs of storms or changes of weather, and report them promptly to this Office. The following points should be particularly noted: Direction and force of the wind; kind, direction, motion, and appearance of the clouds; action of the barometer and thermometer before, during, and after a storm or change of weather, and such other purely local causes as appear to influence the results.

101. The attention of observer-sergeants is directed to the fact that they are required to make their reports absolutely correct, and that any shortcoming in this respect renders them liable to punishment. Aside from this, it should be kept constantly in mind that a single incorrect report may cause the loss of life and property to an unknown amount, and all reports must be made with this responsibility clearly in view. Whenever an observer is unable, from any cause, to get in his report, properly corrected, at the regular hours of report, he will *not* send the uncorrected portion, but will write the word "blank" in each of the spaces that would otherwise have been occupied by this portion of the report. Observers will *never* send any report or part of report which they have reason to believe is incorrect, and will bear in mind that it is safer and more in accordance with instructions to omit a report than to make a false one.

102. In the event of one or more instruments at a station becoming disabled and unfit for use, observers will fill up the space or spaces in the different forms intended for the readings of such instruments with the word "blank," until they are repaired or replaced. If the instruments cannot be properly repaired at the station, the observer will at once notify this Office.

103. Observers are expected and required to improve themselves in the duties of their position, and are liable at any time after one year's service to be called before a board for their second regular enamination.

104. On the first days of January and July (or within ten days thereafter) of each year, every observer-sergeant in charge of a station will make out and forward to this Office a concise statement of the operation of his station for the preceding six months. This statement must show the changes (if any) that have been made, and the number of reports received, during that period, with the reason for such changes when known. It will also show the amount of public interest taken in the service, and the classes of citizens deriving the greatest amount of benefit from the reports. If any marked advantages to commercial or other interests have been derived from the use of the reports or display of cautionary signals, the facts in each instance will be briefly set forth.

105. Observers in charge of stations will mail, on Saturday of each week, a copy of that morning's issue of every daily newspaper published at their stations, which contain the weather reports in any form.

106. All applications from observer-sergeants or assistant observers of the signal-service,

U. S. A., for furloughs, or official privileges of any description, must be made directly to the Chief Signal Officer of the Army.

In cases of urgent necessity such application may be made by telegraph, but in all ordinary cases will be in writing, and forwarded by mail.

107. All communications to this Office from an assistant observer must be forwarded through and indorsed by the observer-sergeant in charge of the station at which he is serving.

PROPERTY.

108. Blank forms entitled "Report of signal-service property," will be furnished to each observer for making out a quarterly report of the property at his station, which report will be rendered at the expiration of the quarters ending, respectively, March 31, June 30, September 30, and December 31, of each year.

This report will be filled out in the following manner: All property received from this Office, and purchased at the station by proper authority from this Office, will be entered on the line containing the words "Total during quarter."

109. Bills for all properly authorized purchases must be forwarded to this Office so as to reach it as near the first day of each month as is practicable.

On the line headed "Issued and expended during the quarter," will be entered in the proper columns the total expenditures of forms, stationery, &c., consumed in performing the regular duties of the station during the quarter, with such articles as may have been returned to this Office. These will be deducted from the amounts in the line beginning "Total during quarter," and the remainders brought down and entered on the line "Total on hand to be accounted for," which completes the *first* report from any station.

Each quarterly report will be made in duplicate, one copy to be transmitted to this Office within ten days after the expiration of the quarter, and the other retained by the observer making it out, to enable him to bring forward for next report the "Total on hand to be accounted for," which will be entered in the next report as "On hand from last report."

No article will be entered in this report that is not invoiced from this Office.

Every article taken up on this report must be entered under its proper heading, as the misplacement of a single figure may occasion serious difficulty. Before the report is sent in the two copies should be carefully compared in order that they may be made to correspond exactly with each other.

110. When an observer is relieved from the charge of a station, he will turn over, on proper invoices, to his successor all property and stores for which he is officially responsible, and will take duplicate receipts therefor, one copy of which he will retain, and forward the other to this Office with a final report, on the regular form, of the property for which he was accountable, at the date of his relief, made out in precisely the same manner as the regular quarterly report.

One copy of the invoice of property so transferred will be forwarded to this Office by the observer taking charge.

111. When public property is receipted for by an observer he will make a careful examination of it, and forward a written report of the result of such examination to this Office.

112. Whenever any article of office furniture, stationery, &c., is purchased by an observer, under proper authority from this Office, it will be entered in a copy of Form 6 as "Received by purchase," with the name of the party furnishing it, and a memorandum bill of the price paid or to be paid, and forwarded to this Office, properly dated and signed, by mail on the day of purchase.

113. Authority must be obtained from this Office for making all repairs and purchases at stations, except those enumerated in paragraph 119 of these instructions, and all applications for such authority must set forth the necessity for the expenditure, and state the estimated amount.

114. No public property will be used or labor employed by observers for any purpose whatever, without special authority from this Office.

115. When any article of public property, not of an expendable nature, for which an observer is responsible, becomes unfit for service, from any cause whatever, he will report the facts in the case to this Office, but will not drop such article from his returns until authorized to do so.

116. Observers will endeavor, by timely repairs, to keep all property for which they are responsible in serviceable condition, and necessary funds for this purpose will be provided, upon satisfactory requisition and estimates forwarded to the property and disbursing officer.

117. If any article of public property be lost or damaged, through the neglect or fault of any observer or assistant, the money value thereof will be stopped against his monthly pay.

118. A rigid economy must be practiced by all observers in the expenses of their several stations, and all irregularities and extravagances will be promptly corrected by charging all excesses to the observers at fault.

119. The following articles will be allowed at each station, and may be purchased at the p ces named, by each observer, without other authority:

One room for the performance of his duties will be rented by the month, at each station, but no more than eighteen dollars per month will be paid therefor without special authority from this Office: one desk, (price not to exceed $20;) one table, with drawers, (stained pine and not to exceed $6;) one wash-stand, (at a price not exceeding $2;) four chairs, (not to exceed $2.25 each;) one stove, with pipe, (not to exceed $25;) one coal-scuttle; one fire shovel; one water-bucket; one cup or dipper; one goblet; one basin; one large lamp; one oil-can; one dust-pan and brush; one broom; two common spittoons; one lantern. The above-mentioned articles must be of a cheap, plain, and substantial kind. Memorandum bills (unreceipted) for rent, labor, and purchases will be sent to this Office as soon as presented, and will be settled at the earliest opportunity.

120. Memorandum bills for labor and for articles purchased must be sent in separately.

121. Fuel will be purchased for heating office, by each observer, at the current market rates, and bills forwarded to this Office for settlement. The cost of carrying coal and other fuel to the observer's office will be included in the price of the fuel, and not charged as a separate item.

122. The pay and allowances of observer-sergeants and enlisted men serving as assistant observers, are obtained from three different sources, and will be drawn through the property and disbursing officer of the Signal Service, United States Army; at the end of each month, on the receipt at this Office of the following blanks, signed in duplicate:

1st. Form 5—Pay Department.

FORM 5.

The UNITED STATES,

To JOHN THOMPSON, DR.

	Dollars.	Cents.
For pay from 1st of ——, 187 , to —— of ——, 187 , being —— months, —— days, at —— dollars per month................		
Amount		
Deduct for Army Asylum .... $——		
Due United States for clothing overdrawn............ ——		
Due United States for tobacco........................ ——		
Balance		

Received of —— ——, paymaster United States Army, this —— day of ——, 187 , —— $\frac{}{100}$ dollars, in full of the above account, by check No. ——, on ——, United States Treasurer, ——, this date, for $——.

JOHN THOMPSON,
Sergeant Signal Service, United States Army.

(Signed in duplicate.)

This payment accords with the soldier's descriptive list, and is noted thereon.

—— ——,
Paymaster, United States Army.

2d. Form Y—Commissary Department.

(FORM Y.)

The UNITED STATES,

To JOHN THOMPSON, *Sergeant Signal Service, U. S. A.*, DR.

	Dollars.	Cents.
For commutation of rations while on extra duty as ——, at ——, from —— to ——. 187 , inclusive, —— days, at 75 cents per day.....		

I certify that the above account is correct and just; that the commutation was made by order of the Secretary of War, and was necessary for the public service, there being no opportunity for messing.

Received at ——, this day of ——, 187 , from ——, C. S., United States Army, the sum of —— dollars and —— cents, in full of the above account.

JOHN THOMPSON,
Sergeant Signal Service, U. S. A.

(Signed in duplicate.)

3d. Signal Service receipt-roll—Quartermaster's Department.

(Voucher to Abstract B.)

We, the subscribers, do hereby acknowledge to have received of —— ——, Quartermaster, —— U. S. Army, the sums set opposite our names, respectively, being in full of our extra-duty pay and allowances for commutation of quarters and fuel for the periods herein expressed, while stationed at ——.

Date of payment.	Names.	Rank.	Occupation.	Period of service.				Extra duty.			Quarters.				Fuel.				Total amount received.		Signatures.	Witnesses.
				From—	To—	Months.	Days.	Cents per day.	Amount.		Rate per month.		Amount.		Rate per month.		Amount.					
									Dolls.	Cts.	Dolls.	Cts.	Dolls.	Cts.	Dolls.	Cts.	Dols.	Cts.	Dolls.	Cts.		
	John Thompson	Sergeant																			John Thompson	
	Henry Smith ..	Private .																			Henry Smith...	
Total..																						

I certify that the above roll is correct; that the enlisted men therein named have been regularly on duty at ——, during the time charged for; that they have not been furnished with quarters or fuel by the public, or received a commutation of money in lieu thereof, and that the services are borne on my Form 3 for the month of ——, 187 .

(Signed in duplicate.)

—— ——

—— ——

These vouchers will be signed by observers and their assistants exactly as shown in the above illustrations.

123. *No part of the body or receipt of either form will be filled up before transmission*, and they must be forwarded direct to this Office at such time as will insure their receipt by the property officer by the 25th of each month.

124. Observers will not be allowed to sell or otherwise dispose of any of the above-mentioned accounts, nor will they be permitted to draw upon this Office, or any of the officers connected therewith, without special authority.

125. The following tables show the amount of monthly pay to be received by observers and their assistants, for the different years of service, and the sources from which it is received:

Estimate of monthly pay proper and commutation of clothing.

Year.	Pay proper.	Clothing.	Total.	Stoppages.	Average pay per month.
SERGEANTS.					
First	$17 00	$4 14	$21 14	$0 12½	$21 02
Second	17 00	2 36	19 36	12½	19 24
Third	18 00	3 28	21 28	12½	21 16
Fourth	19 00	2 36	21 36	12½	21 24
Fifth	20 00	2 94	22 94	12½	22 82
PRIVATES.					
First	13 00	4 08	17 08	1 12½	15 96
Second	13 00	2 34	15 34	1 12½	14 22
Third	14 00	3 23	16 23	1 12½	16 11
Fourth	15 00	2 34	17 34	1 12½	16 22
Fifth	16 00	2 90	18 90	1 12½	17 78

One dollar per month from pay of third year, two dollars per month from pay of fourth year, and three dollars per month from pay of fifth year will be considered as retained pay, and will not be paid until final discharge from the service, and will be forfeited unless the soldier shall have served faithfully to date of discharge.

Monthly estimate of quartermaster.

No. of days in the month.	Fuel—rate per month.	Quarters—rate.	Extra pay—rates.	Total.
28	$8 00	$10 00	$10 15	$28 15
30	8 00	10 00	10 50	28 50
31	8 00	10 00	10 85	28 85

Assistants are not allowed extra-duty pay.

Monthly estimate of commutation of rations.

No. of days in the month.	Rate per day.	Total.
28	$0 75	$21 00
30	75	22 50
31	75	23 25

Estimate of monthly pay of sergeants (observers) and privates, (assistants.)

SERGEANTS.—FIRST YEAR.

No. of days in the month.	Pay proper.	Quartermaster's Dept. pay.	Commissary pay.	Amount of pay received monthly.
28	$17 00	$28 15	$21 00	$66 15
30	17 00	28 50	22 50	68 00
31	17 00	28 85	23 25	69 10

SECOND YEAR.

28	17 00	28 15	21 00	66 15
30	17 00	28 50	22 50	68 00
31	17 00	28 85	23 25	69 10

THIRD YEAR.

28	18 00	28 15	21 00	67 15
30	18 00	28 50	22 50	69 00
31	18 00	28 85	23 25	70 10

One dollar per month retained until discharged.

FOURTH YEAR.

28	19 00	28 15	21 00	68 15
30	19 00	28 50	22 50	70 00
31	19 00	28 85	23 25	71 10

Two dollars per month retained until discharged.

FIFTH YEAR.

28	20 00	28 15	21 00	69 15
30	20 00	28 50	22 50	71 00
31	20 00	28 85	23 25	72 10

Three dollars per month retained until discharged.

PRIVATES.—FIRST YEAR.

28	13 00	18 00	21 00	52 00
30	13 00	18 00	22 50	53 50
31	13 00	18 00	23 25	54 25

Estimate of monthly pay—Continued.

SECOND YEAR.

No. of days in the month.	Pay proper.	Quartermaster's Dept., pay.	Commissary pay.	Amount of pay received monthly.
28	$13 00	$18 00	$21 00	$52 00
30	13 00	18 00	22 50	53 50
31	13 00	18 00	23 25	54 25

THIRD YEAR.

28	14 00	18 00	21 00	53 00
30	14 00	18 00	22 50	54 50
21	14 00	18 00	23 25	55 25

One dollar per month retained until discharged.

FOURTH YEAR.

28	15 00	18 00	21.00	54 00
30	15 00	18 00	22 50	55 50
31	15 00	18 00	23 25	56 25

Two dollars per month retained until discharged.

FIFTH YEAR.

28	16 00	18 00	21 00	55 00
30	16 00	18 00	22 50	56 50
31	16 00	18 00	23 25	57 25

Three dollars per month retained until discharged.

Clothing allowance per month.

	1st year.	2d year.	3d year.	4th year.	5th year.	Total allowance for five years.
Sergeants	$4 14	$2 36	$3 28	$2 36	$2 94	$180 96
Privates	4 08	2 34	3 23	2 34	2 90	178 68

But no clothing allowance will be paid the soldier except on "final statements." When clothing is drawn, if the allowance is exceeded it will be settled by the soldier on the 30th June and 31st December of each year.

In addition to the above rates of pay, enlisted men will receive the usual allowance for first, second, third, and fourth re-enlistments.

126 All useless and broken instruments will be forwarded to this Office by mail, carefully packed.

127. Timely requisition will be made upon the property-officer for books of record, stationery, forms, &c., to insure their receipt before the supply on hand is exhausted.

128. Requisitions for forms and stationery will be made quarterly by mail, and will embrace all the different varieties required for use at stations.

SPECIAL INSTRUCTIONS.

In case of actual or anticipated neglect or refusal on the part of the employés of any telegraph company by which he is directed to transmit telegraphic communications, at the time and in the manner stated in the orders of the Chief Signal-Officer to the observer in charge of a station, then in force, he will proceed as follows:

1. He will prepare every telegraphic communication according to his instructions, and present each, at the time designated, at the proper office of the company for the reception of such communications. He will continue to present all reports, as to the regular tender of which the company has once been advised, until it has been notified by this Office that such tender will cease after a certain date, of which notice the observer will be informed.

2. He will, in advance of the presentation of all telegraphic communications, give specific notice to the company, during its usual hours of business, that an official communication of a certain-mentioned character, from the observer, addressed to a certain official person or persons, (the address to be specified,) will, at a certain subsequent hour, (stating what hour,) be presented at the office of the company for telegraphic transmission. This notice will provide for every regular report to be made during the ensuing twenty-four hours, and also will be given in advance of any special communication when practicable. Such notice will be in writing, addressed to the local manager of the company, and will be delivered, open, to the officer or employé of the company who may be in charge of the local office at the time of delivery. The written notice will be signed in duplicate by the observer, and one copy filed and retained by him. The following general form will be observed:

"SIGNAL-SERVICE, UNITED STATES ARMY,
"*Observer's Office,* ———, ———, 187 .

"To ——— ———
"*Manager of the* ——— *Telegraph Company, at* ———.

"SIR: As an agent of the War Department for the purpose of taking meteorological observations, in pursuance of the laws of the United States, and of preparing telegraphic communications relating thereto, and of presenting the same for transmission to telegraph companies, I have the honor to give notice hereby that, in accordance with orders received by me to that effect, I will present at the office of the above-mentioned telegraph company at this place, severally, at the times hereinafter mentioned, certain official communications from myself, in my official capacity, and addressed as specified, viz:

"One communication will be presented at ——— o'clock — minutes — m. of ——— the ——— day of ———, 1872, addressed to ——— ———

"One communication will be presented at ——— o'clock — minutes — m. of ——— the ——— day of ———, 1872, addressed to ——— ———

"One communication will be presented at ——— o'clock — minutes — m. of ——— the ——— day of ———, 1872, addressed to ——— ——— .

"I have the honor to request that the communications above referred to may be received and transmitted telegraphically by the said company to their respective addresses at the times above mentioned, at which they will severally be presented for that purpose.

"I am, sir, respectfully yours,

"——— ———
"*Observer-Sergeant, Signal Service, U. S. A.*"

He will also record the time, place, and person, when, where, and to whom he delivered such notice, and reduce to writing any oral reply made or action taken. The record must be dated, timed, and made, plainly written, immediately after the service of the notice.

3. He will present his regular reports for transmission at the times, and as directed in his schedule, at the telegraph offices, until further orders, whether or not the company has any employés then present whose usual duty it is to receive them. If the office is open for his admission, although closed for the transmission of messages, the communication should be presented to the most responsible person present in the employ of the company, a copy being always retained, and record made as above directed. If the office appears to be closed, he will make himself sure of the fact that it is so.

In writing the message for transmission the observer will not use any form imposing terms or the limitations of a contract, but will write the communications tendered on the form directed by this Office.

4. He will keep a written record of the time when, place where, and the name of person employed by the company, to whom each communication was presented. In case the office was closed, so that the communication could not be presented to any employé of the company he will record the time and place with the fact. If any employé of any telegraph company refuses to receive the message presented to him, it will be sufficient to have made the tender, and to preserve such record as will establish the fact that it was made. The records, in all cases, must be dated and timed, and must be made, plainly written, immediately after the tender of the message. It should rehearse all facts which may tend to keep his memory of the transaction complete.

It is desirable, though not essential, that on some of the occasions when the above-mentioned notice is delivered, as well as when the message is tendered, the observer should, if practicable, take with him another person, wholly disinterested, who may serve as an additional witness of the transaction.

Should the officer or employé in charge of the telegraph office inform the observer generally that he will not in future be admitted to the office at all, he will not, on that account, discontinue giving notice or making tenders, but will give and make, or attempt to give and make, them precisely as before.

AN ACT to aid in the construction of telegraph lines, and to secure to the Government the use of the same for postal, military, and other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That any telegraph company now organized, or which may hereafter be organized, under the laws of any State in this Union, shall have the right to construct, maintain, and operate lines of telegraph through and over any portion of the public domain of the United States, over and along any of the military or post roads of the United States which have been or may hereafter be declared such by act of Congress, and over, under, or across the navigable streams or waters of the United States: *Provided*, That such lines of telegraph shall be so constructed and maintained as not to obstruct the navigation of such streams and waters, or interfere with the ordinary travel on such military or post roads. And any of said companies shall have the right to take and use from such public lands the necessary stone, timber, and other materials for its posts, piers, stations, and other needful uses in the construction, maintenance, and operation of said lines of telegraph, and may pre-empt and use such portion of the unoccupied public lands subject to pre-emption through which its said lines of telegraph may be located as may be necessary for its stations, not exceeding forty acres for each station; but such stations shall not be within fifteen miles of each other.

SEC. 2. *And be it further enacted*, That telegraphic communications between the several departments of the Government of the United States and their officers and agents shall, in their transmission over the lines of any of said companies, have priority over all other business, and shall be sent at rates to be annually fixed by the Postmaster-General.

SEC. 3. *And be it further enacted*, That the rights and privileges hereby granted shall not be transferred by any company acting under this act to any other corporation, association, or person: *Provided, however*, That the United States may at any time after the expiration of five years from the date of the passage of this act, for postal, military, or other purposes, purchase all the telegraph lines, property, and effects of any or all of said companies at an appraised value, to be ascertained by five competent, disinterested persons, two of whom shall be selected by the Postmaster-General of the United States, two by the company interested, and one by the four so previously selected.

SEC. 4. *And be it further enacted*, That before any telegraph company shall exercise any of the powers or privileges conferred by this act, such company shall file their written acceptance with the Postmaster-General of the restrictions and obligations required by this act.

Approved July 24, 1866.

[PUBLIC RESOLUTION—NO. 9.]

JOINT RESOLUTION to authorize the Secretary of War to provide for taking meteorological observations at the military stations and other points in the interior of the continent, and for giving notice on the northern lakes and sea-board of the approach and force of storms.

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he hereby is, authorized and required to provide for taking meteorological observations at the military stations in the interior of the continent, and at other points in the States and Territories of the United States, and for giving notice on the northern lakes and on the sea-coast, by magnetic telegraph and marine signals, of the approach and force of storms.

Approved February 9, 1870.

[General Orders No. 18.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF SIGNAL-OFFICER,
Washington, D. C., July 3, 1872.

The following order of the Secretary of War, having been received by the Chief Signal Officer of the Army, is published for the information of all concerned:

"WAR DEPARTMENT,
"*Washington City, June* 27, 1872.

"The Chief Signal-Officer of the Army is hereby directed and ordered to carry into effect the special duties imposed upon the Secretary of War by the act of Congress approved July 24, 1866, entitled 'An act to aid in the construction of telegraph lines and to secure to the Government the use of the same for postal, military, and other purposes,' and by the public resolution No. 9, approved February 9, 1870, and entitled 'Joint Resolution to authorize the Secretary of War to provide for taking meteorological observations at the military stations and other points in the interior of the continent, and for giving notice on the northern lakes and sea-board of the approach and force of storms,' and by the act approved June 10, 1872, entitled 'An act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1873, and for other purposes;' and the said Chief Signal-Officer of the Army, and all such persons as have been or shall be designated and employed by him for the taking of meteorological observations, or for preparing or presenting telegraphic communications for transmission, or for transmitting the same, are hereby recognized and appointed as agents of the War Department, for those purposes, and are hereby authorized and directed by and in behalf of said Department to offer to any telegraph company in the United States, for transmission, any and all such telegraph communications as they may be required by the Chief Signal-Officer to make, and to request the transmission thereof by such company or companies, at such times, and in such places, as may be directed by said officer.

"WM. W. BELKNAP,
"*Secretary of War.*"

By order of the Chief Signal-Officer of the Army:

GARRICK MALLERY,
Capt. and Brevet Lieut. Col., U. S. A.,
Acting Signal-Officer and Assistant.

AN ACT making appropriations for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and seventy-three, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated for the objects hereinafter expressed, for the fiscal year ending June thirtieth, eighteen hundred and seventy-three, viz:

* * * * * * *

UNDER THE WAR DEPARTMENT.

* * * * * * *

SIGNAL-OFFICE.

For manufacture, purchase, or repair of meteorological and other necessary instruments; for telegraphing reports; for expenses of storm-signals announcing probable approach and force of storms throughout the United States, for the benefit of commerce and agriculture; for instrument-shelters; for hire, furniture, and expenses of offices maintained for public use in cities or posts receiving reports; for maps and bulletins, to be displayed in chambers of commerce and boards of trade rooms; for books and stationery; and for incidental expenses not otherwise provided for, two hundred and fifty thousand dollars: *Provided*, That the Secretary of War be, and he hereby is, authorized and required to provide, in the system of observations and reports in charge of the Chief Signal-Officer of the Army, for such stations, reports, and signals as may be found necessary for the benefit of agriculture and commercial interests: *And provided*, That no part of this appropriation, nor of any appropriation for the several Departments of the Government, shall be paid to any telegraphic company which shall neglect or refuse to transmit telegraphic communications between said Departments, their officers, agents, or employés, under the provisions of the second section of chapter two hundred and thirty of the statutes of the United States for the year eighteen hundred and sixty-six, and at rates of compensation therefor to be established by the Postmaster-General: *Provided also*, That whenever any telegraphic company shall have filed its written acceptance with the Postmaster-General, of the restrictions and obligations required by the act approved July twenty-fourth, eighteen hundred and sixty-six, entitled "An act to aid the construction of telegraph lines, and to secure to the Government the use of the same for postal, military, and other purposes," if such company, its agents or employés shall hereafter refuse or neglect to transmit any such telegraphic communications as are provided for by the aforesaid act, or by the joint resolution approved the ninth day of February, eighteen hundred and seventy, "To authorize the Secretary of War to provide for taking meteorological observations at the military stations and other points of the interior of the continent, and for giving notice on the northern lakes and sea-board of the approach and force of storms," such telegraphic company shall forfeit and pay to the United

States not less than one hundred and not exceeding one thousand dollars for each refusal or neglect aforesaid, to be recovered by an action or actions at law, in any district court of the United States

Approved June 10, 1872.

NOTE.—In preparing these instructions free use has been made of the Smithsonian "Directions for Meteorological Observers," of those issued by the Surgeon-General of the Army, and of Colonel Williamson's valuable work on the barometer.

PAPER C.

CIPHER USED FOR THE TELEGRAPHIC TRANSMISSION OF THE WEATHER-REPORTS OF THE SIGNAL SERVICE, UNITED STATES ARMY, PREPARED UNDER THE DIRECTION OF THE CHIEF SIGNAL-OFFICER OF THE ARMY.

INSTRUCTIONS.

Each regular report will consist of ten words arranged in two lines of *five* words each.

At all stations designated by this Office as *river* stations, the *afternoon* report will consist of twelve words arranged in two lines of *six* words each, the last word in first line being river, and the last word in second line indicating the change in past twenty-four hours.

In filling up the form of report for telegraphic transmission, the first space of first line will be used for *name of station*, the second for *date* and *time* of report, the third for barometer, the fourth for thermometer, and the fifth for the humidity.

In the second line the first space will be used for state of weather, the second for velocity of wind, third for upper clouds, the fourth for lower clouds, and the fifth for the rain-fall.

The cipher words must in all cases be written plainly and correctly. The word *blank* will be used in all cases when no observation is taken.

EXAMPLE.

REGULAR REPORT.

Mount.	Cake.	Florid.	Throng.	Beast.
Caspian.	Relic.	Hidden.	Three.	Abase.

TRANSLATION.

Station	Mount Washington.	Weather	Cloudy.
Date	2d.	Direction of wind	Northwest.
Time	Morning report.	Velocity of wind	47 miles.
Barometer	30.07.	Upper cloud	Hidden.
Thermometer	19°.	Lower cloud	Foggy.
Humidity	.35.	Rain-fall	.01.

EXAMPLE.

RIVER REPORT.

Orleans.	Gay.	Folks.	Trial.	By.	River.
Burns.	Rancho.	Hidden.	Ten.	Append.	Hang.

TRANSLATION.

Station	New Orleans.	Direction of wind	Southeast.
Date	12th.	Velocity of wind	8 miles.
Time	Afternoon report.	Upper cloud	Hidden.
Barometer	30.19.	Lower cloud	Sky covered.
Thermometer	74°.	Rain-fall	.88.
Humidity	100.	River	9 inches rise.
Weather	Heavy rain.		

LIST OF STATIONS.

TELEGRAPHIC DESIGNATION.

All additional stations will be designated by their proper names unless otherwise ordered.

Albany.
Augusta.
Baltimore.
Benton, (Fort Benton.)
Boston.
Buffalo.
Burlington.
Cairo.
Charleston.
Cheyenne.
Chicago.
Cincinnati.
Cleveland.
Corinne.
Davenport.
Denver.
Detroit.
Diego, (San Diego, Cal.)
Dover, (Port Dover, Ont.)
Du Luth.
Escanaba.
Francisco, (San Francisco.)
Galveston.
Haven, (Grand Haven.)
Indianapolis.
Indianola.
Jacksonville.
Keokuk.
Keys, (Key West.)
Kingston.
Knoxville.
Lake, (Lake City.)
Leavenworth.
London, (New London.)
Louisville.
Lynchburgh.
Marks, (Saint Marks, Fla.)
Marquette.
May, (Cape May.)
Memphis.
Milwaukee.
Mobile.
Montgomery.
Montreal.
Mount, (Mt. Washington.)
Nashville.
Norfolk.
Omaha.
Oregon, (Portland, Oregon.)
Orleans, (New Orleans.)
Oswego.
Paul, (Saint Paul.)
Pembina.
Philadelphia.
Pittsburgh.
Portland.
Rassa, (Punta Rassa.)
Rochester.
Saint, (Saint Louis.)
Santa, (Santa Fé.)
Saugeen.
Savannah.
Shreveport.
Stanley, (Pt. Stanley, Ont.)
Sully, (Ft. Sully, Dakota.)
Toledo.
Toronto.
Vicksburg.
Virginia, (Virginia City, Mont.)
Washington.
Wilmington.
York, (New York.)

DAY OF MONTH AND TIME OF OBSERVATION.

Day.	A. M. report.	P. M. report.	Midnight report.
1	Cad	Gab	Nag.
2	Cake	Gage	Nail.
3	Calf	Gain	Nash.
4	Cam	Game	Nave.
5	Camp	Gang	Navy.
6	Cane	Gap	Nay.
7	Cape	Gard	Neal.
8	Cary	Gas	Neap.
9	Case	Gate	Near.
10	Cash	Gaul	Neck.
11	Cat	Gave	Ned.
12	Chew	Gay	Nero.
13	City	Gem	Nest.
14	Clip	Get	New.
15	Coal	Gift	Next.
16	Cob	Gild	Nice.
17	Coke	Gin	Nick.
18	Cold	Gird	Nigh.
19	Come	Give	Nile.

DAY OF MONTH AND TIME OF OBSERVATION.—Continued.

Day.	A. M. report.	P. M. report.	Midnight report.
20	Copy	Glad	Nip.
21	Cork	Glen	Nod.
22	Cost	Go	Nook.
23	Cox	Gone	Noon.
24	Crab	Good	Nor.
25	Crow	Gray	Nose.
26	Cry	Grin	Not.
27	Cuba	Grub	Noun.
28	Cud	Gulf	Now.
29	Cuff	Gun	Nude.
30	Cup	Gust.	Nut.
31	Cur	Guy	Nye.

The following words will be used to indicate the date and time of observations of 9 o'clock reports, when ordered from any station:

1 Mace	6 Malt	11 Mean	16 Mine	21 Mope	26 Mown
2 Made	7 Man	12 Meek	17 Minx	22 Morn	27 Mud
3 Magi	8 Mark	13 Meg	18 Moat	23 Moss	28 Muff
4 Main	9 Max	14 Mend	19 Mob	24 Moth	29 Mugs
5 Make	10 Maze	15 Met	20 Mood	25 Move	30 Musk
					31 Myth

Observers must write all cipher words clearly and distinctly.

BAROMETER.

28.25 to 28.99.

28.25 Faber.	28.44 Fagin.	28.63 Falstaff.	28.82 Farce.
28.26 Fabian.	28.45 Fagot.	28.64 Falter.	28.83 Fardel.
28.27 Fable.	28.46 Failure.	28.65 Familiar.	28.84 Farewell.
28.28 Fabric.	28.47 Fain.	28.66 Family.	28.85 Farina.
28.29 Fabulous.	28.48 Fairfax.	28.67 Famine.	28.86 Farley.
28.30 Facade.	28.49 Fairly.	28.68 Famish.	28.87 Farm.
28.31 Face.	28.50 Fairness.	28.69 Famous.	28.88 Faro.
28.32 Facial.	28.51 Fairy.	28.70 Fanatic.	28.89 Farrago.
28.33 Facile.	28.52 Faith.	28.71 Fanchon.	28.90 Farrand.
28.34 Facing.	28.53 Faithful.	28.72 Fanciful.	28.91 Farrier.
28.35 Faction.	28.54 Faithless.	28.73 Fancy.	28.92 Farrow.
28.36 Factor.	28.55 Falchion.	28.74 Fandango.	28.93 Fascine.
28.37 Factory.	28.56 Falcon.	28.75 Fane.	28.94 Fashion.
28.38 Factum.	28.57 Fallacy.	28.76 Fang.	28.95 Fast.
28.39 Faculty.	28.58 Fallen.	28.77 Fanning.	28.96 Fasten.
28.40 Fade.	28.59 Fallible.	28.78 Fantail.	28.97 Fastness.
28.41 Fading.	28.60 Fallow.	28.79 Fantasm.	28.98 Fatal.
28.42 Fady.	28.61 False.	28.80 Fantastic.	28.99 Fate.
28.43 Fagend.	28.62 Falsify.	28.81 Far.	

Corrected for temperature and elevation. All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

BAROMETER.

29.00 to 29.99.

29.00 Fatalism.	29.07 Faugh.	29.14 Fayal.	29.21 Feature.
29.01 Fated.	29.08 Fault.	29.15 Fayette.	29.22 Febrile.
29.02 Father.	29.09 Fauna.	29.16 Faxon	29.23 Federal.
29.03 Fathom.	29.10 Faust.	29.17 Fear.	29.24 Feeble.
29.04 Fatigue.	29.11 Favor.	29.18 Fearing.	29.25 Feed.
29.05 Fatling.	29.12 Fawn.	29.19 Feast.	29.26 Feeling.
29.06 Faucet.	29.13 Fay.	29.20 Feather.	29.27 Feline.

BAROMETER.—Continued.

28.99 to 30.99.

29.28	Felix.	29.46	Festus.	29.64	Figaro.	29.82	Finis.
29.29	Felon.	29.47	Fete.	29.65	Fight.	29.83	Finish.
29.30	Felony.	29.48	Fetid.	29.66	Figment.	29.84	Finland.
29.31	Female.	29.49	Feudal.	29.67	Figure.	29.85	Fire.
29.32	Fence.	29.50	Fever.	29.68	Filbert.	29.86	Firkin.
29.33	Fenian.	29.51	Few.	29.69	Filch.	29.87	Fiscal.
29.34	Fennel.	29.52	Fiance.	29.70	File.	29.88	Fish.
29.35	Fenton.	29.53	Fiasco.	29.71	Filed.	29.89	Fit.
29.36	Ferment.	29.54	Fibrin.	29.72	Filial.	29.90	Fitful.
29.37	Fern.	29.55	Fickle.	29.73	Fillet.	29.91	Fixed.
29.38	Ferret.	29.56	Fiddle.	29.74	Film.	29.92	Flag.
29.39	Ferrule.	29.57	Fidget.	29.75	Final.	29.93	Flagon.
29.40	Ferrum.	29.58	Fidus.	29.76	Finance.	29.94	Flail.
29.41	Ferry.	29.59	Field.	29.77	Finch.	29.95	Flake.
29.42	Fertile.	29.60	Fiend.	29.78	Find.	29.96	Flap.
29.43	Festa.	29.61	Fife.	29.79	Finder.	29.97	Flat.
29.44	Fester.	29.62	Fifteeen.	29.80	Finely.	29.98	Flax.
29.45	Festive.	29.63	Fifth.	29.81	Finger.	29.99	Fled.

Corrected for temperature and elevation. All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

BAROMETER.

30.00 to 30.99.

30.00	Fledge.	30.25	Forest.	30.50	Frigid.	30.75	Fumid.
30.01	Fleet.	30.26	Forfeit.	30.51	Frill.	30.76	Fun.
30.02	Flesh.	30.27	Forge.	30.52	Fringe.	30.77	Function.
30.03	Flinch.	30.28	Forget.	30.53	Frisk.	30.78	Fundling.
30.04	Fling.	30.29	Forgive.	30.54	Frit.	30.79	Fundless.
30.05	Flint.	30.30	Formal.	30.55	Frog.	30.80	Funeral.
30.06	Flock.	30.31	Formed	30.56	Frolic.	30.81	Fungus.
30.07	Florid.	30.32	Forth.	30.57	Front.	30.82	Funk.
30.08	Floss.	30.33	Fortune.	30.58	Froth.	30.83	Furbish.
30.09	Flown.	30.34	Forum.	30.59	Frown.	30.84	Furious.
30.10	Flue.	30.35	Forward.	30.60	Frozen.	30.85	Furlong.
30.11	Fluid.	30.36	France.	30.61	Frugal.	30.86	Furnace.
30.12	Flurry.	30.37	Fraud.	30.62	Fudge.	30.87	Furnish.
30.13	Flute.	30.38	Frazer.	30.63	Fuel.	30.88	Furor.
30.14	Foal.	30.39	Freak.	30.64	Fugitive.	30.89	Further.
30.15	Focal.	30.40	Fred.	30.65	Fugue.	30.90	Furtive.
30.16	Focus.	30.41	Freely.	30.66	Fulcrum.	30.91	Fury.
30.17	Foist.	30.42	Freeman.	30.67	Fulfill.	30.92	Furze.
30.18	Folio.	30.43	French.	30.68	Fuller.	30.93	Furzy.
30.19	Folks.	30.44	Frenzy.	30.69	Fully.	30.94	Fusil.
30.20	Fondle.	30.45	Fresco.	30.70	Fullness.	30.95	Fusion.
30.21	Food.	30.46	Friar.	30.71	Fulsome.	30.96	Fuss.
30.22	Forage.	30.47	Friday.	30.72	Fulton.	30.97	Fustian.
30.23	Foray.	30.48	Friend.	30.73	Fumage.	30.98	Futile.
30.24	Forbid.	30.49	Frigate.	30.74	Fumble.	30.99	Future.

Corrected for temperature and elevation. All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

THERMOMETER.

—50° to —1°.

—50	Tabby.	—40	Tamp.	—30	Tariff.	—20	Tease.	—10	Tendril.
—49	Tablet.	—39	Tampico.	—29	Tarsus.	—19	Tedious.	— 9	Tenor.
—48	Taboo.	—38	Tangent.	—28	Tartar.	—18	Teeth.	— 8	Tenting.
—47	Tackle.	—37	Tangle.	—27	Taste.	—17	Telegram.	— 7	Tenure.
—46	Tactic.	—36	Tannic.	—26	Taunt.	—16	Tell.	— 6	Term.
—45	Take.	—35	Tansy.	—25	Tavern.	—15	Temper.	— 5	Terror.
—44	Talbot.	—34	Tape.	—24	Tawny.	—14	Tempest.	— 4	Test.
—43	Talent.	—33	Taper.	—23	Tax.	—13	Temple.	— 3	Texas.
—42	Talmud.	—32	Tardy.	—22	Teach.	—12	Tenant.	— 2	Text.
—41	Talon.	—31	Target.	—21	Teak.	—11	Tender.	— 1	Thaler.

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

THERMOMETER.

0° to 100°.

0 Than.	26 Tiff.	51 Total.	76 Tribune.
1 That.	27 Tiger.	52 Touch.	77 Trick.
2 Thebes.	28 Time.	53 Toulon.	78 Trifle.
3 Thee.	29 Tindall.	54 Towel.	79 Trill.
4 Theft.	30 Ting.	55 Town.	80 Trip.
5 Thence.	31 Tinker.	56 Trace.	81 Triplet.
6 There.	32 Tinsel.	57 Trade.	82 Tripod.
7 Thermo.	33 Tioga.	58 Traduce.	83 Trophy.
8 Thesis.	34 Tip.	59 Traffic.	84 Truant.
9 They.	35 Tipton.	60 Tragic.	85 True.
10 Thibet.	36 Titan.	61 Trail.	86 Truly.
11 Thick.	37 Tivoli.	62 Traitor.	87 Trump.
12 Thief.	38 Toddy.	63 Tram.	88 Trust.
13 Think.	39 Toga.	64 Transit.	89 Truth.
14 Thomas.	40 Toil.	65 Trash.	90 Tube.
15 Thou.	41 Token.	66 Travel.	91 Tuesday.
16 Thrash.	42 Told.	67 Tray.	92 Tuft.
17 Throat.	43 Tomb.	68 Treat.	93 Tug.
18 Throb.	44 Tone.	69 Treble.	94 Tumor.
19 Throng.	45 Tonic.	70 Tree.	95 Tump.
20 Throw.	46 Topaz.	71 Trend.	96 Tunis.
21 Thrum.	47 Topeka.	72 Trepan.	97 Tunnel.
22 Thyme.	48 Topic.	73 Trepid.	98 Turban.
23 Tick.	49 Torpid.	74 Trial.	99 Turbid.
24 Tide.	50 Tory.	75 Tribe.	100 Turf.
25 Tidy.			

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

THERMOMETER.

101° to 125°.

101 Turgid.	108 Tutor.	114 Twixt.	120 Typic.
102 Turkey.	109 Twain.	115 Tybee.	121 Tyrant.
103 Turn.	110 Twenty.	116 Tycoon.	122 Tyrian.
104 Turner.	111 Twig.	117 Tyler.	123 Tyro.
105 Turtle.	112 Twirl.	118 Tymbal.	124 Tyrol.
106 Tuscan.	113 Twist.	119 Type.	125 Tyson.
107 Tusk.			

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

RELATIVE HUMIDITY.

0 to 100 per cent.

0 Babel.	21 Balm.	41 Belle.	61 Blush.	81 Brew.
1 Baden.	22 Bane.	42 Bench.	62 Body.	82 Brick.
2 Bagnio.	23 Bard.	43 Bengal.	63 Bold.	83 Bride.
3 Bailiff.	24 Barge.	44 Benzine.	64 Book.	84 Brief.
4 Balance.	25 Barn.	45 Berth.	65 Botch.	85 Brim.
5 Balcony.	26 Bask.	46 Betel.	66 Both.	86 Bring.
6 Balize.	27 Baste.	47 Bevy.	67 Bow.	87 Brown.
7 Ballad.	28 Bathe.	48 Bilge.	68 Bowl.	88 Brunt.
8 Balsam.	29 Bay.	49 Bind.	69 Box.	89 Brute.
9 Bamboo.	30 Beadle.	50 Bite.	70 Boyle.	90 Buchu.
10 Bandit.	31 Beak.	51 Blame.	71 Brace.	91 Bud.
11 Banish.	32 Beale.	52 Bled.	72 Brad.	92 Budge.
12 Banjo.	33 Bean.	53 Bless.	73 Brain.	93 Buff.
13 Barley.	34 Beard.	54 Blew.	74 Brake.	94 Build.
14 Barren.	35 Beast.	55 Blight.	75 Bran.	95 Bulb.
15 Basil.	36 Beat.	56 Blithe.	76 Brash.	96 Bur.
16 Basket.	37 Beauty.	57 Bloom.	77 Brave.	97 Burg.
17 Bauble.	38 Beck.	58 Blot.	78 Bray.	98 Burst.
18 Baby.	39 Belch.	59 Blown.	79 Bread.	99 Busy.
19 Bade.	40 Belfast.	60 Blurt.	80 Breathe.	100 By.
20 Bail.				

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

STATE OF WEATHER AND DIRECTION OF WIND.

	Wind blowing from the—								
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Clear	Agnes.	Eliza.	Mabel.	Adam.	Cowper.	China.	Danube.	Aral.	Beech.
Foggy	Alice.	Fanny.	Martha.	Allen.	David.	Dublin.	Hudson.	Azof.	Cedar.
Fair	Amy.	Flora.	Mary.	Andrew.	Dickens.	Geneva.	Huron.	Baltic.	Cherry.
Cloudy	Anna.	Grace.	Maud.	Bacon.	Grant.	Italy.	Jordan.	Caspian.	Elm.
Clearing up	Betsey.	Helen.	Nellie.	Ben.	Green.	Japan.	Mohawk.	Como.	Hemlock.
Threatening storm	Carrie.	Ida.	Olive.	Bryant.	Holmes.	Malta.	Niagara.	Garda.	Maple.
Light rain	Chloe.	Isabel.	Rachel.	Burke.	Homer.	Milan.	Ohio.	Java.	Oak.
Heavy rain	Clara.	Jane.	Rhoda.	Burns.	John.	Moscow.	Potomac.	Lomond.	Palm.
Light snow	Delia.	Josie.	Sarah.	Byron.	Mack.	Nantes.	Tagus.	Simcoe.	Pine.
Heavy snow	Dinah.	Judith.	Sophia.	Charles.	Ross.	Naples.	Volga.	Wener.	Spruce.
Hail or sleet	Edith.	Julia.	Susan.	Clark.	Sabine.	Paris.	Wabash.	Yellow.	Walnut.

All cipher words must be written clearly and distinctly.

VELOCITY AND PRESSURE OF WIND.

Velocity in one hour, miles.	Signal-service cipher.		Pressure on one square foot, pounds.	Designation of wind.	Velocity in one hour, miles.	Signal-service cipher.		Pressure on one square foot, pounds.	Designation of wind.
	Wind blowing steadily.	Wind variable.				Wind blowing steadily.	Wind variable.		
0	Race	Race	0	Calm.	72	Retake	Dram	25.92	Storm.
1	Rack	Daisy	0.01	Light.	73	Reveal	Drastic	26.64	Do.
2	Raft	Dale	0.02	Do.	74	Revenge	Dream	27.38	Do.
3	Rage	Daly	0.04	Gentle.	75	Review	Dred	28.12	Do.
4	Raid	Damp	0.08	Do.	76	Revile	Dress	28.88	Do.
5	Rake	Dan	0.12	Do.	77	Revoke	Drip	29.64	Do.
6	Rally	Dance	0.18	Fresh.	78	Rhyme	Drug	30.42	Do.
7	Ralph	Dark	0.24	Do.	79	Riddle	Druid	31.20	Do.
8	Rancho	Data	0.32	Do.	80	Ride	Drunk	32.00	Hurricane.
9	Range	Daub	0.40	Do.	81	Ridge	Dub	32.80	Do.
10	Rank	Deacon	0.50	Do.	82	Ridley	Ducal	33.62	Do.
11	Rapid	Deadly	0.60	Do.	83	Rife	Duce	34.44	Do.
12	Rare	Deaf	0.72	Do.	84	Rifle	Ductile	35.28	Do.
13	Rasp	Deal	0.84	Do.	85	Riga	Due	36.12	Do.
14	Rat	Death	0.98	Do.	86	Riggs	Duello	36.98	Do.
15	Ratio	Decay	1.12	Brisk.	87	Right	Duenna	37.84	Do.
16	Ravel	Deceit	1.28	Do.	88	Rigid	Duke	38.72	Do.
17	Raven	Decide	1.44	Do.	89	Rigor	Dulcet	39.60	Do.
18	Reach	Decry	1.62	Do.	90	Riley	Dungeon	40.50	Do.
19	Read	Debar	1.80	Do.	91	Rill	Dunlap	41.40	Do.
20	Ready	Debris	2.00	Do.	92	Ripe	Dupe	42.32	Do.
21	Rebate	Debt	2.20	Do.	93	Risk	Duplex	43.24	Do.
22	Rebel	Deem	2.42	Do.	94	Roam	During	44.18	Do.
23	Rebuff	Deep	2.64	Do.	95	Roar	Dusty	45.12	Do.
24	Rebuke	Deface	2.88	Do.	96	Roast	Dutch	46.08	Do.
25	Rebut	Defeat	3.12	Do.	97	Robber	Dyke	47.04	Do.
26	Redan	Defy	3.38	Do.	98	Robe	Dwarf	48.02	Do.
27	Redden	Demand	3.64	Do.	99	Robin	Dwindle	49.00	Do.
28	Redeem	Demur	3.92	Do.	100	Robust	Dying	50.00	Do.
29	Reduce	Depart	4.20	Do.	101	Rocket		51.00	Do.
30	Reef	Deploy	4.50	High.	102	Rocky		52.02	Do.
31	Refer	Depot	4.80	Do.	103	Rodent		53.04	Do.
32	Refit	Depth	5.12	Do.	104	Rogue		54.08	Do.
33	Reflect	Derby	5.44	Do.	105	Roland		55.12	Do.
34	Reflex	Design	5.78	Do.	106	Rollo		56.18	Do.
35	Reform	Devil	6.12	Do.	107	Roman		57.24	Do.
36	Refuge	Devote	6.48	Do.	108	Rome		58.32	Do.
37	Refund	Dexter	6.84	Do.	109	Romish		59.40	Do.
38	Regain	Dial	7.22	Do.	110	Romp		60.50	Do.
39	Regal	Diana	7.60	Do.	111	Rosin		61.60	Do.
40	Regard	Diary	8.00	Gale.	112	Rosy		62.72	Do.
41	Regent	Did	8.40	Do.	113	Rough		63.84	Do.
42	Regret	Die	8.82	Do.	114	Round		64.98	Do.
43	Relate	Differ	9.24	Do.	115	Rout		66.12	Do.
44	Relax	Digest	9.68	Do.	116	Royal		67.28	Do.
45	Relay	Digit	10.12	Do.	117	Rubbish		68.44	Do.
46	Relent	Dimple	10.58	Do.	118	Rubrick		69.62	Do.
47	Relic	Dip	11.04	Do.	119	Ruby		70.80	Do.
48	Relish	Direct	1.52	Do.	120	Rudder		72.00	Do.
49	Remain	Dirge	12.00	Do.	121	Ruddy		73.20	Do.
50	Remark	Dish	12.50	Do.	122	Rude		74.42	Do.
51	Remit	Dismal	13.00	Do.	123	Rudely		75.64	Do.
52	Remote	Dismay	13.52	Do.	124	Ruffle		76.88	Do.
53	Renew	Dispose	14.04	Do.	125	Rugby		78.12	Do.
54	Repay	Ditto	14.58	Do.	126	Rugged		79.38	Do.
55	Repeat	Ditty	15.12	Do.	127	Ruler		80.64	Do.
56	Repine	Divan	15.68	Do.	128	Rum		81.92	Do.
57	Replant	Divide	16.24	Do.	129	Rumble		83.20	Do.
58	Report	Dixie	16.82	Do.	130	Rumford		84.50	Do.
59	Repose	Dodge	17.40	Do.	131	Rumney		85.80	Do.
60	Reps	Dome	18.00	Storm.	132	Rumpus		87.12	Do.
61	Reptile	Domino	18.60	Do.	133	Runlet		88.44	Do.
62	Rescue	Donkey	19.22	Do.	134	Running		89.78	Do.
63	Reship	Doric	19.84	Do.	135	Runyon		91.12	Do.
64	Reside	Doubt	20.48	Do.	136	Rupee		92.48	Do.
65	Resist	Dove	21.12	Do.	137	Ruption		93.84	Do.
66	Resolve	Dowdy	21.78	Do.	138	Rural		95.22	Do.
67	Respect	Dowell	22.44	Do.	139	Rush		96.60	Do.
68	Rest	Down	23.12	Do.	140	Rushes		98.00	Do.
69	Result	Dozen	23.80	Do.	141	Ruskin		99.40	Do.
70	Resume	Drab	24.50	Do.	142	Russell		100.82	Do.
71	Retain	Draft	25.20	Do.	143	Russia		102.24	Do.

VELOCITY AND PRESSURE OF WIND.

Velocity in one hour, miles.	Signal-service cipher.		Pressure on one square foot, pounds.	Designation of wind.	Velocity in one hour, miles.	Signal-service cipher.		Pressure on one square foot, pounds.	Designation of wind.
	Wind blowing steadily.	Wind variable.				Wind blowing steadily.	Wind variable.		
144	Rustic	....	103.68	Hurricane.	148	Rutland ..	....	109 52	Hurricane.
145	Rustle	....	105.12	Do.	149	Ryder	....	111 00	Do.
146	Ruth	....	106.58	Do.	150	Ryland ...	....	112.50	Do.
147	Ruthless ..	....	108 04	Do.					

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

AMOUNT, KIND, AND DIRECTION OF UPPER CLOUDS.

	Clouds moving from the—								
	N	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Calm.
Clear	Apple.	Ivy.	Catnip.	Bed.	Bonnet.	Cow.	Canary.	Brass.	Earth.
Hazy	Citron.	Jasmin.	Copal.	Carpet.	Boot.	Dog.	Eagle.	Carbon.	Mars.
Clear to 1-4 cirrus	Currant.	Lily.	Cubeb.	Chair.	Cravat.	Goat.	Grouse.	Cobalt.	Neptune.
1-4 to 2-4 cirrus	Grape.	Lotus.	Epsom.	Clock.	Glove.	Horse.	Magpie.	Copper.	Pallas.
2-4 to 4-4 cirrus	Orange.	Myrtle.	Ergot.	Desk.	Hat.	Lion.	Ostrich.	Iron.	Planet.
Clear to 1-4 cumulus	Peach.	Pansy.	Jalap.	Glass.	Pants.	Mink.	Petrel.	Mica.	Saturn.
1-4 to 2-4 cumulus	Pear.	Pink.	Madder.	Pan.	Shoe.	Mule.	Pigeon.	Nickel.	Ursa.
2-4 to 4-4 cumulus	Plum.	Tulip.	Myrrh.	Stand.	Vest.	Wolf.	Quail.	Silver.	Venus.
Upper clouds hidden	Will be indi	cated by	the word	*Hidden.*					

All cipher words must be written clearly and distinctly.

AMOUNT AND KIND OF LOWER CLOUDS.

Absence of lower cloud will be indicated by	One.
Atmosphere hazy will be indicated by	Two.
Atmosphere fogy will be indicated by	Three.
Atmosphere smoky will be indicated by	Four.
Sky clear to 1-4 covered with stratus clouds will be indicated by	Five.
Sky 1-4 to 2-4 covered with stratus clouds will be indicated by	Six.
Sky 2-4 to 4-4 covered with stratus clouds will be indicated by	Seven.
Sky clear to 1-4 covered with nimbus clouds will be indicated by	Eight.
Sky 1-4 to 2-4 covered with nimbus clouds will be indicated by	Nine.
Sky 2-4 to 4-4 covered with nimbus clouds will be indicated by	Ten.

All cipher words must be written clearly and distinctly.

RAIN-FALL SINCE LAST REPORT.

.00 to .49 inch.

.00 Ab.	.13 Acute.	.26 Afraid.	.38 Aid.
.01 Abase.	.14 Add.	.27 Aft.	.39 Ajar.
.02 Abbot.	.15 Aden.	.28 After.	.40 Akin.
.03 Abet.	.16 Adieu.	.29 Again.	.41 Alas.
.04 Abide.	.17 Adler.	.30 Agate.	.42 Alba.
.05 Able.	.18 Admit.	.31 Age.	.43 Album.
.06 Absent.	.19 Adorn.	.32 Aged.	.44 Alder.
.07 Abyss.	.20 Adri.	.33 Agent.	.45 Alert.
.08 Ache.	.21 Adrift.	.34 Agile.	.46 Alibi.
.09 Acid.	.22 Adult.	.35 Aglow.	.47 Alike.
.10 Act.	.23 Advise.	.36 Ague.	.48 Allay.
.11 Active.	.24 Afar.	.37 Ahead.	.49 Allege.
.12 Actor.	.25 Affix.		

.50 to .99 inch.

.50 Allude.	.63 Amber.	.76 Annex.	.88 Append.
.51 Alma.	.64 Amble.	.77 Annoy.	.89 Apply.
.52 Alms.	.65 Amen.	.78 Annul.	.90 April.
.53 Aloe.	.66 Amid.	.79 Anthem.	.91 Apron.
.54 Aloft.	.67 Amiss.	.80 Antic.	.92 Aqua.
.55 Along.	.68 Ammon.	.81 Anvil.	.93 Arab.
.56 Aloud.	.69 Ample.	.82 Any.	.94 Arcade
.57 Alpha.	.70 Anchor.	.83 Apart.	.95 Arch.
.58 Alps.	.71 And.	.84 Ape.	.96 Ardent
.59 Also.	.72 Angel.	.85 Apex.	.97 Ardor.
.60 Alum.	.73 Angry.	.86 Apish.	.98 Argil.
.61 Am.	.74 Anise.	.87 Appeal.	.99 Argue.
.62 Amaze.	.75 Ankle.		

1.00 to 1.49 inches.

1.00 Arm.	1.13 Asp.	1.26 Attune.	1.38 Avon.
1.01 Armor.	1.14 Aspen.	1.27 Auburn.	1.39 Await.
1.02 Arrow.	1.15 Asset.	1.28 Audit.	1.40 Awake.
1.03 Arson.	1.16 Assign.	1.29 August.	1.41 Aware.
1.04 Art.	1.17 Assist.	1.30 Austere.	1.42 Away.
1.05 Artist.	1.18 Assume.	1.31 Author.	1.43 Awe.
1.06 Artly.	1.19 Astral.	1.32 Autumn.	1.44 Awful.
1.07 Ascend.	1.20 Astray.	1.33 Avant.	1.45 Awhile.
1.08 Ashes.	1.21 Astute.	1.34 Avenge.	1.46 Ax.
1.09 Asia.	1.22 Atone.	1.35 Avenue.	1.47 Axis.
1.10 Aside.	1.23 Attend.	1.36 Averse.	1.48 Axle.
1.11 Ask.	1.24 Attire.	1.37 Avoid.	1.49 Azure
1.12 Asleep.	1.25 Attract.		

1.50 to 1.99 inches.

1.50 Sago.	1.63 Scar.	1.76 Sense.	1.88 Shield.
1.51 Salary.	1.64 Scheme.	1.77 Serf.	1.89 Shift.
1.52 Sale.	1.65 Scorn.	1.78 Serge.	1.90 Shoal.
1.53 Salute.	1.66 Scot.	1.79 Serve.	1.91 Shock.
1.54 Sap.	1.67 Scrap.	1.80 Set.	1.92 Short.
1.55 Saul.	1.68 Scud.	1.81 Shake.	1.93 Shut.
1.56 Savor.	1.69 Sea.	1.82 Shape.	1.94 Sick.
1.57 Saw.	1.70 Seam.	1.83 Shave.	1.95 Sickly.
1.58 Saxon.	1.71 Season.	1.84 She.	1.96 Sidon.
1.59 Say.	1.72 Sedge.	1.85 Shed.	1.97 Sign.
1.60 Scab.	1.73 Seek.	1.86 Shelf.	1.98 Silex.
1.61 Scald.	1.74 Self.	1.87 Shell.	1.99 Silk.
1.62 Scape.	1.75 Send.		

All cipher words must be written clearly and distinctly. . The word *blank* will be used when no observation is taken.

2.00 to 2.49 inches.

2.00 Silly.	2.13 Slight.	2.26 Snob.	2.38 Span.
2.01 Since.	2.14 Slow.	2.27 Snow.	2.39 Spank.
2.02 Size.	2.15 Slug.	2.28 Soap.	2.40 Spasm.
2.03 Skate.	2.16 Smack.	2.29 Soda.	2.41 Speck.
2.04 Skew.	2.17 Smash.	2.30 Sodom.	2.42 Spice.
2.05 Skid.	2.18 Smile.	2.31 Solar.	2.43 Spit.
2.06 Skiff.	2.19 Smoke.	2.32 Solid.	2.44 Spoil.
2.07 Skin.	2.20 Smut.	2.33 Soon.	2.45 Spoke.
2.08 Skip.	2.21 Snail.	2.34 Sort.	2.46 Sponge.
2 09 Sky.	2.22 Snake.	2.35 South.	2.47 Spree.
2.10 Sled.	2.23 Snap.	2.36 Sowing.	2.48 Sprig.
2.11 Slick.	2.24 Sniffle.	2.37 Spade.	2.49 Spring.
2.12 Slide.	2.25 Snipe.		

2.50 to 2.99 inches.

2.50 Spur.	2.63 Steam.	2.76 Strut.	2.88 Swan.
2.51 Spy.	2.64 Stem.	2.77 Stud.	2.89 Swap.
2 52 Stab.	2.65 Step.	2.78 Stuff.	2.90 Sway.
2.53 Stack.	2.66 Stern.	2.79 Stum.	2 91 Swede.
2.54 Stag.	2.67 Stew.	2.80 Style.	2.92 Swell.
2.55 Stain.	2.68 Still.	2.81 Suck.	2.93 Swift.
2.56 Stake.	2.69 Sting.	2.82 Suds.	2.94 Swim.
2.57 Stale.	2.70 Stock.	2.82 Suit.	2.95 Swiss.
2.58 Stall.	2.71 Stray.	2.84 Sum.	2.96 Sylph.
2.59 Star.	2.72 Strict.	2.85 Sunny.	2.97 Synod.
2.60 Stark.	2.73 Stride.	2.86 Surf.	2.98 Syntax.
2.61 Stay.	2.74 String.	2.87 Swag.	2.99 Syria.
2.62 Steal.	2.75 Stroke.		

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken. Any fall of rain of 3 inches and over will be given in special dispatch.

RIVER REPORT.

Change in last twenty-four hours.

0 to 99 inches.

	Rise.	Fall.		Rise.	Fall.
0	Habit.	Habit.	11	Harbor.	Lansing.
1	Hadley.	Labor.	12	Harden.	Lantern.
2	Hague.	Lackey.	13	Harem.	Lapse.
3	Hair.	Lad.	14	Harlot.	Larch.
4	Half.	Laden.	15	Harm.	Lard.
5	Halo.	Lady.	16	Harper.	Large.
6	Halter.	Lager.	17	Harry.	Lash.
7	Hamlet.	Lain.	18	Harsh.	Late.
8	Handy.	Lamb.	19	Harvest.	Lath.
9	Hang.	Land.	20	Haste.	Latin.
10	Happy.	Landing.	21	Hatch.	Latrobe.

Rise.	Fall.	Rise.	Fall.
22 Hawk.	Laugh.	61 Hoist.	Limit.
23 Hayti.	Laura.	62 Holly.	Limpid.
24 Hazard.	Laurel.	63 Holy.	Linen.
25 Hazel.	Lava.	64 Home.	Lingo.
26 Hazy.	Lavish.	65 Homely.	Lisbon.
27 Heal.	Law.	66 Honest.	List.
28 Heap.	Lawn.	67 Honey.	Listen.
29 Heart.	Lawyer.	68 Honor.	Litany.
30 Heath.	Lead.	69 Hood.	Lithia.
31 Heathen.	League.	70 Hoop.	Litmus.
32 Heavy.	Lean.	71 Horde.	Livid.
33 Hebe.	Leaping.	72 Horn.	Loaf.
34 Hebrew.	Learn.	73 Hornet.	Lobby.
35 Hebron.	Leaven.	74 Host.	Local.
36 Hector.	Lecture.	75 Hotel.	Locust.
37 Held.	Ledger.	76 Hound.	Lodi.
38 Helix.	Left.	77 Hour.	Logan.
39 Helm.	Leg.	78 Hovel.	Logic.
40 Helot.	Legal.	79 Hub.	Lonesome.
41 Help.	Legend.	80 Huff.	Loud.
42 Hence.	Leghorn.	81 Huge.	Louse.
43 Henry.	Lemon.	82 Human.	Love.
44 Herald.	Lenox.	83 Humbug.	Lover.
45 Herd.	Lentel.	84 Humid.	Loving.
46 Heresy.	Lesson.	85 Hump.	Loyal.
47 Hermit.	Level.	86 Hunch.	Lubeck.
48 Hernia.	Levity.	87 Hunger.	Lubin.
49 Heroic.	Levy.	88 Hunt.	Lucas.
50 Heron.	Lewd.	89 Hunter.	Luck.
51 Hew.	Lewis.	90 Hunting.	Lucy.
52 Hide.	Leyden.	91 Hurley.	Lumber.
53 High.	Libel.	92 Hush.	Luna.
54 Hinge.	Liberal.	93 Hybrid.	Lunatic.
55 Hinton.	Liberty.	94 Hydra.	Lundy.
56 Hire.	Libra.	95 Hydrant.	Luster.
57 Hoar.	Lichen.	96 Hymen.	Lute.
58 Hoax.	Life.	97 Hymn.	Lydia.
59 Hock.	Light.	98 Hyphen.	Lykens.
60 Hog.	Limbo.	99 Hypo.	Lynx.

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

RIVER REPORT.

Change in last twenty-four hours.

8 to 30 feet.

Rise.	Fall.	Rise.	Fall.
8 Oakum.	Wafer.	20 Only.	Whack.
9 Oath.	Waken.	21 Opal.	Wharf.
10 Obey.	Walk.	22 Oppress.	What.
11 Obtain.	Wander.	23 Optic.	Whig.
12 Odds.	Water.	24 Order.	Wick.
13 Odium.	Wave.	25 Organ.	Wild.
14 Offal.	Wax.	26 Other.	Wing.
15 Offend.	Weak.	27 Ought.	With.
16 Often.	Weigh.	28 Ounce.	World.
17 Ogre.	Well.	29 Owing.	Worse.
18 Omega.	Wench.	30 Oxford.	Worthy.
19 Omit.	Weston.		

The sixth space in first line of Form 5 will be used for the depth in feet whenever it exceeds eight feet, and the sixth space in second line for the odd inches.

Whenever the depth does not exceed eight feet, the word "River" will be used as at present to fill the space in first line, and the whole depth given in the second line in inches. The present cipher words will be used, but the head-line, "Change in last 24 hours," will be erased.

All cipher words must be written clearly and distinctly. The word *blank* will be used when no observation is taken.

PAPER D.

INSTRUCTIONS FOR THE MANAGEMENT OF THE SELF-RECORDING METEOROLOGICAL INSTRUMENTS AT THE OFFICE OF THE CHIEF SIGNAL-OFFICER OF THE ARMY, WASHINGTON, D. C.

INSTRUCTIONS.

Hough's printing barometer.

The paper on the cylinder to the right, and the strips on which the record is printed, are changed every day at noon.

The paper on the cylinder to the left is changed at 12 m., on the 1st and 15th of each month of 30 days, and on the 1st and 16th of each month of 31 days.

For the daily record:

1. Date the papers, across the end of the small strip and on top of the cylinder record.

2. Remove the old record from the cylinder (on the left) by drawing back the pencils from the cylinder, and holding them back by means of the small brass wire between them, and raising the spring-clamps.

3. Put on the new paper in the same position, letting the lower margin rest upon the shoulder on the cylinder, and replace the spring-clamps.

4. On the side of the clock is a small cylinder, around which is wound a cord which revolves the record cylinder. Revolve this small cylinder to the left; which will wind up the cord and move the record around to its proper position.

5. Allow the pencil to press against it again, by letting go the small brass wire which holds it. The pencil is adjusted to the proper horizontal line by the set-screws on the vertical shaft. (Adjust the pencil of the 15-day record in the same manner.)

6. At the time the small cylinder is revolved, (see 4,) the carriage on which the figures are printed is carried back to its starting position on the left; to remove the slip, loosen the set-screws in the middle and at each end, when the old record will drop out.

7. Lay the new strip down, place a small strip of clean paper, three-fourths of an inch wide, on the upper margin, and on top of this a piece of carbon paper the size of the record; then invert the carriage, and, holding the strips together, place them in the slots of the carriage, tighten the set-screws, let the carriage hang down, and slide it to the right, until one inch of it has passed the type, then fasten it to the cord with the set-screw.

8. If the types become misplaced they should be adjusted by revolving the type-wheels until the proper figures are in front; adjust the weight to the striking lever by moving it to the right or left, and the leather on the printing lever by the set-screws.

9. The batteries should be examined daily, and all points of contact kept clean.

10. Compare with standard barometer daily, and write the error (if any) on the back of the record, which should be carefully traced with black ink.

11. To change the 15-day record remove the paper by loosening the spring-clamps; place the new paper in the same position, with the lower margin resting upon the ledge on the cylinder, and fasten with the spring-clamps.

12. Take hold, with the left hand, of the toothed-wheel, around the vertical shaft of which is wound the cord which revolves the 15-day cylinder, at the same time draw the right end of the horizontal lever (which fits in an eccentric on the side of the clock and allows the toothed-wheel to move one tooth each hour) from the eccentric, and revolve the toothed-wheel until the record cylinder turns completely around, and let the pencil rest upon the proper time-line.

13. Wind the clock every day. The weight which drives the record portion of the instrument should be wound as often as it runs down, sometimes three or four times daily. Great care must be taken to prevent the weight from reaching the floor.

Hough's electric meteorograph

records barometer and wet and dry thermometers, the barometer being in the room and the thermometers in a louver-boarded box outside, and connected to the marking-lever by platinum wires. To change the record, (which should be done at noon on the 1st and 15th of each month)—

1. Remove the old record by drawing out the thumb-tacks.

2. Place the new record in the same position, resting the lower edge of it upon the flange on the cylinder, and replace the thumb-tacks to hold it.

3. Take hold of the toothed-wheel, on the axle of which is wound the cord which turns the cylinder, and with the right hand draw out the set-screw from the eccentric on the side of the clock, by lowering of which the toothed-wheel will be allowed to revolve, wind up the cord with this wheel until the record cylinder makes an entire revolution, let the recording point impinge upon the proper-time line, and fasten the cylinder by replacing the set-screw in the eccentric.

The instrument records three times each hour, once for the barometer and once for each thermometer; the barometer recording as the lever is moving upward, and the thermometers recording as it moves downward.

4. The batteries should be inspected daily, and contact points kept clean.

5. Compare with standard barometer every time the record is changed, and note the difference (if any) on the back of the record. The barometer is adjusted by raising or lowering the contact point along the rod which moves by the side of the barometer. The thermometers are adjusted to any desired point, giving sufficient room for the variations of temperature.

Hough's electric barometer.

1. The record is changed at 12 m. on the 1st and 15th of each month. (If the month has 31 days change on the 16th.)

2. Take out the thumb-tack and remove the old record.

3. Place the new paper in position, resting the lower edge of it upon the flange on the cylinder, and replace the thumb-tack to hold it.

4. Take hold of the toothed-wheel, on the axle of which is wound the cord which turns the cylinder, and with the right hand draw back the horizontal lever from the eccentric on the side of the clock, which will allow the toothed-wheel to revolve, wind up the cord with this wheel until the record cylinder makes one complete revolution. See that the recording point impinges upon the proper-time line, and fasten the cylinder by replacing the horizontal lever upon the pin on the eccentric. The instrument should record once every hour.

5. Inspect the batteries daily and see that the contact points are kept clean.

6. Compare with standard barometer every time the record is changed and note the difference (if any) on the back of record. The barometer is adjusted by raising or lowering the nut, which carries the contact point, on the rod which moves vertically by the side of the barometer.

Peelor's barometer.

1. Date the paper, and change the record daily at 12 m.

2. See if the pointer is being driven into the paper; if so, wait until it is out; then remove the elastic bands from the ends of the cylinder, letting go the old record, which remove.

3. Place the new record on the cylinder, with the top of the paper to the right, and replace the elastic bands to fasten the paper.

4. Revolve the cylinder (which is held by a ratchet) in either direction, until the needle points to the proper hour on the paper.

The vertical rod holding the needle is balanced by the weights on the lower end of it. The barometer is adjusted by means of a set screw on top of the upper end of the box which holds the siphon barometer. The instrument should be compared with the standard every fifteen days, and the difference noted on the back of the record.

Wild's barometer

consists of a horizontal lever working on a knife-edge at its center, to the right end of which is suspended the barometer. The lower end of the barometer is suspended in a cistern of mercury. The barometer is balanced by a weight on the left end of lever, and by another lever projecting slightly from the perpendicular with another weight. Perpendicular to the first lever is a long arm carrying a point, which hangs before the paper, (the paper being carried vertically from one roller to another,) and which is driven into the paper once every ten minutes by the action of the magnets, the contact being made through the clock. The paper should be marked each day with the time and height of barometer as compared with the standard, and at the end of each month cut off and properly ruled.

Beck's "aneroid barometer."

1. Date the paper, and change the record every Monday at 12 m.

2. Remove the cylinder which holds the paper, by lifting it upward and to the left.

3. Remove the old record from the cylinder, by loosening the spring-clamps.

4. Put on the new paper so the lower edge of it rests upon the upper side of the lower spring-clamp.

5. Replace the cylinder so that the cogs on the lower margin of it will fit in the endless screw and the brass marker will point to the proper hour.

6. Adjust the marker to the proper height on the paper, by raising or lowering the barometer with the clock-key through the hole in the top of the case.

7. Wind the clock.

8. Compare with standard barometer every two weeks, and adjust the aneroid with the clock-key through the hole in the back of the case until the indicator points to the proper position.

Photographic barometer

consists of a slate slab on which is placed a dark chamber. In this dark chamber is a photograph lens and a cylinder on which is placed the prepared paper and which is revolved by clock-work once in forty-eight hours. The barometer is placed so that the upper end stands in front of a lighted lamp, the light being concentrated and thrown upon the photograph lens by a powerful condensing lens.

Photographic thermometers

consist of a dark chamber and lens, same as in the barometer. The thermometers (wet and dry) are long and the bulbs are outside the room, the upper ends standing before the photograph lens. The light is placed in front and reflected back by means of mirrors. The thermometers are adjusted to the proper height by means of a screw standing between them.

The records are changed in exactly the same manner both on barometer and thermometers, viz:

1. The ordinary photograph waxed paper is used as furnished.
2. Is bathed in a solution of potassium for three hours, of the following proportions:

Iodide potassium, grains	582.5
Bromide potassium, grains	417.5
Distilled water, ounces	40

3. It is then made sensitive by floating for ten minutes on a nitrate of silver solution—

Nitrate of silver, grains	300
Glacial acetic acid, drachms	2
Distilled water, ounces	20

4. Wash twice in distilled water and dry in a dark room, when it is ready to be placed on the cylinder in the photographic dark chamber.
5. Supposing a record to be already on, to remove it first darken the room, then raise the cover of dark chamber, lift off of the cylinder, and place in a dark box for the purpose of carrying it to the dark room.
6. Make a saturated solution of gallic acid in alcohol and dilute it two-thirds with water. Float the record on this solution until developed, then carefully wash.
7. Fix with hyposulphite of soda.

Gibbon's electric self-recording anemometer.

Near the top of the post on which the anemometer is fixed, place two screws "c" and "d," (Fig. 1;) to each of these screws fasten the wires separately, (the insulated wire to one, and the naked wire to the other,) leaving just sufficient of the upper end of each wire to reach to the outside ends of the contact bars "a" and "b," to which securely fasten with the binding screws—taking great care not to loosen the insulating attachment "g." Then pass the lower ends of the wire down the post, over the roof, and down the side of the house (securing so the wind will not sway them) to the top of the office window; pass them in through two small holes (where the sash and shutters will not injure them) and down the inside. In crossing the roof it is well to fasten them between two wooden strips, one on top of the other. One wire should then go to the screw cup "h," (Fig. II,) and the other to one pole of the battery at "i," then from the other pole "m" of the battery run a wire to the screw-cup "k," when the circuit is completed, and the armature will be closed once for each mile the wind travels.

Particular care must be taken that all of the connections are tight.

For putting on the paper:

Place the cylinder "s" on a table in front, with the screw "r" to the left hand; place the paper on the cylinder with the top of it from the screw. Let the line marked 12 m. (noon) come on the line marked on the cylinder, and place a small rubber band on each end. The lines on each end of the paper will then exactly coincide.

Place the cylinder "s" in its position, so that the end on which there is no screw "t" will be close up to the post on which it rests. Slide the small sliding-bar "n" on the horizontal bars "o, o," until it fits on the ends of the screw-axle "r;" then revolve the cylinder until the pencil will rest on the end of the upper line marked 12 m., and tighten the thumb-screw "n."

Much care must be taken in adjusting the armature spring, so that it will not be too strong for the magnet, and still strong enough to draw back the pencil in a straight line.

The mark for the record should be *a little less than one-eighth of an inch long, and never more than this.* This is arranged by moving the armature set-screw P, until the pencil points to the line marked 12 m. Then move the magnets, by means of the adjusting screw Q, until the mark is the proper length.

The pencils should be kept pointed enough to give a clear and distinct mark.

Use No. 3 pencils.

The clock should be wound every day, when the record is changed.

The record should be changed daily, at 12 o'clock, noon.

NOTE.—For the instructions referred to, see Istructions to Observer-Sergeants.

Gibbon's electrical anemometer and anemoscope

consists of the anemometer above described, for showing the velocity of wind, with the cylinder made two and one-half inches longer, on the right end of which is printed the direction of the wind once every five minutes. The magnets consist of four single coils placed in front of the cylinder and connected with the vane on roof of building by means of four wires. To the armatures which lay on the sides of the coils are attached levers, on the ends of which are types which print the direction of the wind once every five minutes, (on some of the instruments, on others the direction is given once in every mile the wind travels,) the contact being made through the clock. The paper for the record is changed exactly as on the anemometer before described, and the marking points and types adjusted to the proper position by means of the set-screw on the right, which moves all the magnets at once, all being fastened upon one plate.

Beck's anemometer.

1. Date the paper.
2. Raise the helices from the cylinder by means of the brass handle between them, loosen the cylinder shaft from the clock by means of the capstan-screw between the cylinders and clock.
3. Take off the old record by pressing the spring-clamps which hold the paper.
4. Place the new paper around the cylinder with the side marked "Direction" to the right, let the small point in the center of cylinder pierce the crossed lines; draw the other end tight and regular and fasten by spring-clamps.
5. Wind the clock.
6. Set the cylinder in its proper position by revolving it until the stylus between the helices points to 10 o'clock a. m., then fasten the cylinder by revolving the capstan-screw.
7. By means of the small brass lever press the helices down upon the paper.
8. The pressure of the helices is regulated by moving the small brass weights to or from them.
9. To adjust the direction helices, loosen the brass nut on the vertical rod, raise the piece to which is attached the ball and socket joint, and adjust the helix by revolving it, at the same time adjusting direction plate indicator on the lower end of the vertical rod, lower it again and make fast the brass nut.
10. The velocity is adjusted in the same manner. They both need adjusting *but once* unless disturbed.

Wild's anemometer, anemoscope, and rain-gauge

consists of an apparatus for measuring the direction and velocity of the wind and the amount of rain-fall, having a horizontal shaft to which is attached points carrying eight small friction-wheels, corresponding to the eight cardinal points of the compass; the wheel which corresponds to the point from which the wind is blowing is continually pressed against the paper by a cam upon a shaft revolved by a vane upon the roof of the building. On the same horizontal shaft is a slide to which is attached a point for recording the amount of rain-fall; the water being conducted from the gauge on the roof of the building to the water-wheel, which revolves, drawing the slide to the left; once every ten minutes the armature is attracted by the magnets, (the contact being made through the clock,) driving the point on the slide through the paper, at the same time letting go the spring which draws the slide, and the slide falls back to its original position, the distance from which, to the hole made, showing the number of liters of water fallen during the preceeding ten minutes.

The velocity of wind is registered in precisely the same manner as the rain-fall, the marking point being drawn to the left by a vertical shaft connected to the Robinson hemispherical cups on the roof of the building; the distance from the fiducial line (marked by a fixed point) to the hole made, showing the number of miles the wind traveled in the preceding ten minutes.

The paper is drawn from one roller to another, and should be recorded and compared as on the hygrometer and thermometer.

Once each day the time and date should be marked on the paper opposite the record made at that moment.

Draper's anemoscope.

1. Date the paper, and change the record daily at noon.
2. Draw out the wire to which is fastened the rubber spring which drives the pencil; re-

move the cylinder, by raising with one hand the vertical shaft (outside the case) about one inch; then raise the cylinder and lift it clear of the lower socket, and by again lowering take it out.

3. Remove the old record, by raising the spring-clamp and sliding the paper off the lower end of the cylinder.

4. Place some paste along the back side of left margin of the new record paper; wrap it around the cylinder, and press the edges together closely.

5. Slide the paper up under the spring-clamp, until the left side of the clamp is in a line with the left margin of the paper at the point marked "North."

6. Raise the vertical shaft; place the cylinder in its proper position, and let the shaft down; then revolve the cylinder until the axle on top of it slips into the notch cut for it in the shaft.

7. Wind the clock, which will raise the weight with marking point to top of cylinder, and to the line marked 12 m.

8. Put in a piece of No. 2 lead one inch long, and replace the spring which presses it, taking care that the pencil points to the proper-time line on the paper.

Draper's anemometer for force of the wind.

1. Date the paper, and change the record at 12 m. daily.
2. Draw out the wire which drives the pencil; remove the old record by raising the spring-clamps which hold the paper to the carriage.
3. Place the new paper in the place from which the old one was removed, taking care to adjust it so the pencil will press directly upon the lower line on the right end of the paper.
4. Wind the clock, which will draw the carriage to the right, drawing until the pencil presses upon the intersecting lines marked 12 m. and the lower line of the paper.
5. Replace the wire which pushes the lead against the paper. Use No. 3 lead.

Draper's anemometer for velocity of the wind.

1. Date the paper, and change the record daily at 12 m.
2. Draw out the wire which pushes the lead against the paper; remove the old record, by raising the spring-clamps which hold it to the carriage.
3. Place the new paper in the place from which the old one was removed; let the lower edge of the paper rest upon the points in the carriage, (which should always be adjusted so the pencil when down will strike on the lower line.)
4. Wind the clock—which will draw the carriage to the right—until the pencil rests upon the proper vertical time line.
5. Replace the wire which pushes the lead against the paper. Use No. 2 lead.

Draper's rain-gauge.

1. Date the paper, and change the record daily at 12 m.
2. Hold the carriage back from the pencil, and remove the old record by raising the spring-clamps which hold it to the carriage.
3. If there has been rain since the noon previous, and water remaining in the suspended reservoir, remove it by means of a siphon.
4. Place the new paper in the same place, and let the pencil point to the upper line.
5. Wind the clock—which will draw the carriage to the right—until the pencil rests upon the upper horizontal line and the proper vertical time line.
6. Adjust the pencil to make a very light line, afterward to be traced with ink. The amount of water should be measured by the hand-gauge every two weeks, and the spring-balance adjusted by screwing it up or down.

Beckley's rain-gauge.

1. Date the paper, and change the record daily at 12 m.
2. Press the spring which holds the pencil back from the record, and lift off the cylinder with the old record on it.
3. Remove the old record by loosening the spring-clamps.
4. Place the new record on the cylinder with the lower edge resting on the lower spring-clamps.
5. Wind the clock by turning the cylinder shaft to the left. If any water remains empty it out by reversing the top portion of the reservoir.
6. Place the cylinder with new record on its shaft, letting the pencil-point rest upon the upper horizontal line and the proper-time line.
7. Start the clock by turning the large thumb-screw over the clock.
8. When rain has fallen trace the record with ink.
9. Adjust the pencil by means of the small set-screw over it.

Wild's hygrometer and thermometer

consists of a metallic coil thermometer and hair hygrometer. The record is made by means of points which are driven through the paper every ten minutes by a lever attached to the armature of two pairs of magnets, the connection being made between the instrument and the battery by a clock. The record paper is drawn from one roller and coiled upon another by the recoil of the armature when the contact is broken. The distance from the armature to the end of the magnets should be adjusted with just sufficient room to allow the ratchet to play properly in the ratchet-wheel, so as to move the friction rollers, between which passes the paper. The paper should be marked each day with the time, the relative humidity, and the height of the thermometer by comparison with the instruments placed in the observatory with it, and at the end of each month the record for that time will be cut off the long strip, and the lines for time, height of thermometer, and for relative humidity ruled upon it.

This instrument runs in conjunction with Wild's "barometer," and Wild's "anemometer and rain-gauge," all being driven by the same battery and the time regulated by one clock, the contacts following each other at intervals of one second.

La Clanche battery.

Place two ounces sal ammoniac in each glass jar; fill in with water to the depth of one inch; let the salts dissolve one hour; then set in the porous cups and the zincs. The glass jar should then be *just half full, and never more than this.* Then connect the zinc of one cell with the carbon of the next. Connect the zinc of the last with the carbon of the first, and let them stand six hours.

The battery, after being set, must not be shaken, and moved as little as possible.

The solution should be saturated, *i. e.*, as much sal ammoniac as the water will dissolve. It will probably be necessary to pour in one or two teaspoonfuls of sal ammoniac every four or five months.

Keep the cells from one-third to one-half full of water, by pouring it down the outside of the porous cup. The water must not be allowed to freeze.

It is essential that the rules for this battery be strictly followed.

Carbon and zinc batteries.

(Large size.)

Dissolve in each jar one pound of salt and one pound of alum in a jar three-fourths full of water. Let them stand ten or twelve hours, then place in the carbon cylinders and the zinc, taking great care that the zinc does not touch the carbon. Wash off the carbon and zinc once every six months, and fill in with water whenever needed.

PAPER E.

THE GREAT FIRES OF 1871 IN THE NORTHWEST. BY PROF. I. A. LAPHAM, ASSISTANT TO THE CHIEF SIGNAL-OFFICER UNITED STATES ARMY.

The great fires that have recently spread, with such disastrous results, over our whole northern frontier, from the Rocky Mountains to Central New York and Pennsylvania, must be regarded as the effect of meteorological causes. Unusual dryness has pervaded the atmosphere during the past two months; the amount of rain-fall has been very considerably less than the average and the amount of evaporation considerably more.* Very little rain has fallen upon most of this extended region since August.

Winds from a southwesterly direction, blowing often with great force and for several days continuously, bring to the great prairie region of the West this excessive dryness. Their prevalence is often shown by the direction toward which the trees lean; they absorb moisture from every source, making everything of a combustible nature still more combustible. The soil itself becomes desiccated to a considerable depth. Pine lumber, of which houses, barns, fences, &c., are made, becomes excessively inflammable. The weeds and grass of the prairies and stacks of hay and grain are deprived of all moisture, and partake of the nature of tinder.

When these winds are blowing, a small spark is sufficient to kindle a great fire; the camp fire, the wad from a gun, a spark from a locomotive, even the remnant of a cigar, or the

* Rain at Milwaukee in September; Maximum (1841) 7.02 inches; mean of twenty-nine years 2.88; minimum (1871) 0.00.

ashes from a pipe, may start a fire that will spread over a county. A stroke of lightning has, doubtless, been the origin of many a prairie fire. The Indians are said to have purposely set them on fire to rout the deer and other game.

The violent wind hastens to spread the flame over a constantly widening space, until large districts are laid waste by the "destroying element." It is familiarly known that these fires have annually spread over the great prairie region of the Mississippi Valley since their first exploration. Prairie fires are no new thing. Of course they vary in extent from year to year, according to the varying dryness of the seasons and other meteorological causes. A smoky atmosphere in autumn has been the common experience every year; and this smokiness has its origin in prairie fires at the West.

The fire once started in the dry grass and weeds of the prairie cannot be extinguished; it must take its own course, gradually widening as it moves forward, until it presents a front of a hundred miles or more: and the flames, often reaching a great height, are blown forward, setting fire to places many rods ahead.

These fires do not kill the roots of the prairie grass, which springs up fresh from the blackened soil when its proper season returns; but the germs of other plants, including all forest trees, are destroyed.

When these fires reach the borders of the forest region the trees are attacked, and many of them destroyed; others are more or less injured. The young shoots are killed; the roots beneath the soil, and in many cases even the soil itself is consumed.

It is when the southwest wind is high, and the atmosphere dry, and when, from long absence of rain, the vegetation is also dry, that we are to look for these great prairie fires.

We thus have before us the true theory of the origin of the prairies: they are clearly due to the dryness of the climate in autumn and the consequent fires. Their existence is not due to the effect of dryness of climate upon the growth of trees themselves, for, when protected from fires, trees are found to flourish in the prairie region. It is by fire (induced by dryness) that the trees are destroyed or prevented from growing.

These conditions of climate, the autumnal dryness and the prevalence of southwest winds, have existed for ages, and hence the normal condition of the great western plains is that of prairie; and so long as these causes exist, this region must always remain in this condition, unless changed by ingenious and persistently-applied devices of art.

The normal condition of other regions is that of forest growth. When old fields are abandoned within these forest regions, as in Virginia, &c., or wherever lakes have been drained, a growth of trees immediately takes possession of the soil. In a few years the forests have resumed their possession.

Within the prairie region the soil is equally well adapted to the growth of trees, and, by continued effort in the prevention of fires, they may soon be made to cover the land with their grateful shade, their beauty, and their usefulness; but should these efforts be discontinued for a few years, the *dry weather*, the *high winds*, and the *accidental fires* will surely do their appointed work, and the prairie grass will resume its possession of the ground. The normal condition of prairie will again be established.

The northern boundary of the region of prairie forms a line which varies from year to year as the seasons vary. A continued succession of dry seasons encourages great fires, that penetrate the forest border and extend the area of the prairie; while a similar succession of wet seasons may allow a growth of trees to spread far within the proper boundaries of the prairie. A constant struggle is thus maintained between the two conditions of forest and prairie, alternating within certain limits, and changing the position of the dividing line. It is here that we find the "openings," or scattered trees, chiefly of the burr-oak, (*Quercus macrocarpa.*) which give so much park-like beauty to the landscape.

The work of extending the prairie border was exhibited in the autumn of 1871 upon the grandest scale. Fires have swept more or less completely along the whole northern frontier, from the Rocky Mountains through Dakota, Minnesota, Wisconsin, and Michigan, and even into New York and Pennsylvania.

Within the past two or three decades this region has been occupied and "improved;" farms have been opened, mills built, especially throughout the "lumber region," or places where the stately white pine (*Pinus strobus*) predominates. Villages, large towns, and even great cities have sprung up along this prairie border-line with a rapidity truly wonderful. And now it is found that these natural, ever-recurring meteorological causes which have for so many ages prevented the growth of forest trees, are equally operative in preventing the *building of houses, towns, and cities.*

Not only has the wild prairie region been swept by the fires of 1871, but thousands of square miles of forests have been destroyed. Many farms, with their houses, barns, stacks of hay and grain, miles of fences, &c., have been destroyed. At the same time a number of towns and a large part of the city of Chicago was consumed, involving the loss of many thousand human lives. The ground upon which these improvements were made has been reduced to the normal condition of prairie.

It becomes apparent, then, that if we wish to occupy and improve this prairie region, to cover it with villages, towns and cities, to cultivate its rich and productive soil, we must contend against this natural law, which constantly and surely tends to assert its power to reduce everything to its former normal condition. To do this will require more than individual effort; only united and enforced, or in other words governmental effort can afford hope of success.

The precautions necessary to resist this destruction of property are of the simplest kind, being only such as are necessary to prevent the occurrence and spread of fire. This involves not only watchfulness, but the disuse, as far as possible, of all combustible materials. The watchfulness should extend not only to our own premises, but to prevent the carelessness and criminality of others, which can only be done by public authority. The use of kerosene in all its forms should be prohibited; no locomotive should be allowed to move without adequate means to prevent the emission of sparks from the smoke-stack, and no fences of wood should be built. If the farmers of France, Germany, &c., can do without fences, certainly we can do the same, and thus save not only this food for the fires, but one-half of the aggregate capital required in the conduct of our agriculture! A thousand other measures, needless here to mention, should be adopted and *enforced*, looking to the same end.

It is announced that some farmers who have "lost their all" by these fires have become disheartened and discouraged, and will entirely abandon their possessions. If this is done now, while everything is fresh and new, while the soil retains its virgin richness, what may we expect in after years? Gradually, but surely, the whole country will be reduced (as have been the once fertile plains of the East) to the condition of a desert. It is true this may be in the distant future, but it is nevertheless our duty to prevent this result, so far as it is within our power.

If fences could be dispensed with, and if our houses could be constructed of materials other than wood, the very great destruction of our forests, now going on with such fearful rapidity, would be checked. It is estimated that fifty years will suffice to consume the pine lumber of Wisconsin and Michigan, the chief present sources of supply; the time therefore is close at hand when the forests will no longer supply the lumber used in temporary construction, erected only to increase the danger of great public calamities by fire!

Should the present policy be continued, the destruction of a large share of the newly-built railroad stations in the prairie-region of the West will surely come; they are built in opposition to the law of the land, a law that sooner or later must be enforced. A dry season, a strong wind, and an accidental fire, whenever they occur together, will do the work.

If these views be correct, it is apparent that the precautions against these greater calamities are most needed at the southwest part of the town or city: here is always the place of greatest safety, and here should be erected buildings for the preservation of the most precious records and works of art, which, if lost, cannot be restored. Had the fire of Chicago originated at the north or east side of the city, the barn in which the kerosene lamp was kicked over alone would have been burned.

The question is often asked whether the great fires of the Northwest, during the months of September, October, and November, 1871, and especially the one which leveled to the ground a large share of the city of Chicago, had any decided effect upon the weather, either by creating or modifying currents of air or by causing a fall of rain. It was reported by telegram to London, England, and there published, "that this fire was chiefly checked on the third or fourth days by the heavy and continuous down-pour of rain, which it is conjectured was partly due to the great atmospheric disturbances which such an extensive fire would cause, especially when we are told that the season just previous to the outbreak of the fire had been particularly dry." This was said to afford an additional example from which to judge of the truth of the so much disputed assertion that extensive fires are almost invariably followed by heavy down-pours of rain which have been caused by them.

A very little attention to the facts exhibited by the great fire will show that no such down-pours occurred, and that the fire was checked, not by rain, but for want of other combustible material in the direction toward which the flames were driven by the wind.

The fire commenced at 9½ p. m. of Sunday, October 8, and continued during that night and most of the succeeding day. By 2 a. m. of the 9th, it had reached the court-house and the Sherman House, and was consuming the most valuable portions of the city. Twelve hours later it was ravishing Lincoln Park, in the north part of the city. The last house consumed (Dr. Foster's) was in flames at 10 p. m. Commencing at a point in the southwest part of the city, the fire moved rapidly to the northeastward, and only ceased when it had reached the extreme north part of the city, or the shore of Lake Michigan on the east. After this time there was but little spread of the flames, though the burning buildings were not yet entirely consumed.

During all this time, twenty-four hours of continuous conflagration upon the largest scale, no rain was seen to fall, nor did any rain fall until 4 o'clock the next morning; and this was not a very considerable "down-pour," but only a gentle rain, that extended over a large district of country, differing in no respect from the usual rains. The quantity, as reported by meteorological observers at various points, was only a few hundredths of an inch. It was not until four days afterward (14th) that anything like a heavy rain occurred.

It is therefore quite certain that this case cannot be referred to as an example of the production of rain by a great fire.

Must we therefore conclude that fires do not produce rain, and that Professor Espy was mistaken in his theory on that subject?

By consulting his reports, it will be found that he only claimed that fires would produce rain under favorable circumstances of high dew-point and a calm atmosphere *

Both these important conditions were wanting at Chicago, where the air was almost entirely destitute of moisture, and the wind was blowing a gale. To produce rain, the air must ascend until it becomes cool enough to condense the moisture, which then falls in the form of rain. But here the heated air could not ascend very far, being forced off in nearly a horizontal direction by the great force of the wind.

The case therefore neither confirms nor disproves the Espian theory; and we may still believe the well authenticated cases where, under favorable circumstances of very moist air, and absence of wind, rain has been produced by large fires.

At some localities where fires occurred of considerable extent, rain was observed to fall during their progress; but so far as is known, these were general rains, extending equally over the country, and not produced or apparently affected by the fire.

Had these great fires occurred during a calm, doubtless many of the phenomena described in Espy's theory—the ascending current, the in-blowing air from all directions, the cloud formation above, and possibly even rain, may have been produced; but all these were prevented or very materially modified, by the lack of moisture and the great force of the southwest gale.

The effect of these great fires upon the currents of air was also materially modified by the great force and velocity of the southwest gale.

While it is undoubtedly true, as stated by Espy and others, that the increased temperature of the air causes it to rise, and thus produce an inflow of the surrounding atmosphere from all sides, it is manifest that the gale prevents an inflow from the front and increases it in the rear. Different observers represent the wind as sweeping along at a fearful rate, increasing as the fire progressed. While some report a whirling motion, others say the motion was direct.

As the flames arose above the tops of the houses, or of the forests, they were forced forward by the fierce gale. Fire-brands were carried a great distance; and even roofs of houses are said to have been lifted up and precipitated upon adjoining buildings. It was, at times, difficult for a strong man to resist the force of the wind. The approach of the fire is represented as very rapid, and accompanied by unusual sounds, increased to that of Niagara. Piles of lumber were blown away, chimneys thrown down, and sand and ashes were swept along like drifting snow.

Under these conditions, the fires of course spread with the most fearful rapidity in the direction toward which the wind was blowing, its velocity being such as to carry the hot air, the flames, and the burning brands directly forward. The predominant force of the southwest wind was sufficient to overcome any tendency toward local currents. But fluctuations in the direction of the wind always occur, and give rise to different statements as to its direction.† The draught of air upon the two sides of this rapidly progressing stream of fire, near the ground, was often very considerable. The lateral spread of the flames was against this draught, and of course was comparatively slow in its progress.

Masses of flames were blown forward, and are described as "balls of fire that were observed to fall like meteors in different parts of the town, igniting whatever they came in contact with." Another account says "that the fire came from the air above, more than from the earth. It swept along in detached clouds borne with a tornado-like fury. The clouds of fire would be swept along in waving masses of different sizes. A man describes one of these clouds as of 40 feet in size each way. Whatever he saw it touch, the object, tree or house, wilted directly down. These clouds of fire usually touched the tops of the tallest houses first, when the building would burn down as if saturated with kerosene. It seems as if the air was charged with clouds of fire."

The intense heat and great rapidity with which houses were consumed, are among the most wonderful facts connected with these fires, and have given occasion for the suggestion of several causes, both natural and supernatural. It is believed, however, that a slight consideration of the effects of the blow-pipe and of the blast-furnace will sufficiently explain all the observed facts. The strong wind, by constantly adding oxygen to the flames, increased their magnitude and the intensity of the heat.

The telegraph wires indicated no unusual disturbance of the electrical condition of the atmosphere, and the rapid production of flame, under the fierce blast of wind, will account for the intensity of the heat, without resorting to the absurdity of the decomposition of the atmospheric air.

We may therefore conclude that these fires were rendered possible, and owe their intensity and magnitude to meteorological causes, and that they neither confirm nor disprove Professor Espy's theory of storms and the artificial production of rain.

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* Fourth Report, 1857, p. 29.

† But there can be no excuse for the blunder of an illustrated New York paper, by which the flames are represented as being carried in a direction exactly contrary to the fact.

PAPER F.

LIST OF THE GREAT STORMS, HURRICANES, AND TORNADOES OF THE UNITED STATES. PREPARED BY I. A. LAPHAM, ASSISTANT TO THE CHIEF SIGNAL-OFFICER, UNITED STATES ARMY.

1635. Aug. 15.—A violent storm or hurricane did much damage in New England.—(Dwight.)

1678.—A bark cast away on Lake Ontario in November—the first lake disaster.—(Hennepin.)

1679, Aug. 26.—The Griffin, the first sail-vessel on the upper lakes, encountered a severe gale on Lake Huron.—(Hennepin.)

Sept.—The Griffin lost on one of the upper lakes.—(Hennepin.)

Oct. 1, 4.—Voyagers driven ashore, on the west coast of Lake Michigan, by stress of weather.—(Hennepin.)

1692, March 4.—A furious storm of wind and rain at New Haven, Connecticut.—(Am. Jour. Sci., 42, p. 399.)

March 13.—Another storm at New Haven.—(Ibid.)

1697, Oct. 18.—Hurricane in Maryland, Delaware, in Philadelphia, &c.—(Tr. Am. Phil. Soc., i, p. 350.)

1699.—A severe hurricane in South Carolina.—(Draper; Blodget, p. 397.)

1700, Sept. 16.—Storm at Charleston, South Carolina.—(Ramsay, Hist., 2, p. 314; Blodget, Climr, p. 397.)

1713, Sept. 16, 17.—Hurricane at Charleston, South Carolina.—(Ramsay, p. 314; Blodget, p. 397.)

1717, Feb. 18, 24 (O. S.)—Great snow-storm in New England.

1723.—A very destructive hurricane at New Orleans, Louisiana.—(Barton; Blodget, p. 397.)

1728, Sept. 14—A great storm at Charleston, South Carolina.—(Hewat; Ramsay, p. 314; Blodget, p. 397.)

1751. March 12.—A violent tempest in New England.

1752.—Hurricane at Charleston, South Carolina, early in September.—(Chalmers's Weather of South Carolina; Blodget, p. 397.)

Sept. 15.—The second hurricane in this month at Charleston, South Carolina.—(Prioleau; Chalmers; Ramsay, p. 314; Blodget, p. 397.)

1754, Oct. 21.—A great storm in New England, with heavy rains.—(Smith; Mass. Agr. Rep., 1854, p. 38.)

1756.—Saint Simon's Island, Georgia, flooded during a storm.—(Lyell, 2d Visit, 1, p. 253; Blodget, p. 397.)

1757, Oct.—A hurricane from West Florida, to Boston.—(Investigated by Benjamin Franklin; Volney's View, p. 196.)

1761, May 2.—A tornado at Charleston, South Carolina, at 2½ p. m.—(Am. Register; Piddington, p. 97.)

1769, Sept. 8.—A tempest in New England.

1770, Oct. 19.—A tempest in New England.

1771, Feb. 8.—A storm at Philadelphia, Pennsylvania, with very high tide.—(Tr. Am. Phil. Soc., 1, p 179.)

1772, Aug. 31 to Sept. 3.—Hurricane in Louisiana.—(Guyarre; Blodget, p. 397.)

1773, Aug. 14.—A very destructive hurricane in Eastern Massachusetts.—(Tr. Am. Phil. Soc., 2, p, 137.)

1778, Aug. 18.—A violent tempest in New England.

Oct. 7, 10.—Storm at New Orleans, Louisiana.—(Golver; Guyarre; Blodget, p. 397.)

1779, Aug. 18.—Hurricane at New Orleans.—(Dunbar in Tr. Am. Phil. Soc., 6, p. 53; Guyarre; Blodgett, p. 397.)

Oct. 7, 10.—Storm in Lower Louisiana. Very high sea.—(Guyarre; Blodget, p. 397.)

1780. May 19.—Was known as the "dark day" in Northern States and Canada.—(Thompson's Vt., p. 16.)

Aug. 24.—Storm in Louisiana.—Guyarre; Blodget, p. 397; Dunbar in Tr. Am. Phil. Soc., 6, p. 53.)

Oct. 3, 5.—Hurricane in Jamaica. Cuba, Florida, &c.—(Redfield, Am. Jour., 31, p. 120, and ii, 2, p. 323; Blodget, p. 397.)

1783, Oct. 14.—A severe storm on Lake Erie.—(Tr. Am. Phil. Soc., 3, p. 63.)

1787, Aug. 15.—Five tornadoes in different States on this day.—(Butler; Atmos. Syst., p. 332.)

1794, June 19.—Tornado at Northford, Connecticut.—(Maltby in Am. Jour. Sci., 39, p. 384.)

1797, September.—Storm at Charleston, South Carolina.—(Drayton; Blodget, p. 397.)

1804, Aug. 19.—A violent tempest from the southwest in New England.

Sept. 3, 9.—Storm at Charleston, 7th; Norfolk, 8th; Boston, 9th.—(Redfield, Am. Jour. 20, p. 42, and 31, p. 124; Chart, No. v; Ramsay; Drayton; Lyell; Blodget, p. 397; Piddington.)

Oct. 9, 10.—Very extensive storm in New England.

1806, Sept. 19.—Tempest at South Hadley, Massachusetts.

1809, Jan.—Violent storm over great part of the country.—(Dewey in N. Y. Reg. Rep., 1849, p. 235.)
May 28.—Tornado at Cincinnati, Ohio, &c.—(Drake: Blodget, p. 403; Butler, p. 310.)
1810, Jan. 19.—Known as the "cold Friday" in the Northern States.
1811, Feb. 2.—A great snow-storm in New England; continued three days.
Sept. 10.—Hurricane on the Atlantic coast, called "the Cuba hurricane."—(Redfield, Am. J., ii, 2, p. 186; Piddington, p. 313; Niles's Register; Blodget, p. 398 and 403; Barton.)
1812, Aug.—Hurricane at mouth of the Mississippi.—(Drake; Blodget, p. 398.)
1813, July 15.—A tornado in New York.
Aug. 27.—Hurricane at Charleston, South Carolina.—(Niles's Register; Blodget, p. 398.)
1814, July 1.—Hurricane at Charleston, South Carolina.—(Niles's Register; Blodget, p. 398.)
1815, Sept., 18, 24.—Hurricane in New England States.—(Farrar; Am. Phil. Trans.; Beck, Am. J., 1. p. 389; Darling, Am. J., 42, p. 243; Piddington, p. 3; Redfield, Am. J., 20, p. 42; Blodget, p. 398.)
1816, late in November.—Schooner Hercules wrecked in a storm on Lake Michigan.—(Schoolcraft Nar., p. 393.)
1819, July 26.—Excessive rain-storm at Catskill, New York.—(Am. J., 4, p. 124.)
Nov. 9.—A very dark day on the upper lakes, Detroit, Green Bay, &c.
Steamboat Walk-in-the-Water, first on the lakes, lost at Fisherman's Point.
1820, June 20, 21.—Violent storm on Lake Superior.—(Schoolcraft Nar., p. 149.)
July 1.—Storm on Lake Superior.—(Schoolcraft Nar., p. 191.)
Sept. 9.—A gale of wind at Mackinac.—(Schoolcraft Nar., p. 403.)
1821, Sept. 1, 4.—Storm on Atlantic coast.—(Redfield, Am. J., 20, p. 20, and 31, p. 126; Chart No. viii; Piddington; Blodget, p. 398; Barton.)
Sept. 9.—Tornado at Warner, New Hampshire, at 5 p. m. Two others same day.—(Hubbard, Am. J., 35, p. 233.)
1822, Aug.—Storm on the coast of the Carolinas.—(Blodget, p. 398.)
1823, May.—Tornado at Natchez, Mississippi.—(E. Loomis, Am. J., 43, p. 299.)
June 19.—Tornado at Morgan, Ohio, at 9½ a. m.—(Loomis, Am. J., 43, p. 298; Butler, p. 318.)
Sept. 18, 20.—Storm on Lake Superior.—(Keating; Long's Ex., 2, p. 182 and 186.)
1824.—Hurricane at Saint Simon's Island, Georgia.—(Lyell; 2d Vis., 2, p. 253.)
May.—Tornado at Natchez, Mississippi.—(E. Loomis, Am. J., 43, p. 298.)
1825. Oct. 7.—A storm and great fire, Mirimichi River, New Brunswick.—(Am. J., 36, p. 55.)
1826, June 28.—Hurricane on the White Mountains, New Hampshire.—(Am. J. Sci., Vol. 15, p. 220.)
Aug. 27.—Hurricane on the White Mountains, New Hampshire. Willey family destroyed.—(Am. J., 15, p. 219.)
1827, April 12.—A storm from Upper Mississippi to Vermont, uprooting trees, &c.—(Hildreth, Am. J., 14, p. 63.)
Aug. 17, 27.—Hurricane at Charleston 24th; New York, 27th.—(Redfield, Am. J., 31, p. 123; Chart No. iii; Blodget, p. 398.)
1829.—A storm on the Rio Grande, Texas, causing inundations.—(Bousignes; Lieutenant Webster; Blodget, p. 398.)
1830, March 30.—Tornado in Maury County, Tennessee.—(E. Loomis, Am. J., 43, p. 298.)
May 31, at midnight.—A tornado at Shelbyville, Tennessee.—(J. H. Kain, Am. J., 31, p. 252.)
Aug. 15, 19.—Hurricane, Saint Augustine, Florida, 15th; Charleston, 16th; New York, 17th; Boston, 18th; Newfoundland, 19th.—(Redfield, Am. J., 20, p. 34; 25, p. 115, and 31, p. 125; Chart No. vi; Piddington; Blodget, p. 398.)
Aug. 22, 27.—Cape Hatteras, &c.—(Redfield, Am. J., 20, p. 39; 25, p. 115; 31, p. 125; Chart No. ix; Blodget, p. 398.)
Sept. 29, Oct. 2.—Storm on Atlantic coast.—(Redfield, Am. J., 31, p. 125; Chart No. vii; Blodget, p. 398.)
Dec. 5, 6.—Storm on Atlantic coast.—(Redfield, Am. J., 31, p. 126; Chart No. x.)
1831, Jan. 13, 15.—Storm on Atlantic coast.—(Redfield, Am. J., 31, p. 126; Chart No. x.)
Aug. 10, 18.—Storm in Florida, Louisiana, &c.—(Redfield, Am. J., 24, p. 191, and 31, p. 123; Chart No. ii; Berlandier; Blodget, p. 398; Barton.)
1832, May 7.—Tornado at Kingston, Mississippi.—(E. Loomis, Am. J., 43, p. 298.)
1833, April 11.—Tornado at Springfield, Ohio.—(E. Loomis, Am. J., 43, p. 298.)
Oct. 12.—Tornado in North Carolina.—(E. Loomis, Am. J., 43, p. 293.)
1834, Aug. 14.—Tornado at Utica, New York, at 4 to 5 p. m.
Sept.—Storm in Lower Texas.—(Lopez; Bousignes; Lieutenant Webster, Survey of Coast at Mouth of the Rio Grande, 1848.)
1835, June 19, at 5 p. m.—Tornado at New Brunswick, New Jersey.—(Beck, Am. J., 36, p. 115, and Bache, Tr. Am. Phil. Soc., 5, p. 421; Hare, Tr. Am. Phil. Soc., 5, p. 375, and

1835, Am. J., 32, p. 153; Redfield, Am. J., 35, p. 206, and 41, p. 69; Piddington, p. 315; Blodget, p. 403.)

June 19.—Tornado at Kinderhook, New York, at 4 p. m.

June 19.—Tornado at Pine Plains, New York, at 6 p. m.

June 19.—Tornado at Paterson, New Jersey, 17 miles north of New Brunswick, 8½ p. m.—(Espy, Tr. Am. Phil. Soc., 5., p. 425.)

Aug. 12, 18.—Hurricane in Louisiana, Texas, and Mexico.—(Redfield, Am. J., 31, p. 124; Chart No. iv; Berlandier; Blodget, p. 378; Piddington; Chart No. v.)

1835, Nov. 9, 11.—Great storm on Lake Erie, &c.—(Redfield, Tr. Am. Assoc., 1854, p. 209; Chart xi. and Am. J., 31, p. 126; Piddington.)

1836, Dec. 20.—Storm on the lakes, &c.—(E. Loomis, Tr. Am. Phil. Soc., 7, p. 126; Pro. Am. Assoc., 1855, p. 170; Sur. Cont., vol. 11; and Am. J., 40, p. 34; Redfield, Pro. Am. Assoc., 154, p. 208; and Am. J., ii, 18, p. 186; Chart No. xxvii.)

1837, March 18.—A northwest gale on Lake Michigan.

July 25, 26.—A heavy storm on Lake Michigan.

Aug. 21.—Great gale and storm on Lake Ontario; began at 7 p. m.—(Doctor E. S. Marsh.)

Oct. 3, 12.—Hurricane, Matamoras, 3d; Galveston, 5th; New Orleans, 6th; Mobile, 7th; Charleston, 8th.—(Berlandier; Lopez; Redfield, Am. J., ii, 1, p. 166; Chart No. 15; Blodget, p. 398; Piddington; Chart No. xv.)

Oct. 20, at 3 p. m.—Tornado at Stow, Ohio.—(Loomis, Am. J., 33, p. 368.)

1838, July 25, p. m.—Tornado in Allegheny County, Belfast, &c., New York.—(W. Gayton. Am. J., 37, p. 90.)

Aug. 30, between 3 and 4 p. m.—Tornado at Providence and Somerset, Rhode Island.—(Robert Hare, Am. J., 38, p. 73; Redfield, Am. J., 43, p. 263.)

Sept.—Hurricane, Florida to Newfoundland.—(Redfield, Am. J., 35, p. 206.)

1839, May 23.—Tornado at Maumee, Ohio.—(Loomis, Am. J., 43, p. 298.)

July 31, at noon.—Tornado at New Haven, Connecticut.—(D. Olmstead, Am. J., 37, p. 340.)

Dec. 15.—Storm in New Jersey, Connecticut, and New Hampshire.—(Redfield, Am. J., 42, p. 112, and ii, 1, p. 169; Chart No. xvi.)

1840, March 24, 7 p. m.—Tornado at Mobile, Alabama.—(E. Loomis, Am. J., 43, p. 298.)

April 23, 4½ p. m.—Tornado at Marietta, Ohio.—(S. P. Hildreth, Am. J., 41, p. 346.)

May 3, 4½ p. m.—Tornado at Gallipolis, Ohio.—(S. P. Hildreth, Am. J., 40, p. 346.)

May 7, 2 p. m.—A very destructive tornado at Natchez, Mississippi.—(Am. J., iii, 2, p. 98; Blodget, p. 403; Loomis, Am. J., 43, p. 298; Tooley.)

Aug. 13.—Storm at Woodbridge, near New Haven, Connecticut.—(Piddington, p. 315.)

Sept. 14.—Destructive thunder-storm at Oneida, Madison, and Onondaga, New York.—(Am. J. Sci., 42, p. 210.)

1842, Feb. 4, 4½ p. m.—Tornado at Mayfield, northeast part of Ohio.—(Loomis, Am. J., 43, p. 298; Tr. Am. Phil. Soc., vol. 9; Pro. Am. Assoc., 1855, p. 181; Butler, p. 318.)

July 12.—Storm off Cape Hatteras, Washington, &c.—(Johnston's Physical Atlas; Blodget, p. 400.)

Storm on Gulf of Mexico, Key West, Louisiana, Texas.—(Redfield, Am. J., ii, 1, p. 17; Lopez; Blodget, p. 399.)

Sept. 18, 22.—Storm on the Gulf of Mexico.—(Redfield, Am. J., ii, 1, p. 15.)

Oct. 5.—Storm in North Florida, &c.—(Redfield, Am. J., ii, 1, p. 153; Chart No. xiii; Blodget, p. 399; Piddington.)

1843, Jan. 12.—Gale on Lake Michigan at 9 p. m.

July 28, 29.—Gale on Lake Michigan.

Aug. 8.—Tornado in Queen Anne's County, Maryland.

Aug. 20.—Water-spouts seen on Lake Michigan, off Kenosha.—(Lapham's Wisconsin, p. 77.)

Sep. 21, 27.—Storm on Lake Michigan.

1844, March 21.—Storm on Lake Michigan.

March 28, 29.—Great snow-storm on Lake Michigan.

Aug. 4.—Very destructive hurricane at mouth of the Rio Grande, Texas. Brazos Santiago destroyed.—(Lopez; Berlandier; Blodget, p. 399.)

Sept. 14.—Hurricane at Charleston, South Carolina.—(Blodget, p. 399.)

Sept. 28.—Storm and deep snow in Pennsylvania, &c.

Oct. 2.—Storm on the Upper Lakes.—(Redfield, Am. J. Sci., ii, 2, p. 316.)

Oct. 5, 7.—"The Cuba hurricane," Atlantic coast.—(Redfield, Am. J., ii, 2, p. 333; Chart No. iv, ii, 2, p. 162; Pro. Am. Assoc., 1854, p. 208; Chart No. xviii; Piddington's Chart, No. xvii; Espy; Thrasher; Blodget, p. 399.)

Oct. 18.—A storm on the lakes; hurricane on Lake Erie.—(Redfield, Am. J., ii, 2, p. 321; Espy, 3d Rep.)

Nov. 10.—Gale at Buffalo, New York.

1845, Feb. 4, 5.—Storm in New York.—(Dewey.)

April 1.—Gale on Lakes Michigan and Erie.

April 7.—Snow-storm on Lake Michigan.

1845, April 10.—Squall on Lake Saint Clair.
May 27.—Squall on Lake Erie.
June 15.—Squall on Lake Michigan.
Sept. 4.—Squall on Lake Huron.
Sept. 11.—Gale on Lake Huron.
Sept. 20.—Tornado on Lake Ontario.—(Dewey in Am. J., ii, 2, p. 86,)
Sept. 23.—Gale on Lake Erie.
Oct. 1.—Gale on Lake Erie.
Oct. 13.—Storm on Lake Superior. Dr. D. Houghton, geologist, drowned.
Nov 2.—Northeast gale with snow on Lake Michigan.
Nov. 23.—Great gale on Lakes Erie and Ontario, from the west, with snow.
Dec. 18.—Gale at Black Rock, New York.
1846, June 13.—Gale on Lake Huron.—(W. W. Mather.)
July 13.—Gale from 6½ to 10 a. m. on Lake Superior.
Aug. 7, 9.—Storm on Lake Superior, uprooting trees, &c.—(Mather, Am. J., ii, 6, p.4.)
Sept. 6, 7.—Gale on Lake Superior.—(Mather.)
Oct. 9, 14.—Storm on Lake Superior; also in Florida, Georgia, &c.—(Redfield; Blodget, p. 399, 400; Mather, Am. J., ii, 6, p. 8; Piddington, Chart. No. xx.)
1847, Feb. 19.—Storm at Milwaukee and New York.—(Davy; Blodget, p. 390.)
July 25. 29.—Heavy northeast gale on Lake Michigan and Lake Superior.
Oct. 24.—Gale on Lake Superior.—(N. Y. Reg. Rep., 1852, p. 278.)
1848, April 8.—Snow-storm on Lake Michigan.
April 18.—Snow-storm on Lake Michigan.
June 4.—Small tornado at Milwaukee, Wisconsin, at 4 p. m.
July 30.—Storm on Lake Superior.—(Geol. Rep., p. 446.)
Aug. 22 to Sept. 3.—Storm on the Atlantic coast.—(Blodget, p. 399.)
Sept. 13, 14.—Storm and gale on Lake Superior.—(Geol. Rep., p. 523.)
Nov. 29.—Northeast snow-storm and gale at Milwaukee, Wisconsin.
1849, March 22.—Tornado at Beardstown, Shelbyville, &c., Kentucky.
June 23.—Hurricane in New Brunswick.
July 29.—Severe storm on the lakes.
Oct. 6, 7.—Storm at New York, &c.—(Blodget, p. 386.)
Nov. 24.—Northeast storm on Lake Michigan.
1850, Feb. 28.—Gale on Lake Michigan.
March 13.—Gale on Lake Michigan.
May 22.—Storm on the lakes —(Dewey, Reg. Rep., 1851, p. 370.)
July 15.—Gale on the Atlantic and the lakes.—(Dewey, p. 371.)
July 30.—Tornado at Saukville, Ozaukee County, Wisconsin.
Aug. 23.—Hurricane in Florida.—(Blodget, p. 399.)
Aug. 28, 29.—Gale on the lakes.—(Dewey, p. 371.)
Nov. 26.—Hurricane in Missouri,
Dec. 6, 8.—Storm in Western New York.—Blodget, p. 385.)
Dec. 23.—Great snow-storm northeast to northwest.—(Dewey; Blodget, p. 384.)
1851, May 31.—Tornado or hurricane at Madison, Oconomowoc and Eagle, Wisconsin.
Aug. 9.—Tornado in Connecticut.—(J. Brocklesby, Pro. Am. Asso., 1854, p. 109.)
Aug. 13.—Hail-storm at Warren, New Hampshire.—(E. Loomis, Pro. Am. Asso., 1853, p. 73.)
Aug. 16.—Storm on Lake Michigan.
Aug. 22.—Tornado at Cambridge, Massachusetts.—(Brooks and Eustis; Blodget, p. 404.)
Aug. 23, 27.—Hurricane from Florida, on Atlantic coast.
1852, Feb. 28, March 1.—Storm on the lakes.—(Dewey, Reg. Rep., 1853, p. 250; Espy, 4th report.)
March 24.—Storm and gale on the lakes.—(Dewey, p. 250.)
April 18, 20.—Great storm on the Atlantic coast.—(Dewey, p. 250.)
April 30.—Tornado at New Harmony, Indiana.—(Chapplesmith, Sm. Cont., vol. 7; Am. J., ii, 23, p. 18; Blodget, p 404.)
Dec. 16, 17.—Gale on Lake Michigan in the night.
1853, July 1, 5 p. m.—Great hail-storm in New York City.—(Loomis, Am. J., ii, 17, p. 35; Pro. Am. Assoc., 1853, p. 56.)
July 2.—Great storm in Wisconsin.
Sept. 6, 16.—Storm on Atlantic coast.—(Redfield, Am. J., ii, 18, pp. 1 and 176; Blodget, p. 400.)
Oct. 24.—Great gale on the Atlantic coast and on the lakes.—(Dewey, N. Y. Reg. Rep., 1854, p. 301.)
1854, Jan. 12.—Storm, Saint Louis, Chicago, &c.; also in Western New York.—(Dewey, Rep, 1855, pp. 290, 294.)
Jan. 30.—Storm traced from Arkansas to New England. Tornado at Brandon, Knox County, Ohio.—(Am. J., ii, 17, p. 290; O. N. Stoddard, Am. J., ii, 18, p. 70; Proc. Am. Assoc., 1854, p. 188; Butler, p. 311; Blodget, p. 404.)

1854, Jan. 20.—Tornado in Washington County, Pennsylvania.
Jan. 29.—Storm on the Ohio River.—(Dewey, 1855, p. 294.)
Feb. 14.—Tornado at Harrison, Ohio.—(O. N. Stoddard, Am. J., ii, 20, p. 161.)
March 17, 18.—Snow-squalls and hurricane on Lakes Erie and Ontario.—(Dewey, 1854, p. 303, and 1855, p. 296.)
Jan. 23.—Hurricane at Manteno, Kankakee County, Illinois.
Sept. 9, 11.—Storm on Atlantic coast—Charleston, Norfolk, and Boston.—(Baldwin; Posey; Blodget, p. 400.)
Nov. 13.—Storm on the lakes.—(Dewey, 1855, p. 298.)
1855, Jan. 4, 6.—Storm on the lakes.—(Blodget, p. 389.)
April 2.—Great snow-storm in New York.—(Dewey, 1856, p. 344.)
Sept. 18.—Violent gale on Lake Michigan.
Oct. 24.—Storm on Lake Ontario.—(Dewey, 1856, p. 347.)
1856, Aug. 9.—Hurricane at New Orleans and Boston.—(Blodget, p. 400.)
Aug. 25.—Northeast gale on Lake Michigan.—(Graham Harbor Report.)
Aug. 30.—Hurricane on Gulf coast.—(Blodget, p. 400.)
Oct. 14.—Heavy blow on Lake Micigan.—(Graham.)
Oct. 23.—Heavy blow on Lake Michigan.—(Graham.)
Nov. 6.—Heavy blow on Lake Michigan.—(Graham.)
Dec. 14.—Gale from the west on Lake Michigan.—(Graham.)
1857, Jan. 18.—Storm on Atlantic coast.
April 1.—Gale from the northeast on the lakes.
June 13, 4 p. m.—Tornado at Schuyler, (near Utica,) New York.—(Am. J., ii, 24, p. 290.)
Aug. 24.—Strong gale from northwest on Lake Ontario.—(Graham.)
Sept. 7.—Gale from northeast on Lake Ontario.—(Graham.)
Nov. 19.—Storm at Rochester, New York.
1858, March 17, 18.—Storm in Ohio and New York.
May 31.—Gale at Chicago.
July 11, 21.—Storm on Lake Ontario.—(Dewey, Reg. Rep., 1859, p. 233.)
Aug. 18.—Heavy gale on Lake Ontario.—(Dewey, p. 233.)
Sept. 30.—Storm on the lakes.—(Dewey.)
1859, March 14, 18.—Storm from Texas to New England.—(Results of Met. Obs. Smithsonian Institution, vol. 2, p. 325.)
March 28, 29.—Gale from north and northeast on Lake Michigan.—(Colonel Graham, Harbor Report.)
Sept. 1.—Storm on Lake Superior.
Sept. 17, 19.—Storm on the lakes, &c.—(Results of Smithsonian Met. Obs., vol. 2, p. 331.)
Sept. 16.—Gale on Lake Michigan.
Nov. 25.—Storm on Lake Michigan.
1860, May 8.—Storm in Wisconsin.
May 21.—Tornado at Cincinnati, Ohio.
Nov. 1, 2.—Storm on the lakes and Atlantic.—(Dewey.)
1861, May 19.—Northeast storm on Lake Michigan.
June 19.—Tornado in Champaign County, Illinois, at 4 p. m.
July 8.—Tornado at Rockford, Freeport, Warren, &c., Illinois.
July 8.—Tornado, at 2 a. m., at Oshkosh, Wisconsin.
Aug. 11.—Storm and flood at Chicago.
Aug. 14.—Hurricane at Key West.—(Hunt, in Am. J., ii, 35, p. 393.)
1862, May 21.—Tornado at Wheeling, &c., West Virginia.
Aug. 10.—Tornado at Dubuque, Iowa.
1863, Aug. 11.—Tornado at New Lisbon, Juneau County, Wisconsin.
Aug. 21.—Tornado at Buena Vista, Portage County, Wisconsin, at 9 p. m.
1864, Jan. 1.—Hurricane on Lake Superior. Excessively cold weather in Wisconsin.
Sept. 23.—Tornado at Paris and Mattoon, Illinois, from 4 to 5 p. m.
1865, June 29.—Destructive tornado at Viroqua, Vernon County, Wisconsin.
June 18.—Tornado near Red Wing, Minnesota; crossed the Mississippi River at Diamond Bluff.
1866, May 29.—Tornado destroyed the light-house at Bay Point, Port Royal Harbor.
June 15.—Storm and hurricane at Winona, Minnesota.
June 17.—Gale in New York City.
Sept. 20.—Severe gale on the lakes.
Oct. 21.—Hurricane at Indianapolis, Indiana, from midnight to 3 a. m.
Dec. 26, 28.—Storm on the lakes and Atlantic coast.
1867, Jan. 20, 21.—Great snow-storm in Middle and Eastern States.
April 29, 10 a. m.—Tornado near Tuscaloosa, Alabama.—(H. S. Whitfield, Am. J., iii, 2, pp. 99, 105.)
July 31.—Water-spout reported on Lake Michigan this morning.
Oct. 3.—Hurricane at Galveston, Texas.

1868, March 17.—Hurricane at Chatham, near Springfield, Illinois. Extended over Illinois, Indiana, &c.
May 3.—Hurricane (or tornado) near Muscatine, Iowa.
May.—Tornado on the Bigbee River, south of Columbus, Mississippi, and across Pickens and Tuscaloosa Counties, Alabama.—(Whitfield, Am. J., iii, 2, p. 97.)
Aug. (17?)—Hurricane at Janesville, Wisconsin.
1869, April 18.—Tornado at Dubuque, Iowa.
April 19.—Hail-storm at Saint Louis. Hurricane at Burlington, Iowa, Indianapolis, &c.
May 28.—Tornado at Athens, Ohio. Hail-storm at Wheeling, West Virginia.
Oct. 4.—Gale at Sackville, New Brunswick. Tidal wave.
1870, Jan. 17.—Gale on Lake Erie.
May 17.—Gale at Saint Paul, Minnesota.
Oct. 15.—Tornado in the city of Milwaukee. A frightful tornado in Southern Ohio and Northern Kentucky.
Oct. 21.—Tornado in the evening at Bellville, Richland County, Ohio.
Oct. 30.—Violent southwest gale on the lakes.

PAPER G.

LIST OF DISASTERS TO SHIPPING UPON THE GREAT AMERICAN LAKES DURING THE YEAR 1872.

JANUARY.

21st.—The propeller Manistee, damaged in the Manistee River, by striking a wreck left by the fire in October last.

24th to 26th.—The steamer Ironsides left Milwaukee for Grand Haven, but compelled to return, being covered with ice.

FEBRUARY.

Propeller Favorite broke her wheel in the ice at Detroit.

8th.—Propeller Ironsides reached Grand Haven after several days' detention in the ice off that harbor.

9th.—Propeller Ironsides broke her wheel in the ice on Lake Michigan, there being more ice than ever before known on that lake.

10th.—Propeller Favorite broke her rudder in the Detroit River.

23d.—Barge Saginaw sprung a leak at Detroit; 200 bushels of grain damaged.

26th.—Steamer Ironsides burst her cylinder-head on her passage from Milwaukee to Grand Haven.

27th.—Scow Onward, in Detroit River, cut through by a mass of floating ice, and sunk in 20 feet of water.

29th.—Schooner Len Higby drifted ashore near Milwaukee, having been abandoned by the crew at Little Point Sauble, damaged by ice; total loss.

MARCH.

2d.—Tug M. I. Mills burned at Amhurstburgh, near mouth of Detroit River; damage $5,000.

3d.—Schooner Jason Parker driven back by a gale from Ashnapee to Manitowoc, on Lake Michigan.

Ferry steamer Detroit broke her wheel on the Detroit River.

7th.—Steamer Ironsides detained by ice during a violent gale on Lake Michigan.

Schooner Challenge sprung a leak at Ludington, on Lake Michigan.

Scow Ellen Doak and schooner Jason Parker detained by ice several weeks at Manitowoc.

Propeller Missouri, grain, injured by ice at Malden, causing a bad leak.

Steamer Manistee aground at Manistee Harbor; goods thrown overboard.

17th.—Propeller Ironsides aground several hours at Milwaukee.

Steam-barge East Saginaw damaged at Centreville pier.

30th, (night.)—Schooner North Star stranded three miles north of Racine, in a snow-storm.

Schooner Two Brothers ashore south of Kenosha; crew jumped ashore from the bowsprit.

Schooner C. L. Johnson damaged in the gale.

Tug Margaret sunk at Milwaukee.

Scow Rough and Ready sunk at Toledo.

31st.—Propeller Saint Joseph had her furniture injured by rough weather.

APRIL.

1st.—Schooners Octavia, Union, and Toledo, slightly damaged by collision at Milwaukee.

4th.—Schooner J. and A. Stronach sprung a leak at Ludington, Lake Michigan; cargo discharged.

5th.—Propeller Saint Joseph damaged by fire at Milwaukee.

Propeller East Saginaw ashore on the west coast of Lake Michigan.

6th.—Propeller Ironsides detained by fog on Lake Michigan.

Scow Laurel, lumber, had her fore-boom broken at night.

8th.—Schooner Horton ashore at Michigan City.

9th.—Schooner Tempest filled with water and capsized at Milwaukee.

Schooner Toledo lost jib-boom at Milwaukee.

Schooner Worthington lost jib-boom by striking a bridge in Cleveland.

Barge Agnes Porter aground at Milwaukee.

11th.—Scow Christie, wood, ashore on a rock, filled with water, on White Fish Point, north of Wolf River, Lake Michigan.

Schooner Two Charlies, wood, struck the south pier at Milwaukee, at 11 p. m., in a southeast gale, and capsized.

Schooner Napoleon lost jib-boom by collision with the steamer City of Toledo, at Milwaukee.

Schooner H. F. Henry, provisions, ran aground at night on Fighting Island, in the Detroit River.

12th.—Propeller Truesdell damaged by contact with a bridge at Chicago.

Scow Planet sunk in the Manistee River.

13th.—Barge Filar slightly damaged at Milwaukee by contact with a bridge.

Propeller Messenger struck a bar at Manistee, and lost rudder, shoe, and anchor.

Scow Annie Tomine struck the pier at Sheboygan; afterward damaged by drifting against a dock.

Scow Nettie dismasted in a gale off Bass Island, Lake Erie.

14th.—Scow Christie sunk in 7 feet of water at Stony Creek.

Schooner Union lost anchor and damaged at Manitowoc.

Schoooner Game-Cock damaged at Bailey's Harbor, on Lake Michigan.

Steamer Jay Cooke slightly damaged at Put-in-Bay, Lake Erie.

Bark El Dorado, lumber, aground at Ludington; lightened. (Owing to low water in the lakes.)

Schooner Eva M. Cone lost foretop on Lake Michigan.

Scow Minnie Corlett lost two of four spars which she was towing on Lake Michigan.

15th.—Schooner Liberty dashed to pieces on the pier at Milwaukee early this morning, in a violent northeast gale and snow-storm. One man (Nicholas Thompson) lost.

Scow Selt, shingles, stranded near North Point light-house, Milwaukee.

Scow Alaska lost deck-load of wood near Milwaukee.

Steamer Sheboygan driven back to Milwaukee by stress of weather.

Propeller Navarino sunk at the pier at Chicago.

Bark Acorn, schooners Sardinia and Jones, scows Chapin and Ereuca, and the bark Two Nellies damaged at Chicago.

Schooner Kate Lyons lost canvas in the gale on Lake Michigan.

Schooner J. Bean lost fore-boom on Lake Michigan.

George Williams, cook, drowned from the propeller Phil Sheridan at Detroit.

Propeller Lady Franklin, with two scows in tow, ran ashore in the Detroit River this afternoon in a violent snow-storm.

Scow Juno, coal, driven ashore at Peninsular Point, near Marble Head light, Lake Erie, in a northeast storm

Schooner L. W. Perry, lumber, aground on Kelley's Island, Lake Erie.

Schooner C. L. Johnson damaged by collision at Manitowoc.

Schooner Charley Hibbard damaged in the gale on Lake Michigan.

Schooner C. L. Davis damaged by collision with the schooner Sea Gem at Manitowoc.

Fish-boat Hattie supposed to be lost, with John Babbineaux and his son, near Herring Creek, Frankfort.

Propeller East Saginaw ashore at South Manitoo Island.

Scow Mary Jane aground at Sandusky in a snow-storm.

16th.—Schooner Gipsey lost main-boom and jib-boom by collision at Chicago.

17th.—Bark Cambridge aground in the Detroit River.

Scow Industry ashore on Saint Joseph, on Lake Michigan.

18th.—Schooner James Couch lost jib-boom by striking a bridge at Chicago.

Schooner Two Brothers injured by collision with the Augustus Ford at Oswego.

Steamer Jay Cooke damaged at Detroit.

Schooner Active ashore and full of water at Saint Joseph.

19th.—Tug Morey broke her wheel at Oswego.

Tug Diana lost smoke-stack by collision with the schooner Ariadne at Oswego.

20th.—Scows Lime Rock and O. T. Wilcox aground in the Detroit River.

Steamer Ottawa damaged wheel in the Portage River.
Schooner Ebenezer lost her yawl on Lake Michigan.
Schooner S. H. Kimball and propeller Michael Groh injured by collision at Cleveland.
Scow C. C. Bates lost scow-load of lumber on Lake Michigan.
21st.—Schooner Speed damaged and sunk at Kenosha on Lake Michigan.
Steam-barge Anna Laura ashore on Colchester Reef, Lake Erie.
22d.—Schooner Eva M. Cone, wood, ashore at Port Ulca, on Lake Michigan.
Tug Monitor seriously damaged by fire at Chicago.
23d.—Schooner Concord aground in the Detroit River.
Bark Alice, coal, struck a rock in the Detroit River and sunk.
(Many accidents on account of the unusually low water of the lakes.)
24th.—Schooner P. Hayden ashore ten miles north of Whitehall, Lake Michigan.
26th.—Schooner Guiding Star ashore at Morgan's Point, Lake Erie.
27.—Several vessels damaged by ice near Kingston, Lake Ontario.
Schooner Mail ashore at Fish Point, Lake Ontario.
Tug Lady Franklin went ashore at 2 a. m. on Gull Point, Lake Ontario.
Schooners Irene and W. W. Grant slightly damaged by collision on Lake Ontario.
Propeller Empire State aground on the Saint Clair Flats.
Schooner Dane damaged by collision at Toledo.
Barge Banner aground at the mouth of Swan Creek.
Schooners Kate L. Bruce and H. Rand injured by collision at Chicago.
29th.—Steamer Marine City and schooner Owasco injured by collision at Detroit.
Barge Birchard sunk (at night) at East Saginaw.
Scow Louisa lost jib-boom in a blow on Lake Michigan.
30th.—Schooner W. H. Chapman lost a spar by collision at Milwaukee.
Scow Agnes aground in the Detroit River.
Steam-barge McKerrell damaged by collision at Bear Creek.
Barge Jennie Graham capsized on Lake Huron. A sailor and the cook were drowned.
Schooner Jane McLeod ashore on East Sister Island, Lake Erie.
Schooner Kate Gillett aground near Malden.
Schooner Fannie Campbell, lumber, capsized in a squall on Lake Huron. The captain and two men lost.
Tug Caroline Williams damaged by fire in the Manistee River.

MAY.

1st.—Three fish-boats capsized by the gale in Saginaw Bay; all saved.
Vessel injured at Buffalo by ice; carried by the current in the harbor.
Bark Lottie Wolf damaged by collision at Chicago.
Schooner Kate Gillett hard aground at Malden.
Scow Saint Stephen aground at Detroit.
Schooner Eliza badly damaged by collision on Lake Michigan.
2d.—Several barges with lumber broke away on Lake Huron, owing to the heavy sea this evening.
Propeller Empire State aground in Milwaukee Harbor.
Schooner Napoleon ashore near Stony Creek on Little Point Sauble, Lake Michigan.
3d.—Ferry-boat damaged by ice between Fort Erie and Buffalo.
Schooner E. M. Carrington, lumber, ashore at head of Belle Isle, Detroit River.
Barge Enterprise, lumber, sunk by collision at East Saginaw.
4th.—Schooners Fitzhue and William Sanderson injured by collision at Port Colborne.
Schooner Red, White, and Blue damaged by collision with the Maria Martin on the Saint Clair Flats.
Schooner Miama Belle, salt, sunk on Raisin Reef, near Monroe, Lake Erie.
Propeller Philadelphia damaged by ice at Buffalo.
Schooner Saint Andrew aground in Detroit River.
Schooner Maria Shaw, lumber, sprung a leak in the Welland Canal.
Schooner Persia, corn, ashore at Silkirk Point, near Port Colborne, Lake Erie.
Schooner Bob Wilson, barley, and William John, ballast, ashore at Northport, near Kingston, Lake Ontario.
Schooner Onward sprung a leak in the Welland Canal.
Schooner W. O. Brown ashore in the Detroit River.
Schooners Evaline, Powhatan, and Czar damaged by collision on the Saint Clair Flats.
Steamer Allegheny and two barges aground on the Saint Clair Flats.
Schooner Jo. Vilas lost jib-boom in a blow on Lake Michigan.
5th.—Schooner Buena Vista dismasted near Chicago.
6th —Thomas Sexton, seaman, drowned from the schooner Jennie and Annie, near Long Point, on Lake Erie.
7th.—Steamer Reynolds damaged on a hidden rock at Pine River.
Schooners Jennie Mullen and Mediator injured by collision in Welland Canal.
Barges D. P. Rhodes and G. H. Illsley aground on the Saint Clair Flats.

Schooner Lake Breeze partially dismasted on Lake Huron.

Schooner Eliza Fisher aground on Mill Point, Lake Ontario.

Schooner Russel Dart, wheat, sunk at Port Colborne.

8th.—Schooner Forest May sunk by collision with propeller Empire State, near Kelley's Island.

Captain John Reed drowned from the bark John Breden at Buffalo.

Bark Vanderbilt and schooners City of the Straits, Hans Crocker, and Perry Hannah damaged by grounding and collision near the mouth of the Detroit River.

9th —The yawl of the schooner H. C. Winslow crushed at Milwaukee.

Tug Compound exploded her boiler and sunk near Buffalo.

Buffalo Harbor blockaded by ice blown in by the gale.

Samuel Krumm drowned, from the barge S. Gardner, at Bay City.

10th.—Scows Fannie and Forest Maid sunk, by collision with the Granite State, near Kelley's Island.

George Burridge died from injuries received from the explosion of the tug Compound.

Propeller Nebraska broke her rudder near Marine City.

Schooner J. B. Penfield damaged at Oswego.

Schooner Clara Parker, coal, aground, forced ashore by ice on Rose Reef, Canada, jettisoned part of her cargo.

Tug Wales fast on a rock at mouth of Muskoga River, Georgian Bay.

11th.—Bark P. S. Marsh lost jib-boom at Chicago.

Vessels injured by the gale at Cleveland.

Barge Somerset, lumber, wrecked off Monroe, Lake Erie.

Bark Sweet aground at Wind-mill Point, Canada, on Lake Erie.

Bark Newsboy damaged in Detroit River.

Schooner Star of the North, railroad ties, capsized in a squall in the afternoon, off Point au Pellee.

Barge Orontes lost anchors in a gale on Lake Erie.

Propeller City of Boston damaged by collision with the bark Sea Gull in the Welland Canal.

Propeller Michigan damaged by ice on Lake Erie.

Schooners James Platt and Mont Blanc damaged by being blown against the dock at Windsor in a squall this afternoon.

Schooner Ashtabula damaged by collision, near Chicago.

Tugs Bismarck and others injured by ice at Buffalo.

Propeller Atlantic delayed twenty-four hours in the Saint Clair River.

Steamer Union broke her shaft on Green Bay.

Barges Dauntless and Wanda aground on Lake Saint Francis.

Schooner Jennie Bell injured by collision at Milwaukee.

Bark Erastus Corning compelled to lighten in crossing Saint Clair Flats, owing to low water in the lakes. (Vessels carrying lighter loads on that account.)

12th.—Propeller Buffalo filled with water in the ice near Buffalo; was towed ashore much damaged.

Propeller Atlantic, ashore at Elk Island, Detroit River.

Propeller-barge Dubuque, with a tow of barges, aground in the Detroit River.

Schooner Perry Hannah damaged at the mouth of the Detroit River.

13th.—Tugs Miller, O. B. Greene, and Mary McLane, damaged by collision at Chicago.

Henry McGuinn drowned from the propeller Saint Lawrence, near Kingston.

14th.—Barge Ocean, lumber, on a reef in Niagara River.

Schooners Tempest and Josephine ashore near Point au Pellee.

Scow Mary Jane aground on Lake Erie.

15th.—Schooner William Young, coal, sunk upon a reef near Buffalo, a tug entangled in ice having abandoned her.

Propeller Winslow damaged and delayed on Lake Erie.

Several vessels injured at Buffalo on account of the blockade of ice.

16th.—Schooner Truman Moss dismasted in passing a bridge in Chicago.

Schooner Wyoming sunk on the Horseshoe Reef near Buffalo.

17th.—An easterly wind cleared the ice from the harbor at Buffalo.

Tug Champion damaged by the ice at Buffalo.

Schooner Josephine ashore in a dense smoke on Point au Pellee.

Schooner Sweet Home lost a man overboard, a seaman named Kilroy, at Hamilton.

18th.—Navigation of Lake Huron rendered dangerous by smoke of burning forests.

Propeller Ontonagon ashore in a fog this morning in the Straits of Mackinac.

Barge Fulton, lumber, sunk at Wenona, Lake Huron.

Schooner Ethan Allen had cargo of corn wet in bad weather on Lake Huron.

At 11 o'clock a wind-storm at Buffalo drove vessels back to port.

Propeller City of Traverse hard aground on Saint Clair Flats, and again on Peach Island.

19th.—Schooner Mary B. Hale aground on a reef and leaking.

Schooner Levi Grant damaged by collision at Milwaukee.

Schooner Hubbard became leaky on Lake Michigan.
Schooner Fearless injured by running upon her anchor at Racine.
Barge Monitor, salt, ashore at Round Island, Straits of Mackinac.
Propeller Idaho injured machinery at Buffalo.
Barge Empire State, lumber, aground on Squaw Island, near Tonawanda, having lost her anchor.
Schooner Maggie, coal, ashore at Marigold's Point, Lake Ontario.
Tug Margaret damaged by collision with schooner Napoleon, at Manistee.
Steam barge East Saginaw disabled her machinery near Manitowoc.
Propeller Saint Louis broke her machinery at Erie, Pennsylvania.
Schooner Ethan Allen detained by heavy weather on Lake Erie by ice at Buffalo.
At night the propeller Merchant, merchandise, sunk on Bar Point, near the mouth of the Detroit River. Loss, $10,000.
Barge Detroit aground on Peach Island, Lake Saint Clair.
Tugs Stranger, Satellite, and Champion, broke wheels in the ice at Buffalo.
Schooner Helen Blood lost jib-boom near Chicago.
Schooner Hero waterlogged near Chicago.
Schooner American lost her jib-boom at Oswego.
Propeller East Saganaw broke down near Manitowoc.
Schooner Tempest ashore at Point au Pellee.
Schooners Petrel and Lorinda severely injured by collision, in a dense fog this morning, off Muskegon, Lake Michigan.
Propeller Manistee and schooner Robinson damaged by collision on Lake Michigan.
21st.—A number of vessels detained by grounding on the Saint Clair flats.
22d.—Schooner Centurian ashore near Rockwell, Lake Ontario, 500 bushels wheat wet.
Steam-barge Detroit aground in Detroit River.
Propeller Burlington ashore on Charity Island, Saginaw Bay.
23d.—Schooner Hattie Johnson, coal, aground in the Milwaukee River.
Barge Fulton sunk at Winona, in Saginaw Bay.
Schooners Arab and R. B. Hubbard arrived at Chicago leaking.
Propeller Colorado on a rocky shore at Point Sturgeon, Lake Erie.
24th.—Schooner S. Robinson, 16,000 bushels of corn, was run into and sunk in Lake Michigan, in a dense fog.
Propeller Kitty Hoyt damaged by striking a log near Bay City.
Steam-barge East Saginaw, lumber, went ashore and materially damaged on the Pancake Shoals, near Manitowoc.
Propeller Enterprise ashore at South Bay Point.
Schooner Mail lost jib-boom by collision at Oswego.
Schooner Bahama broke her rudder on Lake Erie.
Tug Sweepstakes aground at Port Edward.
Schooner Colonel Cook ashore on Forty Mile Point, Lake Huron.
26th.—At 10 p. m. a heavy squall on Lake Michigan.
Schooner Flea damaged in the squall on Lake Michigan.
Schooner Hero sprung a leak and put back to port.
Schooner Harvest Home, railroad iron, sprung a leak on Lake Erie.
Schooner Netta Weaver damaged on Lake Erie, at night.
Schooner Marquette, corn, sprung a leak on Lake Ontario.
Schooner Star of the North, railroad iron, sunk near Point au Pellee.
Schooner Dan Tindall, lumber, ashore near Manitowoc.
27th.—Schooners S. Bates, Mary Collins, Swallow, and Flying Cloud damaged by collision at Chicago.
Barge Guiding Star damaged by collision with the ferry-boat Great Western, at Detroit.
Tug H. P. Smith burned to the water's edge at Portsmouth, Saginaw River, value $4,500.
28th.—E. B. Sackrider jumped from the steamer Winslow and was drowned.
Tug Frank Gule damaged by fire at Sheboygan, ($200.)
30th.—Schooner Josephine and tug Ransom considerably damaged by collision.
Propeller Saint Louis aground in the new canal at Saint Clair Flats.
Schooner Evergreen ashore in a dense fog near Saugatuck, Lake Michigan.
31st.—Bark Nelson and schooner Page aground in the harbor at Milwaukee.
Schooner Irene struck a rock and sprung a leak.

The low stage of water in the lakes in the early part of the year 1872, which has caused so many of the disasters to shipping, is a direct result of the diminished rain-fall and increased evaporation of the latter part of the preceding year.

The mean level of Lake Michigan, as shown by observations made by me at Milwaukee during the month of May, 1872, was one inch below the city zero of street grades; the average level during the same month for the past twenty-six years was one foot and five inches above that zero.

The amount of rain-fall in September, 1871, at Milwaukee, was but little more than half an inch, while the average for twenty-nine years was nearly two inches. The amount of evaporation from the surface of an exposed basin of water during the months of September, October, and November, was nine and three-fourths inches, while the average for the same months during ten years past was only seven and one-fourth inches.

JUNE.

1st.—A dense fog on Lake Michigan.

Schooner Fashion lost her jib-boom at Chicago.

Brig Pilgrim and schooner Bridgewater damaged at Chicago.

2d.—Brig Menomonee and schooner Atlanta damaged on Lake Michigan near Chicago.

Tug Quayle broke her crank in the Saint Croix River.

Tug Goodnow broke her crank in the Detroit River.

Schooner Alva Bradish aground in the Detroit River.

A number of vessels aground on the Saint Clair Flats.

3d.—Steamship Gordon Campbell aground this morning on the Saint Clair Flats.

John Goodrow drowned from the scow Buffalo on Lake Ontario.

Tug American Eagle aground at Milwaukee.

Schooner Toledo damaged by collision at Milwaukee.

Schooner Tom Simms, grain, aground at Kingston, Lake Ontario.

4th.—Steamer Dove damaged by fire at Malden.

Tug L. H. Boole burst her steam-pipe at Pentwater, Lake Michigan, while towing the schooner North Star, lumber: both drifted ashore, and the tug sunk.

Bark American Giant lost 25,000 staves, and became water-logged above Port Stanley.

James Keyes, sailor, drowned from the scow Joseph Wright, near Cleveland.

Steamer Kingston burned to the water's edge, off Grenadier Island, eighteen miles from Brockville; Mrs. Dr. Jones drowned.

Tug J. T. Ransom capsized in Niagara River, and Ira Hanson and —— Smith drowned.

6th.—Propeller Cuyahoga ashore on Beaver Island.

Schooner Millard Fillmore on Hog Island Reef, in the straits of Mackinac.

7th.—Barge Mary Barton struck a snag, causing a leak, near Bay City.

Bark Colonel Ellsworth, corn, ashore near Point Albino and filled with water in thick foggy weather, at night.

Schooner Jennie Graham capsized, and one of her crew drowned.

Schooner Forwarder struck by a heavy squall on Black River, Lake Erie, and damaged.

8th.—Schooner Philo Scoville, coal, becalmed, and drifted upon Rose's Reef, near Buffalo.

9th.—Tug Bismarck broke her wheel at Racine.

Barge Emma E. Tyson ran aground at Racine and became leaky; 2,000 bushels corn wet.

Propeller Union lately ashore on Strawberry Reef, Green Bay, now on Laughing Whitefish Reef, twenty-four miles below Marquette, Lake Superior, at 2 a. m., in a dense fog.

Schooner C. Mears aground at Buffalo.

Schooner Cascade ashore on Laughing Whitefish Reef, Lake Superior.

10th.—Steamer Mary Ward hard aground at mouth of the river Thames.

Schooner Moses ashore in the Detroit River.

Schooner Canadian lost her jib-boom by collision with the Frank D. Baker at Oswego.

Scow Aunt Ruth ashore six miles above Round Eau.

11th.—Scow A. Rust damaged by collision at Chicago.

Bark Racine, railroad iron, sprung a leak on Lake Erie and returned to Buffalo.

12th.—Propeller Cuba hard aground in old channel, Saint Clair Flats.

Steamer Clara damaged by collision in Detroit River.

13th.—Two tows aground on the Saint Clair Flats.

Scow Martin damaged by lightning shortly after noon at Windsor.

Tug Frank Geele slightly damaged by fire at Sheboygan.

Bark Sweepstakes struck an obstruction in Saginaw Bay and filled with water.

A remarkable tidal wave on the lakes on the 12th and 13th. At Oswego at 3.30 p. m. of the 13th.

14th.—Steam barge J. S. Fay aground on the flats of Saint George, Sault River.

Vessels hindered by dense fog on the lakes on the 13th, 14th, and 15th.

16th.—Steamer Alpena aground on the shore of Lake Michigan.

Schooner Forwarder, lumber, aground in Detroit River.

18th.—Schooner Glen Cuyler, staves, lost foremast by collision with the scow Hunter at Manitowoc.

Propeller J. L. Hurd aground several days in South Reach, Saint Clair River.

19th.—Schooner Alvin Bronson damaged by collision at Chicago.

Propeller Missouri, salt, aground in Saginaw River.

Bark Tanner, coal, aground on Two Rivers Point, Lake Michigan.

Schooner Mary Hattie, lumber, ashore in Detroit River.

Schooner Gem of the Lakes, brick, sunk at Cleveland.

20th.—Schooner Jamaica struck (at mast-head suddenly, at noon, without warning) by a tornado and instantly capsized, off Rock Falls on Lake Huron. Eliza Headington drowned. Eighteen thousand bushels of wheat damaged.

Scow Mountain Maid, coal, became leaky on Lake Erie.

Barge Saginaw, timber, struck an obstruction near Saint Catharine's and sunk.

Schooner Lucinda Van Valkenburg and an unknown vessel lost all their canvas in a tornado on Lake Huron.

21st.—Tug Hunter sunk in 8 feet of water by collision on Lake Huron.

22d.—A fleet of vessels passed Detroit, having been detained by calms and fogs for whole days; some were leaky.

Schooner Imperial, lumber, damaged by collision with the bark J S. Austin, near Death's Door, Lake Michigan.

Schooner Portland, grain, ashore on Colchester Reef, Lake Erie.

Steamer Mason and barge American Giant, staves, aground on Carrolton Bar, Saginaw River.

Bark J. S. Austin struck by lightning this morning in the straits of Mackinac; two men injured.

Michael Morrisey, engineer of the tug Magnolia, drowned at La Salle.

23d.—An unknown vessel lost her jib-boom by collision with the schooner Delas De Wolf on Lake Michigan.

Tug L. B. Johnson and steam barge East Saginaw damaged by collision at Chicago.

Canal-boat Russel Smith, lumber, capsized and lost deck-load at Buffalo.

Tug Bob Anderson broke both her cylinder-heads on the Saint Clair River.

Tug Niagara exploded her steam-pipe at Detroit. James De Orsay, deck-hand, killed.

Schooner Algerine, iron ore, damaged by collision with steam-barge Robert Hollen at Cleveland.

24th.—Bark J. S. Austin, coal, damaged by collision on Lake Michigan, near Milwaukee.

Schooner Toledo crushed her yawl in the Milwaukee River.

Schooner William G. Grant, coal, sprung a leak on Lake Michigan.

Schooner Mary struck a snag in Lake Michigan, slightly damaged.

25th.—Schooner Louise Meeker damaged by striking a bridge at Chicago.

Schooners Azov, Apprentice Boy, and Montauk damaged by collision at Chicago.

Propeller Rocket aground in East River, Green Bay, in a fog.

Steamer Marine City ashore near Bark Shanty, Lake Huron.

27th.—Bark City of Painesville, iron ore, ashore on Eleven-Mile Shoal, near Escanaba, Green Bay.

Tug Mystic broke her crank-pin near Port Huron.

28th —Propeller Georgian damaged by fire at Buffalo.

Tug Merchant sunk by collision with the propeller Ironsides at Grand Haven.

Propeller Peerless ashore near Bay City.

29th —Schooner Japan, lumber, ashore near Spider Island, Lake Michigan.

Barge Crow ashore at Stony Island.

Propeller Jay Gould aground at Ecorse.

30th.—Bark City of Milwaukee lost her mizzen-mast by collision with the schooner L. S. Hammond at Milwaukee.

Propeller S. D. Caldwell ashore at Mackinac.

Tug Benton, damaged by fire at Saginaw River.

JULY.

1st.—Propeller Montana, wheat and flour, aground at Milwaukee.

Schooner W. J. Whaling lost jib-boom by collision in the Chicago River.

Propeller East aground in the Middle Channel, opposite Ganaogue, and became leaky.

2d.—Tug Jennie Bell damaged by being struck by the propeller Philadelphia at Detroit.

Steamer Grace Downer (sixty-eight tons) burned to the water's edge at Beaver Island; George Burrows, mate, burned to death.

3d.—Tug J. U. Masters damaged her machinery at Port Huron.

Schooner Sea Bird slightly damaged by collision at Detroit.

4th.—Propeller B. F. Wade ashore at Waukegan.

Tobias Tounessen drowned from the schooner Geo. C. Finney at Kingston.

5th.—Scow Hanson, 12,000 bricks, cut in two and immediately sunk by collision with the propeller Toledo at Port Huron.

6th.—Barge Louisa Bun sunk in Chicago River.

Schooner Herald water-logged by collision with the schooner Ketchum off Chicago.

Propeller Gordon Campbell damaged by a log in her wheel at Milwaukee.

Propeller City of Cleveland had her cargo of wool mattrasses accidentally saturated with linseed oil causing spontaneous combustion.

8th.—Scow Sea Bird lost both masts and bowsprit by collision at Detroit.

Tug Kate Moffatt broke her machinery and was towed to Detroit.

Tug W. A. Moore broke her wheel at Buffalo.

Propeller St. Lawrence broke her piston-head at Kingston.

Propeller Java stove a hole in her bow at Cleveland; she afterward broke her machinery, and went to Detroit for repairs.

9th.—Steam-barge Henry Howard broke her bed-plate at Port Huron.

William Barry, sailor, drowned from the schooner Minnie Slauson, near Big Summer Island, Green Bay.

10th.—Propeller W. M. Tweed aground three hours at Chicago.

12th.—Propeller Bertschy loosened her wheel at Depere, and was towed to Milwaukee.

13th.—John Leitch drowned from the steam-barge Wm. Cowie at Saint Clair.

14th.—Tug H. N. Martin damaged her wheel at Cleveland.

15th.—Schooners Whirlwind and Col. Glover damaged by collision at Milwaukee.

Tug Sol Rummage disabled machinery near Detroit.

Tug Scott broke her wheel on a sunken log at Cleveland.

16th.—Steamer Metropolis damaged at Pentwater.

Propeller Truesdell broke her machinery on Green Bay; towed to Escanaba.

Bark Nelson struck upon a reef in the Straits of Mackinac.

17th.—Steamer Manitoba struck a rock near Michipocoten Island, Lake Superior, and sunk in 12 feet of water.

Steam barge Glascon hard aground on Saint Clair Flats.

Steamer Evening Star broke her piston-head on Lake Erie.

Bark H. Bissell struck a rock in the Niagara River, causing a leak.

18th.—A tow of barges seen adrift off Forestville, Lake Huron.

Tug Champion burned and scuttled at Detroit.

A fish-boat struck by a squall near Mackinac and damaged; men exhausted.

Steamer John Sherman ashore in Detroit River.

Thomas Halbrook drowned from the propeller Fountain City, near Charlevoix.

Scow Ino dismasted in a north-northwest storm on Lake Erie, off Ashtabula.

Steam-barge Henry Howard disabled on Lake Huron.

Schooner Pelican aground on the Saint Clair Flats.

20th.—Scow Nellie damaged by collision with the schooner J. B. Wilber, in the Saint Clair River.

Schooner Anglo Saxon ashore at Forty Mile Point, Lake Huron; jettisoned railroad iron.

Steam-barge Henry Howard, lumber, broke her machinery on Lake Huron.

Steam-barge Charles Reitz broke her wheel near Gratoit.

Schooner C. G. Breed, coal, aground on a reef at Fox Point, twelve miles north of Milwaukee.

Tug Tempest lost a scow, laden with machinery, in a fog near Copper Harbor, Lake Superior, which is supposed to be foundered.

21st.—A son of Julius Sumner drowned from the propeller Pacific, in Saginaw Bay.

Tug Hunter sunk by collision in 8 feet of water in Lake Michigan.

22d.—Propeller Orontes broke her shaft at Harrisonville on Lake Huron.

Tug Harrison capsized near Chicago.

Barge Robert Emmett lost part of her deck-load of staves in a squall on Lake Huron.

Barge Jesse Drummond lost jib-boom, and became leaky by collision on Saint Clair Flats.

A raft of timber broken up by heavy weather on Lake Huron.

23d.—Schooner D. L. Couch, coal, sunk off Long Point, Lake Erie.

24th.—Barge J. S. Austin aground at Milwaukee.

Bark Sardinia and barge Iron City damaged by collision at Buffalo.

Scow Butcher-Boy lost an anchor on Lake Erie.

Steam-yacht Eva Wadsworth, ashore on Peach Island, St. Clair River.

Schooner S. and J. Collier lost maintopmast in a squall on Lake Ontario.

Propellor Benton broke her wheel on Carrolton Bar, mouth of Saginaw River.

Propeller Philadelphia (drawing 13½ feet of water) struck bottom near Grasse Point light, Lake Saint Clair.

John Bassett drowned from the steamer Chicora in Georgian Bay.

26th.—Brig Mechanic damaged by striking a bridge at Milwaukee.

Schooner Pelican, ore, aground on the Saint Clair Flats.

Tug Home ashore at Calumet, Lake Michigan.

Schooner Wanderer ashore at Stony Reef, Detroit River.

Schooner Black Duck, coal, foundered in deep water in Mexican Bay, Lake Ontario. Total loss.

27th.—Scow Ino damaged by collision with the schooner Long Simms.

Schooner Jennie Bell damaged against a bridge at Milwaukee.

——— Goldsmith drowned from the revenue-cutter Commodore Perry at Buffalo.

Scow Lea sprung a leak near Milwaukee.

28th.—Schooner Ellington, staves, ashore at Fairport, Lake Erie.

John Doyle drowned from schooner Rising Star at Chicago.

John Heare drowned from steamer Marine City on Lake Erie.

John Childs drowned from the barge Harvest at Cleveland.

Schooner Theodore Perry, coal, damaged by collision with a propellor on Lake Erie.

Thomas Fleming drowned from the schooner L. B. Crocker at Port Colborne.

29th.—Propeller Mary R. Robinson, 15,000 bushels wheat, burned near Waugoshance light on Lake Michigan.

30th.—Propeller Lake Michigan aground on a shoal at Gananogue, Canada.

Schooner What Ye Call It lost her foremast in a squall at Detroit.

——— Shields drowned from the schooner Webb at Erie, Pennsylvania.

31st.—A seaman from the barge Globe drowned in Tawas Bay, Lake Huron.

A barge towed by the propeller Edith became water-logged off Tawas Bay, Lake Huron.

Steamer City of Montreal damaged her machinery near Windsor.

A raft broke loose in rough weather from the tug Clematis off Point Austin, and was driven upon the beach.

AUGUST.

2d.—Schooner Truman Moss dismasted by collision at Chicago.

Schooner Evening Star lost head-gear by running against a bridge in Chicago.

Scow Home broke from the pier at Free Soil, on Lake Michigan, at 6 p. m., during a norther, and went ashore.

Propeller Chicago Belle sunk at Manitowoc.

Schooner Libbie Nan aground in Green Bay.

Bark Jesse Drummond had her cargo damaged by water on Lake Ontario.

Schooners Star of Hope and Florida damaged by collision on Saint Clair Flats.

Steam canal-boat S. D. Gibson, iron-ore, aground and filled with water on Ford's Shoal, near Oswego.

Barge Seminole, lumber, became water-logged at Tawas, Lake Huron.

Schooners Eliza White and Octavia damaged by collision at Oswego.

4th.—Thomas Morgan drowned from the propeller Tioga, ten miles off Long Point, Lake Erie.

Schooner Fearless, lumber, capsized and filled off White Fish Point, near Manitowoc, at 2 p. m.

Charles Smith drowned from the schooner Welland, at Chicago.

Schooner Capella lost jib-boom at Manitowoc.

Schooner Colonel Hathaway, coal, hard aground in the Detroit River.

Propeller China hard aground in the Neebish, Sault River.

6th.—Fishing-smack Clara lost her canvas in a squall on Green Bay.

Tug Black Ball disabled at Chicago.

A scow took fire in the cabin near Detroit.

Tug Babcock sunk at Chicago.

Schooner Mary Nan had her foremast shivered by lightning at Green Bay, at night.

Scow F. L. Jones lost center-board on Lake Erie.

Propeller Badger State aground in Saint Clair River.

7th.—Steam-barge Concord broke her machinery on Lake Erie.

Steamer Ajax burned to the water's edge near Bay City.

8th.—Tugs New Era and J. T. Ransom sunk at Tonawanda.

Bark Martin, wheat, sunk by collision with a schooner near Long Island, Lake Ontario.

9th.—Tug Bob Anderson broke down off Forestville, Lake Huron.

Schooner Bessie Boalt lost her rudder on Lake Michigan.

Schooner Golden Fleece aground on Saint Clair Flats.

Lighter America lost 300 barrels salt overboard by collision with a bridge at East Saginaw.

Schooners S. S. Osborn and American Union much damaged by collision near Fox Island, Lake Michigan.

Tug Danforth burned to the water's edge at Du Luth, Lake Superior, and sunk in 18 feet water.

Schooner Ardent and bark Sardinia damaged in squalls on Lake Michigan.

Steam-barge Ira H. Owen, iron-ore, sprung a leak.

Scow Clara, coal, ashore at Stoney Island, in the Detroit River.

10th.—Schooner Delaware and bark Sardinia aground at Milwaukee.

Schooner Island lost a gaff in heavy weather on Lake Michigan.

Schooner J. S Walter aground at Milwaukee.

Schooner Midnight ashore at Racine.

Bark John Breden, coal, sprung a leak near Buffalo.

Schooner John Tibbits damaged by collision with the propeller Vanderbilt at Buffalo.

11th.—Propeller Thomas A. Scott aground at Milwaukee.

John Cogsgriff drowned from the schooner O. S. Storrs, at Oswego.

12th.—Captain Elijah Blanchard drowned from the schooner Active, at Oswego.

Bark Zack Chandler had mast damaged by lightning off Point Betsey, Lake Michigan.

13th.—Steamer Margaret ashore in the Ducks, in Lake Ontario, on a dark night.

Schooner Berlin lost jib-boom at Toledo.

Schooner American Union damaged by collision with schooner Osborne on Lake Michigan.

14th.—Schooner Dayspring, wood, struck by lightning off Ashuepee, Lake Michigan; L. Mueller seriously injured, and Tobias Tobiassen instantly killed.

Propeller Lake Michigan aground on a shoal off Kingston.
16th.—Schooner Josephine Lawrence capsized and sunk, by collision with the propeller Favorite, near Two Creeks, Lake Michigan, in a dense fog.
Charles Hill drowned from the schooner Midnight, at Racine.
Steamers Corsican and Watertown damaged by collision near Kingston.
Schooner Edwin Blake, 19,000 bushels wheat, aground on Point Frederick Shoals.
Bark Saginaw, timber, sunk at Saint Catharine's, Lake Ontario.
17th.—Captain Waggoner, of the barge Severn, drowned at Cleveland.
Schooner Len Higby had her topmast broken on Lake Michigan.
Steamer Detroit damaged by collision with the propeller Thomas A. Scott, at Detroit.
18th.—Philip Nolan, of the barge Susan Ward, drowned on Lake Erie.
Daniel Elois, of the Tug Star, drowned in Saginaw River.
Luke Sky, of the barge Hotchkiss, drowned at Buffalo.
19th.—Steamer Favorite damaged by collision at Detroit.
Brig Helfenstein. salt, arrived at Detroit leaking.
Schooners American Union, ore, and S. P. Ely, damaged by collision in a dense fog, at Port Huron.
Scow Industry, walnut lumber, found water-logged and abandoned on Lake Erie; towed to Cleveland.
21st.—Scow Pierrepoint and propeller Mohawk damaged by collision at Detroit.
Tug J. H. Martin broke her machinery; towed into Detroit.
22d.—Bark C. K. Nims, 33,000 bushels corn, struck a reef at Bar Point, Lake Erie.
Schooner Monterey struck a rock, and damaged.
Schooner Middlesex sprung a leak at Marquette,
Schooner Sophia Smith damaged by collision near Detroit.
Steamer W. R. Clinton damaged on a rock at Grindstone City.
24th.—Propeller Cuba aground at Milwaukee.
Schooner Welland ran against the pier at Muskegon, was crushed, filled with water, and capsized.
Scow Snowbird injured and sunk, by a blast intended for the removal of rocks in the Detroit River.
Mr. ——— McDonald drowned from the steamer W. R. Clinton on Lake Huron.
Scow Maria sprung a leak on Lake Huron.
25th.—Propeller Bertschy burned at Depere, near Green Bay, loss $8,000.
Charles Hendrickson drowned from schooner Dayspring, at Ahnepee, Lake Michigan.
Tug J. D. Dudley ashore at Fairport, Lake Erie.
26th.—Schooner David Stewart, ore, hard aground on the Saint Clair Flats.
Schooner Narragansett lost canvas in a squall on Lake Erie.
Schooner Columbia, coal, aground in Detroit River.
A scow driven ashore on Lake Huron, near the entrance of the Saint Clair River.
27th.—Schooner Lewis Ludington lost jib-boom at Chicago.
28th.—A northeast storm on Lake Michigan to-day, driving many vessels into port for shelter.
Scow Ida H. Bloom struck a pier at Milwaukee and lost jib-boom.
Several small sail-boats lost or damaged at Milwaukee.
A canal-boat sunk, and another damaged, in the Niagara River.
Schooner Louie Meeker, 22,000 bushels of oats, struck by a squall at 10 a. m., ten miles from shore, near Point Sauble. Lake Michigan, capsized and sunk. Captain Robert West, Robert West, jr., Charles Baker, E. Nelson, and the steward were drowned.
Schooner Glad Tidings lost jib-boom in the gale on Lake Michigan.
Scow Minnie Corlette, shingles and piles, damaged at Waukegan.
29th.—Schooner Garibaldi had sail torn by a bridge at Milwaukee.
Michael Neupert drowned from the tug Ballentine, at Bay City.
Schooner Angeline lost mainsail in a squall.
Schooner J. R. Sanburn split her mainsail and fore-topsail.
Schooner Cortland had canvas blown away.
Schooner Almina damaged on the piers at Cleveland.
Scow J. W. Porter ashore at Clough's Pier.
A raft of logs broke loose from a tug at Cleveland and washed ashore.
30th.—Barge El Dorado broke her steering gear, and was towed into Milwaukee.
Brig Waucoma, iron, sprung a leak near the Manitous, Lake Michigan.
Schooner Delos De Wolf, grain, sprung a leak on Lake Michigan.
Schooner Sea Gem damaged at the pier at Manistee.
Tug Louie Dole damaged by collision with the tug Black Bell, off Chicago.
Scow C. C. Butts sunk at Kenosha.
Schooner G. J. Whitney, stone, ashore, and full of water, at Vermillion, Ohio.
A number of vessels aground on the Saint Clair Flats, owing to the low stage of the water.
Schooner Alpha, lumber, wrecked at 5 p. m. on a reef near Four-Mile Point, Lake Ontario.
Schooner Orion sunk at Long Point, Lake Erie.

Schooner Richardson ashore at Presque Isle, Lake Erie.
Propeller Buckeye broke her engine on Lake Ontario.
Schooner Odd Fellow, lumber, lost mainsail and a portion of her cargo.
A severe northwester on Lake Huron; vessels unable to proceed, anchored along the coast.
Schooner Franconia, pig-iron, sprung a leak on Lake Huron.
Scow J. F. Porter stranded on south shore of Lake Erie.
Schooner Montauk and Bark Pathfinder lost jib-booms at Port Huron.
Propeller Toledo had her gangways dashed in on Lake Huron.
Schooner C. P. Minch aground at Port Huron.
Scow Hannah lost jib-boom by collision, on entering the Saint Clair River.
Schooner Governor damaged at the pier and grounded at Oswego.
Schooner Two Brothers lost 16,000 feet of lumber on Lake Ontario.
Schooner Olivia lost 6,000 feet of lumber on Lake Ontario.
Revenue-cutter Chase lost anchor and chain on Lake Ontario.
A seaman drowned from the Barge Toledo, at Kingston.
Brig Ocean, stone, sunk in Lake Ontario.
Schooner Vancouver, pig-iron, sprung a leak on Lake Ontario.
31st.—Barks William Howe and Prince of Wales ashore near Port Dalhousie, Lake Erie.
Schooner Fanny Campbell disabled near Point au Pelee.
Bark Alexander, timber, sprung a leak off Long Point.
Schooner Augustus Ford, coal, sprung a leak on Lake Erie.
Schooner Erie sunk while at anchor at Marblehead, Lake Erie.
Schooner Amoskeag struck in Sault Ste. Marie River, and sprung a leak.
Schooner Eliza White damaged by fire at Oswego.
Brig Gen. Worth lost foremast off the Scotch Bonnets.
Barge Argo lost lumber and shingles overboard on Lake Ontario.
Scow Ida and Mary, stone, ashore, at night, on Sturgeon Point, Lake Erie.
Propeller City of Madison damaged and driven back to Marquette, Lake Superior, by the storm.

PAPER H.

METEOROLOGICAL OBSERVATIONS MADE AT MOUNT WASHINGTON, N. H., DURING THE MONTH OF MAY, 1872.

OFFICE OF THE CHIEF SIGNAL-OFFICER,
Washington, D. C., July 10, 1872.

SIR: I have the honor to submit the following report of meteorological observations made in compliance with your orders at Mount Washington, New Hampshire, from May 1 to May 31, 1872, during which time a special station, established at the railroad depot, near the base of the mountain, was in telegraphic communication with the permanent station at the summit.

Fifteen observations were made daily at both stations at hourly intervals, and especial pains taken to have them made synchronously. (Papers A and B.)

Instruments used at Summit Stations.—Barometer, Green's standard No. 1797; instrumental error, —.005; thermometer, Green's mercurial; hygrometer, (Glaisher's model;) anemometer, Robinson's; rain-gauge, signal-service model.

At base of mountain.—Barometer, Green's, No. 1914; instrumental error, —.002; thermometer, Green's; hygrometer, Glaisher's; anemometer, Robinson's, with Gibbon's self-registering attachment; rain-gauge, signal-service model.

Observers.—Summit station: Sergeant A. R. Thornett, signal-service, United States Army; Private R. J. Bell, signal service, United States Army. Lower station: Sergeant Theodore Smith, signal service, United States Army; Private J. H. Garrad, signal service, United States Army.

Attention is invited to the special report of Sergeant Smith, (Paper C,) and to the daily journals kept at both stations, (Papers D and E.)

Paper F exhibits, in tabulated form, the daily observations made at the mountain stations, and Paper G those made at Portland, Maine, for the same period of time, at an elevation of 54 feet above mean-tide level. Of the Portland observations, those made at 8.2 a. m., 5.2 p. m., and 12.2 a. m. are synchronous with those made on the mountain stations at 7.57 a. m., 4.57 p. m., and 11.57 p. m.

Very respectfully, your obedient servant,

H. W. HOWGATE,
Second Lieutenant and Brevet Captain, United States Army,
Acting Signal-Officer and Assistant.

Brigadier-General ALBERT J. MYER,
Chief Signal-Officer of the Army.

Paper A.

WAR DEPARTMENT, OFFICE OF CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS
FOR THE BENEFIT OF COMMERCE,
Washington, April 20, 1872.

SERGEANT: A special series of observations at the base of Mount Washington, in connection with the station on the summit, will be made, under your supervision, during the month of May next, beginning at 6 a. m. of the 1st and terminating at 11.57 p. m. of the 31st of the month. These observations will be the same in all respects as those taken at regular stations, and will be entered in the same manner upon Form 4, and will be brought by you in person to this Office when called in, unless otherwise ordered.

The observations will be made at the following hours, (local time:) 6 a. m., 7 a. m., 7.57 a. m., 9 a. m., 10 a. m., 11 a. m., 12 m., 1 p. m., 2 p. m., 3 p. m., 4 p. m., 4.57 p. m., 6 p. m., 9 p. m., 11.57 p. m.

Upon your arrival at the base of the mountain you will put yourself in telegraphic communication with the observer on the summit, and will, if practicable, keep this communication unbroken during your occupation of the station. The observation at each station must be synchronous, and, in order to effect this, the time-pieces at both stations must be kept carefully adjusted with each other by comparing them three times each day, (by telegraph,) at intervals of eight hours. Five minutes before the time of each observation you will call the observer at the summit, and, after getting his acknowledgment, will prepare for taking the observation. The signal for reading the barometer will be given from your station one minute before the time. The instruments will be read in the following order: 1st, attached thermometer; 2d, barometer; 3d, thermometer; 4th, hygrometer; 5th, anemometer; 6th, wind-vane; 7th, rain-gauge.

It is expected that both observers and assistants at both stations will unite in doing this special work accurately and promptly, as the anticipated results will be of general scientific interest.

Very respectfully,

H. W. HOWGATE,
Second Lieutenant and Brevet Captain, United States Army,
Acting Signal-Officer and Assistant.

Sergeant THEODORE SMITH,
Base of Mount Washington, New Hampshire.

Paper B.

WAR DEPARTMENT, OFFICE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS
FOR THE BENEFIT OF COMMERCE,
Washington, D. C., April 18, 1872.

SERGEANT: A special series of observations will be made at your station, in connection with an observer at the base of the mountain, during the month of May; beginning at 6 a. m. of the 1st and terminating at 6 p. m. of the 31st, and at the following hours: 6 a. m., 9 a. m., 10 a. m, 11 a. m., 12 m., 1 p. m., 3 p. m., 4 p. m., and 6 p. m. These special observations will be the same in all respects as those taken at the regular hours, and will be entered in the same manner upon Form 4, but on separate sheets from the two regular series. They are not for telegraphic transmission, but will be sent by mail to this Office at the end of the month. These observations must not interfere with the regular reports, which will be taken, recorded, and transmitted as usual. The observer at the base of the mountain will be in telegraphic communication with the summit, and the observations at both stations must be synchronous. To effect this, the observers will keep their time-pieces carefully adjusted with each other, making a comparison three times each day, (by telegraph,) at intervals of eight hours. Five minutes before the time for each observation the observer at the lower station will call the observer at the summit, who will promptly acknowledge the call, and get ready for work. The signal for reading the barometer will be given from the lower station one minute before the time. The instruments will be read in the following order: 1st, attached thermometer; 2d, barometer; 3d, thermometer; 4th, hygrometer; 5th, anemometer; 6th, wind-vane; 7th, rain-gauge.

It is expected that both observers and assistants will unite in doing this work accurately and promptly. The observer at the lower station will take observations for record at the same times as the regular observations are taken at the summit station.

Very respectfully, &c.,

H. W. HOWGATE,
Second Lieutenant and Brevet Captain, United States Army, and Acting Signal-Officer and Assistant.

Sergeant A. R. THORNETT,
Mount Washington, New Hampshire.

Paper C.

WASHINGTON, D. C., *June* 8, 1872.

SIR: I have the honor to submit the following report in reference to the work at the temporary station at the base of Mount Washington, New Hampshire, during the month of May, 1872:

I arrived at the station on the evening of April 25, but the two cases containing the different instruments to be used there were still at Littleton, New Hampshire, as the roads were impassable for heavy teams. Captain J. W. Dodge, the manager of the Mount Washington railway, engaged a team at Bethlehem to bring provisions and my instruments at all hazards on Friday, April 26, and by using eight horses they succeeded in reaching the base of the mountain the following day. I found the instruments in pretty fair condition under the circumstances, as only two glass jars of the Daniell battery and two porous cups of the Le Glanche battery were broken.

Immediately upon my arrival I placed myself in telegraphic communication with the observer at the summit of Mount Washington, using six cups of the Daniell battery, and Littleton office put up a separate battery for the main wire, connecting me with Concord and Boston at report hours: and, also, regularly every night after 8 o'clock. The wire to Littleton had been kept in fair condition during the winter by Mr. Ranlet, of Bethlehem, but the cable to the summit worked very hard, owing to imperfect insulation. The observer at the summit was unable to break any station during rain-storms, and after the snow upon the trestle-work of the railway commenced to melt, and therefore I concluded to divide and relay his reports whenever it would be necessary.

Sunday, April 28, was occupied in putting up the instruments. During the afternoon, Sergeant A. R. Thornett came down from the summit, and we made the necessary arrangements for carrying out the instructions received from the Chief Signal-Office in regard to our special observations.

I divided the hours of duty between myself and assistant, Private J. H. Garrard, in such a manner that whoever took the night observations was to take the afternoon observations on the following day, thus giving twelve hours of duty to each; but whenever the wire worked hard, and I was not on duty at midnight, my assistant was to waken me for relaying the midnight reports. The signal for reading the barometer, &c., was given from my station by calling Mount Washington five minutes before the hour of observation, and then making single dots one-half minute before, and double dots at the exact hour, then reading the barometer the instant the acknowledgment was received from Mount Washington. I had given my assistant sufficient instructions in the use of the Morse code for giving these signals, and this plan was kept up during the entire month with but few interruptions, which were caused by the bad condition of the cable. The time-pieces at both stations were adjusted three times each day, at intervals of eight hours, according to instructions.

The different meteorological instruments were exposed as follows:

Barometers in a room on the second floor of the depot building, about 24 feet above the surrounding ground; thermometer and hygrometer outside of a window of the same room, facing the north, being well sheltered by the large projecting roof of the depot building; the anemometer and anemoscope on the roof of the old log cabin, standing south of and about 20 feet higher than the depot; the rain-gauge in a clearing some 40 feet from the buildings on the ground.

The instruments worked well and remained in good condition during the month, and the barometer I used was from time to time compared with the additional one I had, both instruments reading alike.

In obedience to orders received from the Chief Signal-Officer, I left the station on the morning of June 2, arriving at Washington on the evening of June 4.

Very respectfully, your obedient servant,

THEODORE SMITH,
Observer-Sergeant, Signal Service, United States Army.

Captain H. W. HOWGATE,
Acting Signal-Officer and Assistant.

Paper D.

ABSTRACT OF DAILY JOURNAL FOR THE MONTH OF MAY, 1872.

April 30.—Day opened with cold and fair weather. Barometer, high and steady since yesterday afternoon. Temperature, 22° at 6 o'clock a. m. Wind, west and light. Sky covered with about one-fourth cirrus clouds moving rapidly from the northwest. Very clear around the summits of Mounts Washington and the Green or Franconia ranges. Hazy in the west. Wind increased somewhat toward noon; but barometer remained unchanged; temperature rising very rapidly, being 51° at 1 o'clock p. m. Commenced clouding up in the afternoon, and looked hazy and threatening all around, but the clouds are still considerably higher than the summit of Mount Washington. Saw some butterflies to-day on the snow, which melts away very fast. Cleared away again about 5 o'clock p. m., leaving the sky covered with about one-fourth cirro-stratus clouds. Barometer, still high and steady; temperature, 42° at 9 o'clock p. m.

May 1.—Sky entirely overcast at day-break, looking very threatening. Barometer falling slowly until 9 o'clock a. m. Temperature rising rapidly. Commenced to clear up at 10 o'clock a. m. Wind southwest and gentle. Barometer continued to fall until 4 p. m., and the wind suddenly changed to southeast. Very black masses of nimbus clouds came moving from that direction, soon after enveloping the mountain down to the line of vegetation. The summits of Lafayette and the Twin Mountains are still uncovered, but the clouds are filling all of the valleys rapidly. At 8 p. m. barometer still falling; wind, due south and gentle. All the mountain-summits are now enveloped in clouds, reaching down below the line of vegetation. Observer at the summit reports, "Rain and wind southwest and sixty miles per hour." Very dark below: could not see objects at more than a few yards distance. Temperature remains almost unchanged since 8 a. m., being 50° at midnight. Appearances indicate heavy rain on the mountains, the little stream here rising very rapidly, and the rush of waters in the different ravines resounds from all sides.

May 2.—Commenced raining shortly after midnight, and continued quite hard at day-break. Wind still south, but veering at times to southeast. Barometer still falling slowly. Temperature steady. Humidity, 100 per cent.; the clouds moving very fast from the southwest and reaching far below this station, forming one large continuous sheet over the valley of the Amonoosuc. Rain ended at 9.45 a. m., and soon after the blue sky became visible in the west. The clouds in the valley and around the summits of the different mountains dissipated quite rapidly, and shortly after 10 a. m. the top of Mount Washington became clear. The telegraph line works very hard this morning, and no communication has been had with the summit since 12 m. of last night, when we adjusted our time-pieces. The rain has taken nearly all of the snow away from the mountain-sides, and the Amonoosuc River is higher than at any time during this spring. Wind changed to northwest after 12 m., and it commenced to cloud up again. Raised Mount Washington at 1 p. m. for barometer signal, and compared time. "Relayed" his morning report; he said that he had been unable to "break in" this a. m. Barometer showed tendency to rise again between 1 and 2 p. m., but temperature is falling slowly. Clouds again cover all the mountains and move very rapidly from due west, but some lower masses are moving from the southwest: between 3 and 4 p. m. all of the mountain-summits were clear of clouds, and the atmosphere generally was remarkably transparent. At 4.30 p. m. it commenced clouding up again. Temperature falling, but barometer rising. A heavy rain commenced at 5 p. m., the observer at the summit reporting, "Dense fog here." The observer at Mount Washington being unable to break Littleton, I relayed his p. m. report at 5 02 p. m. Rain ended at 5 30 p. m., but commenced again at night-fall, barometer and temperature falling with southerly winds. Relayed Mount Washington midnight report.

May 3.—Heavy rain during latter part of night, continuing until day-break. Temperature, 39°. It having snowed upon the mountains during the night, they present quite a wintery appearance this a. m. Weather still threatening. Shortly after 7 a. m. all of the mountains became enveloped in dense clouds. Barometer steady. From 7 a. m. until 4 p. m. we had rain, snow, and sleet, but rain prevailing, temperature ranging from 33° to 37°. Calm nearly all day; commenced clearing in the west shortly after 4 o'clock, the upper clouds (huge cumuli) moving at a moderate rate from the west, while the lower ones (below the summit) are moving very swiftly from due north. Perfectly calm at this station. Sky became almost clear at 6 p. m., and remained so until 11 p. m., when it clouded up again, wind being southeast and light. Temperature 32, and barometer rising slightly. Faint aurora in the north.

May 4.—Threatening at day-break, and shortly before 7 a. m. heavy snow set in. Barometer steady. Temperature 35°; wind northwest and light. Observer at summit reported sleet at 10 a. m. and brisk southeaster. Continued snowing all day; between 2 and 3 p. m. the snow fell in flakes of an unusually large size, and by midnight nearly 6 inches covered the ground. Barometer rising since 6 p. m.; temperature steady.

May 5.—Clearing up rapidly at day-break, with very light westerly wind and rather low temperature. All of the mountain-summits were visible and had the appearance of midwinter. The temperature reached 38° before midday and the snow commenced to melt very rapidly. Littleton reported this a. m., "Heavy rain during night." The barometer reached its maximum between 1 and 2 p. m. Cloudy in the afternoon; wind northwest and fresh; temperature 41° at 6 p. m.; clouding up again shortly after 10 p. m. Mount Washington observer reported, "Temperature 18°; wind northwest and 96 miles." Barometer fell quite rapidly after midnight.

May 6.—Commenced snowing at 5 p. m.; temperature 30° and wind south; barometer low but steady; continued snowing until 12.30 p. m., when the clouds began to clear away, both upper and lower clouds moving very rapidly from the northeast. Barometer rising since 8 a. m.; temperature 42° at 3 p. m.; wind northeast and fresh. The summit of Mount

Washington is still enveloped in clouds. Wind changed to northwest at 4 p. m.; observed some cirri moving from the east, while the cumuli came from the north, and small detached masses of strata were going with the wind prevailing at this station. The snow is melting very rapidly, and the ground is bare on the south side of the houses. Barometer still rising slowly. Weather fair after sunset. Barometer steady at midnight.

May 7.—Day opened with fair weather. Barometer steady; wind northwest and light; thermometer 41°; remarkably clear around the western horizon. Mount Lafayette and the entire Franconia range clear, but Mount Washington enveloped in dense clouds, reaching down far below the line of vegetation. The summit became clear at 1.30 p. m., but the sky remained overcast with large masses of cumuli. Barometer steady in afternoon. Thermometer 56° at 3 p. m. Observer at summit reports: "Wind north, with heavy gale; temperature 37°; barometer 30.09, with tendency to rise." The snow upon the west side of Mount Washington seems to melt but very slowly. Between 5 and 6 p. m. the thermometer reached 62°; perfectly clear all around after 6 p. m., barometer rising, wind east and light. Wind changed to north toward midnight. Weather clear and pleasant.

May 8.—Cloudy at day-break, with easterly wind, but cleared away before 8 a. m., wind changing to northwest. Barometer steady; temperature 49°. Summit of Mount Washington remained enveloped in clouds after the sky had become perfectly clear. Summit clear at 12.30 p. m. Barometer steady; temperature rising; 60° at 2 p. m.; humidity 49 per cent. Hazy along the different mountain-ranges, probably caused by evaporation, as large masses of snow still remain in the woods. Sky overcast with cirri after 3 p. m., moving in a southerly direction; barometer rising until 8 p. m., when it began to fall slowly. Observer at summit reports: "Fine weather all day; highest temperature 40°." Private Bell, who came down from the summit this p. m., reports there is hardly any snow at the summit, but that he found it from 4 to 6 feet deep near the line of vegetation, and also large masses throughout the woods. No change in the weather until shortly before midnight, when the wind changed to due east and the sky became overcast.

May 9.—Commenced raining about 2 a. m., and rained quite heavy at day-break; barometer fell somewhat during the night, but the temperature is steady; began to clear up at 8.30 a. m., and wind changed to northwest. Thermometer 63° at midday, the warmest day we have had so far. Franconia Mountains clear, but Mount Washington still enveloped. Observer at summit reports: "Thermometer 39° at 10 a. m." Weather remained cloudy all day. Barometer fell very rapidly until 6 p. m. Temperature 65° at 4 p. m. Very hazy during the afternoon, and only the outlines of the different mountains could be distinguished. Commenced clearing up at 7 p. m., the sky becoming perfectly clear. The wind increased somewhat toward midnight, being from the northwest. Temperature 50° all night.

May 10.—Day opened with warm and fair weather. Barometer rising; remarkably clear in the west. Detached masses of stratus clouds were moving with an extraordinary rapidity from the northwest, being of a whitish color before reaching Mount Washington, and then assuming a dark black color; they envelop almost the entire mountain, and it seems to be raining very hard there, for the Amonoosuc is rising rapidly. Mount Lafayette, only eighteen miles distant, is clear to the very top, forming quite a contrast to the Mount Washington range. Telegraph line to the summit works very hard, and I had to relay the Mount Washington signals. Barometer continued rising very rapidly, and between 2 and 3 p. m. the summit of Mount Washington became visible. Temperature steady. Barometer still rising at 9 p. m., being now 40° higher than at 6 o'clock this a. m. Sky perfectly clear, excepting a small bank of strata along the western horizon. The mountains now are entirely free of snow. Temperature quite low this evening; clouding up after 10 p. m. Barometer steady.

May 11.—Barometer fell but slightly during night. Sky overcast this morning and Mount Washington in dense clouds. Lafayette and Twin Mountains clear. Barometer pretty steady all day, with warm and pleasant weather generally. Much free electricity on the wires during the afternoon. Hazy after dark. Humidity 92 per cent. at 9 p. m. Sky perfectly clear.

May 12.—Barometer fell very rapidly during the night, and at day-break the sky was entirely overcast. Wind east, but changed to northwest before 9 a. m. Barometer steady until 8 p. m.; perfectly clear at midnight.

May 13.—Clear at day-break; temperature 39°, and humidity 100 per cent. Barometer steady. Commenced clouding up at 9 a. m., and now, 11 a. m., it looks rather threatening. The summit, which was clear this morning, is enveloped in dense clouds, apparently moving from the south. Barometer rising slowly during the day, and after sunset the clouds cleared away. Temperature falling rapidly during the afternoon, and the humidity increases. The telegraph line has worked very well for the past three days. Barometer rising rapidly after 6 p. m.

May 14.—Day opened with cool and fair weather. Barometer still rising. Wind northwest, and gentle. Weather remained unchanged, excepting a rise in the temperature, until sunset; clear at midnight. Barometer very high.

May 15.—Hazy at day-break. Wind east and light; considerable ice was formed during the night. Temperature 39° at 6 a. m., and barometer very high. Wind changed to northwest after 8 o'clock and clouded up, but the clouds are far above the different mountain summits. Trouble on the telegraph line between here and Littleton; divided here and relayed Mount Washington signals. Barometer commenced falling shortly after 10 a. m., and the sky began to assume a threatening aspect. Heavy masses of nimbus clouds moving from the north soon enveloped the summit, and the observer there reported snow at 3.30 p. m. A light shower, of short duration, set in at 3.10 p. m.; appeared to be raining very hard a few miles west of this station. Cleared up again at 4.30 p. m., but another shower from the north passed this station between 7 and 8 p. m. Clear, with easterly wind and steady barometer, until midnight. Temperature 34°, and falling.

May 16.—Very cold during night and at day-break. The wind changed to west between 8 and 9 a. m. Barometer falling. Brisk northerly and northwesterly winds during the day. Clouding up gradually after 2 p. m. Appearances very threatening at 4 p. m. Temperature 40°. Barometer still falling; no change during the evening.

May 17.—Day opened with threatening weather. Barometer rising; temperature steady since yesterday morning. Wind west and light. Mount Washington entirely enveloped in clouds, but Franconia range and summit of Mount Lafayette clear. Fair in the afternoon; temperature 51° at 1 p. m. Barometer still rising steadily. After a calm of a few hours' duration the wind began to blow from the east; at 9 p. m. the sky was perfectly clear, but began to cloud up again between 10 and 11 p. m. Mount Washington observer reported snow this a. m., and very low temperature; the effect of which was felt here, for although the sun shone brightly during the afternoon, the air was very chilly. Weather clear at midnight.

May 18.—Day opened with clear and cold weather. Barometer steady; wind east, but changed to west shortly after 8 a. m. Temperature rising very rapidly, reaching 61° at 4 p. m. Barometer falling very slowly since 9 a. m. Wind veered again to east between 7 and 8 p. m. Dense haze around the different mountain ranges at 9 p. m. Sky perfectly clear. No change till midnight.

May 19.—Very hazy at day-break; the haze increasing in density as the morning advanced until 11 a. m., when large cumuli commenced to form. Barometer quite low this morning and still falling. Temperature 59° before midday. Wind from east, veering at times to southeast. Very heavy masses of cumuli came moving from the southeast after 1 p. m., and 1.55 p. m. rain set in. The wind shortly after increased to brisk. Barometer very low and still falling. Observer at summit reported, "rain; wind south but variable." Telegraph line works very hard; divided and relayed Mount Washington reports; unable to raise Mount Washington for p. m. reports; raining hard. Concord reports, "Heavy rain most of the day." The clouds broke away for a short time between 9 and 10 p. m., but rained very hard all night; nearly an inch fell since yesterday morning.

May 20.—Raining very hard at day-break. Barometer stands lower than at any time since this station has been opened. Nearly calm since midnight, but commenced to blow again between 6 and 7 a. m.; the wind now being west. Temperature steady since yesterday morning, having fallen only 2° during last night. Impossible to raise Mount Washington for signals, but wire works well between here and Boston. Mount Washington appears unable to break us on account of the bad condition of the cable; called him for two hours this morning, but without success. Ceased raining at 10.50 a. m., and commenced clearing shortly afterward. The different mountain summits covered with snow. Barometer seems to have reached its minimum, (10 a. m.) Just raised Mount Washington, and relayed all of the delayed reports and gave him the time. Quite pleasant during the afternoon, but barometer remained low and steady. Clouded up at 7 p. m., and has been raining ever since.

May 21.—Raining hard at day-break; wind west and light. Barometer rising. The clouds are very low this morning, enveloping the station completely. Temperature steady. I relayed Mount Washington reports again this morning. Commenced to clear up at 10.30 a. m., but clouded up again between 12 and 1 p. m. A very heavy shower set in shortly after 2 p. m., barometer rising rapidly all day. Wind changed to east at 8 p. m. Weather fair. Humidity 100 per cent. Temperature fell rapidly during the evening. Fair at midnight. Wind north. Barometer still rising.

May 22.—Day opened with cool and fair weather; ice being formed during the night. Barometer rising until 11.30 a. m.; falling steadily during the afternoon. Sky remained overcast nearly all day. Between 5 and 6 p. m. I observed a peculiar phenomenon, (which I frequently beheld at the summit during the winter of 1870–'71, while in charge of that station,) consisting of heavy masses of cumuli moving from the south and southeast toward the Mount Washington range, from the summit westward to Mount Pleasant; but, on reaching the ridge of this range, they suddenly dissolve, only small detached masses passing over to the north side, but they also dissolve soon afterward. Temperature steady all day. Humidity variable. Threatening at midnight.

May 23.—A severe rain-storm, accompanied by a brisk southeasterly wind, set in about 1 a. m.; for a time the rain came down in torrents, and after 3 a. m. the wind increased to high. The rain abated somewhat about this time, but the wind kept up a velocity of 20 miles an hour until 10 a. m. Barometer falling rapidly all night. Temperature steady. Showed signs of clearing after 11 p. m., but a drizzling rain still prevails. The cable to the summit works very hard. Relayed Mount Washington morning reports, but could not raise him after that time. Concord and Littleton both report rain. Wire working hard south of this station. Lieutenant Greely reached the summit at 6 o'clock last evening, by way of the old carriage road. Threatening after 12 m., and at 3 p. m. the wind veered to the west. Another shower of short duration set in between 3 and 4 p. m. Barometer commenced to rise at 7 p. m., and after dark a dense fog prevailed. No change in the weather at midnight.

May 24.—Heavy shower at 4 a. m., and drizzling rain after 6 a. m. Concord reported clear weather this morning, saying, "Not a cloud to be seen here" Barometer and temperature steady. Wind west and light; nearly calm since 1 p. m. of yesterday. Fair during the afternoon; temperature 61° at 4 p. m. No change in the weather at midnight.

May 25.—Cloudy and threatening at day-break; temperature unusually high; barometer falling, wind west and light. Humidity very high. Cleared up toward evening; temperature 64° at 5 p. m.; clear at midnight, with rising barometer.

May 26.—Day opened with threatening weather. Very cold during night. Barometer rising rapidly after 6 a. m.; clearing up at 9 a. m. Sky became overcast again between 3 and 4 p. m., with cirri, which formed quite rapidly, but disappeared again after dark.

May 27.—Clear at day-break. Barometer falling slightly; temperature high; wind southeast. Commenced to cloud up after 1 p. m., the wind being due east and increasing in velocity. Barometer still falling. Appearances very threatening at 6 p. m., and the peculiar haze which always precedes rain in this section of the country commenced to form around the mountains, threatening rain at midnight. Barometer falling rapidly.

May 28.—Rain set in about 2 a. m., and rained quite hard for a time; drizzling after day-break. Barometer very low. Mount Washington is once more covered with snow. Wind changed to west about 9 a. m., and the clouds began to break away. Showers at intervals during the day. Barometer rising after midday. Cable to the summit works very hard, and I divided and relayed Mount Washington signals. A very heavy rain set in at 6.30 p. m. Mount Washington reports snow.

May 29.—Raining very hard all night, especially toward day-break. Barometer rising rapidly, and at 5 a. m. the rain ceased; began to clear up at 6.30 a. m., and the mountains are perfectly covered with a thick coat of snow, reaching down close to this station. Thermometer only 40° at 6 a. m. Heavy showers during the day. The cable working extremely hard at 2 p. m. Concord wire failed also, but commenced working again shortly after 6 p. m. Clear westward after dark, but Mount Washington is still enveloped in dense clouds. Barometer rising all day. Temperature varied only 2° the entire day. No change in the state of the weather at midnight. Unable to raise Mount Washington for signals.

May 30.—Threatening at day-break, with high barometer and low temperature. Showed signs of clearing in the west; and at 8 a. m. the clouds began to break away, moving from the northwest, while an easterly wind prevailed at this station. Could not raise Mount Washington until 8 a. m., when I relayed his reports. Concord wire works well. Clouded up again after 2 p. m., and commenced raining at 4 p. m. Threatening at midnight.

May 31.—A very heavy rain set in about 1 p. m., lasting all night. Barometer falling rapidly; temperature steady. Nearly calm ever since 12 m. of yesterday. Unable to raise Mount Washington this morning, although we used Concord and Littleton batteries. Received his morning reports at 11 a. m., after much trouble. Wire south of here works well. Continued raining until 3.45 p. m., but commenced again at 5.30 p. m. Barometer rising since 6 p. m.; temperature steady. Still raining at midnight. Nearly calm all day.

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Instruments in excellent condition during the entire month. During the first two days that the instruments were in position I observed a difference, ranging from 2° to 6°, between the standard thermometer and the dry bulb of the hygrometer, although the instruments were exposed under precisely the same condition. I changed the position of the standard frequently, but without success. I then cut a circular opening (diameter three inches) in the lower part of the hygrometer-board, the center of the opening being about at the height of the bulbs, thus creating a free circulation of the air around the same; and my experiment proved a success, as the two dry bulbs read alike. As similar differences are reported from quite a number of our stations, it is believed that the above might be applied with equal advantage.

THEODORE SMITH,
Observer-Sergeant, Signal Service, United States Army.

BASE OF MOUNT WASHINGTON, N. H., *June* 1, 1872.

Paper E.

EXTRACTS FROM DAILY JOURNAL FOR THE MONTH ENDING MAY 31, 1872.

May 1.—The barometer fell very steadily throughout the day. The thermometer fluctuated slightly, ranging between 37° and 42°. Humidity 58 to 100 per cent. Wind from the west until noon, when it changed to southwest, veering between that point and south the rest of the day; velocity steady, at from forty to fifty miles per hour, the maximum being sixty-six miles per hour at 9 p. m. The weather was very doubtful in the early day and afternoon, the clouds changing their formation very often, but always moving with the wind. They were principally ill-defined cirro-stratus and cirro-cumulus clouds, blended in all sorts of shapes. The glens and ravines were filled with dense haze until 2.30 p. m., when a change took place; the summit of the mountain became completely shrouded in a heavy, saturating fog, which turned to rain at 7 p. m. ending at 9.30 p. m., with about .02 rain-fall. After 9 p. m. the weather continued threatening, the wind blowing sixty-five miles per hour from the south.

May 2.—The barometer fell gradually, and oscillated a little during the day. The thermometer steady at from 36° to 38° until night-fall, when it fell to 32°. Wind ranging between west and south, with a velocity of from thirty to sixty miles per hour, falling off to gentle wind at midnight. The weather was very unsettled throughout the twenty-four hours, raining and hailing in a drizzle at intervals, turning to sleet at times. At 10 a. m. the sky partially cleared, and the atmosphere became very transparent for a few minutes. The glens and surrounding ravines were full of large cumulus clouds, which in a short time surrounded the summit and formed dense fog, which hung over us until late at night. At midnight the sky was covered with well-defined stratus clouds. The hail that fell came down in very fine stones, turning to drizzling rain. My morning report was delayed, in consequence of not being able to break Sergeant Smith or Littleton, who called me repeatedly and distinctly, but were not able to get my answer to the call. I succeeded in raising Sergeant Smith at 1.20 p. m., who then took the report and forwarded it.

May 3.—The barometer still falling; total fall through the day, .10. The thermometer steady, fluctuating between 28° and 31°, falling rapidly after night-fall, to 23° at midnight; the wind blowing steadily from south to southwest, with a velocity from fresh to high wind. The weather has been very unsettled, constantly changing from light snow to sleet, drizzling rain, and dense fog; at intervals making feeble attempts to clear, but always failing to do so. After 8 p. m. the sky partially cleared, but remained half covered with stratus clouds; the stars shining brightly through the spaces. A little before 9 p. m. I noticed a brilliant sheet of pale yellow light in the northern horizon, partially obscured by a heavy clump of stratus clouds; this "aurora" remained stationary until after midnight, but steadily diminished in intensity.

May 4.—The barometer showed a steady decrease of pressure in the early part of the day, rising at night a little higher than the morning maximum. The thermometer steady, ranging between 21° and 24°; very steady nearly all day at 22° and 23°. The wind fluctuated between north and south from the eastern points, with brisk and high wind until after 8 p. m., when it increased to hurricane velocity of from ninety to one hundred miles per hour. The day opened with threatening weather, changing to snow and sleet, settling down to a heavy fall of snow throughout the day.

May 5.—The barometer fell steadily all day, and rapidly after 8 p. m. to midnight. The thermometer ranged between 15° and 22°. The wind steady from the north, with brisk and high velocity, veering to northwest and turning to hurricane at night-fall. The weather, during the hours of daylight, gave a prospect of clearing, the sun going down clear and red, and that portion of the sky not covered with stratus clouds being entirely clear. This changed to threatening weather after 9 p. m., the clouds massing round the summit very thickly, so as to obscure all surrounding objects from view. A slight fall of snow after midnight; no measurement.

May 6.—The barometer showed a steady increase of pressure, rising rapidly after sundown. The thermometer rose steadily, and gave higher endings than on yesterday, (23° to 27°.) The wind blew steadily from the north, with brisk velocity up to night-fall, rising to gale and afterward to storm. The weather was very unsettled all day, snowing lightly at intervals, clearing partially at 2 p. m., becoming overcast shortly after, and set in threatening the rest of the day.

May 7.—The barometer rose steadily all day. The thermometer rose steadily, and gave a maximum of 39°. The wind changed from north to west at 2 p. m., and settled afterward from northwest. The day opened with drizzling rain and a storm-velocity of wind, then turned to fog after 8 a. m., remaining so until 2 p. m., when there were evident signs of clearing weather; turning fair shortly afterward, and remaining so throughout the rest of the day and night. The wind turned to high, and (gradually) to brisk at night. Upper clouds moved from the northwest.

May 8.—The barometer still rising steadily, with a slight rise in the temperature. The wind from the northwest, and of brisk and high velocity, blowing at very uniform rates. The weather opened and remained fair all day until evening approached, when the sky became gradually obscured by stratus and cirro-stratus clouds, which turned to nimbus and rain at 2 a. m. the following day, (9th instant.)

May 9.—The barometer fell steadily all day, and rapidly after sundown. The thermometer gave a steady increase of temperature, rising to 47°. The wind steady from the west, with an exceptional puff from the southwest. The velocity of "high" and "gale" rose rapidly after sundown to a violent hurricane, fairly staggering the building at times, coming in tremendous gusts. The day set in with a miserable drizzling rain, stopping at 8.30 a. m., turning into very cloudy weather until evening, when the stars and young moon shone out brightly, but became obscured at 11 p. m., from which hour the sky was nearly covered with stratus clouds. A slight margin of clear sky remained near the eastern horizon.

May 10.—The barometer rose rapidly all day. (I made a report at midday of .16 rise.) The thermometer fell rapidly in the early morning, steady through the day at 31°, rising a little at night. The wind steady from the west, decreasing gradually from hurricane to high velocity. The day began with rain, which held up after 8.40 a. m. Cloudy weather from that hour up to 1.30 p. m., when the sky cleared rapidly, and fair weather prevailed until 11 p. m., when the stars and moon were nearly obscured by about three-quarters stratus clouds. After 11 p. m. the barometer remained very steady.

May 11.—The barometer changed very little until midday; after that time it fell slightly and steadily. The thermometer rose steadily all day. The wind blew from the west all day with gale velocity up to night-fall, and then increased to a storm from the same quarter; sky clear. The weather was very cloudy until after midday, then cleared rapidly, and at 9 p. m. and after the sky was quite free from cloud, the stars and moon being very clear and bright. During the afternoon the chief part of the clouds were below the summit.

May 12.—The barometer and thermometer steady; wind from the west and northwest, gradually falling off in velocity and settling down to a fresh breeze. The weather fair during the day, becoming perfectly clear after night-fall. At midnight I noticed a few faint shooting-stars crossing the western horizon in close proximity to the moon. Earlier a halo encircled the moon; it was of very narrow diameter.

May 13.—The barometer rose steadily all day, but not enough to denote any particular change in the pressure. The thermometer fell evenly, dropping to 26° at midnight. The wind fluctuated between west and northwest, settling steadily from the north after sundown. The velocity was steady all day, alternating between fresh and brisk wind, except in the early morning, at which time it was nearly calm. The weather was quite fair, except during the latter part of the forenoon, when the summit was covered with dense clouds, rising from the ravines. The clouds were principally well-defined cirrus, mixing at times with cumulus, forming cirro-cumulus.

May 14.—The barometer continued rising all last night and to-day. The thermometer rose gradually until 4 p. m., when it attained a maximum temperature, for the day, of 34°, remaining steady at that height until after 6 p. m., when it began to fall steadily. The wind has fluctuated between the points north and west, with a velocity fluctuating between fresh and high wind. The weather has been very fair and bracing; the lower atmosphere com paratively clear. Principal clouds cirro-cumulus, with here and there well-defined cirrus and cumulus; very little stratus.

May 15.—The barometer fell steadily all day. The thermometer very steady, falling a little toward night-fall. The wind settling from the north; after sundown, rising to a strong gale. During the day the wind fluctuated between north and west. The weather during the early forenoon and afternoon was very cloudy, turning to light flurries of snow at intervals. The sky became almost free from clouds after 9 p. m.; only a slight streak of cirro-stratus remained hanging on the horizon at midnight.

May 16.—The barometer fell slightly during the day, going up slowly after dark. The thermometer fell rapidly last night and this morning, going down to 15°; rose slightly through the day, and remained nearly stationary at 22° after night set in. The wind blew a hard gale from the north nearly all day, the direction veering to west, and intermediate points between west and north. The weather was fair in the morning and forenoon, turning to cloudy weather after 1 p. m., and remained so the rest of the day.

May 17.—The barometer indicated a gradual increase of pressure throughout the day The thermometer rose 8° higher than yesterday. The direction of the wind changed tinually all day between the points of northeast and northwest; the velocity brisk all day with a slight falling off to gentle wind in the afternoon. The morning opened with light snow, which had been falling some hours during the night. This changed to cloudy weather up to 10 a. m., when the weather became very fair, and the atmosphere transparent enough to allow of seeing the Atlantic Ocean and the surrounding country. The night set in clear, the moon and stars coming out with unusual brightness.

May 18.—This day has been almost a duplicate of yesterday. The barometer remained almost stationary until after 8 p. m., when it began to fall slightly. The thermometer rose steadily, reaching a maximum of 41°. The direction of the wind changed frequently from northeast to northwest, and sometimes died out entirely; the velocity gentle to fresh, rising to brisk wind at night. Clouds nearly all well-defined cumulus, changing to cirrus after the moon rose. The atmosphere was not quite so transparent as on yesterday, but the view of the surrounding country was very fine and extensive.

May 19.—The barometer fell rapidly all day. The thermometer nearly steady, rising to 44°. The wind changed direction, blowing from all points of the compass in five minutes' space, making it very difficult to determine the true direction. The velocity rose to a heavy gale, and blew principally from the southeast and southwest. The weather was fair until about 11 a. m., when the summit became completely shrouded with dense stratus clouds; turned to heavy rain at 1.30 p. m., which continues falling the entire day and night, keeping on after the midnight observation was taken Owing to the heavy wind, a very imperfect measurement of rain-fall was taken. The rain-storm to-day affected the telegraph communication very much, cutting it entirely off after 4.30 p. m.; up to that time I could communicate with the base (Sergeant Smith) and Littleton. I could hear Boston and Littleton call me repeatedly, and answer promptly; but from the bad working of the line was unable to break in, or make them understand me. In consequence, to-days's p. m. and midnight reports have been unavoidably held over. No electrical phenomena accompanied the storm to-day. The roof of the building is letting in water by the gallon, and we feel damp.

May 20.—The barometer continued falling until after 5 p. m., when it began to rise slightly. The barometer was very even throughout the day, fluctuating between 34° and 37°. The wind came from the southeast and southwest in the morning, changing direction to northwest at 9 a. m., blowing steadily from that point the remainder of the day, with a heavy gale velocity, falling a little after 9 p. m. The rain continued falling all last night and throughout the day with very little intermission, the water streaming into our habitation like "all possessed," and it was with great difficulty that we succeeded in keeping the books and stationery from destruction. At 2.15 p. m. the weather showed signs of clearing up a little; the sun broke through a chink in the stratus clouds and a few cumulus formed; this lasted until a few minutes past 6 p. m., when it rained and sleeted until 10.30 p. m. The weather, from that hour until after sending the midnight report, was threatening; changed to rain again in the early morning, and continues falling heavily. I had much trouble in getting off my midnight report, through the bad working of the line, and would have failed in doing so had not Sergeant Smith received it at the base and forwarded it to Boston for me. As it was, it required upward of twenty minutes' close application to send it through correctly.

May 21.—The barometer rose rapidly all day. The thermometer comparatively steady at 34°, falling to 29° after 11 p. m. The wind steady from the northwest, with decreasing velocity, going down to a fresh breeze at midnight. The rain and sleet continued almost incessantly until 5.50 p. m., when it cleared rapidly; and in half an hour from that time the sky was half covered with a mixture of cirrus and cumulus clouds. At midnight it was nearly clear weather, only a few light cirrus clouds dotting the blue canopy above. The moon and stars were very brilliant. From 9 to 10 p. m., however, a haze obscured the moon partially, and it was surrounded by a broadly marked halo.

May 22.—The barometer steady all day, falling rather rapidly toward night-fall. Thermometer steady. The direction of the wind changed to all points of the compass, with gentle and fresh velocity, rising to a gale from the south at night. Weather fair until night set in, when it turned very cloudy and threatening. Lieutenant Greely arrived here to-day at 5.50 p. m., and consumed the rest of the day in making his inspection of the station.

May 23.—The barometer continued falling all last night, and remained comparatively steady to-day, with an occasional rise or fall, varying from .01 to .03. The thermometer showed an increase in temperature, and oscillated at times to the extent of 3° between the hourly observations. The wind from the west and southwest, in the morning, with heavy gale velocity, changing to west and northwest after 2 p. m., the velocity falling off to brisk wind. The day opened with rain, which had commenced during the night, and, with slight intermission, continued falling all day. Lieutenant Greely departed at 2 p. m., after finishing his inspection and making a list of articles considered necessary for use on this station.

May 24.—The barometer rose in the early morning a little and remained very steady through the middle of the day, falling gradually after 8 p. m. The thermometer rose to 48°, the highest recorded temperature here this year. The wind from the northwest and west, with gentle and fresh velocity, rising to a gale at night. At 10 a. m. it was dead calm for about thirty minutes. Clouds in dense masses rose from the glens all day, making what might have been a very fair day, very cloudy at times. Stratus clouds on the summit formed about 3 p. m., and continued so the rest of the day and night.

May 25.—The barometer fell steadily all day, more rapidly after 9 p. m. The thermometer very steady through the day up to 5 p. m. at 43°, then it fell very rapidly, reaching a minimum of 31° at midnight. The wind came steadily from the west, with a high wind and gale velocity; changed to northwest after 6 p. m., and the velocity gradually increased, until at midnight it blew a storm. The morning opened with light rain, which had been falling through the latter hours of the night, but stopped at 7 a. m. From that hour until early afternoon the weather was of a very cloudy nature. About 3 p. m. it began clearing rapidly, and at 6 p. m. the sky was about one-half covered with cumulus clouds, changing in another hour to very clearly defined cirrus clouds. From 9 p. m. there appeared a few stratus clouds high up, the cirrus clouds disappeared, and a dense haze obscured the brightness of the stars; this weather continued until midnight and after, the thermometer still falling, and everything below the summit free from haze or cloud.

NOTE.—At 7 p. m., while the wind blew from the northwest, the upper clouds were being driven rapidly from the southwest.

May 26.—The barometer rose very steadily all day, and I forwarded a midday telegram showing an increased height of .17 between the hours of 8 a. m. and 12 m. The maximum height of the barometer was given at 9 p. m., falling gradually from that hour. The thermometer fell last night to 28°, rising gradually from 7 a. m. to 40° in the late afternoon. The day opened with a heavy gale from the northwest, which subsided gradually, and in heavy gusts, to a fresh breeze in the evening, changing direction at intervals to north. The weather was very fine and almost clear nearly all day. Nothing extraordinary took place to require recording.

May 27.—The barometer fell steadily all day, with a slight exception at midday, when it rose a little. The thermometer rose up to 11 a. m., standing steady from that time until 1 p. m., at 43°; it was 44° at 2 p. m., and fell steadily afterward. The prevailing wind came from the south and southwest, with high wind and gale velocity. At 4.50 p. m. the wind changed very abruptly, and without any decrease of velocity, to the southeast, blowing from that point about thirty minutes. The weather was fair until 3 p. m., when dense stratus clouds covered the summit and remained there until rain began falling at 11 p. m. This weather continued into the night.

May 28.—The barometer fell a little in the early forenoon, rising afterward steadily. The thermometer fell last night, and through the day showed a decrease of about 10°. The wind prevailed from the west, changing a few points at times north and south, with brisk and high velocity. The weather was very bad all day. Snow fell during the night and continued up to 10.30 a. m., changing then to rain and sleet; there was a slight cessation, of rain and snow at times, but there was no indication of clearing up.

May 29.—Barometer still going up, and the thermometer falling a few degrees. The wind from the northwest, with high and gale velocity. The rain of last night changed to snow, which continued falling until a little before day-break, and some of the drifts measured upward of 15 inches in depth. The mountain, above "Jacob's Ladder," was covered with snow, excepting where the wind had cleared the points of rocks. Heavy stratus clouds obscured the sky and covered the summit all day.

May 30.—The barometer rose steadily until 11 a. m., falling steadily afterward. The thermometer showed a slight increase of temperature. The wind came from all points of the compass, decreasing from gale in the morning to fresh velocity in the middle of the day, rising to brisk wind at night. The forenoon and afternoon were very cloudy, most of the clouds settling below the summit until evening set in, then the summit became covered with dense stratus clouds which turned to heavy driving rain at 6.40 p. m., and continued thus after midnight report was sent. I had unusual difficulty in telegraphing my midnight report to Boston, although a strong current was put on, as the bad weather caused frequent breaks.

May 31.—The barometer continued falling all through last night and to-day, rising slightly toward night. The thermometer has been very steady at 32° and 34°, dropping to 31° at night. The wind has blown from all the points of the compass with brisk and high velocity; it chopped very suddenly, between 9 and 10 a. m., from southwest to due east, and back to southwest; the direction of the wind was very uncertain, and changed many times during the twenty-four hours. The weather has been one continuous round of snow, hail, sleet, and rain all day.

Instruments, &c.—In addition to the instruments previously reported by me as being out of order, I have the honor to name the following: One cup blew off the anemometer on the 16th instant, during a heavy gale, and was lost down "Tuckerman's Ravine." I supplied its place by putting on a cup taken from the other instrument, which had been reported out of order. Also, one min. thermometer, slightly out of order.

I am, sir, very respectfully, your obedient servant,

ALFRED R. THORNETT,
Observer-Sergeant, Signal Service, United States Army.

SUMMIT OF MOUNT WASHINGTON, N. H., *June* 1, 1872.

Paper F.—(Form 4.)

Meteorological record for May 1, 1872

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.999	57	37	37	36	90	W.	42	8.82	....	Stratus ...	2-4	Cirro-strat	2-4	W.					Dense haze below.
Base...		27.34	48	43	44	40	68	S.W.	4	.08	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	7.00 a. m.	23.981	57	37	37	36	90	W.	33	5.44	....	Stratus ...	2-4	Cirro strat	1-4	W.					Dense haze below.
Base...		27.32	48	46	47	42	62	S.W.	4	.08	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	7.57 a. m.	23.981	58	39	39	37	81	W.	30	4.50	....	Stratus ...	1-4	Cirro-strat	2-4	W.					Dense haze below.
Base...		27.31	47	49	49	43	57	S.W.	1	.01	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	9.00 a. m.	23.972	58	42	42	37	58	W.	48	11.52	....	Stratus ...	1-4	Cirrus	1-4	W.					Dense haze below.
Base...		27.31	48	51	51	45	59	Calm	...	......	....	Clear	0	Cirrus	3-4	0					Cloudy.
Summit	10.00 a. m.	23.959	58	42	42	37	58	W.	42	8.82	....	Dense haze	....	Cumulus..	2-4	W.					Dense haze below.
Base...		27.31	49	50	50	45	65	S.W.	2	.02	....	Clear	0	Cirrus	3-4	0					Cloudy.
Summit	11.00 a. m.	23.961	58	40	40	36	64	W.	30	4.50	....	Dense haze	....	Cirro-cum	3-4	W.					Dense haze below.
Base...		27.31	51	53	53	47	61	S.W.	6	.18	....	Clear	....	Cirrus	3-4	0					Cloudy.
Summit	12.00 m...	23.958	59	41	41	37	65	S.W.	42	8.82	....	Dense haze	....	Cirro-strat	3-4	S.W.					Dense haze below.
Base...		27.31	53	55	55	48	56	S.W.	8	.32	....	Clear	....	Cirrus	3-4	0					Cloudy.
Summit	1.00 p. m.	23.940	60	42	42	38	65	S.W.	28	3.92	....	Dense haze	....	Cirro-cum	3-4	S.W.					Dense haze below.
Base...		27.30	55	54	55	48	56	S.W.	6	.18	....	Clear	....	Cirrus	3-4	0					Cloudy.
Summit	2.00 p. m.	23.939	64	42	42	37	58	S.W.	36	6.48	....	Hazy	....	Cirro-strat	2-4	S.W.					
Base...		27.28	54	54	55	49	63	W.	10	.50	93	Stratus ...	2-4	Cirrus	1-4	0					Threatening.
Summit	3.00 p. m.	23.930	71	40	40	38	82	S.W.	42	8.82	....	Dense fog	....	Hidden ...	....	....					Dense fog around summit.
Base ..		27.29	55	52	53	49	73	W.	10	.50	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	4.00 p. m.	23.919	75	38	38	37	90	S.W.	48	11.52	....	Dense fog	...	Hidden ...	....	....					Dense fog around summit.
Base...		27.29	51	50	51	48	79	S.W.	9	.40	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	4.57 p. m.	23.91	77	39	39	38	91	S.	48	11.52	....	Dense fog	....	Hidden ...	....	....					
Base...		27.17	54	49	51	47	72	S.	6	.18	....	Stratus ...	4-4	Hidden ...	....	....					Threatening.
Summit	6.00 p. m.	23.912	82	39	39	38	91	S.W.	50	12.50	....	Dense fog	....	Hidden ...	....	....					Dense fog around summit, and very saturating.
Base...		27.26	49	50	50	47	79	S.E.	6	.18	....	Nimbus...	4-4	Hidden ...	....	....					Threatening.
Summit	9.00 p. m.	23.851	73	39	39	39	100	S.W.	66	21.78	...	Nimbus...	4-4	Hidden ...	....	....	7.00 p. m.				
Base...		27.28	54	47	49	47	86	S.	4	.08	....	Nimbus...	4-4	Hidden ...	....	....					Threatening.
Summit	11.57 p. m.	23.84	66	36	36	36	100	S.	65	21.12	....	Stratus ...	4-4	Hidden ...	....	....		9.40 p. m.	Rain .02	42–34	
Base...		27.25	57	51	53	47	61	S.	8	.32	....	Nimbus...	4-4	Hidden ...	....	....					Threatening.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

NOTE.—The summit station is ten feet and five-tenths below the highest point of the mountain,

Meteorological record for May 2, 1872.

Place of observation.	Time of observation.	Barometer.	Therm.		Hygrom.		Relative humidity.	Wind.				Lower clouds.		Upper clouds.			Rain or snow.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from —)	Comm'nc'd.	Ended.			
Summit	6.00 a.m.	23.810	68	40	40	40	100	S.W.	36	6.48		Nimbus	4-4	Hidden							Heavy rain.
Base		27.15	55	45	47	46	93	N.E.	2	.02		Nimbus	4-4	Hidden							Light rain.
Summit	7.00 a.m.	23.790	76	39	39	39	100	S.W.	54	14.58		Nimbus	4-4	Hidden							
Base		27.14	54	46	47	47	100	Calm.				Nimbus	4-4	Hidden							Heavy rain.
Summit	7.57 a.m.	23.77	72	38	38	38	100	S.W.	36	6.48		Nimbus	4-4	Hidden			Dur. night		.07		Hail and rain.
Base		27.13	52	44	46	45	92	E.	2	.02		Nimbus	4-4	Hidden			Dur. night		.30		Light rain.
Summit	9.00 a.m.	23.790	70	37	37	37	100	S.W.	36	6.48		Nimbus	4-4	Hidden							Heavy rain.
Base		27.14	53	43	45	44	92	S.E.	3	.04		Nimbus	4-4	Hidden							Heavy rain.
Summit	10.00 a.m.	23.760	72	36	36	35	90	W.	66	21.78		Stratus	2-4	Cumulus	2-4			9.45 a.m.	.03		Clearing; all clouds below summit.
Base		27.11	53	46	47	46	93	S.W.	3	.04		Nimbus	4-4	Hidden				9.45 a.m.	.16		Clearing up.
Summit	11.00 a.m.	23.740	75	36	36	35	90	S.W.	66	21.78		Stratus	4-4	Hidden							Dense fog around summit.
Base		27.09	53	48	49	47	86	S.W.	2	.02		Stratus	3-4	0	0	0					Clearing up.
Summit	12.00 m.	23.710	73	36	36	35	90	S.W.	57	16.24		Stratus	4-4	Hidden							Dense fog around summit.
Base		27.10	53	48	50	48	86	N.	2	.02		Stratus	1-4	Cumulus	3-4	S.W.					Fair.
Summit	1.00 p.m.	23.739	74	38	38	37	90	S.W.	50	12.50		Stratus	4-4	Hidden							Dense fog around summit.
Base		27.10	58	51	52	50	86	N.W.	6	.18		0	0	Cumulus	3-4	S.W.					Fair.
Summit	2.00 p.m.	23.731	71	37	37	36	90	S.W.	36	6.48		Stratus	4-4	Hidden							
Base		27.09	54	51	52	49	80	W.	6	.18	125	Clear		Cumulus	3-4	S.W.					Fair.
Summit	3.00 p.m.	23.705	73	38	38	37	90	S.W.	54	14.58		Clear		Cumulus	2-4	S.W.					Cumulus clouds above and below summit.
Base		27.06	55	56	57	52	69	N.	6	.18		Clear		Cumulus	2-4	S.W.					Fair.
Summit	4.00 p.m.	23.740	72	38	38	37	90	S.W.	36	6.48		Stratus	4-4	Hidden							Dense fog around summit.
Base		27.07	55	53	54	50	74	S.W.	4	.08		Clear		Cumulus	3-4	S.W.					Threatening.
Summit	4.57 p.m.	23.75	70	37	37	36	90	S.W.	34	5.78		Stratus	4-4	Hidden							
Base		27.09	49	46	48	47	92	W.	2	.02		Nimbus	4-4	Hidden			4.55 p.m.				Heavy rain.
Summit	6.00 p.m.	23.730	68	34	34	34	100	W.	33	5.44		Nimbus	4-4	Hidden			5.05 p.m.				Hail, turned to rain.
Base		27.11	55	43	46	45	92	Calm.				Nimbus	4-4	Hidden							Heavy rain.
Summit	9.00 p.m.	23.729	72	32	32	31	89	W.	30	4.50		Nimbus	4-4	Hidden							
Base		27.12	53	41	43	42	92	S.E.	4	.08		Nimbus	4-4	Hidden							Light rain.
Summit	11.57 p.m.	23.76	61	32	32	31	89	W.	4	.08		Stratus	4-4	Hidden				9.10 p.m.	.04	40–32	Snow and sleet.
Base		27.15	55	39	42	41	92	S.E.	2	.02		Stratus	4-4	Hidden				10.00 p.m.	.34		Cloudy.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 3, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from)—	RAIN OR SNOW. Comm'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.709	66	30	30	30	100	S. W.	18	1.62	....	Nimbus	4-4	Hidden ...							Light snow.
Base		27.11	50	36	38	37.5	95	Calm.			....	Nimbus	4-4	Hidden ...							Light rain.
Summit	7.00 a. m.	23.690	67	30	30	30	100	S. W.	12	.72	....	Nimbus	4-4	Hidden ...							
Base		27.09	48	33	41	39	83	Calm.			....	Nimbus	4-4	Hidden ...							Threatening.
Summit	7.57 a. m.	23.69	68	31	31	31	100	S. W.	12	.72	....	Nimbus	4-4	Hidden ...			Dur. night		.05		
Base		27.08	46	37	39	38	91	Calm.			....	Nimbus	4-4	Hidden ...			Dur. night	6.30 a. m.	.20		Threatening.
Summit	9.00 a. m.	23.669	70	31	31	30	89	S.	18	1.62	....	Stratus	4-4	Hidden ...							Dense fog around summit.
Base		27.05	46	38	39	38	91	Calm.			....	Nimbus	4-4	Hidden ...							Threatening.
Summit	10.00 a. m.	23.670	68	30	30	29	89	S. W.	20	2.00	....	Nimbus	4-4	Hidden ...							Spitting snow.
Base		27.05	46	36	37	37	100	Calm.			....	Nimbus	4-4	Hidden ...							Threatening.
Summit	11.00 a. m.	23.658	72	30	30	29	89	S.	39	7.60	....	Stratus	4-4	Hidden ...							Dense fog around summit.
Base		27.03	46	37	37	37	100	Calm.			....	Nimbus	4-4	Hidden ...							Drizzling.
Summit	12.00 m...	23.661	74	30	30	29	89	S. W	18	1.62	....	Nimbus	4-4	Hidden ...							Light snow and sleet.
Base		27.04	46	35	37	36	91	Calm.			....	Nimbus	4-4	Hidden ...							Sleet.
Summit	1.00 p. m.	23.620	72	29	29	28	89	S. W.	25	3.12	....	Nimbus	4-4	Hidden ...							Dense fog around summit.
Base		27.02	46	36	37	36	91	Calm.			....	Nimbus	4-4	Hidden ...							Light rain.
Summit	2.00 p. m.	23.620	74	29	29	27	78	S. W.	30	4.50	....	Stratus	2-4	Cirro-str..	2-4	S.W.					
Base		27.02	47	35	36	36	100	N. W.	1	.01	76	Nimbus	4-4	Hidden ...							Light rain.
Summit	3.00 p. m.	23.609	74	28	28	26	77	S. W.	24	2.88	....	Stratus	2-4	Cirrus	1-4	S.W.					Clearing rapidly.
Base		27.01	45	35	36	36	100	Calm.			....	Nimbus	4-4	Hidden ...							Threatening.
Summit	4.00 p. m.	23.611	71	28	28	26	77	S. W.	12	.72	....	Stratus	4-4	Hidden ...							Dense fog on summit.
Base		27.00	45	37	38	37	90	Calm.			....	Nimbus	2-4	Cumulus..	1-4						Clearing up.
Summit	4.57 p. m.	23.61	70	28	28	27	88	W.	18	1.62	....	Stratus	2-4	Cumulus..	2-4	N.W.		8.35 a. m.	.01		
Base		26.99	45	43	44	41	76	Calm.			....	0	0	Cumulus..	3-4	W.	10.30 a. m.	4.15 p. m.	.07		Fair.
Summit	6.00 p. m.	23.630	75	28	28	27	83	S. W.	15	1.12	....	Stratus	4-4	Hidden ...							Dense fog on summit.
Base		27.01	47	44	45	41	69	Calm.			....	0	0	Cumulus..	2-4	N.W.					Fair.
Summit	9.00 p. m.	23.650	77	24	24	23	87	S. W.	20	2.00	....	Clear ...	....	Cirrus	1-8	S.W.					
Base		27.04	45	32	33	33	100	Calm.			....	Stratus	1-4	0	0	0					Fair.
Summit	11.57 p. m.	23.66	66	23	23	22	86	W.	22	2.42	....	Stratus	2-4	Clear			(*)	(*)		32-23	Aurora in N. horizon from 8.30 p. m. to midnight.
Base		27.04	47	33	34	34	100	S. E.	4	.08	....	Stratus	4-4	Hidden ...							Cloudy.

*Rain and sleet at intervals.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 4, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23. 610	51	24	24	23	87	S.	39	7. 60		Stratus	4-4	Hidden							Threatening.
Baso		27. 03	43	34	35	34	90	N. E.	4	. 08		Stratus	4-4	Hidden							Cloudy.
Summit	7.00 a. m.	23. 600	52	22	22	22	100	S.	33	5. 44		Nimbus	4-4	Hidden							
Base		27. 01	41	35	36	33	70	N. E.	4	. 08		Nimbus	4-4	Hidden							Light snow.
Summit	7.57 a. m.	23. 60	52	23	23	23	100	S.	30	4. 50		Nimbus	4-4	Hidden			*6.10 a. m.		*. 04		
Base		27. 02	40	35	36	34	89	N. W.	2	. 02		Nimbus	4-4	Hidden			†6.50 a. m.				Light snow.
Summit	9.00 a. m.	23. 605	63	23	23	22	86	E.	21	2. 20		Nimbus	4-4	Hidden							Heavy snow.
Base		27. 02	41	35	36	34	80	N. W.	4	. 08		Nimbus	4-4	Hidden							Light snow.
Summit	10.00 a. m.	23. 600	62	23	23	22	86	S. E.	24	2. 88		Nimbus	4-4	Hidden							Heavy sleet.
Base		27. 03	41	34	35	35	100	N. W.	2	. 02		Nimbus	4-4	Hidden							Heavy snow.
Summit	11.00 a. m.	23. 600	65	23	23	22	86	N. E.	24	2. 88		Nimbus	4-4	Hidden							Light snow.
Base		27. 03	41	36	37	37	100	W.	2	. 02		Nimbus	4-4	Hidden							Light snow.
Summit	12.00 m	23. 620	69	22	22	22	100	S. E.	36	6. 48		Nimbus	4-4	Hidden							Light snow.
Base		27. 05	41	34	35	35	100	W.	4	. 08		Nimbus	4-4	Hidden							Heavy snow.
Summit	1.00 p. m.	23. 640	66	22	22	22	100	E.	24	2. 88		Nimbus	4-4	Hidden							Light snow.
Base		27. 04	41	34	35	35	100	Calm.				Nimbus	4-4	Hidden							Light snow.
Summit	2.00 p. m.	23. 631	64	23	23	23	100	E.	26	3. 32		Nimbus	4-4	Hidden							
Base		27. 05	42	34	34	34	100	Calm.			53	Nimbus	4-4	Hidden							Heavy snow.
Summit	3.00 p. m.	23. 651	65	23	23	23	100	E.	26	3. 38		Nimbus	4-4	Hidden							Light snow.
Baso		27. 05	42	34	34	34	100	Calm.				Nimbus	4-4	Hidden							Heavy snow.
Summit	4.00 p. m.	23. 641	62	23	23	23	100	E.	27	3. 64		Nimbus	4-4	Hidden							Light snow.
Base		27. 07	42	33	34	34	100	Calm.				Nimbus	4-4	Hidden							Heavy snow.
Summit	4.57 p. m.	23. 65	59	23	23	23	100	E.	18	1. 62		Nimbus	4-4	Hidden					. 11		
Base		27. 07	42	32	23	23	100	N. W.	2	. 02		Nimbus	4-4	Hidden					. 31		Heavy snow.
Summit	6.00 p. m.	23. 659	60	23	23	23	100	E.	40	8. 00		Nimbus	4-4	Hidden							Light snow.
Base		27. 09	41	31	32	32	100	Calm.				Nimbus	4-4	Hidden							Light snow.
Summit	9.00 p. m.	23. 655	60	22	22	22	100	N.	96	46. 08		Nimbus	4-4	Hidden							
Base		27. 15	48	32	34	33	90	Calm.				Nimbus	4-4	Hidden							Heavy snow.
Summit	11.57 p. m.	23. 70	65	21	21	21	100	N.	92	42. 32		Nimbus	4-4	Hidden					. 14	24-21	
Baso		27. 16	46	31	33	32	90	W.	2	. 02		Stratus	4-4	Hidden					Blank		Cloudy.

* Snow. † Not enough to measure.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 5, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commenc'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.640	42	17	17	16	83	N.	36	6.48		Stratus	2-4	Cumulus	1-4	N.					Fair.
Base		27.18	41	26	28	27	89	Calm				Stratus	2-4	Cumulus	1-4	0					Fair.
Summit	7.00 a.m.	23.620	45	17	17	15	67	N. E.	30	4.50		Stratus	3-4	Hidden							
Base		27.19	41	29	30	29	89	S.	4	.08		Stratus	1-4	Cumulus	2-4	N. E.					Fair.
Summit	7.57 a.m.	23.670	56	17	17	15	67	N.	40	8.00		Stratus	1-4	Cumulus	3-4	N.		Dur. night	Snow .03		
Base		27.19	42	32	33	30	79	N.	2	.02		Stratus	1-4	Cumulus	1-4	0		Dur. night	.35		Fair.
Summit	9.00 a.m.	23.670	58	17	17	15	67	N.	42	8.82		Stratus	4-4	Hidden							Foggy.
Base		27.20	42	32	33	31	80	N. W.	3	.04		Stratus	1-4	Cumulus	3-4	W.					Cloudy.
Summit	10.00 a.m.	23.686	64	18	18	17	84	N.	60	18.00		Stratus	4-4	Hidden							Foggy.
Base		27.19	43	33	34	32	79	W.	4	.08		Clear		Cumulus	3-4	N. W.					Cloudy.
Summit	11.00 a.m.	23.690	63	20	20	19	85	N.	30	4.50		Stratus	4-4	Hidden							Foggy.
Base		27.19	42	36	36	35	90	W.	4	.08		Clear		Cumulus	2-4	0					Fair.
Summit	12.00 m.	23.680	66	21	21	20	85	N.	32	5.12		Stratus	4-4	Hidden							Foggy.
Base		27.18	43	38	38	37	90	N. W.	7	.24		Clear		Cumulus	2-4	N. W.					Fair.
Summit	1.00 p.m.	23.693	68	22	22	20	72	N.	24	2.88		Stratus	1-4	Cumulus	1-4	N.					
Base		27.16	43	39	40	36	64	W.	4	.08		Clear		Cumulus	3-4	N. W.					Fair.
Summit	2.00 p.m.	23.681	62	22	22	20	72	N.	30	4.50		Stratus	2-4	Cumulus	2-4	N.					
Base		27.16	43	39	39	35	64	W.	6	.18	61	Clear		Cumulus	3-4	N.					Fair.
Summit	3.00 p.m.	23.670	65	22	22	20	72	N.	29	4.20		Stratus	3-4	Cumulus	1-4	N.					Hazy.
Base		27.14	43	38	39	35	64	W.	8	.32		Stratus	1-4	Cumulus	3-4	N.					Cloudy.
Summit	4.00 p.m.	23.640	62	22	22	20	72	N.	40	8.00		Stratus	3-4	Cumulus	1-4	N.					Fair.
Base		27.12	43	39	39	35	64	N. W.	6	.18		Stratus	1-4	Cumulus	3-4	N.					Cloudy.
Summit	4.57 p.m.	23.640	60	22	22	20	72	N.	45	10.12		Stratus	2-4	Cumulus	1-4	N.					
Base		27.12	43	42	43	37	51	N. W.	10	.50		Clear		Cumulus	2-4	N.					Fair.
Summit	6.00 p.m.	23.600	63	21	21	19	85	N.	38	7.22		Stratus	2-4	Cumulus	1-4	N.					Fair.
Base		27.12	46	41	42	38	66	N. W.	6	.18		Clear		Cumulus	2-4	N.					Fair.
Summit	9.00 p.m.	23.531	62	18	18	16	68	N. W.	60	18.00		Stratus	2-4	Clear							
Base		27.12	43	33	35	31	63	W.	4	.08		Stratus	1-4	Clear							Fair.
Summit	11.57 p.m.	23.480	52	16	16	15	83	N. W.	85	36.12		Stratus	4-4	Hidden						22-15	
Base		27.06	45	33	34	31	71	W.	6	.18		Stratus	2-4	Clear							Fair.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 6, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'en'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23. 540	37	20	20	19	84	N.	24	2. 88		Stratus	3-4	Hidden							Hazy.
Base		27. 04	42	30	31	31	100	N. W.	2	. 02		Nimbus	4-4	Hidden							Heavy snow.
Summit	7.00 a. m.	23. 580	47	20	29	19	85	N.	18	1. 62		Stratus	4-4	Hidden							
Base		27. 05	41	30	32	31	90	S.	2	. 02		Nimbus	4-4	Hidden							Light snow.
Summit	7.57 a. m.	23. 600	61	22	22	20	72	N.	24	2. 88		Stratus	4-4	Hidden							
Base		27. 05	41	31	32	31	90	Calm				Nimbus	4-4	Hidden			Dur.night		. 07		Light snow.
Summit	9.00 a. m.	23. 630	68	23	23	22	86	N.	13	. 84		Nimbus	4-4	Hidden			8.30 a. m.				Light snow.
Base		27. 05	41	31	34	32	100	Calm				Nimbus	4-4	Hidden							Heavy snow.
Summit	10.00 a. m.	23. 640	68	23	23	22	86	N.	8	. 32		Nimbus	4-4	Hidden							Light snow.
Base		27. 06	40	33	33	34	100	Calm				Nimbus	4-4	Hidden							Heavy snow.
Summit	11.00 a. m.	23. 655	67	23	23	22	86	N.	24	2. 88		Nimbus	4-4	Hidden				10.45 a. m.	Snow. 01		Dense fog.
Base		27. 07	41	34	35	35	100	Calm				Nimbus	4-4	Hidden							Light snow.
Summit	12.00 m.	23. 665	65	25	25	23	74	N.	21	2. 20		Nimbus	4-4	Hidden							Dense fog.
Base		27. 09	43	35	35	35	100	S. W.	4	. 08		Nimbus	4-4	Hidden							Light snow.
Summit	1. 00 p. m.	23. 670	62	25	25	23	74	N.	24	2. 88		Nimbus	4-4	Hidden							Dense fog.
Base		27. 09	43	37	38	37	90	W.	4	. 08		Stratus	1-4	Cumulus	2-4	N. E.					Fair.
Summit	2. 00 p. m.	23. 690	60	25	25	23	74	N.	25	3. 12		Clear		Cumulus	3-4	N.					
Base		27. 10	43	41	42	40	83	N. E.	5	. 12	110	Clear		Cumulus	3-4	N. E.					Fair.
Summit	3. 00 p. m.	23. 690	61	26	26	24	76	N.	20	2. 00		Nimbus	4-4	Hidden							Dense fog.
Base		27. 11	44	41	41	39	74	N.	2	. 02		Clear		Cumulus	3-4	N. E.					Fair.
Summit	4. 00 p. m.	23. 690	61	26	26	24	76	N.	22	2. 42		Nimbus	4-4	Hidden							Dense fog.
Base		27. 12	44	43	44	40	68	N. W.	6	18. 00		Clear		Cumulus	3-4	N.					Fair.
Summit	4. 57 p. m.	23. 690	60	26	26	25	88	N.	48	11. 52		Nimbus	4-4	Hidden							
Base		27. 14	45	44	45	41	68	W.	4	. 08		Clear		Cumulus	3-4	N.		12.30 p. m			Fair; hail from 1. 20 to 1. 30 p. m.
Summit	6. 00 p. m.	23. 720	60	27	27	25	77	N.	40	8. 00		Stratus	3-4	Cumulus	1-4	N.					Hazy.
Base		27. 14	46	45	45	43	69	W.	4	08		Clear		Cumulus	3-4	N. E.					Fair.
Summit	9. 00 p. m.	23. 740	66	25	25	24	88	N.	42	8. 82		Nimbus	4-4	Hidden			8.00 p. m.				
Base		27. 16	45	35	37	35	81	W.	2	. 02		Clear		Cumulus	3-4	N. E.					Fair.
Summit	11. 57 p. m.	23. 670	50	26	26	25	88	N.	68	23. 12		Nimbus	4-4	Hidden				Dur.night	. 03	27–16	
Base		27. 15	45	38	40	36	64	W.	2	. 02		Clear		Cumulus	2-4	0					Fair.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 7, 1872.

Place of observation.	Time of observation.	Barometer.	THERM.		HYGROM.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from—)	Commen'd.	Ended.			
Summit	6.00 a. m.	23.750	56	32	32	31	89	N.	66	21.78		Nimbus	4-4	Hidden							Drizzling.
Base	6.00 a. m.	27.20	46	41	42	40	83	N. W.	4	.08		Stratus	4-4	Hidden							Threatening.
Summit	7.00 a. m.	23.740	62	33	33	31	79	N.	66	21.78		Stratus	4-4	Hidden							
Base	7.00 a. m.	27.20	46	41	42	40	83	N. E.	4	.08		Stratus	3-4	Cumulus	1-4	N.					Cloudy.
Summit	7.57 a. m.	23.740	59	33	33	31	79	N.	72	25.92		Stratus	4-4	Hidden			Dur. night	6.45 a.m.	Rain, .06		
Base	7.57 a. m.	27.21	46	43	44	41	76	E.	3	.04		Stratus	4-4	Hidden							Threatening.
Summit	9.00 a. m.	23.760	60	34	34	33	90	N.	68	23.12		Nimbus	4-4	Hidden							Dense fog.
Base	9.00 a. m.	27.20	46	45	46	44	84	N.	2	.02		Stratus	4-4	Hidden							Cloudy.
Summit	10.00 a. m.	23.770	59	35	35	34	90	N.	60	18.00		Nimbus	4-4	Hidden							Dense fog.
Base	10.00 a. m.	27.21	46	48	48	45	78	W.	4	.08		Stratus	1-4	Cumulus	2-4	N. E.					Fair.
Summit	11.00 a. m.	23.780	61	35	35	34	90	N.	54	14.58		Nimbus	4-4	Hidden							Dense fog.
Base	11.00 a. m.	27.20	47	49	50	46	72	S. W.	6	.18		Stratus	1-4	Cumulus	2-4	N. E.					Fair.
Summit	12.00 m.	23.800	61	36	36	35	90	N.	54	14.58		Nimbus	4-4	Hidden							Dense fog.
Base	12.00 m.	27.21	49	51	52	48	73	N.	6	.18		Clear		Cumulus	3-4	N.					Cloudy.
Summit	1.00 p. m.	23.829	66	36	36	35	90	N.	50	12.50		Nimbus	4-4	Hidden							Dense fog.
Base	1.00 p. m.	27.20	50	52	54	48	61	W.	4	.08		Clear		Cumulus	3-4	N.					Cloudy.
Summit	2.00 p. m.	23.850	64	37	37	36	90	N.	48	11.52		Stratus	3-4	Hazy							
Base	2.00 p. m.	27.20	50	56	56	50	63	N. W.	6	.18	86	Clear		Cumulus	3-4	N.					Cloudy.
Summit	3.00 p. m.	23.850	68	37	37	35	80	W.	42	8.82		Stratus	2-4	Cumulus	2-4	N. W.					Clearing rapidly.
Base	3.00 p. m.	27.19	54	57	58	51	58	W.	6	.18		Clear		Cumulus	3-4	N.					Fair.
Summit	4.00 p. m.	23.863	69	37	37	35	80	N. W.	40	8.00		Clear		Cumulus	3-4	N. W.					Clearing rapidly.
Base	4.00 p. m.	27.20	54	56	57	50	58	N. W.	6	.18		Clear		Cumulus	3-4	N.					Fair.
Summit	4.57 p. m.	23.880	72	38	38	36	90	N. W.	22	2.42		Clear		Cumulus	2-4	N. W.					
Base	4.57 p. m.	27.20	56	59	60	52	55	W.	4	.08		Clear		Cumulus	2-4	N.					Fair.
Summit	6.00 p. m.	23.900	76	38	38	36	90	N. W.	20	2.00		Clear		Cumulus	2-4	N. W.					Clearing rapidly
Base	6.00 p. m.	27.22	58	58	59	52	59	W.	2	.02		Clear		Cumulus	1-4	N.					Fair.
Summit	9.00 p. m.	23.899	65	37	37	35	80	N. W.	48	11.52		Clear		Cirro-strat.	2-4	N. W.					
Base	9.00 p. m.	27.24	54	44	46	44	84	E.	6	.18		Clear		Clear							Clear.
Summit	11.57 p. m.	23.900	68	37	37	35	80	N. W.	16	1.28		Stratus	2-4	Clear						39-26	
Base	11.57 p. m.	27.23	56	44	46	44	84	N.	6	.18		Clear		Clear							Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 8, 1872.

Place of observation.	Time of observation.	Barometer.	Therm. Attached.	Therm. Exposed.	Hygrom. Dry bulb.	Hygrom. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Lower clouds. Kind.	Lower clouds. Amount.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction, (moving from—)	Rain or snow. Comm'cd.	Rain or snow. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23. 880	57	38	38	36	80	N. W.	36	6. 48		Hazy		Cumulus	3-4	N. W.					Fair.
Base		27. 25	51	43	45	43	84	E.	3	. 04		Clear		Cumulus	4-4	0					Cloudy.
Summit	7.00 a. m.	23. 880	58	38	38	36	80	N. W.	30	4. 59		Hazy		Cumulus	3-4	N. W.					
Base		27. 26	50	42	43	42	92	E.	4	. 08		Stratus	1-4	Cumulus	1-4	0					Fair.
Summit	7.57 a. m.	23. 871	61	38	38	36	80	N. W.	28	3. 92		Hazy		Cumulus	2-4	N. W.					
Base		27. 26	50	48	49	46	78	N. W.	2	. 02		Stratus	1-4	Clear							Fair.
Summit	9.00 a. m.	23. 890	63	39	39	37	82	N. W.	33	5. 44		Hazy		Cumulus	1-4	N. W.					Fair.
Base		27. 26	50	50	51	47	72	Calm				Clear		Cumulus	1-4	0					Fair.
Summit	10.00 a. m.	23. 890	61	37	37	35	80	N. W.	30	4. 50		Hazy		Cumulus	1-4	N. W.					Fair.
Base		27. 30	52	51	52	47	66	Calm				Stratus	1-4	Cumulus	2-4	N.					Fair.
Summit	11.00 a. m.	23. 890	58	39	39	37	82	N. W.	35	6. 12		Hazy		Cumulus	1-4	N. W.					Fair.
Base		27. 29	53	53	54	49	67	N. W.	4	. 08		Clear		Cumulus	1-4	N.					Fair.
Summit	12.00 m	23. 890	57	40	40	38	82	N. W.	36	6. 48		Hazy		Cumulus	1-4	N. W.					Fair.
Base		27. 29	54	55	56	49	57	N. W.	6	. 18		Clear		Clear							Clear.
Summit	1.00 p. m.	23. 910	58	40	40	38	82	N. W.	30	4. 50		Hazy		Cumulus	1-4	N. W.					Fair.
Base		27. 29	54	57	59	50	48	N. W.	6	. 18		Clear		Clear							Clear.
Summit	2.00 p. m.	23. 915	63	40	40	37	73	N. W.	36	6. 48		Hazy		Hazy							
Base		27. 29	55	59	60	51	49	W.	4	. 08	111	Clear		Clear							Clear.
Summit	3.00 p. m.	23. 935	59	40	40	37	73	N. W.	30	4. 50		Hazy		Cir. & cu.	1-4	N. W.					Fair.
Base		27. 30	59	59	60	52	55	S. W.	8	. 32		Hazy		Cirrus	1-4	N.					Fair.
Summit	4.00 p. m.	23. 942	65	40	40	38	82	N. W.	27	3. 64		Hazy		Cir. & cu.	1-4	N. W.					Fair.
Base		27. 32	58	59	60	52	55	N. W.	6	. 18		Hazy		Cirrus	1-4	N.					Fair.
Summit	4.57 p. m.	23. 960	67	40	40	38	82	N. W.	30	4. 50		Clear		Cirrus	1-4	N. W.					
Base		27. 32	59	58	59	52	59	N. W.	4	. 08		Clear		Cirrus	3-4	0					Cloudy
Summit	6.00 p. m.	23. 970	70	40	40	38	82	N. W.	30	4. 50		Stratus	1-4	Cirrus	1-4	N. W.					Fair.
Base		27. 33	59	55	56	51	69	W.	2	. 02		Stratus	1-4	Cirrus	2-4	N.					Fair.
Summit	9.00 p. m.	23. 970	60	38	38	29	27	N. W.	25	3. 12		Stratus	2-4	Cirro-strat	1-4	N. W.					
Base		27. 34	58	43	45	43	84	E.	3	. 04		Stratus	3-4	Hidden							Cloudy.
Summit	11.57 p. m.	23. 950	62	36	36	30	45	N. W.	27	3. 64		Stratus	4-4	Hidden						40–34	
Base		27. 32	56	44	46	43	77	E.	4	. 08		Stratus	3-4	Hidden							Cloudy.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282. 5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 9, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'n'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.900	56	39	39	38	91	W.	60	18.00	....	Nimbus...	4-4	Hidden...							Dense fog.
Base..		27.25	53	44	46	45	92	E.	2	.02	....	Nimbus...	3-4	Hidden...							Drizzling.
Summit	7.00 a. m.	23.870	56	39	39	38	91	W.	60	18.00	....	Nimbus...	4-4	Hidden...							
Base...		27.25	52	47	48	46	85	S. E.	4	.08	....	Nimbus...	4-4	Hidden...							Threatening.
Summit	7.57 a. m.	23.861	65	39	39	39	100	W.	58	16.82	....	imbus...	4-4	Hidden...			1.00 a. m. 7.45 a. m.	During night.	Rain .17		
Base...		27.26	51	46	47	45	85	E.	2	.02	....	Nimbus...	4-4	Hidden...			Dur. night		Rain .05		Light rain.
Summit	9.00 a. m.	23.851	68	41	41	40	90	N. W.	54	14.58	....	Nimbus...	4-4	Hidden...							Dense fog.
Base...		27.20	52	50	51	49	86	E.	4	.08	....	Nimbus...	4-4	Hidden...							Cloudy.
Summit	10.00 a. m.	23.840	67	42	42	41	91	W.	45	10.12	....	Stratus...	4-4	Hidden...							Clouds above and below.
Base...		27.20	53	56	57	54	81	N. W.	6	.18	....	Foggy...	....	Cirrus....	2-4	0					Fair.
Summit	11.00 a. m.	23.841	66	42	42	41	91	W.	36	6.48	....	Stratus...	4-4	Hidden...							Clouds above and below.
Base...		27.18	53	59	60	55	71	Calm			....	Hazy...	....	Cumulus..	3-4	W.					Cloudy.
Summit	12.00 m..	23.830	67	44	44	43	92	W.	37	6.84	....	Stratus...	4-4	Hidden...							Cloudy above summit and hazy.
Base...		27.15	57	62	62	55	61	W.	2	.02	....	Stratus...	3-4	Hidden...							Fair.
Summit	1.00 p. m.	23.831	70	45	45	43	85	W.	37	6.84	....	Stratus...	2-4	Cirrus....	1-4	W.					Slight haze below.
Base...		27.13	59	63	63	56	62	S. W.	6	.18	....	Stratus...	3-4	Hidden...							Fair.
Summit	2.00 p. m.	23.810	70	45	45	43	85	W.	45	10.12	....	Hazy....	....	Cirro-strat.	2-4	W.					
Base...		27.13	60	62	63	55	57	S. W.	6	.18	102	Stratus...	4-4	Hidden...							Cloudy.
Summit	3.00 p. m.	23.797	71	46	46	43	76	W.	45	10.12	....	Hazy....	....	Cirro-strat.	2-4	W.					Fair, (clearing.)
Base...		27.11	60	62	63	56	52	S. W.	4	.08	....	Stratus...	4-4	Hidden...							Cloudy.
Summit	4.00 p. m.	23.770	71	46	46	43	76	W.	42	8.82	....	Hazy....	....	Cir. cum..	3-4	W.					Fair.
Base...		27.09	62	63	65	57	58	W.	8	.32	....	Stratus...	3-4	Hidden...							Threatening.
Summit	4.57 p. m.	23.760	73	47	47	44	77	W.	49	12.00	....	Hazy....	....	Cirrus....	2-4	W.		8.30 a. m.	Rain .01		
Base...		27.08	62	65	66	58	59	W.	6	.18	....	Stratus...	3-4	Hidden...				8.30 a. m.	(*)		Threatening.
Summit	6.00 p. m.	23.770	72	46	46	43	76	W.	40	8.60	....	Hazy....	....	Cir. cum..	3-4	W.					Fair.
Base...		27.08	61	61	62	54	56	W.	4	.08	....	Stratus...	3-4	Cumulus..	1-4	N. W.					Threatening.
Summit	9.00 p. m.	23.700	75	46	46	43	76	S. W.	78	30.42	....	Stratus...	3-4	Clear....							
Base...		27.66	63	62	63	54	52	Calm			....	Stratus...	1-4	Clear....							Fair.
Summit	11.57 p. m.	23.650	69	45	45	42	76	W.	84	35.28	....	Stratus...	3-4	Clear....						47–36	Fair.
Base...		27.03	64	62	63	55	57	N. W.	13	.84	....	Stratus...	1-4	Clear....							Fair.

* Not enough to measure.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 21 feet.

Meteorological record for May 10, 1872.

Place of observation.	Time of observation.	Barometer.	THERM.		HYGROM.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from—)	Commen'd.	Ended.			
Summit	6.00 a. m.	23.600	57	37	37	36	90	W.	90	40.50	....	Nimbus	4-4	Hidden							Cloudy, (dense fog.)
Base	6.00 a. m.	27.12	62	49	50	48	86	N. W.	6	.18	....	Stratus	2-4	Clear							Fair.
Summit	7.00 a. m.	23.600	57	35	35	34	90	W.	90	40.50	....	Nimbus	4-4	Hidden							
Base	7.00 a. m.	27.15	59	48	48	46	85	N. W.	8	.32	....	Clear	....	Cumulus	3-4	N. W.					Cloudy.
Summit	7.57 a. m.	23.620	62	34	34	33	90	W.	88	38.72	....	Nimbus	4-4	Hidden			7.35 a. m.	Dur. night	.08		
Base	7.57 a. m.	27.17	59	48	48	45	78	N. W.	6	.18	....	Clear	....	Cumulus	2-4	N. W.					Fa r.
Summit	9.00 a. m.	23.641	63	32	32	31	89	W.	84	35.28	....	Stratus	4-4	Hidden							Cloudy, (dense fog,)
Base	9.00 a. m.	27.18	58	47	47	44	77	N. W.	10	.50	...	Clear	....	Cumulus	2-4	N. W.					Fair.
Summit	10.00 a. m.	23.720	70	32	32	31	89	W.	72	25.92	....	Stratus	4-4	Hidden							Cloudy, (dense fog.)
Base	10.00 a. m.	27.20	57	48	48	44	70	N. W.	8	.32	....	Clear	....	Cumulus	3-4	N. W.					Cloudy.
Summit	11.00 a. m.	23.750	70	31	31	30	89	W.	66	21.78	....	Stratus	4-4	Hidden							Cloudy, (dense fog.)
Base	11.00 a. m.	27.24	59	50	50	46	72	N. W.	6	.18	....	Clear	....	Cumulus	2-4	N. W.					Fair.
Summit	12.00 m.	23.790	68	31	31	30	89	W.	60	12.00	....	Stratus	4-4	Hidden							Cloudy, (dense fog.)
Base	12.00 m.	27.28	58	48	48	44	70	N. W.	8	.32	....	Stratus	4-4	Hidden							Cloudy.
Summit	1.00 p. m.	23.820	66	31	31	30	89	W.	60	18.00	....	Stratus	4-4	Hidden							Cloudy, (dense fog.)
Base	1.00 p. m.	27.31	57	46	45	43	84	W.	4	.08	....	Stratus	4-4	Hidden							
Summit	2.00 p. m.	23.840	70	31	31	29	79	W.	54	14.58	....	Stratus	2-4	Cirrus	1-4	W.					
Base	2.00 p. m.	27.33	56	47	47	43	70	W.	4	.08	177	Stratus	4-4	Hidden							Cloudy.
Summit	3.00 p. m.	23.850	71	31	31	29	79	W.	50	12.50	....	Stratus	2-4	Cirrus	1-4	W.					Fair.
Base	3.00 p. m.	27.35	52	50	50	45	65	N. W.	4	.08	....	Clear	....	Cumulus	1-4	N. W.					Fair.
Summit	4.00 p. m.	23.920	69	32	32	30	79	W.	30	4.50	....	Clear	....	Cirrus	1-4	W.					Fair.
Base	4.00 p. m.	27.35	57	52	52	46	60	N. W.	4	.08	....	Clear	...	Cumulus	1-4	N. W.					Fair.
Summit	4.57 p. m.	23.923	61	33	33	30	69	W.	24	2.88	....	Clear	...	Cirrus	2-4	W.		8.45 a. m.	.01		
Base	4.57 p. m.	27.37	58	54	54	47	55	E.	3	.04	....	Clear	....	Cirrus	1-4	0					Fair.
Summit	6.00 p. m.	23.965	67	34	34	30	61	W.	28	3.92	....	Clear	....	Cirrus	2-4	W.					Fair.
Base	6.00 p. m.	27.40	61	58	58	55	82	W.	2	.02	....	Clear	....	Cirrus	1-4	0					Fair.
Summit	9.00 p. m.	24.020	70	33	33	29	61	W.	36	6.48	....	Stratus	2-4	Clear							
Base	9.00 p. m.	27.43	56	39	40	39	91	E.	2	.02	....	Stratus	1-4	Clear							Fair.
Summit	11.57 p. m.	24.060	65	33	33	31	79	W.	32	5.12	....	Stratus	3-4	Hidden						45–30	
Base	11.57 p. m.	27.47	56	40	40	39	91	W.	4	.08	...	Stratus	3-4	Hidden							Cloudy.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 11, 1872.

Place of observation.	Time of observation.	Barometer.	Therm. Attached.	Therm. Exposed.	Hygrom. Dry bulb.	Hygrom. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Lower clouds. Kind.	Lower clouds. Amount.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction, (moving from—)	Rain or snow. Commen'd.	Rain or snow. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	24.021	54	38	38	37	90	W.	36	6.48		Stratus	1·4	Cumulus	3·4	W.					Fair.
Base	6.00 a.m.	27.45	50	40	40	38	82	Calm				Clear		Cumulus	3·4	N. W.					Cloudy.
Summit	7.00 a.m.	24.051	57	41	41	40	91	W.	42	8.82		Hazy		Cirro-strat	2·4	W.					
Base	7.00 a.m.	27.45	50	42	42	39	74	Calm				Stratus	4·4	Hidden							Cloudy.
Summit	7.57 a.m.	24.070	65	41	41	40	91	W.	42	8.82		Stratus	4·4	Hidden							
Base	7.57 a.m.	27.44	50	44	44	41	76	Calm				Stratus	4·4	Hidden							Cloudy.
Summit	9.00 a.m.	24.070	69	41	41	40	91	W.	42	8.82		Stratus	4·4	Hidden							Cloudy; dense fog.
Base	9.00 a.m.	27.43	51	47	47	44	77	Calm				Stratus	4·4	Hidden							Cloudy.
Summit	10.00 a.m.	24.070	71	41	41	40	91	W.	40	8.00		Stratus	4·4	Hidden							Cloudy; dense fog.
Base	10.00 a.m.	27.41	50	53	53	48	67	S.W.	6	.18		Clear		Cumulus	2·4	S.W.					Fair.
Summit	11.00 a.m.	24.080	73	41	41	40	91	W.	46	10.58		Stratus	4·4	Hidden							Cloudy; denss fog.
Base	11.00 a.m.	27.43	51	54	54	49	67	W.	4	.08		Stratus	4·4	Hidden							Cloudy.
Summit	12.00 m.	24.062	72	40	40	39	91	W.	42	8.82		Stratus	4·4	Hidden							Cloudy; dense fog.
Base	12.00 m.	27.42	52	55	55	49	62	Calm				Clear		Cumulus	3·4	S.W.					Cloudy.
Summit	1.00 p.m.	24.050	73	41	41	40	91	W.	36	6.48		Stratus	4·4	Hidden							Cloudy; dense fog.
Base	1.00 p.m.	27.40	52	55	55	50	68	W.	6	.18		Clear		Cumulus	3·4	S.W.					Cloudy.
Summit	2.00 p.m.	24.040	71	42	42	41	91	W.	40	8.00		Stratus	4·4	Hidden							
Base	2.00 p.m.	27.39	54	56	56	51	69	W.	4	.08	76	Clear		Cumulus	3·4	S.W.					Cloudy.
Summit	3.00 p.m.	24.038	69	43	43	41	83	W.	48	11.52		Hazy		Cumulus	1·4	W.					Clearing; clouds below summit.
Base	3.00 p.m.	27.36	55	58	58	52	64	N. W.	4	.08		Stratus	4·4	Hidden							Cloudy.
Summit	4.00 p.m.	24.020	69	43	43	42	91	W.	50	12.50		Hazy		Cumulus	3·4	W.					Fair and hazy; clouds principally below summit.
Base	4.00 p.m.	27.36	50	59	59	52	59	N. W.	6	.18		Clear		Cumulus	1·4	W.					Fair.
Summit	4.57 p.m.	24.000	70	44	44	42	84	W.	32	5.12		Hazy		Cumulus	3·4	W.					
Base	4.57 p.m.	27.55	55	56	56	51	69	Calm				Stratus	1·4	Clear							Fair.
Summit	6.00 p.m.	24.000	75	45	45	43	84	W.	54	14.58		Hazy		Cirrus	3·4	W.					Hazy.
Base	6.00 p.m.	27.34	57	55	55	51	74	W.	2	.02		Stratus	1·4	Clear							Fair.
Summit	9.00 p.m.	23.960	74	42	42	40	83	W.	66	21.78		Clear		Clear							
Base	9.00 p.m.	27.30	56	44	44	43	92	Calm				Clear		Clear							Clear.
Summit	11.57 p.m.	23.860	64	46	46	42	69	W.	72	25.92		Hazy		Clear						46·33	
Base	11.57 p.m.	27.27	57	49	49	46	78	W.	5	.12		Hazy		Clear							Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 12, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commenc'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.800	57	43	43	41	83	W.	32	5.12	....	Hazy	....	Hazy							Fair and hazy.
Base...		27.15	54	50	50	48	86	E.	4	.08	....	Stratus ...	4-4	Hidden ...							Threatening.
Summit	7.00 a.m.	23.790	60	43	43	41	83	W.	28	3.92	....	Clear	....	Clear							
Base...		27.140	54	53	53	48	67	E.	3	.05	....	Stratus ...	4-4	Hidden ...							Cloudy.
Summit	7.57 a.m.	23.800	62	43	43	41	83	W.	30	4.50	....	Clear		Clear							
Base...		27.14	54	54	54	49	67	Calm			....	Stratus ...	4-4	Hidden ...							Cloudy.
Summit	9.00 a.m.	23.790	67	43	43	41	83	W.	30	4.50	....	Stratus ...	4-4	Hidden ...							Cloudy; dense fog.
Base...		27.14	54	57	57	52	69	W.	2	.02	....	Stratus ...	4-4	Hidden ...							Threatening.
Summit	10.00 a.m.	23.780	69	43	43	42	91	W.	36	6.48	....	Stratus ...	4 4	Hidden ...							Cloudy; dense fog.
Base...		27.14	54	58	58	53	70	W.	2	.02	....	Stratus ...	4-4	Hidden ...							Threatening.
Summit	11.00 a.m.	23.760	68	41	41	39	83	W.	40	8.00	....	Stratus ...	4-4	Hidden ...							Cloudy; dense fog.
Base...		27.15	57	60	60	53	60	W.	8	.32	....	None	....	Cumulus..	3-4	W.					Fair.
Summit	12.00 m..	23.770	68	41	41	40	91	N. W.	35	6.12	....	Stratus ...	4-4	Hidden ...							Cloudy; clearing slightly.
Base...		27.14	57	60	60	53	60	W.	8	.32	....	None	....	Cumulus..	3-4	W.					Fair.
Summit	1.00 p.m.	23.785	68	43	43	41	83	N. W.	36	6.48	....	Stratus ...	3-4	Hidden ...							Cloudy; clearing slightly.
Base...		27.13	58	63	63	55	59	W.	10	.50	....	None	....	Cumulus..	3-4	W.					Fair.
Summit	2.00 p.m.	23.810	69	42	42	41	91	N. W.	30	4.50	....	Hazy	....	Cumulus..	3-4	N. W.					
Base...		27.13	59	63	63	54	52	W.	4	.08	102	Hazy	....	Cumulus..	3-4	W.					Cloudy.
Summit	3.00 p.m.	23.810	69	44	44	42	83	N. W.	27	3.64	....	Hazy	....	Cumulus..	2-4	N. W.					Fair.
Base...		27.13	60	64	64	55	53	W.	6	.18	....	Hazy	....	Cumulus..	3-4	Calm					Cloudy.
Summit	4.00 p.m.	23.795	69	45	45	42	76	W.	24	2.88	....	Hazy	....	Cirro-cum.	3-4	W.					Fair.
Base...		27.12	62	66	66	56	49	W.	6	.18	....	Stratus ..	1-4	Cumulus..	2-4	W.					Fair.
Summit	4.57 p.m.	23.820	67	45	45	40	60	N. W.	24	2.88	....	Hazy	....	Cirrus	3-4	N. W.					
Base...		27.11	62	68	68	57	47	W.	8	.32	....	Hazy	....	Cirrus ...	3-4	Calm					Fair.
Summit	6.00 p.m.	23.820	71	44	44	40	67	N. W.	24	2.88	....	Hazy	....	Cirro-cum.	3-4	N. W.					Fair.
Base...		27.12	63	63	63	55	57	W.	6	.18	....	Stratus ...	1-4	Cirrus	1-4	W.					Fair.
Summit	9.00 p.m.	23.820	66	41	41	38	73	N. W.	7	.25	....	Clear	....	Cirro-strat	2-4	N. W.					
Base...		27.15	61	48	48	47	85	W.	4	.08	....	Stratus ...	1-4		0	0					Fair.
Summit	11.57 p.m.	23.790	67	39	39	35	63	W.	13	.84	....	Clear	....	Clear						46–32	
Base...		27.12	57	43	43	42	92	W.	4	.08	....	Clear	....	Clear							Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 13, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'ced.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.730	59	36	36	32	61	N.W.	7	.25	....	Clear	....	Cumulus	2-4	N.W.					Fair.
Base	6.00 a. m.	27.09	53	37	37	37	100	E.	2	.02	....	Clear	....	Clear							Clear.
Summit	7.00 a. m.	23.740	64	36	36	33	70	N.W.	5	.12	....	0	0	Cumulus	2-4	N.W.					
Base	7.00 a. m.	27.09	50	43	43	41	83	Calm.			....	0	0	Cirrus	1-4	0					Fair.
Summit	7.57 a. m.	23.760	70	37	37	33	62	N.W.	4	.08	....	0	0	Cumulus	3-4	N.W.					
Base	7.57 a. m.	27.10	51	48	48	44	70	Calm.			....	0	0	Cirrus	1-4	0					Fair.
Summit	9.00 a. m.	23.760	71	39	39	36	71	W.	2	.02	....	Hazy		Cirro-cum.	3-4	W.					Fair.
Base	9.00 a. m.	27.10	51	51	51	46	65	W.	2	.02	....	0	0	Cumulus	2-4	0					Fair.
Summit	10.00 a. m.	23.760	65	38	38	35	71	W.	6	.18	....	Stratus	4-4	Hidden							Cloudy—fog.
Base	10.00 a. m.	27.11	51	51	51	46	65	W.	4	.08	....	0	0	Cumulus	3-4	0					Cloudy.
Summit	11.00 a. m.	23.780	68	38	38	35	71	N.W.	4	.08	....	Stratus	3-4	Hidden							Cloudy—fog.
Base	11.00 a. m.	27.12	51	50	50	46	72	W.	3	.05	....	0	0	Cumulus	3-4	0					Cloudy.
Summit	12.00 m.	23.800	75	37	37	35	80	W.	5	.12	....	Stratus	4-4	Hidden							Cloudy—fog.
Base	12.00 m.	27.12	51	50	50	45	65	Calm.			....	0	0	Cumulus	3-4	0					Cloudy.
Summit	1.00 p. m.	23.780	71	35	35	33	80	W.	7	.25	....	Stratus	4-4	Hidden							Cloudy—fog.
Base	1.00 p. m.	27.12	51	49	49	44	64	N.W.	2	.02	....	0	0	Cumulus	4-4	0					Threatening.
Summit	2.00 p. m.	23.800	73	34	34	32	79	W.	7	.25	..	Stratus	4-4	Hidden							
Base	2.00 p. m.	27.12	54	48	48	45	78	Calm.			96	Stratus	4-4	Hidden							Threatening.
Summit	3.00 p. m.	23.800	70	33	33	30	69	W.	8	.32	....	Stratus	3-4	Cirro-strat.	1-4	W.					Cloudy—fog.
Base	3.00 p. m.	27.12	54	49	49	44	64	W.	2	.02	....	Stratus	4-4	Hidden							Threatening.
Summit	4.00 p. m.	23.781	74	32	32	30	79	W.	10	.50	....	Stratus	3-4	Cirro-strat.	1-4	W.					Fair.
Base	4.00 p. m.	27.12	52	49	49	43	57	Calm.			....	Stratus	4-4	Hidden							Threatening.
Summit	4.57 p. m.	23.780	73	32	32	29	69	W.	18	1.62	....	Stratus	3-4	Cirro-strat.	1-4	W.					
Base	4.57 p. m.	27.14	51	47	47	42	62	N.W.	2	.02	....	Stratus	4-4	0	0	0					Cloudy.
Summit	6.00 p. m.	23.790	70	31	31	28	69	W.	18	1.62	...	Stratus	1-4	Cirro-strat.	2-4	W.					Fair.
Base	6.00 p. m.	27.14	51	47	47	42	62	N.W.	2	.02	....	Stratus	3-4	Hidden							Fair.
Summit	9.00 p. m.	23.790	61	28	28	25	67	N.	12	.72	....	0	0	Cirro-strat.	1-4	N.					
Base	9.00 p. m.	27.21	53	41	41	39	82	E.	4	.08	....	0	0	0	0	0					Clear.
Summit	11.57 p. m.	23.790	61	26	26	24	76	N.	17	1.44	....	Stratus	1-4	0	0	0				39-26	
Base	11.57 p. m.	27.23	54	38	39	37	82	E.	2	.02	....	0	0	0	0	0					Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 14, 1872.

Place of observation.	Time of observation.	Barometer.	Therm. Attached.	Therm. Exposed.	Hygrom. Dry bulb.	Hygrom. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Lower clouds. Kind.	Lower clouds. Amount.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction, (moving from—)	Rain or snow. Comm'd.	Rain or snow. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23. 800	43	25	25	21	48	N.	36	6. 48	....	0	0	Cirro-strat.	2-4	N.	....	....	....	....	Fair.
Base...		27. 29	46	36	36	33	70	Calm.	....	....	....	0	0	Cumulus ..	1-4	0	....	....	....	....	Fair.
Summit	7.00 a. m.	23. 820	45	25	25	21	48	N.	36	6. 48	....	0	0	Cirro-strat.	1-4	N.	....	....	....	....	
Base...		27. 31	42	39	39	34	55	Calm.	....	....	....	0	0	Cumulus ..	2-4	0	....	....	....	....	Fair.
Summit	7.57 a. m.	23. 850	47	26	26	22	49	N.	30	4. 50	....	0	0	Cirro-strat.	1-4	N.	....	....	....	....	
Base...		27. 32	43	44	44	37	45	N.W.	4	.08	....	0	0	0	0	....	....	....	....	....	Clear.
Summit	9.00 a. m.	23. 890	58	27	27	24	66	N.	12	.72	....	0	0	Cirro-strat.	1-4	N.	....	....	....	....	Fair.
Base...		27. 32	44	45	45	38	46	N.W.	5	.12	....	0	0	0	0	....	....	....	....	....	C.ear.
Summit	10.00 a. m.	23. 900	60	28	28	25	59	N.	13	.84	....	0	0	Cirro cum .	1-4	N.	....	....	....	....	Fair.
Base...		27. 32	45	48	48	40	43	N.W.	5	.12	....	0	0	0	0	....	....	....	....	....	Clear.
Summit	11.00 a. m.	23. 930	67	30	30	26	59	N.W.	6	.18	....	0	0	Cumulus ..	1-4	N.W.	....	....	....	....	Fair.
Base...		27. 32	46	49	49	41	44	N.W.	4	.08	....	0	0	Cumulus ..	1-4	W.	....	....	....	....	Fair.
Summit	12.00 m...	23. 933	66	31	31	27	60	N.	7	.25	....	0	0	Cumulus ..	2-4	N.	....	....	....	....	Fair.
Base...		27. 32	47	50	50	41	39	N.W.	4	.08	....	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	Fair.
Summit	1.00 p. m.	23. 940	64	32	32	28	60	N.W.	15	1. 12	....	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	Fair.
Base...		27. 32	48	52	52	42	35	E.	6	.18	....	0	0	Cumulus ..	3-4	0	....	....	....	....	Fair.
Summit	2.00 p. m.	23. 950	63	33	33	28	50	N.W.	20	2. 00	....	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	
Base...		27. 33	49	51	51	42	40	N.W.	4	.08	67	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	Fair.
Summit	3.00 p. m.	23. 950	65	34	34	29	51	N.W.	10	.50	....	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	Fair.
Base...		27. 33	49	53	53	43	36	N.W.	4	.08	....	0	0	Cumulus ..	2-4	N.W.	....	....	....	....	Fair.
Summit	4.00 p. m.	23. 960	66	34	34	29	51	N.W.	30	4. 50	....	0	0	Cirro-cum .	2-4	N.W.	....	....	....	....	Fair.
Base...		27. 34	50	53	53	43	36	N.W.	6	.18	....	0	0	Cumulus ..	3-4	0	....	....	....	....	Fair.
Summit	4.57 p. m.	23. 965	67	34	34	29	51	N.W.	26	3. 38	....	0	0	Cirro-cum .	3-4	N.W.	....	....	....	....	
Base...		27. 36	51	54	54	44	38	N.W.	8	.32	....	Hazy	....	Cumulus ..	3-4	N.W.	....	....	....	....	Fair.
Summit	6.00 p. m.	23. 970	68	34	34	29	51	N.W.	28	3. 92	....	0	0	Cirro-cum .	2-4	N.W.	....	....	....	....	Fair.
Base...		27. 37	52	54	54	48	61	N.W.	4	.08	....	Hazy	0	Cumulus ..	2-4	0	....	....	....	....	Fair.
Summit	9.00 p. m.	23. 970	68	29	29	26	67	W.	18	1. 62	....	0	0	Cumulus ..	1-4	W.	....	....	....	....	
Base...		27. 40	52	39	39	36	73	N.W.	4	.08	....	0	0	0	0	....	....	....	....	....	Clear.
Summit	11.57 p. m.	23. 970	63	28	28	26	77	N.W.	9	.40	....	Stratus ...	1-4	Cirrus	1-4	N.W.	....	....	....	34-20	
Base...		27. 40	52	39	39	36	73	Calm.	....	....	....	0	0	0	0	....	....	....	....	....	Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 15, 1872.

Place of observation.	Time of observation.	Barometer.	Therm. Attached.	Therm. Exposed.	Hygrom. Dry bulb.	Hygrom. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Lower clouds. Kind.	Lower clouds. Amount.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction, (moving from—)	Rain or snow. Comm'cd.	Rain or snow. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.940	51	27	27	25	77	W.	3	.05	....	0	0	Hazy	....	......	....	....	....	......	Hazy.
Base...	6.00 a.m.	27.40	46	39	39	36	73	E.	3	.05	....	Hazy	....	Hazy	....	......	....	....	....	......	Hazy.
Summit	7.00 a.m.	23.961	57	27	27	25	77	W.	3	.05	....	Hazy	....	Hazy	....	......	....	....	....	......	
Base...	7.00 a.m.	27.39	45	42	42	37	58	Calm	....	....	....	0	0	Hazy	....	......	....	....	....	......	Hazy.
Summit	7.57 a.m.	23.980	64	27	27	25	77	W.	3	.05	....	Hazy	....	Cir.-strat..	1-4	W.	....	....	....	......	
Base...	7.57 a.m.	27.40	45	45	45	38	46	S. E.	1	.01	....	0	0	Hazy	....	......	....	....	....	......	Fair.
Summit	9.00 a.m.	23.972	66	28	28	27	88	N.W.	10	.50	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Light snow.
Base...	9.00 a.m.	27.40	45	43	43	37	51	N.W.	4	.08	....	Stratus...	4-4	Hidden ...	....	......	....	....	....	......	Cloudy.
Summit	10.00 a.m.	23.972	66	28	28	27	88	W.	7	.25	....	Nimbus...	2-4	Cirro-strat.	1-4	W.	....	....	....	......	Light snow.
Base...	10.00 a.m.	27.39	45	44	44	38	52	N.W.	2	.02	....	0	0	Cumulus..	4-4	0	....	....	....	......	Cloudy.
Summit	11.00 a.m.	23.960	65	29	29	28	89	W.	7	.25	....	Hazy	....	Cumulus..	3-4	W.	....	....	....	......	Clearing.
Base...	11.00 a.m.	27.38	47	47	47	40	48	W.	2	.02	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	12.00 m..	23.952	64	30	30	29	89	W.	12	.72	....	Stratus ...	3-4	Cirro-strat	1-4	W.	....	....	....	......	Cloudy.
Base...	12.00 m..	27.38	46	47	47	40	48	W.	2	.02	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	1.00 p.m.	23.962	67	30	30	29	89	W.	10	.50	....	Hazy	....	Cumulus..	3-4	W.	....	....	....	......	Cloudy.
Base...	1.00 p.m.	27.36	46	48	48	41	49	N.W.	4	.08	....	0	0	Cumulus..	3-4	N.W.	....	....	....	......	Fair.
Summit	2.00 p.m.	23.950	68	31	31	30	89	N.W.	12	.72	....	Hazy	....	Cumulus..	3-4	N.W.	....	....	....	......	
Base...	2.00 p.m.	27.34	46	47	47	40	48	W.	4	.08	95	0	0	Cumulus..	3-4	N.W.	....	....	....	......	Fair.
Summit	3.00 p.m.	23.939	69	31	31	30	89	W.	24	2.88	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Light snow.
Base...	3.00 p.m.	27.33	46	45	45	40	61	N.W.	6	.18	....	Nimbus...	3-4	Hidden ...	....	......	....	....	....	......	Threatening.
Summit	4.00 p.m.	23.950	72	29	29	28	88	W.	30	4.50	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Light snow.
Base...	4.00 p.m.	27.35	47	43	43	40	75	Calm	....	....	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Light rain.
Summit	4.37 p.m.	23.900	69	28	28	27	88	N.	36	6.48	....	Stratus ...	2-4	Cumulus..	2-4	N.	8.50 a.m. 2.30 p.m.	10 10 a.m. 4.40 p.m.	.02	......	Snow.
Base...	4.37 p.m.	27.35	48	48	48	44	70	N.W.	2	.02	....	0	0	Cumulus..	1-4	N.W.	3.10 p.m.	4.40 p.m.	(*)	......	Clearing.
Summit	6.00 p.m.	23.900	64	28	28	27	88	N.	36	6.48	....	Stratus ...	3-4	Cumulus..	1-4	N.	....	....	....	......	Cloudy.
Base...	6.00 p.m.	27.34	48	45	45	40	61	N.W.	4	.08	....	0	0	Cumulus..	4-4	N.W.	....	....	....	......	Threatening.
Summit	9.00 p.m.	23.870	65	26	26	25	88	N.	62	19.22	....	0	0	Cumulus..	3-4	N.	....	....	....	......	
Base...	9.00 p.m.	27.35	49	37	37	36	90	S. E.	4	.08	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	11.57 p.m.	23.860	66	24	24	23	87	N.	55	15.12	....	0	0	0	0	0	....	....	....	31–24	
Base...	11.57 p.m.	27.33	50	34	35	34	90	E.	4	.08	....	0	0	0	0	0	....	....	....	......	Clear.

* Not enough to measure.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of the summit above sea-level, 6,282.5 feet, Height of barometer at summit above ground, 3 feet. Elevation of the base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 16, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.640	35	16	16	15	83	N.	66	21.78	....	Stratus ...	3-4	Cumulus ..	1-4	N.	....	....	....	......	Fair.
Base ...		27.27	43	30	30	28	78	N.	2	.02	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	7.00 a.m.	23.651	51	15	15	14	83	N.	62	19.22	....	Stratus ...	3-4	Cumulus ..	1-4	N.	....	....	....	......	
Base ...		27.25	41	30	30	27	67	N.E.	4	.08	....	0	0	Cumulus ..	1-4	N.	....	....	....	......	Fair.
Summit	7.57 a.m.	23.650	50	15	15	14	83	N.	66	21.78	....	Stratus ...	2-4	Cumulus ..	1-4	N.	....	....	....	......	
Base ...		27.21	41	32	32	29	69	S.E.	4	.08	....	0	0	Cumulus ..	1-4	N.	....	....	....	......	Fair.
Summit	9.00 a.m.	23.610	57	17	17	16	83	N.W.	60	18.00	....	0	0	Cirrus	1-4	N.W.	....	....	....	......	Fair.
Base ...		27.21	41	36	36	31	55	W.	8	.32	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	10.00 a.m.	23.618	61	18	18	17	84	W.	72	25.92	....	0	0	Cirrus	1-4	W.	....	....	....	......	Fair.
Base ...		27.17	41	39	39	33	46	W.	12	.72	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	11 00 a.m.	23.660	63	20	20	19	85	N.W.	58	16.82	....	Hazy	....	Cirrus	1-4	N.W.	....	....	....	......	Fair.
Base ...		27.15	42	41	41	34	41	W.	10	.50	....	0	0	Cirrus	1-4	W.	....	....	....	......	Fair.
Summit	12.00 m ..	23.660	61	21	21	20	85	N.	66	21.78	....	Hazy	....	Cirro-cum.	2-4	N.	....	....	....	......	Fair.
Base. ..		27.16	42	43	43	36	43	W.	10	.50	....	0	0	Cirrus	1-4	W.	....	....	....	......	Fair.
Summit	1.00 p.m.	23.632	63	23	23	22	86	N.	70	24.50	....	Hazy	....	Cirro-cum.	2-4	N.	....	....	....	......	Fair.
Base ...		27.15	42	42	42	35	42	W.	10	.50	....	0	0	Cumulus ..	2-4	N.	....	....	....	......	Fair.
Summit	2.00 p.m.	23.670	68	24	24	23	87	N.	54	14.58	....	Hazy	....	Cirro-cum.	3-4	N.	....	....	....	......	
Base ...		27.14	42	42	42	35	42	W.	10	.50	108	0	0	Cumulus ..	3-4	W.	....	....	....	......	Fair.
Summit	3.09 p.m.	23.640	60	24	24	23	87	N.	54	14.58	....	Hazy	....	Cirro-strat.	3-4	N.	....	....	....	......	Cloudy.
Base ...		27.16	42	41	41	34	41	W.	9	.40	....	0	0	Cumulus ..	4-4	0	....	....	....	......	Cloudy.
Summit	4.00 p.m	23.610	52	22	22	21	85	N.	66	21.78	....	Hazy	....	Cirro-cum.	3-4	N.	....	....	....	......	Cloudy.
Base ...		27.16	42	40	40	33	39	N.	8	.32	....	0	0	Cumulus ..	4-4	N.	....	....	....	......	Threatening.
Summit	4.57 p.m.	23.610	54	23	23	22	87	N.	68	23.12	....	Stratus ...	1-4	Cirro-strat	2-4	N.	....	....	....	......	
Base ...		27.16	42	41	41	34	41	N.W.	4	.08	....	0	0	Cumulus ..	4-4	N.	....	....	....	......	Threatening.
Summit	6.00 p.m.	23.691	64	23	23	22	86	N.	58	16.82	....	Hazy	....	Cirro-cum.	3-4	N.	....	....	....	......	Clearing.
Base ...		27.16	43	41	41	36	57	N.W.	8	.32	....	Hazy	....	Cumulus ..	3-4	N.	....	....	....	......	Threatening.
Summit	9.00 p.m.	23.690	55	22	22	21	85	N.W.	72	25.92	....	Stratus ...	1-4	Cumulus ..	1-4	N.W.	....	....	....	......	
Base ...		27.18	44	38	38	33	54	W.	4	.08	....	0	0	Cumulus ..	1-4	0	....	....	....	......	Fair.
Summit	11.57 p.m.	23.700	50	22	22	21	85	N.	64	20.48	....	Stratus ..	4-4	Hidden ...	....	......	....	....	....	24-15	
Base ...		27.18	42	35	35	32	70	E.	1	.01	....	0	0	Cumulus ..	1-4	0	....	....	....	......	Fair.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 17, 1872.

Place of observation.	Time of observation.	Barometer.	THERM.		HYGROM.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from—)	Commen'd.	Ended.			
Summit	6.00 a.m.	23.731	60	22	22	22	100	N.	24	2.88	....	Nimbus...	4-4	Hidden ...	....	....	....	....	....	......	Light snow.
Base...		27.18	43	35	35	33	80	W.	2	.02	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	Threatening.
Summit	7.00 a.m.	23.730	60	23	23	22	86	N.	36	6.48	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	
Base...		27.18	42	36	36	34	80	Calm	...	......	....	Stratus ...	1-4	Cumulus..	3-4	N. W.	....	....	....	......	Cloudy.
Summit	7.57 a.m.	23.741	58	24	24	23	87	N.	30	4.50	....	Stratus ...	4-4	Hidden ...	....	....	Dur.night	6.45 a.m.	.05	......	Snow.
Base...		27.19	42	39	39	36	73	W.	4	.08	....	Stratus ...	1-4	Cumulus..	3-4	N.	....	....	....	......	Cloudy.
Summit	9.00 a.m.	23.756	62	25	25	24	87	N. E.	20	2.00	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	Cloudy—fog.
Base...		27.18	42	40	40	37	73	W.	2	.02	....	Stratus ...	1-4	Cumulus..	3-4	N.	....	....	....	......	Cloudy.
Summit	10.00 a.m.	23.760	61	25	25	24	87	N. E.	30	4.50	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	Cloudy—fog.
Base...		27.18	42	41	41	38	74	W.	2	.02	....	Stratus ...	1-4	Cumulus..	3-4	N.	....	....	....	......	Cloudy.
Summit	11.00 a.m.	23.762	64	27	27	25	77	N. E.	5	3.12	....	Hazy	...	Cumulus..	2-4	N. E.	....	....	....	......	Fair.
Base...		27.17	43	47	47	41	55	S.	4	.08	....	0	0	Cumulus..	2-4	N.	....	....	....	......	Fair.
Summit	12.00 m..	23.800	71	29	29	27	78	N. E.	22	2.42	....	Hazy	...	Cumulus..	2-4	N. E.	....	....	....	......	Fair.
Base...		27.16	45	50	49	43	57	S.	5	.12	....	0	0	Cumulus..	2-4	N. E.	....	....	....	......	Fair.
Summit	1.00 p.m.	23.800	69	30	30	28	78	N. E.	1	.01	....	Hazy	...	Cumulus..	3-4	N. E.	....	....	....	......	Fair.
Base...		27.16	45	51	51	44	52	W.	5	.12	....	0	0	Cumulus..	2-4	N. E.	....	....	....	......	Fair.
Summit	2.00 p.m.	23.800	69	31	31	29	89	N. E.	7	.25	....	0	0	Cumulus..	3-4	N. E.	....	....	....	......	
Base...		27.16	42	51	51	44	52	W.	5	.12	108	0	0	Cumulus..	2-4	N. E.	....	....	....	......	Fair.
Summit	3.00 p.m.	23.810	64	32	32	31	89	N.	7	.25	....	Hazy	...	Cirro-cum.	3-4	N.	....	....	....	......	Fair.
Base...		27.16	42	50	50	43	51	W.	2	.02	....	0	0	Cumulus..	3-4	N. E.	....	....	....	......	Cloudy.
Summit	4.00 p.m.	23.820	65	32	32	31	89	N. E.	8	.32	....	Hazy	...	Cirro-cum.	3-4	N. E.	....	....	....	......	Fair.
Base...		27.16	48	50	50	43	51	W.	2	.02	....	0	0	Cumulus..	3-4	N. E.	....	....	....	......	Cloudy.
Summit	4.57 p.m.	23.800	67	32	32	30	79	N. E.	9	.40	....	0	0	Cumulus..	3-4	N. E.	....	....	....	......	
Base...		27.17	48	51	51	44	52	W.	3	.05	....	0	0	Cumulus..	3-4	N. W.	....	....	....	......	Cloudy.
Summit	6.00 p.m.	23.810	67	32	32	29	69	N. E.	5	.12	....	0	0	Cumulus..	3-4	N. E.	....	....	....	......	Fair.
Base...		27.17	49	50	50	43	51	Calm	...	......	....	0	0	Cumulus..	3-4	0	....	....	....	......	Cloudy.
Summit	9.00 p.m.	23.820	69	29	29	27	78	E.	2	.02	....	0	0	Cirro-cum.	1-4	E.	....	....	....	......	
Base..		27.20	52	40	40	37	73	Calm	...	......	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	11.57 p.m.	23.800	64	28	28	26	77	N. E.	5	.12	....	0	0	0	0	0	....	....	....	32-22	
Base.		27.20	52	38	38	37	90	E.	4	.08	....	0	0	0	0	0	....	....	....	......	Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 18, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.780	55	28	28	26	77	N. W.	12	.72	....	Hazy	....	Cirro-strat	1-4	N. W.	....	....	....	....	Fair.
Base...	6.00 a.m.	27.18	46	36	36	35	90	E.	4	.08	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	7.00 a.m.	23.771	53	29	29	27	78	N. W.	12	.72	....	Hazy	....	Cirro-strat	1-4	N. W.	....	....	....	....	
Base...	7.00 a.m.	27.17	45	41	41	38	74	E.	4	.08	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	7.57 a.m.	23.771	53	30	30	27	68	N.	10	.50	....	Hazy	....	Cirro-cum.	1-4	N.	....	....	....	....	
Base...	7.57 a.m.	27.18	46	47	47	41	55	N. E.	4	.08	....	0	0	Cirrus	less 1-8	N. W.	....	....	....	....	Clear.
Summit	9.00 a.m.	23.800	60	32	32	29	69	N. W.	6	.18	....	0	0	Cumulus..	1-4	N. W.	....	....	....	....	Fair.
Base...	9.00 a.m.	27.17	46	47	47	42	62	N. W.	4	.08	....	0	0	Cirrus	1-4	N.	....	....	....	....	Fair.
Summit	10.00 a.m.	23.810	63	33	33	30	69	N. W.	4	.08	....	0	0	Cumulus..	1-4	N. W.	....	....	....	....	Fair.
Base...	10.00 a.m.	27.17	48	50	50	44	58	W.	4	.08	....	0	0	Cirrus	1-8	N.	....	....	....	....	Fair.
Summit	11.00 a.m.	23.810	62	36	36	31	53	N. E.	4	.08	....	0	0	Cumulus..	1-4	N. E.	....	....	....	....	Fair.
Base...	11.00 a.m.	27.17	49	51	51	44	52	W.	4	.08	....	0	0	Cumulus..	1-4	N.	....	....	....	....	Fair.
Summit	12.00 m..	23.800	62	36	36	31	53	N. W.	3	.05	....	0	0	Cumulus..	2-4	N. W.	....	....	....	....	Fair.
Base...	12.00 m..	27.15	51	55	55	46	45	S. W.	4	.08	....	0	0	Cumulus..	less 1-8	0	....	....	....	....	Clear.
Summit	1.00 p.m.	23.820	61	39	39	34	56	N. W.	1	.01	....	0	0	Cumulus..	2-4	N. W.	....	....	....	....	Fair.
Base...	1.00 p.m.	27.14	54	58	59	48	42	W.	4	.08	....	0	0	Cumulus..	1-4	N. W.	....	....	....	....	Fair.
Summit	2.00 p.m.	23.800	67	38	38	33	54	N. W.	10	.50	....	Hazy	....	Cumulus..	2-4	N. W.	....	....	....	....	
Base...	2.00 p.m.	27.13	54	58	58	47	37	W.	4	.08	87	0	0	Cumulus..	1-4	0	....	....	....	....	Fair.
Summit	3.00 p.m.	23.810	65	40	40	35	56	N. W.	5	.12	....	0	0	Cumulus..	2-4	N. W.	....	....	....	....	Fair.
Base...	3.00 p.m.	27.11	56	60	60	49	39	W.	5	.12	....	0	0	Cumulus..	less 1-8	0	....	....	....	....	Fair.
Summit	4.00 p.m.	23.780	64	41	41	35	48	N. W.	15	1.12	....	0	0	Cumulus..	2-4	N. W.	....	....	....	....	Fair.
Base...	4.00 p.m.	27.11	58	61	61	49	35	S. W.	8	.32	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	4.57 p.m.	23.780	67	41	41	35	48	N. E.	13	.84	....	0	0	Cumulus..	1-4	N. E.	....	....	....	....	
Base...	4.57 p.m.	27.10	59	61	61	49	35	W.	6	.18	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	6.00 p.m.	23.756	70	41	41	35	48	N. E.	24	2.88	....	0	0	Cumulus..	1-4	N. E.	....	....	....	....	Fair.
Base...	6.00 p.m.	27.10	61	61	61	49	35	W.	7	.25	....	Hazy	....	0	0	0	....	....	....	....	Clear.
Summit	9.00 p.m.	23.770	71	40	40	35	56	N. W.	24	2.88	....	0	0	Cirro-strat	1-4	N. W.	....	....	....	....	
Base...	9.00 p.m.	27.09	59	46	47	43	70	E.	4	.08	....	Hazy	....	0	0	0	....	....	....	....	Clear.
Summit	11.57 p.m.	23.750	69	37	37	34	71	N. W.	22	2.42	....	0	0	Cirrus	1-4	N. W.	....	....	....	41-28	
Base...	11.57 p.m.	27.08	54	44	44	42	84	S. E.	4	.08	....	0	0	0	0	0	....	....	....	....	Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 19, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commenc'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.709	62	35	35	31	61	E.	6	.18	....	0	0	Cirrus	2-4	E.	....	....	....	......	Fair.
Base...		27.02	51	44	44	40	68	E.	4	.08	....	Hazy	....	Hazy	....	......	....	....	....	......	Hazy.
Summit	7.00 a. m.	23.700	65	37	37	30	37	S.W.	18	1.62	....	Stratus ...	1-4	Cirrus	1-4	S. W.	....	....	....	......	
Base...		27.01	51	50	50	43	51	E.	4	.08	....	Hazy	....	Hazy	....	......	....	....	....	......	Hazy
Summit	7.57 a. m.	23.710	71	38	38	30	30	E.	19	1.80	....	Stratus ...	1-4	Cirrus	2-4	E.	....	....	....	......	
Base...		26.99	52	54	54	45	43	Calm.	......	......	....	Dense haze	....	....	....	......	....	....	....	......	Hazy.
Summit	9.00 a. m.	23.718	76	39	39	31	30	S.W.	15	1.12	....	Stratus ...	1-4	Cirrus	2-4	S. W.	....	....	....	......	Fair.
Base...		26.99	52	56	56	45	35	S.	4	.08	....	Dense haze	....	....	....	......	....	....	....	......	Hazy
Summit	10.00 a. m.	23.680	69	42	42	37	58	S. E.	20	2.00	....	Stratus ...	1-4	Cirrus	2-4	S. E.	....	....	....	......	Fair.
Base...		26.98	53	58	58	50	53	S.	6	.18	....	Denso haze	....	....	....	......	....	....	....	......	Hazy.
Summit	11.00 a. m.	23.680	74	44	44	41	75	S.W.	30	4.50	....	Stratus ...	3-4	Hidden	....	0	....	....	....	......	Cloudy.
Base...		26.96	56	59	59	53	65	S. E.	6	.18	....	Hazy	....	Cumulus..	2-4	......	....	....	....	......	Fair.
Summit	12.00 m...	23.670	75	43	43	41	83	S.W.	28	3.92	....	Stratus ...	4-4	Hidden	....	......	....	....	....	......	Cloudy—fog.
Base...		26.96	58	58	58	53	70	S. E.	8	.32	....	Hazy	....	Cumulus..	4-4	......	....	....	....	......	Threatening.
Summit	1.00 p. m.	23.639	75	41	41	39	83	S. E.	40	8.00	...	Stratus...	4-4	Hidden	....	......	....	....	....	......	Cloudy—fog.
Base...		26.94	56	54	54	51	80	S. E.	4	.08	....	Hazy	....	Cumulus..	4-4	S. E.	....	....	....	......	Threatening.
Summit	2.00 p. m.	23.610	75	40	40	39	91	S.	42	8.82	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	
Base...		26.92	56	52	52	50	86	S. E.	4	.08	121	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Light rain.
Summit	3.00 p. m.	23.540	72	39	39	38	91	S. E.	48	11.52	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Heavy rain.
Base...		26.90	56	51	51	49	86	S. E.	6	.18	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Light rain.
Summit	4.00 p. m.	23.540	72	39	39	38	91	S. E.	54	14.58	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Heavy rain.
Base...		26.88	58	51	51	49	86	S. E.	14	.98	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Light rain.
Summit	4.57 p. m.	23.510	72	39	39	38	91	S. E.	60	18.00	....	Nimbus...	4-4	Hidden	....	......	1.30 p. m.	....	.08	......	
Base...		26.84	58	51	51	49	86	S. E.	14	.98	....	Nimbus...	4-4	Hidden	....	......	1.55 p. m.	9.15 p. m.	.12	......	Heavy rain.
Summit	6.00 p. m.	23.490	72	38	38	37	90	S.	65	21.12	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Heavy rain.
Base...		26.82	58	50	50	48	86	S. E.	12	.72	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Heavy rain.
Summit	9.00 p. m.	23.450	69	38	38	37	90	S. E.	66	21.78	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	
Base...		26.79	59	48	48	47	92	S. E.	5	.12	....	Nimbus...	4-4	Hidden	....	......	....	....	....	......	Light rain.
Summit	11.57 p. m.	23.460	74	37	37	36	90	S. E.	52	13.52	....	Nimbus...	4-4	Hidden	....	......	....	....	.11	44–34	
Base...		26.77	58	46	46	46	100	Calm.	......	......	....	Nimbus...	4-4	Hidden	....	......	11.15 p. m.	....	.21	......	Light rain.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 20, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23. 390	63	36	36	35	90	S. E.	60	18. 00	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Heavy rain.
Base...		26. 76	56	46	46	46	100	Calm.	......	......	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Summit	7.00 a. m.	23. 390	66	35	35	34	90	S. E.	66	21. 78	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	
Base...		26. 77	54	47	47	47	100	W.	4	. 08	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Summit	7.57 a. m.	23. 371	65	35	35	34	90	S.W.	60	18. 00	....	Nimbus...	4-4	Hidden ...	...	......	....	....	. 20	......	
Base...		26. 77	54	48	48	47	92	W.	4	. 08	....	Nimbus...	4-4	Hidden ...	...	......	....	....	. 51	......	Light rain.
Summit	9.00 a. m.	23. 380	66	35	35	34	90	N. W.	54	14. 58	....	Nimbus...	4 4	Hidden ...	...	......	....	....	....	......	Light rain.
Base...		26. 77	54	47	47	47	100	W.	6	. 18	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Summit	10.00 a. m.	23. 410	74	36	36	35	90	N. W.	54	14. 58	...	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Base...		26. 79	54	48	48	48	100	W.	6	. 18	...	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Threatening.
Summit	11.00 a. m.	23. 430	77	35	35	34	90	N. W.	50	12. 50	...	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Base...		26. 79	54	50	50	48	86	W.	5	. 12	....	0	0	Cumulus..	3-4	N. W.	....	....	....	......	Clearing.
Summit	12.00 m...	23. 430	75	35	35	34	90	N. W.	48	11. 52	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Threatening.
Base...		26. 78	54	49	49	48	93	W.	4	. 08	....	Hazy	....	Cumulus..	3-4	N. W.	....	....	....	......	Threatening.
Summit	1.00 p. m.	23. 390	72	35	35	34	90	N. W.	48	11. 52	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Base...		26. 78	54	50	50	48	86	S. W.	4	. 08	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Drizzling.
Summit	2.00 p. m.	23. 381	69	34	34	33	90	N. W.	68	23. 12	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	
Base...		26. 78	55	52	52	48	73	W.	6	. 18	133	0	0	Cumulus..	3-4	N. W.	....	....	....	......	Fair.
Summit	3.00 p. m.	23. 430	67	34	34	33	90	N. W.	68	23. 12	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Threatening.
Base...		26. 77	55	55	55	49	62	W.	10	. 50	....	0	0	Cumulus..	3-4	N. W.	....	....	....	......	Fair.
Summit	4.00 p. m.	23. 410	70	34	34	33	90	N. W.	48	11. 52	....	Stratus ...	3-4	Cumulus..	1-4	N. W.	....	....	....	......	Clearing.
Base...		26. 77	55	54	54	49	67	W.	4	. 08	....	0	0	Cumulus..	2-4	N. W.	....	....	....	......	Fair.
Summit	4.57 p. m.	23. 420	72	36	36	35	90	N. W.	46	10. 58	....	Stratus ...	1-4	Cirrus	2-4	N. W.	....	12.45 p. m.	. 06	......	
Base...		26. 78	56	56	56	49	57	N. W.	8	. 32	....	0	0	Cumulus..	1-4	N. W.	....	10.00 a. m.	. 04	......	Fair.
Summit	6.00 p. m.	23. 470	74	35	35	34	90	N. W.	42	8. 82	....	Stratus ...	2-4	Cumulus..	1-4	N. W.	....	....	....	......	Clearing.
Base...		26. 79	57	54	55	49	62	Calm.	......	......	....	0	0	Cumulus..	2-4	N. W.	....	....	....	......	Fair.
Summit	9.00 p. m.	23. 471	71	35	35	34	90	N. W.	42	8. 82	....	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	
Base...		26. 83	55	46	46	45	92	E.	4	. 08	...	Nimbus...	4-4	Hidden ...	...	......	....	....	....	......	Light rain.
Summit	11.57 p. m.	23. 470	71	34	34	33	90	N.	44	9. 68	....	Stratus ...	4-4	Hidden ...	......	......	12.50 m... 6.30 p. m.	2.15 p. m. 10.30 p. m.	. 01 . 09	37–34	
Base...		26. 84	54	45	45	45	100	W.	4	. 08	....	Nimbus...	4-4	Hidden ...	....	......	8.00 p. m.	....	(*)	......	Light rain.

* Not enough to measure.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 21, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.520	64	33	33	32	89	N. W.	42	8.82	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Heavy rain.
Base...	6.00 a. m.	26.91	54	43	44	44	100	W.	3	.05	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Light rain.
Summit	7.00 a. m.	23.531	64	33	33	32	89	N. W.	42	8.82	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	
Base...	7.00 a. m.	26.91	54	44	44	44	100	W.	2	.02	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Heavy rain.
Summit	7.57 a. m.	23.580	64	33	33	32	89	N. W.	42	8.82	....	Nimbus...	4-4	Hidden ...	....	......	Dur. night	11.35 a. m.	.13	......	
Base...	7.57 a. m.	26.93	53	44	44	44	100	Calm	...	...	....	Nimbus...	4-4	Hidden ...	....	......	....	....	.50	......	Heavy rain.
Summit	9.00 a. m.	23.610	67	34	34	33	90	N. W.	30	4.50	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Light rain.
Base...	9.00 a. m.	26.95	53	46	46	45	92	Calm	...	...	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Light rain.
Summit	10.00 a. m.	23.640	68	35	35	34	90	N. W.	13	.84	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Light rain.
Base...	10.00 a. m.	26.98	52	46	46	46	100	Calm	...	...	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Drizzling rain.
Summit	11.00 a. m.	23.671	73	35	35	34	90	N. W.	15	1.12	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Drizzling rain.
Base...	11.00 a. m.	26.99	52	49	49	48	93	Calm	...	...	....	Stratus ...	2-4	Cumulus..	3-4	N. W.	....	....	......	......	Clearing.
Summit	12.00 m...	23.671	71	36	36	35	90	N. W.	15	1.12	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Threatening.
Base...	12.00 m...	27.02	53	48	48	48	100	W.	3	.05	....	Stratus ...	3-4	Hidden ...	....	......	....	....	......	......	Clearing.
Summit	1.00 p. m.	23.675	71	35	35	34	90	N. W.	25	3.12	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Heavy rain.
Base...	1.00 p. m.	27.02	53	48	49	47	85	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Threatening.
Summit	2.00 p. m.	23.680	71	35	35	34	90	N. W.	16	1.28	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	
Base...	2.00 p. m.	27.02	54	49	49	48	93	W.	4	.03	78	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Threatening.
Summit	3.00 p. m.	23.681	70	35	35	34	90	N. W.	20	2.00	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Heavy rain.
Base...	3.00 p. m.	27.04	53	50	50	49	93	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Cloudy.
Summit	4.00 p. m.	23.694	73	34	34	33	90	N. W.	22	2.42	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Drizzling rain.
Base...	4.00 p. m.	27.07	54	48	48	47	92	W.	4	.03	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Threatening.
Summit	4.57 p. m.	23.690	69	33	33	32	89	N. W.	34	5.78	....	Nimbus...	4-4	Hidden ...	....	......	12.15 p. m.	....	.11	......	
Base...	4.57 p. m.	27.11	54	50	50	48	86	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	......	(*)	10.35 a. m.	.15	......	Threatening.
Summit	6.00 p. m.	23.740	70	32	32	31	89	N. W.	18	1.62	....	Nimbus...	4-4	Hidden ...	....	......	....	....	......	......	Threatening.
Base...	6.00 p. m.	27.14	55	50	50	48	86	Calm	...	...	....	0	0	Cumulus..	3-4	N. W.	....	....	......	......	Fair.
Summit	9.00 p. m.	23.730	60	31	31	30	89	N. W.	17	1.44	....	0	0	Cirrus	2-4	N. W.	....	....	......	......	Halo around the moon.
Base...	9.00 p. m.	27.18	53	40	41	41	100	E.	4	.08	....	Stratus ...	1-4	Cirrus	1-4	0	....	....	......	......	Fair.
Summit	11.57 p. m.	23.770	55	29	29	28	89	N. W.	8	.32	....	0	0	Cirrus	1-4	N. W.	....	5.50 p. m..	.01	37-29	
Base...	11.57 p. m.	27.21	55	38	38	38	100	N.	4	.08	....	0	0	Cirrus	1-4	0	....	....	......	......	Fair.

* Shower between 2 and 3 p. m.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 22, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.830	44	28	28	27	88	N. W.	7	.25	....	0	0	Cirrus	1-4	N. W.	....	....	....	......	Fair.
Base...	6.00 a. m.	27.21	48	40	40	39	91	N. E.	4	.08	....	0	0	Cirrus	3-4	0	....	....	....	......	Fair.
Summit	7.00 a. m.	23.840	47	29	29	28	89	N. W.	5	.12	....	0	0	Cirrus	2-4	N. W.	....	....	....	......	
Base...	7.00 a. m.	27.25	48	44	44	42	84	Calm	....	0	....	0	0	Cirrus	3-4	0	....	....	....	......	Fair.
Summit	7.57 a. m.	23.850	48	30	30	28	78	N. W.	4	.08	....	0	0	Cirrus	2-4	N. W.	....	....	....	......	
Base...	7.57 a. m.	27.27	48	48	48	44	70	Calm	....	0	....	0	0	Cirrus	2-4	0	....	....	....	......	Fair.
Summit	9.00 a. m.	23.880	58	32	32	30	79	N. W.	4	.08	....	0	0	Cirrus	2-4	N. W.	....	....	....	......	Fair.
Base...	9.00 a. m.	27.26	48	50	50	45	65	Calm	....	0	....	0	0	Cirrus	1-4	0	....	....	....	......	Fair.
Summit	10.00 a. m.	23.900	60	33	33	31	79	N. W.	2	.02	....	0	0	Cumulus..	2-4	N. W.	....	....	....	......	Fair.
Base...	10.00 a. m.	27.26	50	52	52	46	60	S.	4	.08	....	0	0	Cumulus..	1-4	0	....	....	....	......	Fair.
Summit	11.00 a. m.	23.925	63	34	34	31	69	N. W.	8	.32	....	0	0	Cumulus..	2-4	N. W.	....	....	....	......	Fair.
Base...	11.00 a. m.	27.28	52	54	54	47	55	W.	4	.08	....	0	0	Cumulus..	2-4	0	....	....	....	......	Fair.
Summit	12.00 m...	23.930	65	37	37	33	62	N. W.	3	.05	....	0	0	Cumulus..	2-4	N. W.	....	....	....	......	Fair.
Base...	12.00 m...	27.27	52	58	58	48	42	W.	3	.05	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	1.00 p. m.	23.920	66	38	38	35	71	W.	6	.18	....	0	0	Cumulus..	3-4	W.	....	....	....	......	Fair.
Base...	1.00 p. m.	27.25	54	58	58	48	42	W.	3	.05	....	0	0	Cumulus..	2-4	0	....	....	....	......	Fair.
Summit	2.00 p. m.	23.931	69	39	39	36	72	S. W.	3	.05	....	0	0	Cumulus..	3-4	S. W.	....	....	....	......	
Base...	2.00 p. m.	27.25	56	59	59	49	43	W.	8	.32	77	0	0	Cumulus..	3-4	S.	....	....	....	......	Fair.
Summit	3.00 p. m.	23.930	70	39	39	36	72	S. W.	3	.05	....	0	0	Cumulus..	3-4	S. W.	....	....	....	......	Fair.
Base...	3.00 p. m.	27.25	59	59	59	50	48	N.	4	.08	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	4.00 p. m.	23.910	68	39	39	36	72	S.	5	.12	....	0	0	Cumulus..	3-4	S.	....	....	....	......	Fair.
Base...	4.00 p. m.	27.24	58	60	60	51	49	W.	4	.08	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	4.57 p. m.	23.900	68	39	39	36	72	S. W.	7	.25	....	0	0	Cumulus..	3-4	S. W.	....	....	....	......	
Base...	4.57 p. m.	27.23	58	58	58	49	47	S.	5	.12	....	0	0	Cumulus..	4-4	N. W.	....	....	....	......	Cloudy.
Summit	6.00 p. m.	23.930	72	38	38	37	90	S. W.	10	.50	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	Cloudy and fog.
Base...	6.00 p. m.	27.23	58	55	55	49	62	E.	6	.18	....	0	0	Cumulus..	3-4	S. E.	....	....	....	......	Cloudy.
Summit	9.00 p. m.	23.860	65	35	35	33	78	S. W.	27	3.64	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	......	
Base...	9.00 p. m.	27.22	59	50	51	48	79	S. E.	6	.18	....	Stratus ...	2-4	Cumulus..	2-4	0	....	....	....	......	Cloudy.
Summit	11.57 p. m.	23.821	65	34	34	32	79	S.	42	8.82	....	Stratus ...	4-4	Hidden ...	....	....	....	....	....	39-29	
Base...	11.57 p. m.	27.12	56	48	48	43	63	S. E.	9	.40	....	Stratus ...	3-4	Cumulus..	1-4	0	....	....	....	......	Threatening.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 23, 1872.

Place of observation.	Time of observation.	Barometer.	THERM.		HYGROM.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from—)	Comm'cd.	Ended.			
Summit	6.00 a.m.	23.625	58	32	32	32	100	S.	66	21.78	....	Nimbus....	4-4	Hidden....	....	......	Dur. night	....	....	......	Heavy rain.
Base...	6.00 a.m.	27.02	53	45	46	44	84	S. E.	16	1.28	....	Nimbus....	4-4	Hidden....	....	......	1.00 a. m.	....	....	......	Heavy rain.
Summit	7.00 a.m.	23.609	59	32	32	32	100	S.	66	21.78	....	Nimbus...	4-4	Hidden....			....			......	
Base...	7.00 a.m.	27.01	52	46	47	45	85	S. E.	18	1.62	....	Nimbus...	4-4	Hidden....			....	....	....	......	Heavy rain.
Summit	7.57 a.m.	23.609	66	34	34	33	90	S. W.	72	25.92	....	Nimbus...	4-4	Hidden....	....	......	....	....	.09	......	
Base...	7.57 a.m.	27.00	53	48	48	46	85	S. E.	20	2.00	....	Nimbus...	4-4	Hidden....	....	......	....	....	.62	......	Heavy rain.
Summit	9.00 a.m.	23.638	67	35	35	34	90	S. W.	66	21.78	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy rain.
Base...	9.00 a.m.	27.00	53	49	49	47	85	S. E.	20	2.00	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy rain.
Summit	10.00 a.m.	23.660	64	37	37	36	90	S. W.	54	14.58	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Light rain.
Base...	10.00 a.m.	26.99	52	51	51	49	86	S. E.	20	2.00	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Light rain.
Summit	11.00 a.m.	23.690	77	39	39	38	91	S. W.	48	11.52	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Base...	11.00 a.m.	26.98	53	53	53	50	80	S. E.	16	1.28	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Summit	12.00 m..	23.710	77	38	38	37	90	S. W.	18	1.62	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Base...	12.00 m..	26.99	54	51	51	49	83	S. E.	8	.32	....	Nimbus...	4-4	Cirrus.....	1-4	W.	....	....	....	......	Threatening.
Summit	1.00 p.m.	23.690	75	42	42	41	91	W.	17	1.44	...	Stratus....	4-4	Hidden....	....	......	....	....	....	......	Clearing up.
Base..	1.00 p.m.	26.98	54	52	52	50	86	S. E.	4	.08	....	Stratus....	4-4	Hidden....	....	......	....	....	....	......	Cloudy.
Summit	2.00 p.m.	23.679	73	39	39	38	91	N. W.	15	1.12	...	Stratus....	4-4	Cumulus..	4-4	0	....	....	....	......	
Base...	2.00 p.m.	26.96	56	55	55	53	87	W.	4	.08	247	0	0	Hidden....	....	......	....	....	....	......	Cloudy.
Summit	3.00 p.m.	23.680	73	44	44	43	92	N. W.	20	2.00	....	Stratus....	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Base..	3.00 p.m.	26.97	58	54	54	52	87	W.	2	.02	....	Stratus....	4-4	Hidden....	....	......	....	....	....	......	Cloudy.
Summit	4.00 p.m.	23.691	73	44	44	43	92	N.	26	3.38	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy rain.
Base...	4.00 p.m.	26.98	58	53	53	51	86	Calm.	....	0	....	Stratus....	4-4	Hidden....	....	......	....	....	....	......	Cloudy.
Summit	4.57 p.m.	23.680	72	44	44	43	92	N. W.	24	2.88	....	Stratus....	4-4	Hidden....	....	......	....	....	.17	......	
Base..	4.57 p.m.	26.98	57	52	52	51	93	Calm.	....	0	....	Nimbus...	4-4	Hidden....	....	......	(*)	11.10 a. m.	.09	......	Light rain.
Summit	6.00 p.m.	23.690	74	44	44	43	92	N. W.	30	4.50	....	Nimbus...	4-4	Hidden....			....	....	....	......	Light rain.
Base...	6.00 p.m.	26.98	58	51	51	51	100	E.	1	.01	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Summit	9.00 p.m.	23.680	74	42	42	41	91	N. W.	40	8.00	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	
Base...	9.00 p.m.	27.03	60	50	50	49	93	Calm.	....	0	....	Fog.......	....	Hidden....	....	......	....	....	....	......	Dense fog.
Summit	11.57 p.m.	23.700	68	39	39	38	91	N. W.	58	16.82	....	Nimbus...	4-4	Hidden....	....	......	....	11.45 p. m.	.14	44–31	
Base...	11.57 p.m.	27.05	60	50	50	50	100	Calm.	....	0	....	Fog.......	....	Hidden....	....	......	....	....	....	......	Foggy.

* Shower between 3 and 4 p. m.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 24, 1872.

Place of observation.	Time of observation.	Barometer.	Therm. Attached.	Therm. Exposed.	Hygrom. Dry bulb.	Hygrom. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Lower clouds. Kind.	Lower clouds. Amount.	Upper clouds. Kind.	Upper clouds. Amount.	Upper clouds. Direction, (moving from—)	Rain or snow. Comm'd.	Rain or snow. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.760	64	36	36	34	80	N.	5	.12	....	0	0	Cumulus..	2-4	N.	Dur.night	Dur.night	......	......	Fair.
Base...		27.10	58	45	45	45	100	Calm.	....	......	....	Nimbus...	4-4	Hidden ...	....	......	3 a.m.	......	......	......	Light rain.
Summit	7.00 a.m.	23.770	65	38	38	36	80	N.	5	.12	....	0	0	Cumulus..	2-4	N.	......	......	......	......	
Base...		27.11	55	50	50	48	86	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	......	......	......	......	......	Drizzling.
Summit	7.57 a.m.	23.780	65	40	45	38	82	N.	4	.08	....	0	0	Cumulus..	2-4	N.	......	......	.12	......	
Base...		27.12	57	46	46	46	100	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	......	......	7.20 a.m.	.06	......	Threatening.
Summit	9.00 a.m.	23.790	66	44	44	43	92	W.	5	.12	....	Hazy	....	Cumulus..	3-4	N.	......	......	......	......	Fair.
Base...		27.13	58	46	46	46	100	W.	2	.02	....	Nimbus...	4-4	Hidden ...	....	......	......	......	......	......	Drizzling.
Summit	10.00 a.m.	23.800	65	45	45	43	84	Calm.	....	......	....	Hazy	....	Cumulus..	3-4	0	......	......	......	......	Clouds above and below summit.
Base...		27.14	56	47	47	47	100	Calm.	....	......	....	Nimbus...	4-4	Hidden ...	....	......	......	......	......	......	Threatening—heavy mist.
Summit	11.00 a.m.	23.800	64	45	45	42	76	W.	2	.02	....	Hazy	....	Cirro-cum.	3-4	W.	......	......	......	......	Clouds above and below summit.
Base...		27.13	55	48	48	48	100	Calm.	....	......	....	Nimbus...	4-4	Hidden ...	....	......	......	......	......	......	Drizzling.
Summit	12.00 m..	23.800	67	47	47	44	77	W.	6	.18	....	Stratus ...	1-4	Cirro-cum.	3-4	W.	......	......	......	......	Clouds above and below summit.
Base...		27.11	56	53	53	51	86	Calm.	....	......	....	Stratus ...	3-4	Hidden ...	....	......	......	......	......	......	Clearing.
Summit	1.00 p.m.	23.800	68	48	48	45	77	S.W.	7	.25	....	Stratus ...	2-4	Cirro-cum.	3-4	S.W.	......	......	......	......	Clouds above and below summit.
Base...		27.10	57	60	59	55	76	S.W.	4	.08	....	0	0	Cumulus..	3-4	S.E.	......	......	......	......	Fair.
Summit	2.00 p.m.	23.802	73	46	46	44	85	W.	8	.32	....	Stratus ...	4-4	Hidden ...	....	......	......	......	......	......	
Base...		27.10	59	60	59	55	76	W.	2	.02	36	0	0	Cumulus..	4-4	S.E.	......	......	......	......	Cloudy.
Summit	3.00 p.m.	23.800	73	45	45	44	92	W.	15	1.12	....	Stratus ...	4-4	Hidden ...	....	......	......	......	......	......	Dense clouds on summit.
Base...		27.10	60	60	60	56	76	Calm.	....	......	....	0	0	Cumulus..	3-4	S.E.	......	......	......	......	Cloudy.
Summit	4.00 p.m.	23.800	72	45	45	43	84	N.W.	6	.18	....	Stratus ...	4-4	Hidden ...	....	......	......	......	......	......	Cloudy.
Base...		27.10	61	61	61	56	71	W.	4	.08	....	0	0	Cumulus..	4-4	0	......	......	......	......	Cloudy.
Summit	4.57 p.m.	23.800	72	45	45	43	84	N.W.	16	1.28	....	Stratus ...	2-4	Cumulus..	1-4	N.W.	......	......	......	......	
Base...		27.09	62	62	61	56	71	Calm.	....	......	....	0	0	Cumulus..	3-4	0	......	(*)	.01	......	Cloudy.
Summit	6.00 p.m.	23.800	71	44	44	43	92	W.	15	1.12	....	Stratus ...	4-4	Hidden ...	....	......	......	......	......	......	Cloudy, and over summit.
Base...		27.10	61	58	58	54	76	W.	4	.08	....	0	0	Cumulus..	4-4	0	......	......	......	......	Cloudy.
Summit	9.00 p.m.	23.780	72	40	40	39	91	N.W.	32	5.12	....	Stratus ...	3-4	0	0	0	......	......	......	......	
Base...		27.10	59	53	53	51	86	W.	3	.04	....	0	0	Cumulus..	1-4	0	......	......	......	......	Fair.
Summit	11.57 p.m.	23.760	70	42	42	41	91	N.W.	48	11.52	....	Stratus ...	3-4	Hidden ...	....	......	......	......	......	48-35	
Base...		27.10	60	51	51	50	93	Calm.	....	......	....	Stratus ...	1-4	Cumulus..	1-4	......	......	......	......	......	Fair.

* Drizzling during a. m.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 25, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.740	66	44	44	43	92	W.	50	12.50		Nimbus	4-4	Hidden							Light rain.
Base		27.07	59	55	55	54	93	W.	3	.05		Stratus	4-4	Hidden							Cloudy.
Summit	7.00 a.m.	23.730	65	44	44	43	92	N. W.	48	11.52		Stratus	4-4	Hidden							
Base		27.05	60	57	57	54	81	Calm.				Stratus	4-4	Hidden							Threatening.
Summit	7.57 a.m.	23.720	64	44	44	43	92	W.	42	8.82		Stratus	4-4	Hidden			Dur.night	6.45 a.m.	.08		
Base		27.05	61	60	60	56	76	W.	4	.08		Stratus	4-4	Hidden							Cloudy.
Summit	9.00 a.m.	23.710	68	44	44	43	92	W.	42	8.82		Stratus	4-4	Hidden							Clearing up.
Base		27.05	62	60	60	56	76	W.	4	.08		Stratus	4-4	Hidden							Cloudy.
Summit	10.00 a.m.	23.725	71	44	44	43	92	W.	38	7.22		Stratus	4-4	Hidden							Cloudy—fog.
Base		27.05	63	61	61	56	71	W.	4	.08		Stratus	1-4	Cumulus	3-4	S. E.					Cloudy.
Summit	11.00 a.m.	23.725	71	43	43	42	91	W.	48	11.52		Stratus	4-4	Hidden							Cloudy—fog.
Base		27.06	63	64	63	57	67	S. W.	6	.18		Stratus	1 4	Cumulus	4-4	0					Cloudy.
Summit	12.00 m.	23.728	70	43	43	42	91	W.	45	10.12		Stratus	4-4	Hidden							Cloudy—fog.
Base		27.05	63	63	62	56	66	W.	8	.32		0	0	Cumulus	4-4	0					Cloudy.
Summit	1.00 p.m.	23.715	70	43	43	42	91	W.	42	8.82		Stratus	3-4	Cirrus	1-4	W.					Clearing up.
Base		27.04	62	62	62	55	61	W.	6	.18		0	0	Cumulus	3-4	S.					Fair.
Summit	2.00 p.m.	23.710	72	43	43	42	91	W.	48	11.52		Hazy		Cumulus	4-4	W.					
Base		27.03	62	62	62	55	61	S.	6	.18	63	0	0	Cumulus	3-4	0					Fair.
Summit	3.00 p.m.	23.715	75	43	43	42	91	W.	36	6.48		Hazy		Cumulus	4-4	W.					Clearing.
Base		27.01	64	63	63	56	62	S. W.	6	.18		Hazy		Cumulus	4-4	0					Cloudy.
Summit	4.00 p.m.	23.715	76	43	43	42	91	W.	36	6.48		Stratus	3-4	Hidden							Clearing up.
Base		27.02	64	62	62	55	61	S. W.	6	.18		Hazy		Cumulus	3-4	0					Cloudy.
Summit	4.57 p.m.	23.699	75	42	42	41	91	W.	36	6.48		Hazy		Cumulus	3-4	W.					
Base		27.02	64	60	60	51	49	S. W.	8	.32		Hazy		Cumulus	3-4	0					Cloudy.
Summit	6.00 p.m.	23.685	75	41	41	39	83	N. W.	40	8.00		0	0	Cumulus	3-4	N. W.					Fair.
Base		27.03	65	60	60	51	49	N. W.	8	.32		0	0	Cumulus	1-8	W.					Fair.
Summit	9.00 p.m.	23.680	75	35	35	33	80	N. W.	54	14.58		0	0	Cirro-cum.	1-4	N. W.					
Base		27.06	60	49	49	45	64	W.	4	.08		0	0	0	0						Clear.
Summit	11.57 p.m.	23.610	60	31	31	30	89	N. W.	74	27.38		Stratus	1-4	Hazy						44-31	
Base		27.10	58	45	45	41	68	W.	4	.08		0	0	0	0	0					Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 26, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commenc'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a.m.	23.600	52	28	28	27	88	N. W.	68	23.12	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Heavy snow.
Base...		27.15	54	42	42	40	83	W.	6	.18	....	Stratus...	4-4	Hidden...	....	....	....	....	....	....	Cloudy.
Summit	7.00 a.m.	23.609	57	28	28	27	89	N. W.	65	21.12	....	Stratus...	4-4	Hidden...	....	....	....	6.30 a.m.	....	....	Clearing up.
Base...		27.16	53	43	43	41	83	W.	6	.18	....	Stratus...	4-4	Hidden...	....	....	....	....	....	....	Cloudy.
Summit	7.57 a.m.	23.650	58	29	29	28	89	N. W.	62	19.22	....	Stratus...	4-4	Hidden...	....	....	....	....	.06	....	Clearing up.
Base...		27.16	52	43	44	41	76	W.	5	.12	....	Stratus...	4-4	Hidden...	....	....	....	....	....	....	Cloudy.
Summit	9.00 a.m.	23.690	62	30	30	28	78	N. W.	59	17.40	....	Stratus...	1-4	Cirro-cum.	3-4	N. W.	....	....	....	....	Dense clouds above and below summit.
Base..		27.16	53	48	48	44	70	E.	2	.02	....	0	0	Cumulus..	3-4	N.	....	....	....	....	Fair.
Summit	10.00 a.m.	23.758	65	31	31	29	79	N.	40	8.00	....	Hazy....	....	Cirrus....	1-4	N.	....	....	....	....	Fair.
Base...		27.18	53	51	51	45	59	W.	4	.08	....	0	0	Cirrus....	1-4	0	....	....	....	....	Fair.
Summit	11.00 a.m.	23.780	67	32	32	29	69	N. W.	42	8.82	....	Hazy....	....	Cirrus....	1-4	N. W.	....	....	....	....	Fair.
Base...		27.19	54	54	54	46	49	W.	6	.18	....	0	0	Cirrus....	1-4	N. W.	....	....	....	....	Fair.
Summit	12.00 m..	23.820	70	33	33	30	69	N. W.	48	11.52	....	Hazy....	....	Cirrus....	1-4	N. W.	....	....	....	....	Fair.
Base...		27.22	59	56	56	48	51	S. W.	6	.18	....	0	0	Cirrus....	1-8	N. W.	....	....	....	....	Fair.
Summit	1.00 p.m.	23.860	70	35	35	32	70	N.	20	2.00	....	Hazy....	....	Cirro-cum.	1-4	N.	....	....	....	....	Fair.
Base...		27.21	59	58	58	48	42	W.	5	.12	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	2.00 p.m.	23.870	68	36	36	32	61	N.	6	.18	....	Hazy....	....	Cirrus....	1-4	N.	....	....	....	....	Fair.
Base...		27.21	59	61	61	50	40	W.	6	.18	139	0	0	0	0	0	....	....	....	....	Clear.
Summit	3.00 p.m.	23.880	67	37	37	33	62	N.	4	.08	....	Hazy....	....	Cirrus....	2-4	N.	....	....	....	....	Fair.
Base...		27.21	60	64	63	52	42	W.	4	.08	....	0	0	Cirrus....	1-4	N. W.	....	....	....	....	Fair.
Summit	4.00 p.m.	23.874	59	39	39	36	71	N. W.	12	.72	....	Hazy....	....	Cirrus....	2-4	N. W.	....	....	....	....	Fair.
Base...		27.21	62	63	63	51	37	W.	6	.18	....	0	0	Cirrus....	4-4	0	....	....	....	....	Cloudy.
Summit	4.57 p.m.	23.865	57	40	40	37	73	N. W.	15	1.12	....	0	0	Cirrus....	2-4	N. W.	....	....	....	....	Fair.
Base...		27.21	61	62	62	51	41	W.	6	.18	....	0	0	Cirrus....	4-4	0	....	....	....	....	Cloudy.
Summit	6.00 p.m.	23.870	62	40	40	36	65	N.	5	.12	....	Hazy....	....	Cirro-cum.	4-4	N.	....	....	....	....	Fair.
Base...		27.22	59	59	58	50	53	W.	1	.01	....	0	0	Cirrus....	4-4	0	....	....	....	....	Cloudy.
Summit	9.00 p.m.	23.918	69	38	38	34	63	N. W.	5	.12	....	Clear....	....	Cirrus....	1-4	N. W.	....	....	....	....	Fair.
Base...		27.23	58	49	49	45	71	W.	2	.02	....	0	0	0	0	0	....	....	....	....	Clear.
Summit	11.57 p.m.	23.895	64	38	38	33	54	N. W.	13	.84	....	0	0	Cirrus....	1-4	N. W.	....	....	....	40–28	Fair.
Base...		27.22	59	46	46	44	84	W.	4	.08	....	0	0	0	0	0	....	....	....	....	Clear.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 27, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.850	57	36	36	32	61	S.W.	12	.72	....	Hazy	....	Cirro-cum.	2-4	S.W.	....	....	....	......	Fair.
Base...		27.16	54	47	47	43	70	E.	2	.02	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	7.00 a. m.	23.830	58	38	38	34	63	S.W.	18	1.62	....	Hazy	....	Cirro-cum.	2-4	S.W.	....	....	....	......	Fair.
Base...		27.15	54	53	53	47	61	S.W.	4	.08	....	0	0	0	0	0	....	....	....	......	Clear.
Summit	7.57 a. m.	23.810	59	39	39	35	62	S.W.	26	3.38	....	0	0	Cirro-cum.	2-4	S.W.	....	....	....	......	Fair.
Base...		27.14	55	58	58	49	47	S.	8	.32	....	0	0	Cirrus	1-4	0	....	....	....	......	Fair.
Summit	9.00 a. m.	23.835	65	40	40	36	62	S.W.	32	5.12	....	0	0	Cumulus..	2-4	S.W.	....	....	....	......	Fair.
Base...		27.13	56	59	59	49	43	S.	10	.50	....	0	0	Cirrus	1-4	0	....	....	....	......	Fair.
Summit	10.00 a. m.	23.820	70	42	42	38	65	S.	35	6.12	....	0	0	Cirro-cum.	2-4	S.	....	....	....	......	Fair.
Base ..		27.11	56	60	60	50	44	S. E.	8	.32	....	0	0	Cirrus	1-4	0	....	....	....	......	Fair.
Summit	11.00 a. m.	23.820	73	43	43	40	75	S. W.	30	4.50	....	0	0	Cirro-cum.	2-4	S.W.	....	....	....	......	Fair.
Base...		27.11	57	60	60	51	49	E.	8	.32	....	0	0	Cirrus	1-4	0	....	....	....	......	Fair.
Summit	12.00 m ..	23.770	73	43	43	40	75	S.	35	6.12	....	0	0	Cirro-cum.	2-4	S.	....	....	....	......	Fair.
Base...		27.09	59	63	63	52	42	S. E.	7	.25	....	0	0	Cumulus..	2-4	S. E.	....	....	....	......	Fair.
Summit	1.00 p. m.	23.780	73	43	43	39	67	S..	35	6.12	....	0	0	Cirro-cum.	2-4	S.	....	....	....	......	Fair.
Base...		27.08	60	65	65	53	39	S.	12	.72	....	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	2.00 p. m.	23.740	70	44	44	39	59	S.	44	9.68	....	Hazy	....	Cumulus..	2-4	S.	....	....	....	......	Fair.
Base...		27.06	62	63	63	53	47	S.	10	.50	119	0	0	Cumulus..	3-4	0	....	....	....	......	Fair.
Summit	3.00 p. m.	23.730	69	42	42	39	75	S.	35	6.12	....	Stratus ...	4-4	Hidden ...	....	......	....	....	....	......	Cloudy.
Base...		27.03	63	62	62	53	51	S. E.	10	.50	....	0	0	Cumulus..	4-4	S. E.	....	....	....	......	Cloudy.
Summit	4.00 p. m.	23.710	68	39	39	37	81	S.	48	11.52	....	Stratus ...	4-4	Hidden ...	....	......	....	....	....	......	Cloudy.
Base...		27.04	62	64	64	52	38	E.	12	.72	....	0	0	Cumulus..	2-4	S. E.	....	....	....	......	Fair.
Summit	4.57 p. m.	23.710	68	38	38	36	81	S. E.	38	7.22	....	0	0	Cirrus	3-4	S. E.	....	....	....	......	Fair.
Base...		27.03	62	61	61	53	55	E.	10	.50	....	0	0	Cumulus..	4-4	0	....	....	....	......	Cloudy.
Summit	6.00 p. m.	23.710	71	37	37	35	80	S.W.	48	11.52	....	Stratus ...	4-4	Hidden ...	....	......	....	....	....	......	Cloudy.
Base...		27.04	59	57	57	49	52	E.	12	.72	....	Hazy	....	Cumulus..	4-4	......	....	....	....	......	Threatening.
Summit	9.00 p. m.	23.691	68	36	36	35	90	S.W.	62	19.22	....	Stratus ...	4-4	Hidden ...	....	......	....	....	....	......	Foggy.
Base...		27.04	58	50	50	46	71	E.	12	.72	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Threatening.
Summit	11.57 p. m.	23.620	69	35	35	34	90	S.W.	44	9.68	....	Nimbus...	4-4	Hidden ...	....	......	11.00 p. m.	....	.03	44–35	Heavy rain.
Base...		27.02	59	47	47	45	85	E.	6	.18	....	Nimbus...	4-4	Hidden ...	....	......	....	....	....	......	Threatening.

Stations summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 28, 1872.

Place of observation.	Time of observation.	Barometer.	THERM.		HYGROM.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction (moving from—)	Comm'd.	Ended.			
Summit	6.00 a. m.	23.580	58	30	30	30	100	S. W.	16	1.28	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy snow.
Base...	6.00 a. m.	26.96	54	42	42	42	100	S. W.	4	.08	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Summit	7.00 a. m.	23.600	60	31	31	30	89	S. W.	14	.98	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Light snow.
Base...	7.00 a. m.	26.96	53	44	44	42	84	S.	4	.08	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Light rain.
Summit	7.57 a. m.	23.600	63	31	31	30	89	S. W.	12	.72	....	Nimbus...	4-4	Hidden....	....	......	....	....	Snow .29	......	Light snow.
Base...	7.57 a. m.	26.96	53	46	46	43	77	E.	4	.08	....	Nimbus...	3-4	Hidden....	....	......	(*)	5.40 a. m.	Snow .46	......	Clearing.
Summit	9.00 a. m.	23.610	69	31	31	30	89	W.	12	.72	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy snow.
Base...	9.00 a. m.	26.95	53	45	45	44	92	Calm	...	......	....	Nimbus...	3-4	Hidden....	....	......	....	....	....	......	Clearing.
Summit	10.00 a. m.	23.620	69	32	32	31	89	N. W.	10	.50	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy snow.
Base...	10.00 a. m.	26.95	52	47	47	45	85	W.	4	.08	....	Nimbus...	3-4	Hidden....	....	......	....	....	....	......	Clearing.
Summit	11.00 a. m.	23.640	68	33	33	32	89	W.	12	.72	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Base...	11.00 a. m.	26.96	53	48	48	45	78	Calm	...	......	....	Nimbus...	3-4	Hidden....	...	......	....	....	....	......	Clearing.
Summit	12.00 m...	23.630	67	33	33	31	79	W.	18	1.62	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Light snow.
Base...	12.00 m...	26.97	53	48	48	46	85	W.	4	.08	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling.
Summit	1.00 p. m.	23.639	68	33	33	31	79	W.	22	2.42	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Base...	1.00 p. m.	26.97	54	49	49	47	85	W.	4	.08	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Summit	2.00 p. m.	23.630	70	34	34	33	79	W.	32	5.12	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Drizzling rain.
Base...	2.00 p. m.	26.97	54	51	51	48	79	W.	8	.32	183	Nimbus...	3-4	Hidden....	....	......	....	....	....	......	Clearing.
Summit	3.00 p. m.	23.670	75	35	35	33	80	W.	24	2.88	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Base...	3.00 p. m.	26.97	54	53	53	49	73	S. W.	8	.32	....	Nimbus...	3-4	Hidden....	....	......	....	....	....	......	Clearing.
Summit	4.00 p. m.	23.672	76	35	35	33	80	W.	20	2.00	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Base...	4.00 p. m.	26.99	56	52	52	49	79	S. W.	1	.01	....	Nimbus...	3-4	Hidden....	....	......	....	....	....	......	Clearing.
Summit	4.57 p. m.	23.672	76	35	35	33	80	W.	18	1.62	....	Nimbus...	4-4	Hidden....	....	......	....	2.40 p. m.	Rain .16	......	
Base...	4.57 p. m.	27.00	56	53	53	49	73	W.	3	.05	....	Nimbus...	3-4	Hidden....	....	......	(†)	....	Rain .01	......	Clearing.
Summit	6.00 p. m.	23.690	76	35	35	33	80	N. W.	15	1.12	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Base...	6.00 p. m.	27.00	54	50	50	47	79	Calm	...	......	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Threatening.
Summit	9.00 p. m.	23.660	71	32	32	31	89	N. W.	42	8.82	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy rain.
Base...	9.00 p. m.	27.05	54	43	43	43	100	Calm	...	......	....	Nimbus...	4-4	Hidden....	....	......	....	....	....	......	Heavy rain.
Summit	11.57 p. m.	23.650	67	29	29	28	89	N. W.	24	2.88	....	Nimbus...	4-4	Hidden...	....	......	6.10 p. m.	....	Hail .13	36–29	Light snow.
Base...	11.57 p. m.	27.05	54	38	38	38	100	S. W.	4	.08	....	Nimbus...	4-4	Hidden....	....	......	6.10 p. m.	....	Rain .65	......	Light rain.

* Commenced about 2 a. m.

† Showers during day.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 29, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Comm'n'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.660	50	26	26	25	88	W.	48	11.52	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	6.00 a. m.	27.13	50	40	40	39	91	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	.....	....	5.00 a. m.	....	......	Threatening.
Summit	7.00 a. m.	23.650	51	26	26	25	88	N. W.	38	7.22	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	7.00 a. m.	27.14	51	41	41	40	91	Calm	...	.....	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Clearing.
Summit	7.57 a. m.	23.681	62	27	27	26	88	N. W.	35	6.12	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	.08	......	Cloudy.
Base...	7.57 a. m.	27.14	48	43	43	41	83	Calm	...	.....	....	Nimbus...	3-4	Hidden ...	....	.....	....	....	.25	......	Clearing.
Summit	9.00 a. m.	23.700	66	28	28	27	88	N. W.	32	5.12	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	9.00 a. m.	27.14	49	43	43	41	83	W.	2	.02	....	Nimbus...	3-4	Hidden ...	....	.....	....	....	....	......	Clearing.
Summit	10.00 a. m.	23.740	68	29	29	28	89	N. W.	28	3.92	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	10.00 a. m.	27.15	48	41	41	40	91	S.	4	.08	...	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	11.00 a. m.	23.728	62	30	30	29	89	N. W.	28	3.92	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	11.00 a. m.	27.15	49	42	42	41	91	Calm	...	.....	....	Nimbus...	3-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	12.00 m ..	23.728	62	29	29	28	89	N. W.	41	8.40	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	12.00 m ..	27.15	48	43	43	42	92	Calm	...	.....	....	Nimbus ..	4-4	Hidden ..	....	.....	....	....	....	......	Cloudy.
Summit	1.00 p. m.	23.750	69	31	31	30	89	N. W.	38	7.22	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	1.00 p. m.	27.16	48	42	42	41	91	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	2.00 p. m.	23.721	70	31	31	30	89	N. W.	45	10.12	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	2.00 p. m.	27.17	49	43	43	42	92	Calm	...	.....	63	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	3.00 p. m.	23.750	71	31	31	30	89	N. W.	40	8.00	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base...	3.00 p. m.	27.18	48	42	42	41	91	Calm	...	.....	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Light rain.
Summit	4.00 p. m.	23.770	74	31	31	30	89	N. W.	40	8.00	....	Stratus ...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Base ...	4.00 p. m.	27.19	48	41	41	41	100	W.	6	.18	....	Dense fog.	....	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	4.57 p. m.	23.788	70	31	31	30	89	N. W.	40	8.00	....	Nimbus...	4-4	Hidden ...	....	.....	4.10 p. m.	....	.01	......	Sleeting.
Base...	4.57 p. m.	27.20	48	41	41	41	100	W.	6	.18	....	Nimbus...	4-4	Hidden ...	....	.....	(*)	....	.04	......	Drizzling.
Summit	6.00 p. m.	23.768	71	30	30	29	89	N. W.	46	10.58	....	Stratus ...	4-4	Hidden ...	....	.....	6.00 p. m.	5.40 p. m.	....	......	Cloudy.
Base...	6.00 p. m.	27.20	48	42	42	42	100	Calm	...	.....	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	9.00 p. m.	23.738	65	28	28	27	88	N. W.	62	19.24	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Sleeting.
Base...	9.00 p. m.	27.23	48	40	40	40	100	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.
Summit	11.57 p. m.	23.838	64	28	28	27	89	N. W.	37	6.84	....	Stratus ...	4-4	Hidden ...	....	.....	....	10.30 p. m.	.02	32-25	Cloudy.
Base...	11.57 p. m.	27.25	50	38	38	38	100	W.	4	.08	....	Nimbus...	4-4	Hidden ...	....	.....	....	....	....	......	Cloudy.

* Showers during day.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above the ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above the ground, 24 feet.

Meteorological record for May 30, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commen'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.750	57	31	31	30	89	N. W.	41	8.40	....	Stratus ...	3-4	Cumulus..	1-4	N. W.					Cloudy.
Base...		27.27	48	41	41	41	100	Calm			....	Stratus ...	4-4	Hidden ...							Cloudy.
Summit	7.00 a. m.	23.770	56	31	31	30	89	N. W.	35	6.12	....	Stratus ...	1-4	Cumulus..	2-4	N. W.					Fair and clearing fast.
Base...		27.29	48	40	40	40	100	Calm			....	Stratus ...	4-4	Hidden ...							Cloudy.
Summit	7.57 a. m.	23.760	55	31	31	30	89	N. W.	36	6.48	....	0	0	Cumulus..	3-4	N. W.					Fair.
Base...		27.29	48	45	45	43	84	E.	5	.12	....	Stratus ...	1-4	Cumulus..	3-4	N. W.					Clearing. [summit.
Summit	9.00 a. m.	23.800	57	31	31	30	89	N. W.	15	1.12	....	0	0	Cumulus..	2-4	N. W.					Fair; clouds all below
Base ..		27.29	48	46	46	45	92	Calm			....	Stratus ...	4-4	Hidden ...							Cloudy. [summit.
Summit	10.00 a. m.	23.880	63	32	32	31	89	S.	8	.32	....	Stratus ...	1-4	Cumulus..	2-4	S.					Fair; clouds all below
Base...		27.31	49	44	44	43	92	S. W.	1	.01	....	Stratus ...	4-4	Hidden ...							Cloudy. [summit.
Summit	11.00 a. m.	23.930	68	35	35	31	61	S. W.	4	.08	....	Stratus ...	2-4	Cumulus..	2-4	S. W.					Fair; clouds all below
Base...		27.29	49	50	50	47	79	S. E.	4	.08	....	Stratus ...	1-4	Cumulus..	3-4	0					Cloudy.
Summit	12.00 m ..	23.930	69	36	36	31	52	S. W.	4	.08	....	Dense haze	....	Hazy ...							Fair.
Base...		27.28	50	54	54	49	67	N. W.	1	.01	....	0	0	Cumulus..	3-4	N. W.					Cloudy. [summit.
Summit	1.00 p. m.	23.920	70	36	36	33	70	S. W.	4	.08	....	Stratus ...	4-4	Hidden ...							Clouds on and below
Base...		27.27	52	53	53	49	73	Calm			...	0	0	Cumulus..	4-4	0					Cloudy.
Summit	2.00 p. m.	23.930	74	36	36	34	80	S. W.	2	.02	...	Stratus ...	4-4	Hidden ...							Dense clouds.
Base...		27.26	53	55	55	50	68	S. W.	2	.02	54	Stratus ...	1-4	Cumulus..	2-4						Fair [summit.
Summit	3.00 p. m.	23.930	74	36	36	34	80	S. W.	2	.02	....	Stratus ...	4-4	Hidden ...							Clouds on and below
Base...		27.26	55	55	50	59	68	N. W.	1	.01	....	0	0	Cumulus..	4-4	S. E.					Cloudy. [summit.
Summit	4.00 p. m.	23.923	75	36	36	35	90	S. W.	-9	.40	....	Stratus ...	4-4	Hidden ...							Clouds on and below
Base...		27.26	53	52	52	49	79	Calm	...	0	....	Nimbus...	4-4	Hidden ...							Threatening.
Summit	4.57 p. m.	23.920	77	35	35	34	90	S. W.	6	.18	....	Nimbus...	4-4	Hidden ...			4.10 p. m.	5.50 p. m.	.03		Light rain.
Base...		27.25	53	50	50	49	93	Calm			....	Nimbus...	4-4	Hidden ...							Drizzling.
Summit	6.00 p. m.	23.910	76	35	35	34	90	S.	3	.05	....	Stratus ...	4-4	Hidden ...							Threatening.
Base...		27.25	53	49	49	48	93	Calm			....	Stratus ...	4-4	Hidden ...							Cloudy.
Summit	9.00 p. m.	23.874	71	34	34	33	90	S. E	13	.84	....	Nimbus...	4-4	Hidden ...							Light rain.
Base...		27.23	53	46	46	46	100	Calm			....	Nimbus...	4-4	Hidden ...							Drizzling rain.
Summit	11.57 p. m.	23.820	65	34	34	33	90	S.	17	1.44	....	Nimbus...	4-4	Hidden ...			6.40 p. m.		.17	36 28	Heavy rain.
Base...		27.20	55	45	45	45	100	Calm			....	Nimbus...	4-4	Hidden ...			4.00 p. m.		.08		Light rain.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Meteorological record for May 31, 1872.

Place of observation.	Time of observation.	Barometer.	THERM. Attached.	THERM. Exposed.	HYGROM. Dry bulb.	HYGROM. Wet bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	LOWER CLOUDS. Kind.	LOWER CLOUDS. Amount.	UPPER CLOUDS. Kind.	UPPER CLOUDS. Amount.	UPPER CLOUDS. Direction, (moving from—)	RAIN OR SNOW. Commenc'd.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Maximum and minimum thermometer.	Remarks.
Summit	6.00 a. m.	23.732	53	32	32	32	100	S.W.	39	7.60	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base..		27.15	53	44	44	44	100	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Heavy rain.
Summit	7.00 a. m.	23.750	55	32	32	32	100	S.W.	18	1.62	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base...		27.15	53	44	44	44	100	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Heavy rain.
Summit	7.57 a. m.	23.751	60	32	32	32	100	S.W.	14	.98	....	Nimbus...	4-4	Hidden...	....	....	....	....	.59	....	Light snow.
Base...		27.15	52	49	49	46	78	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	.41	....	Heavy rain.
Summit	9.00 a. m.	23.761	65	33	33	32	89	S.W.	14	.98	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base...		27.14	52	49	49	47	85	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	10.00 a. m.	23.760	65	33	33	32	89	E.	24	2.88	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base..		27.14	51	50	50	48	86	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	11.00 a. m.	23.771	64	34	34	33	90	S.W.	14	.98	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Drizzling rain.
Base...		27.14	51	48	48	48	100	W.	4	.08	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	12.00 m...	23.772	66	34	34	33	90	S.W.	15	1.12	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Threatening.
Base...		27.15	51	50	50	47	79	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	1.00 p. m.	23.772	68	33	33	32	89	W.	18	1.62	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base...		27.14	51	50	50	48	86	S.	4	.08	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	2.00 p. m.	23.773	71	33	33	32	89	W.	33	5.44	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light snow.
Base...		27.14	53	49	49	47	85	N.	2	.02	32	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Threatening.
Summit	3.00 p. m.	23.780	69	34	34	33	90	N.W.	24	2.88	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Threatening.
Base..		27.14	53	49	49	48	93	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	4.00 p. m.	23.772	70	34	34	33	90	W.	30	4.50	....	Stratus...	4-4	Hidden...	....	....	....	....	....	....	Slight indications of clearing.
Base...		27.14	54	50	50	49	93	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Threatening.
Summit	4.57 p. m.	23.790	71	34	34	33	90	W.	20	2.00	....	Stratus...	2-4	Hazy....	....	....	12.10 p. m.	11.40 a.m 2.30 p.m	.32	....	Clearing up.
Base...		27.15	54	50	50	48	86	N.W.	4	.08	....	Stratus...	1-4	Cumulus..	3-4	N. W.	....	3.45 p.m	.08	....	Clearing up.
Summit	6.00 p. m.	23.811	70	34	34	33	90	N.E.	28	3.92	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Heavy snow.
Base...		27.17	53	48	48	48	100	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	9.00 p. m.	23.810	64	33	33	32	89	N.W.	26	3.38	....	Nimbus...	4-4	Hidden...	....	....	....	....	....	....	Heavy snow.
Base...		27.21	52	44	44	44	100	Calm	....	....	....	Nimbus...	4 4	Hidden...	....	....	....	....	....	....	Light rain.
Summit	11.57 p. m.	23.790	62	31	31	30	90	N.W.	56	15.68	....	Nimbus...	2-4	Hidden...	....	....	5.10 p. m.	....	.38	35–31	Sleeting.
Base...		27.24	54	44	44	44	100	Calm	....	....	....	Nimbus...	4-4	Hidden...	....	....	4.30 p. m.	....	.03	....	Light rain.

Stations, summit and base of Mount Washington, New Hampshire. Elevation of summit above sea-level, 6,282.5 feet. Height of barometer at summit above ground, 3 feet. Elevation of base above sea-level, 2,615 feet. Height of barometer at base above ground, 24 feet.

Paper G, (sub-paper.)

Meteorological record for the five days ending May 5, 1872.

Day and date of observation.	Time of observation.	Barometer.	Thermometer. Attached.	Thermometer. Exposed.	Hygrometer. Dry bulb.	Hygrometer. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Clouds. Amount.	Clouds. Direction, (moving from—)	Rain or snow. Commenced.	Rain or snow. Ended.	Amount of rain or melted snow.	Remarks.
Wednesday, May, 1, 1872	7.00 a. m	30.28	66	47	47	43	70	S.W.	12	.72		1-4					
	8.02 a. m	30.28	66	48	48	44	70	S.W.	12	.72		1-4					
	2.00 p. m	30.22	69	52	52	46	60	S.	14	.98		3-4					
	5.02 p. m	30.20	70	46	45	42	76	S.	14	.98		4-4					
	9.00 p. m	30.18	68	44	43	36	43	S.	14	.98	234	4-4					
	12.02 a. m	30.15	69	44	43	41	83	S.	11	.60		3-4					
Thursday, May 2, 1872	7.00 a. m	30.02	64	45	44	43	92	S.	6	.18		3-4	N.				Threatening.
	8.02 a. m	30.01	64	46	45	44	92	S.	8	.32		3-4	N.	7.10 a. m		.05	Light rain.
	2.00 p. m	29.93	67	53	52	52	100	S.	8	.32		4-4					
	5.02 p. m	29.89	67	49	49	49	100	S.	13	.84		4-4			11 a. m.	.12	Fog.
	9.00 p. m	29.96	68	49	49	49	100	S.	9	.40	260	4-4					Dense fog.
	12.02 a. m	29.95	66	48	48	48	100	Calm.				4-4					Fog.
Friday, May 3, 1872	7.00 a. m	29.89	60	47	47	47	100	E.	3	.04		4-4					Fog.
	8.02 a. m	29.85	59	45	45	45	100	E.	3	.04		4-4		After 2 a. m	6 a. m.	.24	
	2.00 p. m	29.86	72	51	50	49	93	N.W.	6	.18		4-4					Threatening.
	5.02 p. m	29.85	71	50	49	48	93	N. E.	6	.18		2-4	S. E.				
	9.00 p. m	29.94	71	44	44	43	92	N.	3	.04	150	1-4					
	12.02 a. m	29.94	71	42	42	41	91	N.	3	.04		0					
Saturday, May 4, 1872	7.00 a. m	29.95	70	40	39	39	100	N. E.	4	.08		4-4					Fog and light rain.
	8.02 a. m	29.96	69	40	39	39	100	N. E.	6	.18		4-4		6.20 a. m		.05	Light rain.
	2.00 p. m	29.95	67	43	41	41	100	E.	12	.72		4-4					Fog.
	5.02 p. m	29.95	64	43	43	42	92	N. E.	6	.18		2-4			8.30 a. m	.03	
	9.00 p. m	29.96	60	43	43	43	100	N. E.	1	.01	108	4-4					Light rain.
	12.02 a. m	29.98	63	41	41	41	100	N.W.	9	.40		4-4		9 p. m		.12	Heavy rain.
Sunday, May 5, 1872	7.00 a. m	29.97	58	40	39	38	91	N.	7	.24		2-4	S.				
	8.02 a. m	29.97	58	42	41	39	82	N.	8	.32		2-4	S.		2 a. m.	.08	
	2.00 p. m	29.93	70	58	57	45	30	N.W.	12	.72		2-4	S.W.				
	5.02 p. m	29.92	73	52	51	44	52	N.W.	14	.98		3-4	S.				
	9.00 p. m	29.92	72	50	50	40	32	W.	9	.40	194	2-4	E.				
	12.02 a. m	29.87	68	48	48	44	70	W.	10	.50		4-4					

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meteorological record for the five days ending May 10, 1872.

Day and date of observation.	Time of observation.	Barometer.	THERMOMETER. Attached.	THERMOMETER. Exposed.	HYGROMETER. Dry bulb.	HYGROMETER. Wet-bulb.	Relative humidity.	WIND. Direction.	WIND. Velocity per hour.	WIND. Pressure per sq. ft.	WIND. Daily velocity.	CLOUDS. Amount.	CLOUDS. Direction, (moving from—	RAIN OR SNOW. Commenced.	RAIN OR SNOW. Ended.	Amount of rain or melted snow.	Remarks.
Monday, May 6, 1872	7.00 a. m	29.91	70	45	45	42	76	N.	8	.32		4-4	S.				
	8.02 a. m	29.93	68	45	45	41	68	N.	8	.32		3-4	S.				
	2.00 p. m	29.98	69	49	48	44	70	E.	10	.50		2-4	W.				
	5.02 p. m	30.00	69	48	47	44	77	S. E.	2	.02		3-4	S.	9 a. m	10 a. m	.02	
	9.00 p. m	30.01	70	44	44	42	84	S. W.	7	.24	229	2-4					
	12.02 a. m	29.95	71	45	45	44	92	S. W.	2	.02		4-4					
Tuesday, May 7, 1872	7.00 a. m	29.93	65	59	59	52	59	N. W.	8	.32		1-4	S. E.				
	8.02 a. m	29.94	67	61	61	54	61	N. W.	12	.72		1-4	S.				
	2.00 p. m	29.98	63	49	49	45	71	S. E.	5	.12		2-4	S.				
	5.02 p. m	29.99	64	52	52	48	73	S.	8	.32		2-4	S.				
	9.00 p. m	30.00	61	46	46	44	84	S.	6	.18	162	1-4					
	12.02 a. m	30.00	62	45	45	42	76	S. W.	4	.08		0					Faint aurora.
Wednesday, May 8, 1872	7.00 a. m	30.01	71	46	46	44	84	Calm				2-4	S.				
	8.02 a. m	30.00	70	48	48	46	85	S. W.	3	.04		1-4	S.				
	2.00 p. m	30.01	72	68	66	58	59	E.	6	.18		0					
	5.02 p. m	30.05	71	65	64	56	57	S.	7	.24		1-4	S. E.				
	9.00 p. m	30.11	67	56	56	54	87	Calm			103	1-4					
	12.02 a. m	30.09	65	53	53	50	80	N.	3	.04		2-4					
Thursday, May 9, 1872	7.00 a. m	30.07	59	49	48	46	85	E.	3	.04		4-4					
	8.02 a. m	30.04	59	47	47	45	85	E.	4	.08		4-4	E.				Threatening.
	2.00 p. m	29.88	62	48	48	46	85	S. E.	6	.18		4.4					
	5.02 p. m	29.79	61	48	47	45	85	E.	6	.18		2-4					
	9.00 p. m	29.74	61	49	48	47	92	Calm			89	0					
	12.02 a. m	29.70	63	64	64	57	62	S.	9	.40		0					
Friday, May 10, 1872	7.00 a. m	29.80	65	64	64	52	38	W.	11	.60		0					
	8.02 a. m	29.83	68	74	74	60	39	W.	16	1.28		1-4					
	2.00 p. m	30.06	70	70	69	56	39	N.	15	1.12		1-4					
	5.02 p. m	30.14	68	62	62	51	41	N. E.	13	.84		1-4					
	9.00 p. m	30.28	64	51	51	45	59	N. E.	6	.18	191	0					
	12.02 a. m	30.35	63	50	50	45	65	N.	3	.04		2-4					

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meteorological record for the five days ending May 15, 1872.

Day and date of observation.	Time of observation.	Barometer.	Thermometer. Attached.	Thermometer. Exposed.	Hygrometer. Dry bulb.	Hygrometer. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Clouds. Amount.	Clouds. Direction, (moving from—)	Rain or snow. Commenced.	Rain or snow. Ended.	Amount of rain or melted snow.	Remarks.
Saturday, May 11, 1872.	7.00 a. m....	30. 38	62	51	51	45	59	S. E.	2	.02	......	1-4	......	....	....	......	
	8.02 a. m....	30. 39	63	50	49	44	64	S.	8	.32	......	3-4	......	....	....	......	
	2.00 p. m ...	30. 34	62	49	48	45	78	S. E.	7	.24	......	1-4	E.	....	....	......	
	5.02 p. m ...	30. 29	60	46	46	43	77	S. E.	8	.32	......	3-4	E.	....	....	......	
	9.00 p. m ...	30. 21	58	42	42	41	91	S. E.	4	.08	167	4-4	......	....	....	......	Light rain.
	12.02 a. m....	30. 11	60	42	42	41	91	E.	4	.08	......	4-4	......	8.30 p. m....	....	.02	Light rain.
Sunday, May 12, 1872...	7.00 a. m....	29. 99	58	45	44	44	100	S.	1	.01	......	4-4	......	....	....	......	Dense fog.
	8.02 a. m...	29. 96	58	46	45	45	100	S.	2	.02	......	4-4	......	....	....	......	Dense fog.
	2.00 p. m ...	29. 89	74	64	64	58	67	S.	8	.32	......	0	......	....	....	......	Hazy.
	5.02 p. m ...	29. 85	74	61	61	56	71	S. W.	10	.50	......	1-4	N. E.	....	....	......	
	9.00 p. m ...	29. 85	69	55	55	52	80	S. W.	9	.40	108	2-4	......	....	....	......	
	12.02 a. m....	29. 84	71	51	51	50	93	N.	6	.18	......	2-4	......	....	....	......	
Monday, May 13, 1872..	7.00 a. m....	29. 90	73	53	53	47	61	N. E.	14	.98	......	1-4	E.	....	....	......	
	8.02 a. m....	29. 90	71	55	55	49	62	N. E.	10	.50	......	2-4	E.	....	....	......	
	2.00 p. m ...	29. 91	69	57	57	51	63	S. E.	10	.50	......	0	......	....	....	......	
	5.02 p. m ...	29. 91	67	56	56	54	87	S. E.	4	.08	......	2-4	N. E.	....	....	......	Cumulus and stratus.
	9.00 p. m ...	29. 98	68	52	52	49	79	S. W.	4	.08	208	4-4	......	....	....	......	
	12.02 a. m....	30. 00	64	56	56	46	40	N.	5	.12	......	4-4	......	....	....	......	
Tuesday, May 14, 1872..	7.00 a. m....	30. 13	63	52	52	42	35	N.	10	.50	......	2-4	......	....	....	......	
	8.02 a. m....	30. 14	63	54	54	43	32	N.	8	.32	......	1-4	......	....	....	......	
	2.00 p. m ...	30. 16	64	62	61	50	40	S. E.	5	.12	......	1-4	......	....	....	......	
	5.02 p. m ...	30. 18	62	55	54	47	55	S.	12	.72	......	1-4	S. E.	....	....	......	
	9.00 p. m ...	30. 21	62	51	51	44	52	S. W.	7	.24	Blk	2-4	......	....	....	......	
	12.02 a. m....	30. 21	62	51	51	44	52	S. W.	5	.12	......	4-4	......	....	....	......	
Wednesday, May 15, 1872	7.00 a. m....	30. 27	66	53	53	43	36	N.	9	.40	......	1-4	......	....	....	......	Cirro-cumulus clouds.
	8.02 a. m....	30. 27	66	54	54	43	32	N. E.	5	.12	......	1-4	......	....	....	......	
	2.00 p. m ...	30. 17	63	60	60	47	29	S. E.	8	.32	......	1-4	S. E.	....	....	......	
	5.02 p. m ...	30. 17	62	53	53	45	48	N. W.	8	.32	......	2-4	S. E.	....	....	......	
	9.00 p. m ...	30. 17	62	51	51	46	65	N. W.	4	.08	Blk	2-4	S. E.	....	....	......	
	12.02 a. m....	30. 14	67	46	46	42	69	W.	4	.08	......	0	......	....	....	......	

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meteorological record for the five days ending May 20, 1872.

Day and date of observation.	Time of observation.	Barometer.	Thermometer. Attached.	Thermometer. Exposed.	Hygrometer. Dry bulb.	Hygrometer. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Clouds. Amount.	Clouds. Direction (moving from —)	Rain or snow. Commenced.	Rain or snow. Ended.	Amount of rain or melted snow.	Remarks.
Thursday, May 16, 1872	7.00 a. m	30.11	73	48	48	39	36	N. W.	8	.32		0					
	8.02 a. m	30.09	73	51	51	40	28	N.	10	.50		0					
	2.00 p. m	29.94	69	55	54	41	21	N.	12	.72		4-4					
	5.02 p. m	30.02	69	51	50	41	39	N.	20	2.00		0					
	9.00 p. m	30.03	65	50	49	41	44	N. W.	6	.18	156	2-4	S. W.				
	12.02 a. m	30.02	68	47	47	40	48	Calm.				3-4	S. W.				Dense haze.
Friday, May 17, 1872	7.00 a. m	30.01	66	50	50	43	51	N.	9	.40		2-4	S.				
	8.02 a. m	30.02	69	52	52	44	47	N.	18	1.28		1-4	S.				
	2.00 p. m	29.97	66	60	59	49	43	N. E.	12	.72		1-4	S.				
	5.02 p. m	29.99	63	55	55	48	56	S. E.	6	.18		3-4	S.				
	9.00 p. m	30.04	62	49	49	45	70	S.	6	.18	221	3-4	S.				
	12.02 a. m	30.02	63	48	48	44	70	S. W.	8	.32		4-4	S. E.				
Saturday, May 18, 1872	7.00 a. m	30.02	67	50	50	44	58	N.	4	.08		0					
	8.02 a. m	30.03	66	53	53	46	54	N. E.	5	.12		0					
	2.00 p. m	29.94	63	58	58	49	47	S.	11	.60		0					Hazy.
	5.02 p. m	29.88	62	55	55	47	50	S.	15	1.12		0					
	9.00 p. m	29.85	61	50	50	46	72	S. W.	7	.24	137	0					
	12.02 a. m	29.84	62	48	48	45	78	S. W.	6	.18		0					
Sunday, May 19, 1872	7.00 a. m	29.85	78	57	57	49	52	S.	6	.18		0					Hazy.
	8.02 a. m	29.83	72	60	60	52	55	S.	4	.08		3-4	E.				
	2.00 p. m	29.74	70	52	51	49	86	E.	6	.18		4-4					Threatening.
	5.02 p. m	29.66	61	49	48	48	100	N. E.	6	.18		4-4		3 p. m		.13	Light rain.
	9.00 p. m	29.55	70	50	50	50	100	N. E.	11	.60	202	4-4					Light rain.
	12.02 a. m	29.49	72	49	49	49	100	N. E.	10	.50		4-4				.33	
Monday, May 20, 1872	7.00 a. m	29.50	72	55	55	54	93	W.	8	.32		4-4					
	8.02 a. m	29.50	72	57	57	55	87	W.	8	.32		3-4	E.		2 a. m.	.04	Clearing.
	2.00 p. m	29.50	75	70	70	57	40	W.	12	.72		2-4	E.				
	5.02 p. m	29.51	71	69	69	56	39	W.	9	.40		1-4	E.				
	9.00 p. m	29.57	68	58	58	52	64	W.	6	.18	192	2-4	E.				
	12.02 a. m	29.58	66	55	55	51	74	W.	2	.02		1-4	W.				

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meteorological record for the five days ending May 25, 1872.

Day and date of observation.	Time of observation.	Barometer.	Thermometer. Attached.	Thermometer. Exposed.	Hygrometer. Dry bulb.	Hygrometer. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Clouds. Amount.	Clouds. Direction, (moving from—)	Rain or snow. Commenced.	Rain or snow. Ended.	Amount of rain or melted snow.	Remarks.
Tuesday, May 21, 1872	7.00 a. m	29.66	64	56	55	52	80	W.	2	.02		4-4					
	8.02 a. m	29.69	65	60	59	54	70	N. W.	2	.02		4-4					
	2.00 p. m	29.79	65	61	60	55	71	Calm.				1-4	E.				
	5.02 p. m	29.86	64	54	54	53	93	S. W.	4	.08		3-4	S.	4 p. m		.09	Light rain.
	9.00 p. m	29.98	64	53	53	52	93	Calm.			152	1-4			5.30 p. m.		
	12.02 a. m	30.00	63	51	51	50	93	Calm.				1-4	S. E.			.06	Clear sky.
Wednesday, May 22, 1872	7.00 a. m	30.08	63	56	56	53	81	Calm.				4-4					
	8.02 a. m	30.10	63	60	60	53	60	Calm.				1-4					
	2.00 p. m	30.08	65	63	62	53	51	S. E.	9	.40		1-4					
	5.02 p. m	30.08	64	58	58	52	64	S. E.	12	.72		2-4	E.				
	9.00 p. m	30.07	63	50	50	48	86	S.	3	.04	76	1-4					
	12.02 a. m	30.05	62	49	49	48	93	Calm.				4-4					
Thursday, May 23, 1872	7.00 a. m	29.91	55	47	47	46	92	S. E.	10	.50		4-4					Light rain.
	8.02 a. m	29.87	57	47	47	47	100	S. E.	8	.32		4-4		6.30 a. m		.09	Light rain.
	2.00 p. m	29.73	59	49	49	49	100	N. E.	6	.18		4-4					Fog.
	5.02 p. m	29.73	60	53	53	52	93	N.	5	.12		4-4			1.30 p. m.	.79	
	9.00 p. m	29.72	62	53	53	52	93	N.	4	.08	204	2-4					
	12.02 a. m	29.79	61	49	49	49	100	Calm.				1-4					
Friday, May 24, 1872	7.00 a. m	29.85	62	58	58	55	82	Calm.				0					
	8.02 a. m	29.87	65	60	60	55	71	Calm.				0					
	2.00 p. m	29.90	66	60	60	55	71	S.	8	.32		4-4					
	5.02 p. m	29.88	66	62	62	56	66	S.	7	.24		1-4	E.				
	9.00 p. m	29.90	62	51	51	49	86	S.	6	.18	96	1-4					
	12.02 a. m	29.89	61	48	48	47	93	S. E.	5	.12		4-4					
Saturday, May 25, 1872	7.00 a. m	29.85	60	52	52	51	93	S.	5	.12		4-4					
	8.02 a. m	29.84	61	53	52	51	93	S.	7	.24		4-4		12.35 a. m.	1.30 a. m.	.05	
	2.00 p. m	29.80	62	55	55	53	87	S.	8	.32		4-4					
	5.02 p. m	29.76	62	56	56	54	87	S.	4	.08		2-4	N.				
	9.00 p. m	29.76	61	58	58	57	94	Calm.			152	1-4					
	12.02 a. m	29.82	61	51	51	49	86	Calm.				1-4					

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meterological record for the five days ending May 30, 1872.

Day and date of observation.	Time of observation.	Barometer.	THERMOMETER.		HYGROMETER.		Relative humidity.	WIND.				CLOUDS.		RAIN OR SNOW.		Amount of rain or melted snow.	Remarks.
			Attached.	Exposed.	Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. ft.	Daily velocity.	Amount.	Direction, (moving from—)	Commenced.	Ended.		
Sunday, May 26, 1872	7.00 a. m.	29.91	62	57	57	54	81	Calm.				3-4					
	8.02 a. m.	29.93	65	63	63	55	57	Calm.				2-4	E.				
	2.00 p. m.	29.98	66	65	64	53	43	S.	10	.50		1-4	N.				
	5.02 p. m.	29.95	65	59	59	51	54	S.	12	.72		0					Hazy.
	9.00 p. m.	29.98	63	53	53	48	67	S. W.	9	.40	74	1-4					
	12.02 a. m.	30.00	65	48	48	46	85	Calm.				1-4					
Monday, May 27, 1872	7.00 a. m.	29.95	60	51	51	49	86	Calm.				2-4					
	8.02 a. m.	29.96	64	57	57	52	69	S.	4	.08		1-4					
	2.00 p. m.	29.89	65	60	60	53	60	S. E.	8	.32		1-4					
	5.02 p. m.	29.87	64	59	59	51	54	S. E.	7	.24		1-4					
	9.00 p. m.	29.87	62	50	50	48	86	Calm.			143	2-4					
	12.02 a. m.	29.81	62	53	53	50	80	S. W.	8	.32		4-4		11.55 p. m.			
Tuesday, May 28, 1872	7.00 a. m.	29.79	61	49	49	49	100	S. E.	3	.04		4-4					Light rain.
	8.02 a. m.	29.79	61	52	52	51	93	S. E.	4	.08		4-4				.49	
	2.00 p. m.	29.82	65	55	55	52	80	S.	12	.72		4-4					
	5.02 p. m.	29.81	64	56	56	53	81	S.	8	.32		1-4			8.20 a. m.	.01	
	9.00 p. m.	29.86	63	51	51	50	93	S. W.	7	.24	106	4-4					Light rain.
	12.02 a. m.	29.87	68	48	48	47	92	S. W.	6	.18		1-4		84.40 p. m.	10 p. m.	.11	
Wednesday, May 29, 1872	7.00 a. m.	29.99	71	51	51	48	79	S. W.	7	.24		0					
	8.02 a. m.	29.98	74	54	54	49	67	S. W.	7	.24		0					
	2.00 p. m.	29.98	71	62	62	52	46	W.	12	.72		3-4	E.				
	5.02 p. m.	30.00	70	60	60	51	49	W.	10	.50		2-4	E.				
	9.00 p. m.	30.07	68	56	56	51	69	Calm.			180	4-4					
	12.02 a. m.	30.07	66	52	52	49	79	W.	6	.18		1-4					
Thursday, May 30, 1872	7.00 a. m.	30.12	65	53	53	48	67	W.	5	.12		0					
	8.02 a. m.	30.13	67	57	56	49	57	W.	8	.32		0					
	2.00 p. m.	30.09	68	61	61	52	50	S.	12	.72		2-4					
	5.02 p. m.	30.07	65	56	56	50	63	S.	6	.18		3-4	N.				
	9.00 p. m.	30.04	64	52	52	50	86	Calm.			135	4-4					Threatening.
	12.02 a. m.	29.98	64	51	51	50	93	N. E.	3	.04		4-4					

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

Meteorological record for May 31, 1872.

Day and date of observation.	Time of observation.	Barometer.	Thermometer. Attached.	Thermometer. Exposed.	Hygrometer. Dry bulb.	Hygrometer. Wet bulb.	Relative humidity.	Wind. Direction.	Wind. Velocity per hour.	Wind. Pressure per sq. ft.	Wind. Daily velocity.	Clouds. Amount.	Clouds. Direction, (moving from—)	Rain or snow. Commenced.	Rain or snow. Ended.	Amount of rain or melted snow.	Remarks.
Friday, May 31, 1872	7.00 a. m.	29.95	67	50	50	49	93	N. E.	6	.18	......	4-4	......	....	....	.....	Light rain.
	8.02 a. m.	29.94	67	51	51	50	93	N. E.	8	.32	......	3 4	S.W.	After 2 a. m.	....	.08	
	2.00 p. m.	29.91	70	60	60	55	71	N. W.	4	.08	......	3-4	S.				
	5.02 p. m.	29.92	69	58	58	56	83	W.	2	.02	......	4-4	S. E.	2.30 p. m.	10 a. m. 4 p. m.	.21	
	9.00 p. m.	29.98	68	56	56	55	93	W.	6	.18	134	3-4	E.				
	12.02 a. m.	29.98	69	53	53	51	86	N. W.	4	.08	......	1-4	......	9.30 p. m.	10.15 p. m.	.02	

Station, Portland, Maine. Elevation of ground above sea-level, 35 feet. Elevation of barometer above ground, 19 feet.

PAPER I.

ON THE AURORAL DISPLAYS DURING THE MONTH OF FEBRUARY, 1872.

[*Extracts from the monthly journals of the different stations established by the Signal Service, United States Army.*]

LAKE CITY.

February 12.—A slight aurora.

February 18.—A very bright aurora in the west. This light may have been caused by fire.

February 28.—Spots of aurora throughout the western sky. Weather cloudy.

February 29.—A faint aurora throughout the whole heavens; that in the south somewhat brighter than elsewhere.

JACKSONVILLE, FLORIDA.

February 4.—Aurora polaris visible from 7.25 p. m. until nearly 9 p. m. One nearly perfect arch, streamers quite numerous and of a rose tint, at 8 p. m.

MOBILE, ALABAMA.

February 4.—On the night of the 4th a brilliant aurora was visible from 7 to 11 p. m. It became visible in the east, and spread along the sky from a point south of east to northwest, and at times rising in the sky to an altitude of about 60°. At 10.45 p. m. it rose higher, presenting at that time a most brilliant appearance. A portion extending from east to a point east of north, maintained a uniform color varying but little from a beautiful rose to a deep blood. The portions lying between north and northwest and east and southeast were throughout less brilliant, and varying very often in color, sometimes presenting a whitish appearance, and at other times deepening to a light rose color; at 9.30 p. m. it disappeared for a short time in the north and northwest, but presenting the appearance of an elliptical cloud in the east, its length being about three times its height, and of a beautiful deep blood color. The base was clearly defined, being about 10″ above the horizon. Between its base and horizon a dense haze existed. It disappeared very quickly at 11.05 p. m.

CAPE MAY, NEW JERSEY.

February 4.—Clear and pleasant, with brisk and fresh winds. Barometer rising. Red aurora in the evening, in the southeast.

NASHVILLE, TENNESSEE.

February 4.—Weather cloudy. Wind southeast. An aurora made its appearance about 6½ o'clock, extending from east to west. It assumed no definite shape, but was of an extreme bright red color, and was brightest about 8.36 p. m., when it gradually disappeared, ceasing to be seen at 9.30 p. m.

BALTIMORE, MARYLAND.

February 3.—A brilliant aurora polaris was seen this evening, on the southern horizon, between 8 and 9 o'clock.

BOSTON, MASSACHUSETTS.

February 4.—6.30 p. m.—Fine display of aurora polaris south of zenith, of a deep red color.

KNOXVILLE, TENNESSEE.

February 4.—8½ p. m.—Brilliant aurora; beams shoot almost north to south, and through the zenith. The sky is deep red.

11 p. m.—Aurora disappearing very slowly.

MARQUETTE, MICHIGAN.

February 5.—9 p. m.—Brilliant auroral display. The arch throughout very well defined, being of a brilliant color, and of not much elevation above the horizon, the streamers moving along the arch from west to east, and presenting the appearance somewhat of broad waves of light.

10 p. m.—The streamers having subsided, the arch is better defined, but not of such a bright color.

11.20 p. m.—Aurora more brilliant than ever, streamers shooting up very high. The arch has not been very well defined during the display, rather resembling a great light in the north, with intervals of almost clear sky. Up to 10 p. m. there was no haze or cloud to be seen beneath the arch, but at this writing a few very long, thin, and perfectly straight-edged clouds are seen at the western end of the arch.

February 15.—11.20 p. m.—An aurora is now visible, consisting of an arch, quite well defined, resting upon a bank of thick dark haze at the eastern end of arch: streamers are observed to be shooting both upward and downward, but not to a great elevation upward, while downward they reach almost to the horizon.

11.30 p. m.—The arch has merged into a broad sheet of light, and shows signs of disappearing.

February 26.—8 p. m.—Brilliant aurora; elevation of top arch about 45°, base nearly touching horizon; colors principally white and pale crimson.

8.30 p. m.—Aurora much fainter; but few streamers visible as yet.

11.20 p. m.—Aurora no longer visible.

OSWEGO, NEW YORK.

February 9.—Northern lights commenced at 11.30 p. m., lasted until 1.30 a. m.; not brilliant.

February 19.—Northern lights same as described in article 351, page 176, Loomis. Commenced 7 p. m. and lasted until 12 p. m.; nothing unusual in their appearance.

ROCHESTER, NEW YORK.

February 28.—The assistant observer, Private Tighe, reports, at 9 p. m. last evening, the existence of two luminous arches, extending across the northern sky, being about 2° apart, and the upper one, the more luminous of the two, about 60° above northern horizon. He is unable to give duration of this phenomenon.

LYNCHBURGH, VIRGINIA.

February 4.—The aurora borealis was visible during the night of the 4th. At 7 p. m., owing to the cloudy state of the atmosphere, a reddish hue of the clouds was the only indication of the presence of the aurora. As the night advanced the weather became clear, and that quarter of the heavens from northwest to southwest, from zenith to horizon, presented a bright red appearance. The aurora grew dim in the southwest and brighter in the west and northwest at 10.30 p. m. At midnight the lights became very bright due north, resembling daylight, while in the rest of the heavens the aurora entirely disappeared.

NEW YORK CITY.

February 4.—Clear weather and brisk northwest winds. At 6.30 p. m. a brilliant aurora appeared in the north, which soon overspread the whole northern heavens. At 7 o'clock it had extended eastward and upward until it occupied a space in the southeast from about 15° to 50° above the horizon, about 70° in breadth, and assumed a blood-red tinge, so dense at times as to obscure the stars. On either side of the crimson was a perpendicular line about 10° in width and 50° in length, of a bright orange and green tint. The display lasted until about 11 p. m., when it gradually disappeared.

PHILADELPHIA.

February 4.—On the north the aurora borealis was displaying, while on the south the aurora australis reflected back with tenfold beauty the light of its cold antipodes. As at 7.20 p. m. I opened the latticed door of the shelter, a most brilliant display of glorious crimson light struck upon my gaze. Further observation discovered that a blood-tinted light, ever varying, was extending from the south to the southeast. At times the light would subside to a mellow crimson, and again, with gentle flushings, would shoot up toward the zenith. At first I thought the lurid light was the reflection of some conflagration upon the sky; yet upon opening the east door, I discovered that the northern horizon was also lighted by a pale silvery light, which at times would assume a tinge of pale green. These phenomena remained visible for the greater part of the night, for at 11.43 p. m., when my last observation was made, the rays of the aurora borealis were plainly and magnificently visible above the bank of the stratus clouds that interposed above the horizon. The aurora australis had faded; "'twas 'neath a cloud as dark as woe," for huge and black banks of stratus had piled themselves on the horizon, so lately illuminated by the soft crimson light of the australis. The sky was becoming rapidly overcast, and at 1 a. m. was entirely obscured.

SAINT PAUL, MINNESOTA.

February 4.—A display of aurora was visible in the north and northwest. It was first seen at 6 p. m.; did not present any particular form, but was a diffused light. It had the appearance of crimson sand falling to the earth, then rolling in billows and waving toward the south, and disappearing. It became more brilliant at 8 p. m., and was then of a deep rich crimson color.

WASHINGTON, D. C.

February 4.—The auroral display first attracted the attention of the observer at 7.15 p. m. Presenting a brilliant carmine color, it gradually crept up from the northeastern limit of the horizon till it reached the zenith, when the rays began to appear divided, and presented an appearance as of a flickering flame darting down toward the southwest.

Apart from this track across the heavens there appeared curious globe-like spots of about 15° in diameter, having the same carmine color, and being arranged by the side of the path of the aurora; not less than three of these spots were noticed.

The auroral track was about 40° in width, less brilliant at the borders than in the center, and when complete could not be seen below an angle of 30°. The observation was continued until 9.15 p. m., the phenomenon presenting but slight changes.

Another, but not confined to any particular part of the heavens, was observed for a few moments at 2 a. m February 5. The color was the same as the first, but was somewhat less brilliant.

CHICAGO, ILLINOIS.

February 4.—At 9 p. m. it cleared, and a slight aurora was perceptible. These have always or nearly always been found at this station to be precursors of colder weather and northerly winds.

February 19.—A slight dawn-like aurora was observed in the evening.

February 27.—In the evening there was a slight aurora, resembling the dawn.

KEY WEST, FLORIDA.

February 4.—At 7 p. m. a faint light, without any definite form or shape, was observed in the northeast, reaching from the east to the north and extending half-way to the zenith; gradually moving westward, passing by the north, until about 2.30 a. m., when its center had reached the western point of the horizon, and could no longer be observed, in consequence of the sky becoming overcast with clouds. A dense haze was observed at its base during the entire time, and at 9 p. m. large black clouds moved from the west and passed by its base. When it first appeared its color was very faint, and after intervals of five minutes it increased in brightness, its color becoming a rose hue, and again, after an interval of five minutes, it would entirely disappear, and again re-appear, very faint at first, but would gradually increase in brightness, and so on during the entire time it could be observed. It was brightest at about 1 a. m., when it was of a red color, the amount of moisture in the air at the time being 88 per cent.

CHARLESTON, SOUTH CAROLINA.

February 4.—An aurora visible in the northeast at 7 p. m., extending from zenith to the horizon, of a light red color at first, but died away into a pale yellow at 9 p. m., when the haze became very dense.

GALVESTON, TEXAS.

February 4.—Cloudy, barometer falling. Brilliant aurora, color bright red; began 6.45 p. m.; too cloudy to see it plainly till about 10.50 p. m., when the sky cleared. It gave a steady light, shining up about 35° above the horizon. Began to disappear 11.30 p. m.; totally disappeared 11.40. Barometer falling, temperature 57° and relative humidity 100. Wind southeast, 16 miles per hour. Heavy dew falling.

DU LUTH, MINNESOTA.

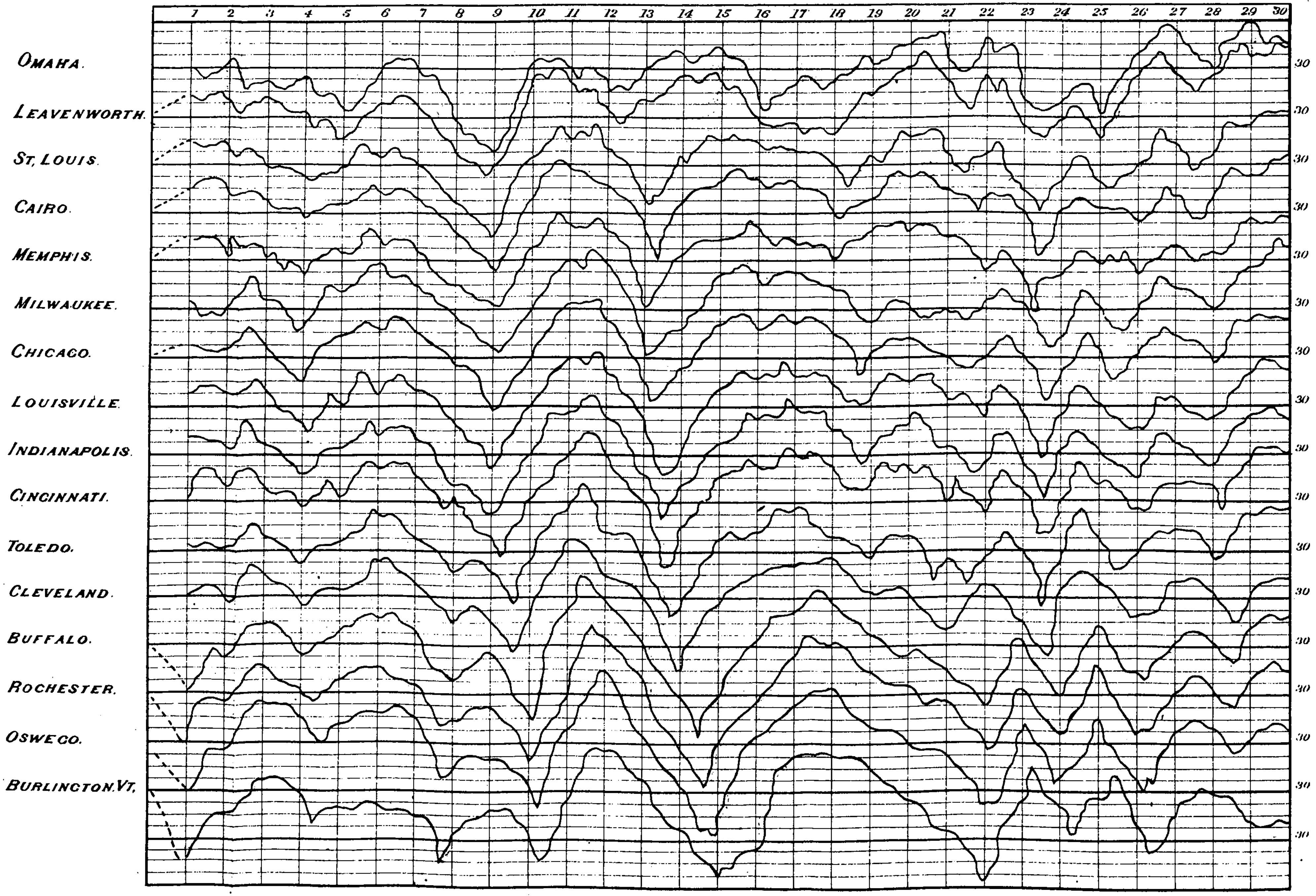
February 4.—At 6.30 p. m. very red light running east and west. South of Du Luth it was brightest at the east. At 9 p. m. beams began to shoot up at the north; it was not very brilliant.

MILWAUKEE, WISCONSIN.

February 4.—Snow; aurora in the southeast.

BAROGRAMS FOR NOVEMBER 1871.

Office, Chief Signal Officer U.S. Army, Washington, D.C.



PAPER J.

DESCRIPTION OF THE STORM OF NOVEMBER 11-16, 1871, IN ITS PROGRESS FROM OMAHA EASTWARD.

At Omaha the barometer commenced falling on the morning of the 11th from 30.19; temperature raised 18°; barometer continued falling until the morning of the 13th to 29.83, when it rose rapidly; .70 of an inch of rain had fallen; wind unsteady, from fifteen to twenty-five miles per hour, northwest.

At Leavenworth, barometer 30.40, began to fall at 7 a. m. on the 11th; continued falling until the afternoon, when it held pretty steady until 7 a. m. of the 12th, again falling rapidly until midnight to 29.95; thermometer raised 25°; 1.10 rain-fall; wind thirty-five to thirty-eight miles, first from southeast, changing to northwest by the south. At this time one central area of high barometer was about Cairo, and another about Chicago and Milwaukee.

At St. Louis the barometer, 30.38 at noon of the 12th, began falling; continued until 6 p. m. of the 13th to 29.70; thermometer raised 15°: a high wind followed at midnight of the 14th from northwest, and 1.94 inches rain fell. The high area is now in Pennsylvania, and the low area west of Omaha.

At Cairo the barometer began falling at 3 a. m. of the 11th; continued falling rapidly until near midnight of the 13th-14th, at which time the wind raised to thirty-five miles per hour, first from the southeast, and changing to northwest. It began to rain at 6.30 a. m. of the 13th; amount, 1.83 inches.

At Davenport the barometer, 30.38 at 7 a. m. of the 12th, fell rapidly until its minimum, at noon of the 13th, was 29.83; the temperature rose 15°; wind brisk from east, changing to southeast, thence northwest. Rain began at 7.20 p. m. of the 12th, continued until 9.40 a. m. of the 13th; amount, .61 of an inch.

At Chicago the barometer, 30.47, began falling at 7 a. m. of the 12th; continued until midnight of the 13th-14th to 29.66; at 10.53 p. m. of the 13th the wind raised to 33 miles, from northwest, having veered from the south. Rain began at 6.30 a. m. of the 13th, ceased at 12.30 a. m. of the 14th; amount, 1.18 inches.

"Up signals" ordered at 6.40 p. m. of the 13th; "Down" at 1.13 a. m. of the 15th; thirteen hours' notice was given of the storm. Observer reports, "Signal justified; several vessels staid in harbor and escaped the gale."

At Milwaukee the barometer, 30.49, began falling at 7 a. m., and continued until 6 p. m. of the 13th to 29.68, followed by brisk wind from northwest. Rain commenced falling at 7.30 a. m. of 13th; ended at 2 a. m. of 14th; amount .60 inch. "Up signal" was ordered at 7 p. m. of 13th, thirteen hours previous to the storm. Observer reports: "No damage to vessels, as all remained in harbor."

At Memphis the barometer, 30.31 at 6 a. m. of the 12th, commenced falling; reached 29.62 at 4 p. m. of the 13th; temperature rose 20°; wind twenty miles an hour from the northwest; rain began at 6 p. m. of the 12th; amount, .50 inch.

At Louisville, on the morning of the 12th, the barometer, 30.40, commenced falling, and fell rapidly until 8 a. m. of the 14th to 29.44, the thermometer rising 14°. At 7 a. m. of the 14th the wind rose to twenty-two miles, and at 4 p. m. to twenty-five from the northwest. Rain began at 8 a. m. of the 13th; ended at 3 p. m. of the 14th; amount, 1.15 inches.

At Indianapolis the barometer commenced falling at 7 a. m. from 30.45; fell to 29.45 at 6 a. m. of the 14th; thermometer rose 17°; wind brisk from southeast; changed to northwest; rain began at 8.30 a. m. of the 13th; ended at 4.20 p. m. of the 14th; amount, 1.93 inches.

At Grand Haven the barometer fell from 30.56, 6 a. m., on the 12th, to 29.58, 7 a. m. on the 14th; temperature rose 20°; the wind at 5 p. m. of the 14th rose to thirty-one miles from the north; rain commenced at 9 a. m. of the 13th, ended at 8 a. m. of the 14th; amount, 1.06 inches.

"Up signals" was ordered at 12.37 p. m. of the 14th, giving five hours' notice of the gale.

At Cincinnati the barometer commenced falling about 7 a. m. of the 12th from 30.55; fell rapidly to 29.45 at about 7 a. m. of the 14th; temperature rose 25°; rain commenced at 12.30 p. m. of the 13th; ended at 8 p. m. of the 14th; amount, 2.21 inches; the wind at 11 p. m. of the 14th rose to thirty miles an hour from northwest.

At Toledo the barometer began to fall during early morning of the 12th; fell until 4 p. m. of the 14th; at 11 p. m. of the 14th the wind had risen to a gale from the northwest; rain fell to the amount of 3.19 inches. "Up-signals" was ordered at 11 a. m. of the 14th, giving twelve hours' notice.

At Detroit the barometer at 30.58 began to fall on the morning of the 12th; fell rapidly until the morning of the 14th to 29.48. The storm reached its height at midnight of the 14th-15th, blowing a gale from the northwest; rain-fall 1.95 inches. "Up signals" ordered twelve hours previous to gale.

At Cleveland the barometer 30.58, at 7 a. m. of the 12th, fell rapidly to 29.35 at 4. p. m. of the 14th; at 11 p. m. of the 14th the wind rose to 36 miles an hour, unsteady between northwest and southwest; thermometer raised 25°, and fell rapidly following the storm; barometer rising rapidly; rain-fall 1.54 inches. "Up signals" ordered at 11.10 a. m., twelve hours before the gale. Observer reports: "Screw H. C. Williams, Captain Fuller, saw signal being hoisted, but left port. She was obliged to put back about 7 p. m., and in endeavoring to enter the harbor struck the pier and went down; one of the crew drowned. Some other vessels which put out returned in a damaged condition, and several lives lost. Many steamers, schooners, &c., staid in port on account of warning signal."

At Buffalo the barometer 30.62, at 7.28 a. m. of the 12th, fell to 29.23 at 11.28 p. m. of the 14th; at 3.30 a. m. of the 15th the storm began, and at 7.30 a. m. was at its highest. The observer states: "An unknown amount of property and perhaps a great many lives have been saved. The warning was given some fifteen hours before the violence of the storm was felt at this station. It was heeded by marine men, and no vessels left port during its display. The storm was the most violent known on the lakes for years." Rain fell to the amount of 2.70 inches.

At Rochester the barometer 30.63, at 7.32 a. m. of the 12th, fell to 29.25 at 7.32 a. m. of the 15th; temperature raised 24°. The wind at 2 p. m. of the 14th raised to 30 miles an hour, first from southeast, then changed to northwest. Rain fell to the depth of 2.09 inches.

At Oswego, at 7.37 a. m. of the 12th, the barometer at 30.61 fell rapidly to 29.29 on the 15th at 7 a. m.; thermometer raised 13°. The gale commenced at 6.45 a. m. of the 16th. "Up signal" was ordered at 1.15 on the 14th, twenty-two hours before the gale reached its height. Many vessels were detained by the signal. Some put out and returned in a damaged condition. One vessel went ashore and was a total wreck.

This storm did not reach Montreal, although the barometer fell nearly an inch; the wind did not exceed fourteen miles, but a heavy fall of rain, amounting to 3.54 inches, is recorded.

At Burlington, Vermont, the barometer fell 1.03; the wind raised to eighteen miles, and but .18 inch rain fell. At the same time (between the 13th and 16th) another storm, or part of this one, was moving up the Atlantic coast.

PAPER K.

THE STORM OF MARCH 1 AND 2, 1872, ALONG THE ATLANTIC COAST.—(With seven maps.)

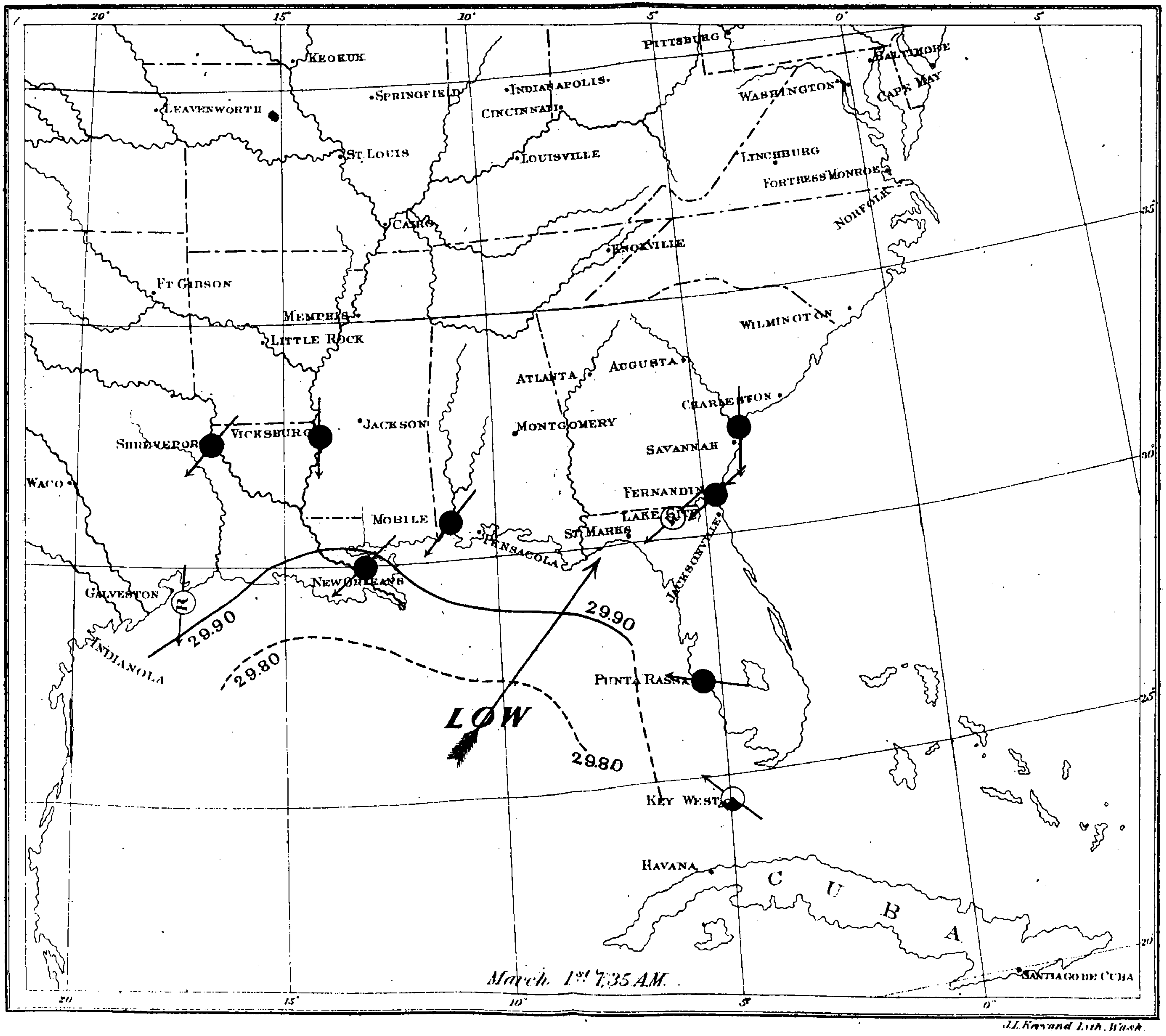
The morning telegraphic weather reports of March 1, 1872, from the signal stations along the Gulf coast, indicated an area of low barometer to be rapidly developing in that region. The barometer at New Orleans was then 29.87, and the direction of the wind at all of the Gulf stations was northeast, while at Punta Rassa and Key West westerly winds prevailed. The probabilities issued on that morning predicted falling barometer for the eastern gulf, with continued cloud and rain and increasing easterly winds. Toward the afternoon the wind at Punta Rassa and Key West changed to south and southwest respectively, and the storm-center was rapidly approaching the northwestern coast of Florida. The barometer fell quite rapidly at the Gulf and south Atlantic stations, and rain set in at New Orleans, Mobile, Lake City, Jacksonville, Savannah, and Charleston, and by 4.35 p. m. (Washington mean time) about one-half inch had fallen at most of these stations. The wind was still northeast there, and reached a velocity of twenty-two miles at New Orleans, but the lowest barometer was reported from Lake City, 29.71—falling .21 in eight hours.

The probabilities in reference to this storm, issued at 7 p. m., read as follows: "The low barometer south of Western Florida move northeastwardly into the South Atlantic States during the night; the area of rain extending by Saturday morning to Virginia," and dangerous winds were predicted for the South Atlantic coast.

The storm, now fully developed, moved during the evening into Georgia, with fearful violence, cutting off telegraphic communication with Florida, and at 11.35 p. m. (Washington mean time) the barometer at Savannah had fallen to 29.37, a depression of .52 in eight hours, with a northeasterly gale blowing sixty miles an hour. It was raining then at Wilmington, Augusta, Charleston, and Savannah, and snowing at Lynchburg and Knoxville.

The storm was then predicted to move, or to continue moving, northeastward along the South Atlantic coast, the area of rain to extend during the night over the middle Atlantic coast, and cautionary signals were promptly ordered and displayed by 2 a. m. of March 2, at Savannah, Charleston, Wilmington, and Norfolk, and the further progress of this severe storm will show how fully these predictions were verified.

The reports of the morning of March 2 showed the storm-center to be central over the southern coast of North Carolina, the barometer at Wilmington being extremely low, 29.27, having fallen .53 during the latter part of the night; at Charleston 29.47, at Norfolk 29.47, (wind fifty-five miles per hour,) while the pressure gradually recovered at the more southern stations. The heaviest rain-fall was then reported from Savannah, being nearly one inch in a few hours. The steamer Rising Star, *en route* from New York to Aspinwall, encountered this storm when entering the Gulf stream on the morning of March 2; the barometer fell



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BALTIMORE
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LINCHBURG
FORTRESS MONROE
NORFOLK
CAIRO
KNOXVILLE
FT GIBSON
MEMPHIS
LITTLE ROCK
WILMINGTON
ATLANTA
AUGUSTA
CHARLESTON
JACKSON
MONTGOMERY
SHREVEPORT
VICKSBURG
SAVANNAH
WACO
FERNANDINA
LAKE CITY
MOBILE
PENSACOLA
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JACKSONVILLE
GALVESTON
NEW ORLEANS
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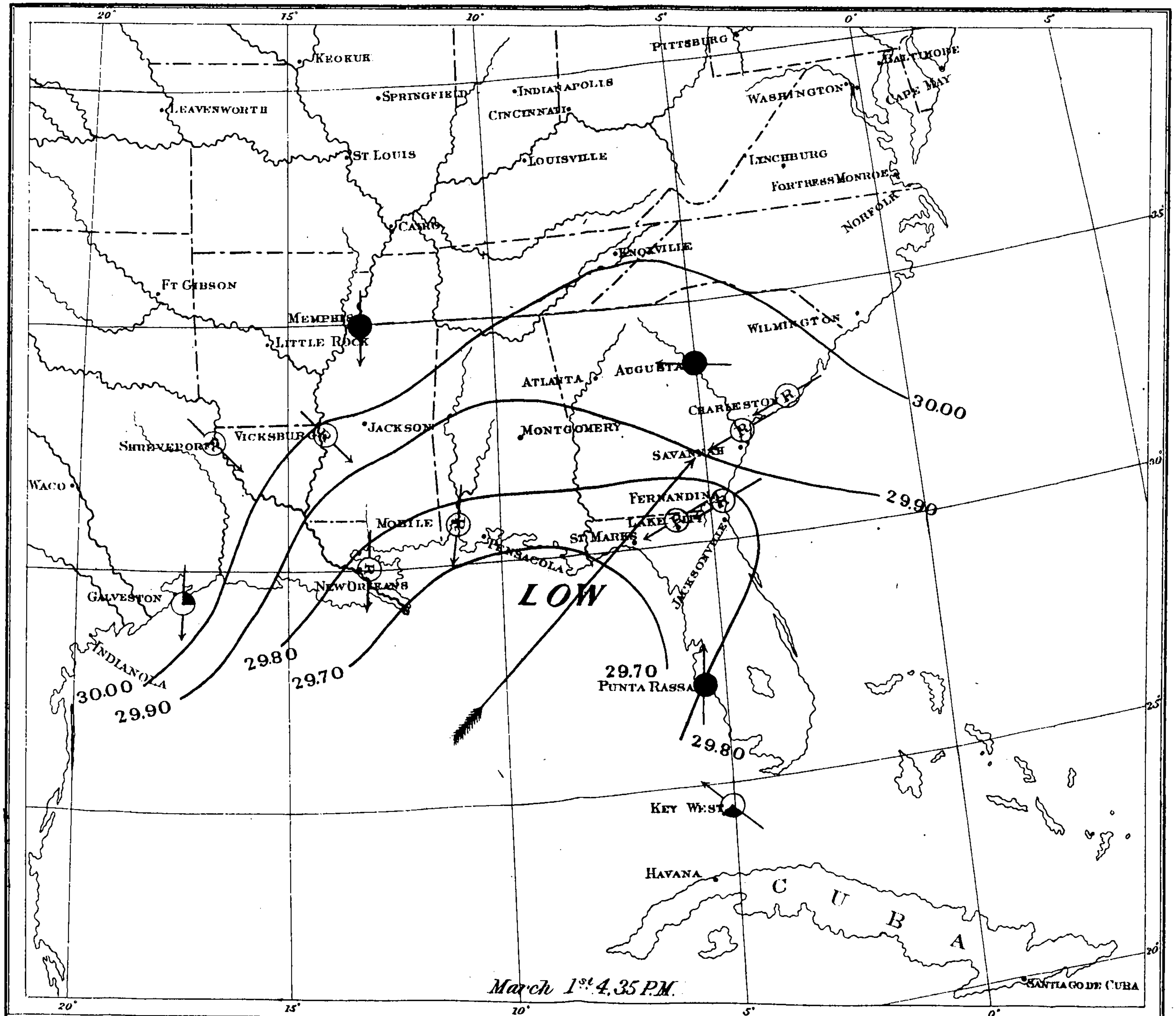
March 1st 7.35 A.M.
J.L. Kavand Lith. Wash.



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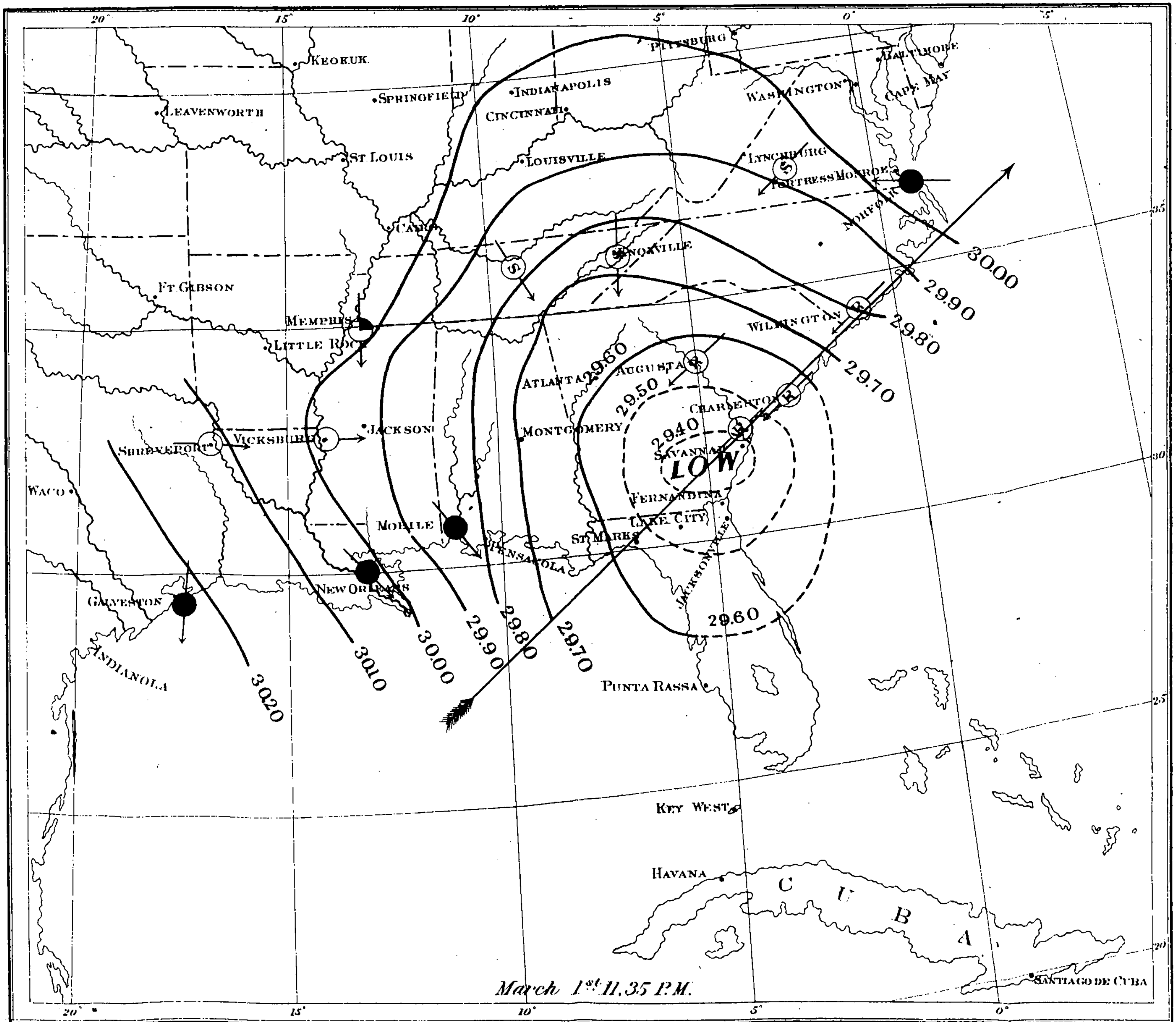

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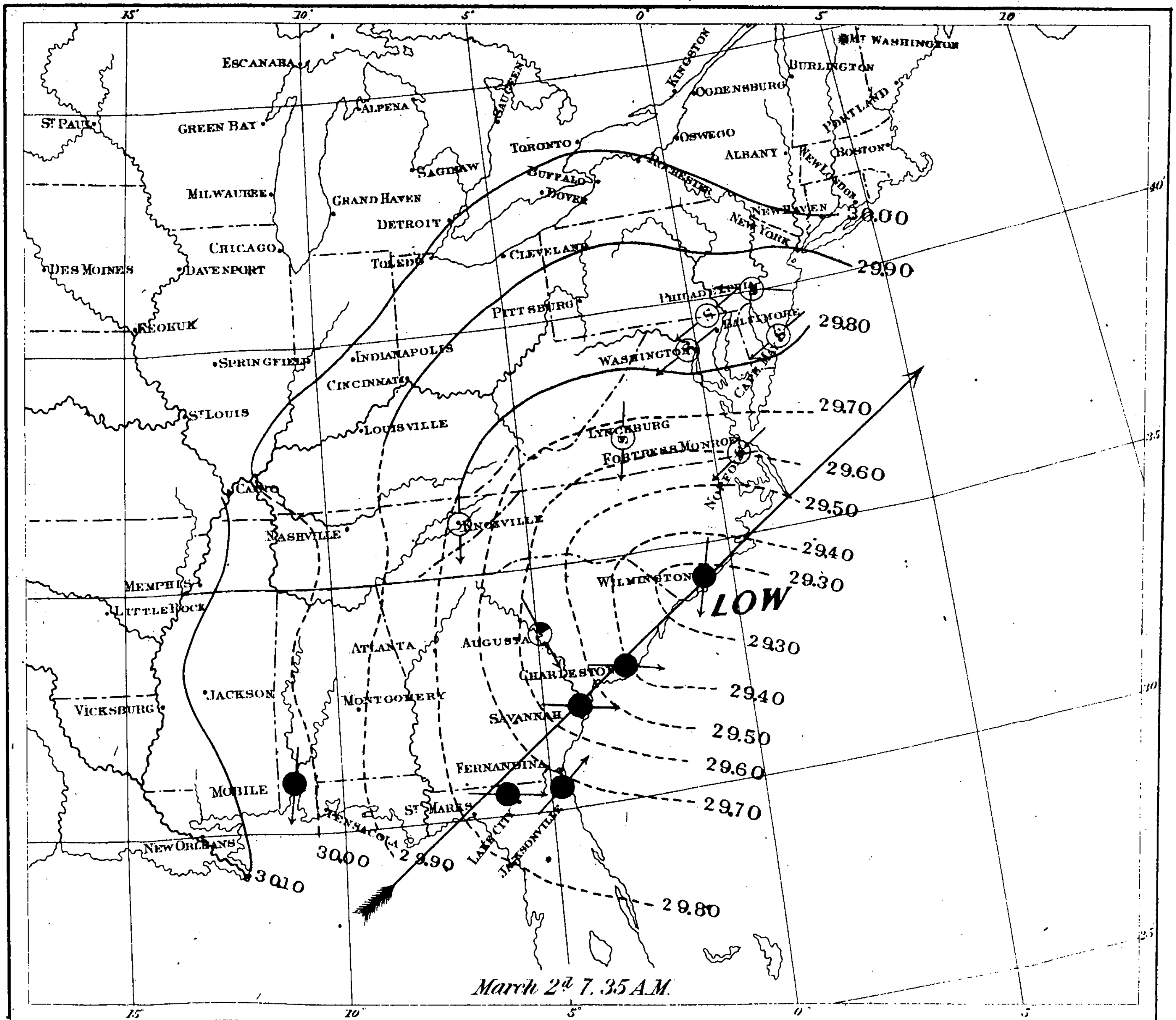
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Buffalo
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New London
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Grand Haven
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Des Moines
Davenport
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Philadelphia
Pittsburg
Baltimore
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Washington
Springfield
Indianapolis
Cape May
Cincinnati
29.70
St Louis
Louisville
Lynchburg
Fortress Monroe
Norfolk
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Cairo
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Knoxville
Nashville
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Memphis
Wilmington
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Little Rock
LOW
Augusta
Atlanta
29.30
Charleston
Jackson
Montgomery
29.40
Vicksburg
Savannah
29.50
Fernandina
29.60
Mobile
St Marks
29.70
Pensacola
Lake City
Jacksonville
New Orleans
30.00
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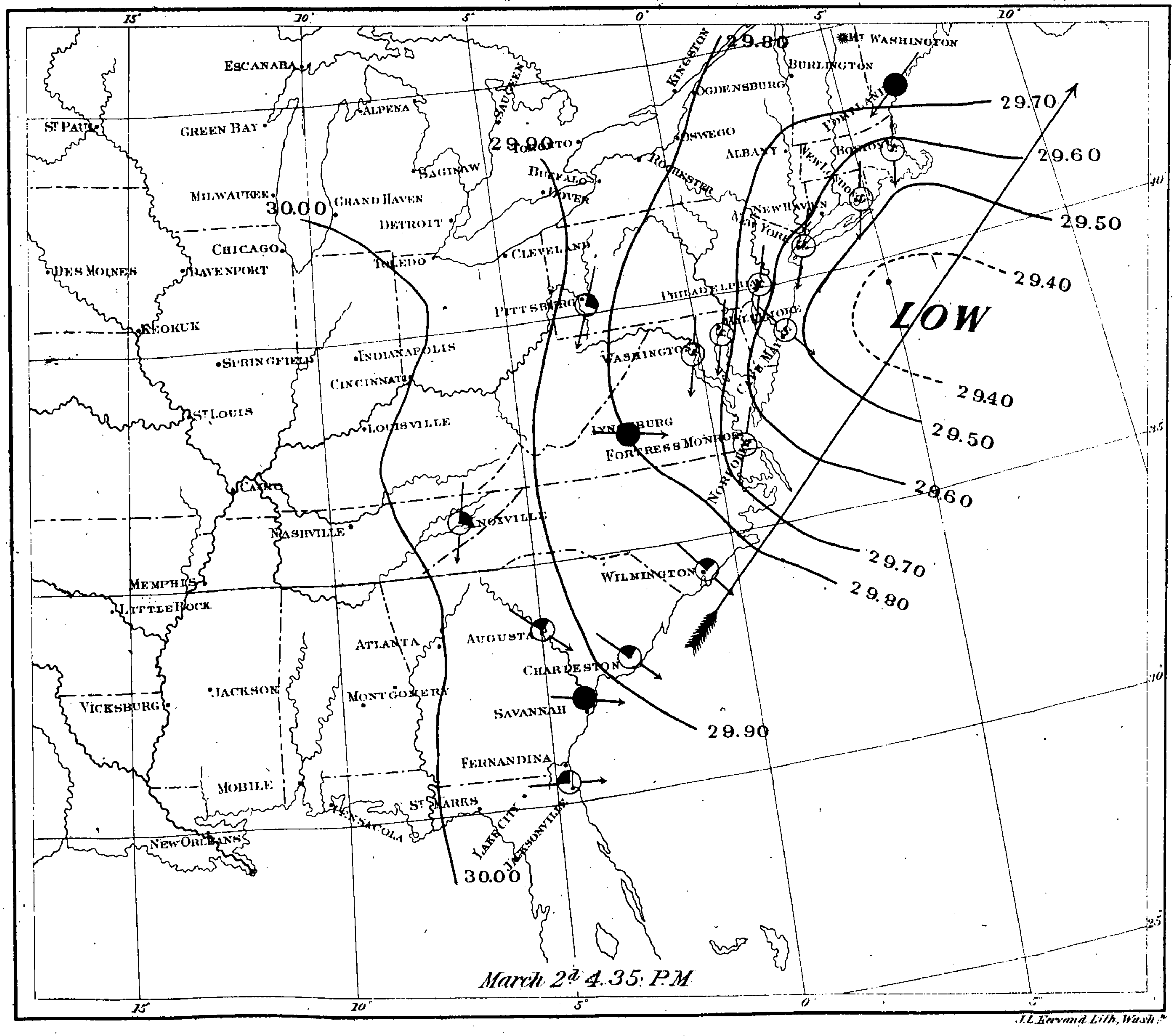
29.80
March 2d 7.35 A.M.
M. Fevaud Lith. Wash.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BURLINGTON
MT WASHINGTON
KINGSTON
PORTLAND
BOSTON
NEW LONDON
NEW HAVEN
NEW YORK
ROCHESTER
BUFFALO
DOVER
MILWAUKEE
GRAND HAVEN
DETROIT
CHICAGO
TOLEDO
CLEVELAND
DES MOINES
DAVENPORT
PITTSBURG
PHILADELPHIA
BALTIMORE
KEOKUK
SPRINGFIELD
INDIANAPOLIS
CINCINNATI
WASHINGTON
CAPE MAY
ST LOUIS
LOUISVILLE
LYNCHBURG
FORTRESS MONROE
NORFOLK
CAIRO
NASHVILLE
KNOXVILLE
WILMINGTON
MEMPHIS
LITTLE ROCK
ATLANTA
AUGUSTA
CHARLESTON
VICKSBURG
JACKSON
MONTGOMERY
SAVANNAH
FERNANDINA
MOBILE
ST MARKS
PENSACOLA
LAKE CITY
JACKSONVILLE
NEW ORLEANS
LOW
29.80
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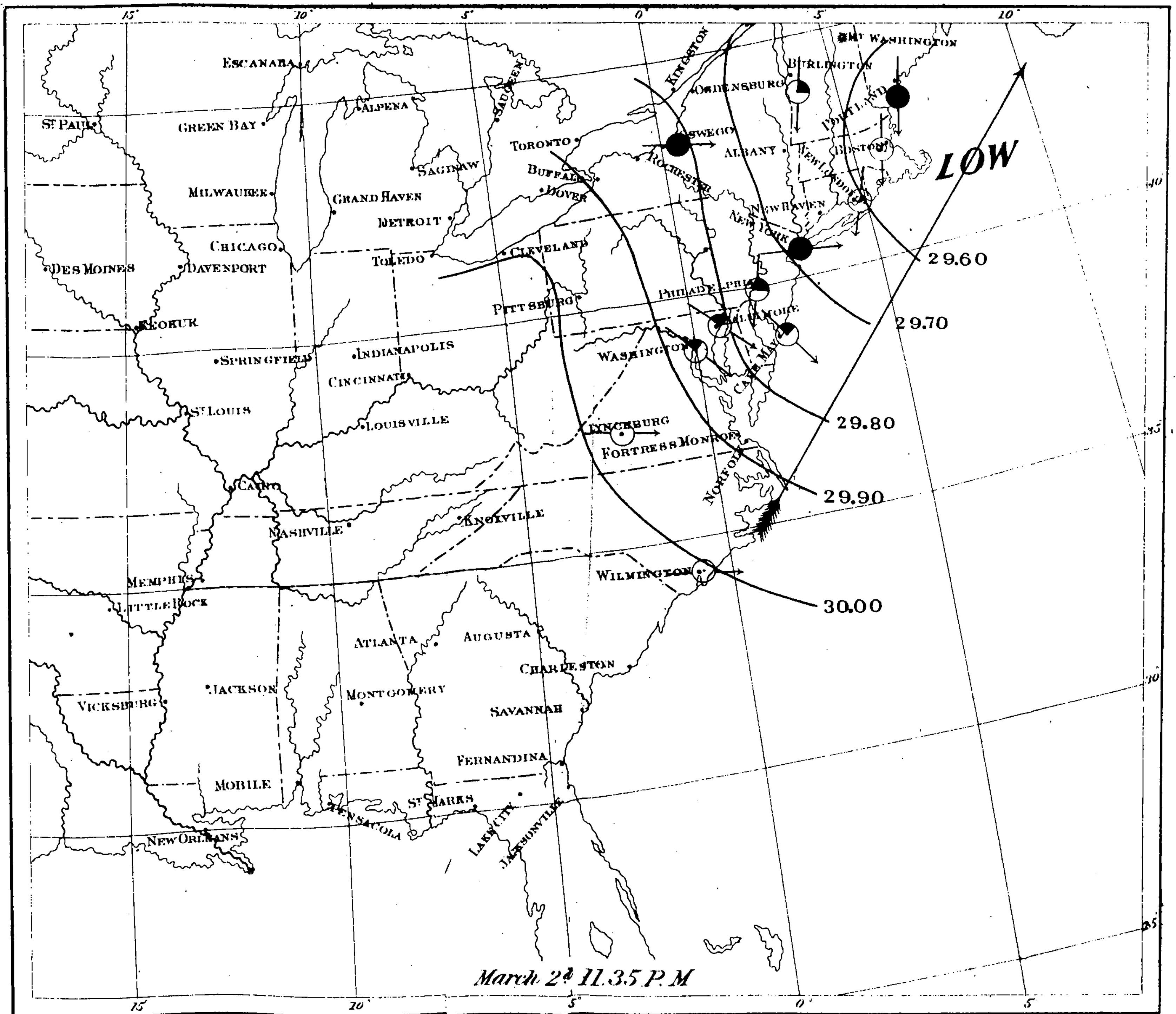
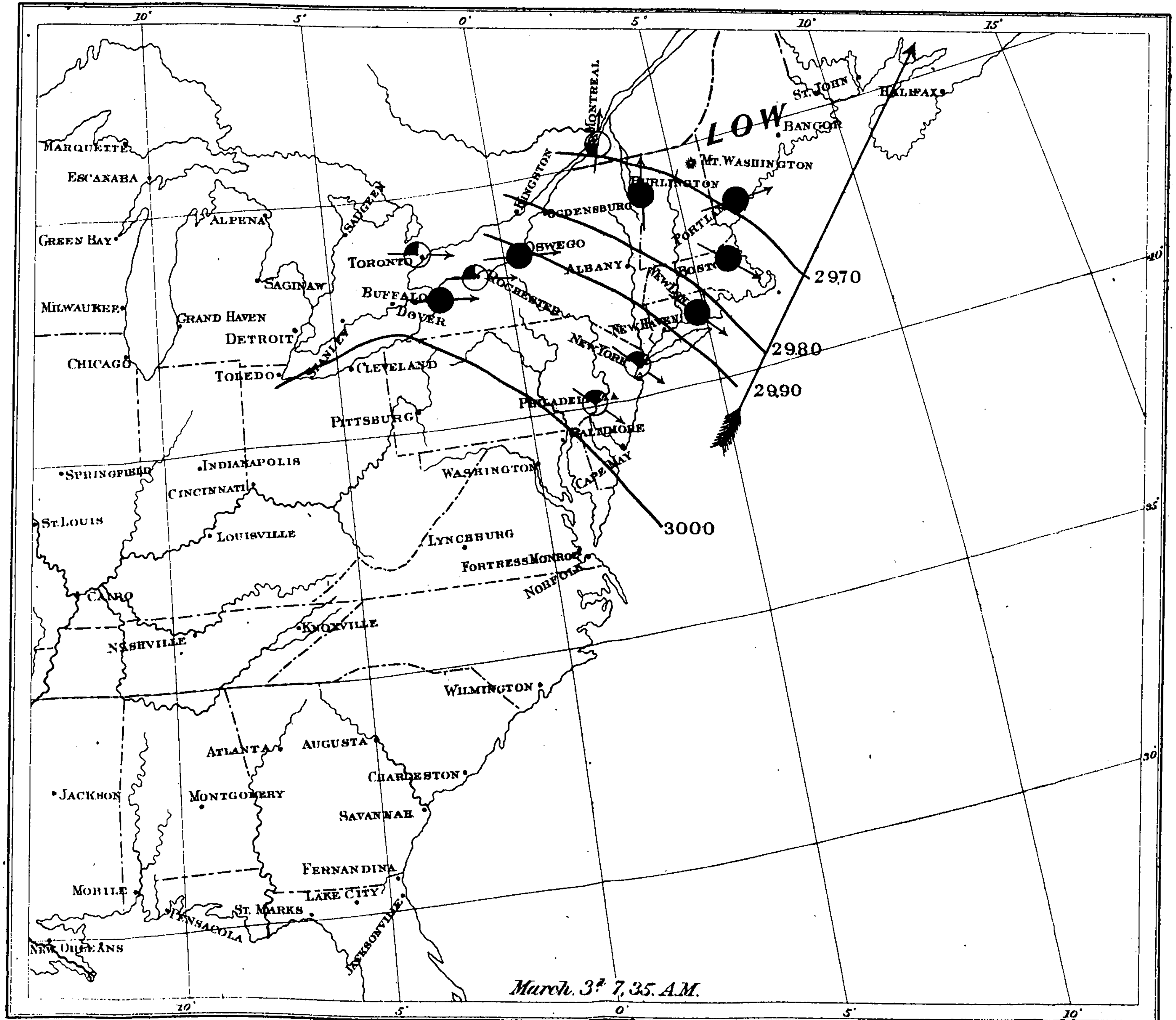
March 2d 4.35 P.M.
J.L. Kervand Lith, Wash.



March 2d 11.35 P.M.

A. Hoen & Co. Lith. Wash.



March. 3d 7, 35. A.M.

J. L. Kervand, Lith. Wash.

.76 in eight hours; and when in longitude 74° 12′ and latitude 34° 3′, at 12 m., the barometer stood at 29.00. A "tremendous sea" raged all that day, and the vessel made hardly any progress. The storm moderated toward midnight, and the steamer escaped without any serious damage.

The morning probabilities in regard to this storm read: "The very low barometer over the southern North Carolina coast move northeastwardly over Cape Hatteras, preceded by very brisk and high northeasterly winds from thence to Cape Cod; the area of snow extending northeastward over the southern New England States during the day."

The display of cautionary signals at Wilmington and Norfolk was continued, while orders to hoist them were at once sent to Baltimore, Cape May, New York, and New London.

As predicted, the storm kept moving northeastwardly along the coast with terrific violence, and by 4.35 p. m. its center was evidently at some distance off the New Jersey coast, and the area of snow had extended into Massachusetts, with rapidly falling barometer; the barometer fell at Philadelphia to 29.67; at New York, to 29.67; at Cape May, to 29.48—the wind at the latter place being northwest, and blowing thirty-two miles per hour, and one continuous snow-storm prevailed along the coast from Portland, Maine, to Norfolk, Virginia.

The afternoon probabilities predicted the storm to still continue moving northeastwardly during the night, and the midnight reports of this day showed its center off the coast of Maine, with undiminished force, the barometer at Portland being 29.57, and at Boston 29.55, while the pressure began to recover south of New York. On the morning of March 3, the pressure was still very low over and along the coast of Maine; but the storm-center had already passed within the limits of the stations, and shipping disasters reported from Halifax showed that the storm must have been very severe over New Brunswick and Nova Scotia.

The accuracy with which the early development and the subsequent progress and path of this storm has been traced and predicted by this Office, prevented many disasters, both on land and sea, and the reports from the stations where cautionary signals had been displayed state that numerous vessels were kept in port, thereby saving many lives and an immense amount of property. Savannah, Georgia, papers estimate the amount of property saved at that and other southern ports at "probably several millions."

PAPER L.

THE STORM OF SEPTEMBER 28 AND 29, 1872.

(With seven maps.)

A rapid fall of the barometer at Fort Sully, Dakota, on the 27th of September, indicated the existence of an area of low pressure in the far Northwest; and, although no further telegraphic reports were received from that station at midnight of the same day, it was evident that a storm was moving down the Upper Missouri Valley, by the diminishing pressure reported from Omaha and Leavenworth. The wind was blowing from a southerly direction from Omaha eastward to Lake Michigan, and southward as far as Saint Louis.

The reports, received the following morning, showed that the storm had advanced very rapidly during the night southeastward, as predicted; and its center was then somewhere between Leavenworth and Keokuk. The wind at Omaha had already changed to northwest; while at Leavenworth it was north, at Saint Louis east, at Keokuk southeast, and at Davenport east; thus completely encircling the storm center, and clearly defining its rotary motion. It was also raining hard at Saint Louis, Keokuk, and Cairo. The "probabilities" issued at 10 a. m. on the morning of the 28th predicted diminishing pressure and rain for the upper lakes and Lake Erie; thus giving a timely warning of the approach of the storm along the lakes, where the barometer was then still above the normal height. The storm path had been due southwest so far; but the afternoon reports of the 28th showed that the predictions from this Office, viz, falling barometer on the upper lakes, &c., were fully justified, as the pressure diminished very rapidly at Chicago, Grand Haven, and Toledo; and it was then evident that the storm, now fully developed, would sweep across the lakes, and cautionary signal orders were at once telegraphed to Milwaukee, Chicago, Grand Haven, Toledo, Cleveland, Buffalo, and Detroit; but were not received at Milwaukee and Grand Haven, through the neglect of the telegraphic company charged with their transmission and delivery.

The storm was then central over the southwestern portion of Illinois, with heavy rain and very brisk northwesterly winds at Keokuk, Davenport, and Chicago; while at Saint Louis, Cairo, Louisville, and Indianapolis, the wind had already changed to a southerly direction. The lowest barometer was now reported from Saint Louis, being 29.44; and from Lake Erie westward, toward the storm center, the atmospheric pressure diminished .10 of an inch for every sixty miles. The storm moved northeastwardly during the day, with terrific northeasterly gales on Lake Michigan, and westerly gales on Lake Erie; and from the midnight reports of the 28th, was found to be central over Northern Indiana. The lowest barometer was then reported from Chicago, being 29.35; and heavy rain prevailed at Chicago, Milwaukee, Grand Haven, and Detroit.

The midnight "probabilities" predicted the storm to continue moving northeastward over the lower lake region, with easterly gales for Lake Michigan, backing to northwesterly toward the morning; and for Lakes Erie and Huron, shifting to northwesterly during the evening; and for Lake Ontario, shifting to northwesterly toward the night. And the cautionary signals, hoisted at the lake-stations in the forenoon, were continued.

These prognostications were verified with fatal punctuality; and the severity of the storm over the lakes, during the following night, was almost unprecedented; and, as its approach had been announced from 8 to 12 hours in advance, the amount of property saved must have been immense. Still, quite a number of shipwrecks occurred, the storm overtaking vessels that had not been within reach of the warnings.

The reports of the morning of the 29th showed that the storm was then central over Northern Michigan, and that the pressure had diminished eastward to the Atlantic coast, while brisk westerly winds prevailed over Lake Michigan, and southwesterly over Lake Erie.

The storm was then predicted to continue moving northeastward into Canada, and down the Saint Lawrence Valley, with northwesterly gales over Lake Huron during the day, and over Lake Ontario during the night; and the warning-signals, already ordered on Lake Ontario, were continued; and the Canadian stations were properly notified of the approaching storm.

Lake Huron came in for its full share of the storm during the day, with heavy rain at Alpena, Saugeen, and Toronto; and the storm-center reached Canada in the afternoon, and the Saint Lawrence Valley on the morning of the 30th, thus having traveled a distance of nearly 2,400 miles in about eighty-four hours, at an average velocity of thirty miles an hour. The path of this storm described an almost perfect rectangle, with its vertex at Saint Louis; and its severity, especially after reaching the lake-region, exceeded anything experienced on those waters for years.

PAPER M.

ROCHESTER, NEW YORK, *September* 5, 1872.

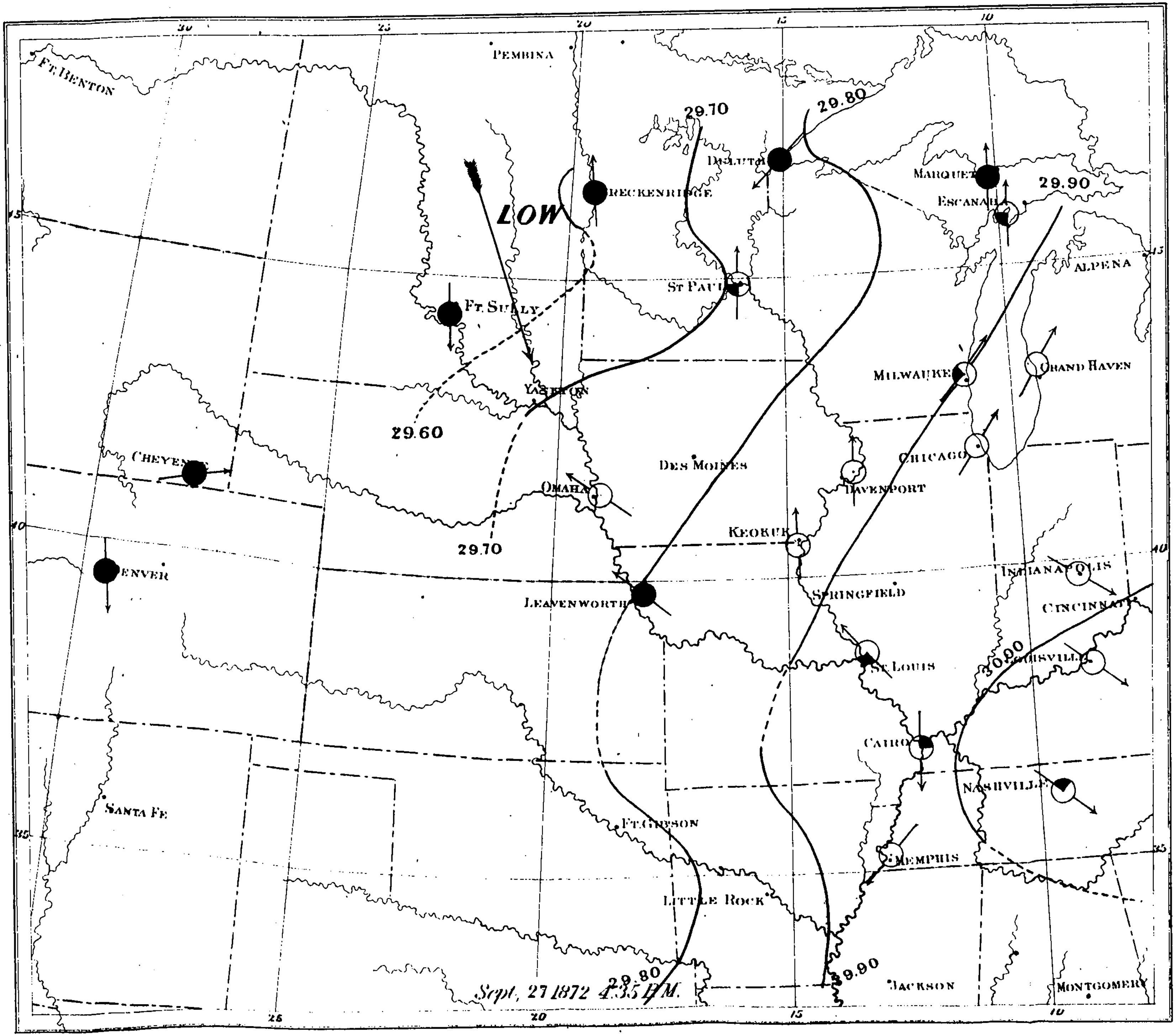
GENERAL: In accordance with Special Order No. 103, dated Office of the Chief Signal-Officer of the Army, August 16, 1872, and written instructions previously received from you, I proceeded to Rochester, New York, to make such observations as you had directed, in the balloon "Aurora," which was expected to ascend from Falls Field, Rochester, on Thursday, the 29th day of August, at 3 p. m.

Having made careful comparisons of the different instruments, with the several standards, previous to leaving Washington, the comparisons were renewed upon arriving in Rochester with the instruments at the observer's office in Power's Block.

All necessary arrangements were made, and I repaired to the ground selected for the ascension some time previous to the hour named, with the instruments in readiness to ascend.

Professor Samuel A. King, the aeronaut, had selected his balloon "Aurora" for this ascension. This balloon and the car belonging to it were made in France, and have been used by Professor King in various ascensions during the past two or three years, the capacity being about 20,000 cubic feet. The balloon was two-thirds inflated on my arrival on the ground. Professor King informed me that owing to the heavy wind then prevailing, the fact of its blowing directly toward Lake Ontario, and the threatening state of the weather, he had decided to postpone the ascension until Monday, September 2, at 3 o'clock p. m. I at once advised you of this fact by telegraph. The wisdom of Professor King's decision was manifest shortly after dark the same evening, when a steady rain set in and continued during the night, accompanied by a high southerly wind. The great difficulty the aeronaut had to contend with was the long time required for inflating the balloon, being about fifteen hours. This fact, in conjunction with the presence of a high wind, led Professor King to further postpone the ascension until Tuesday, the 3d of September, at 3 p. m., of which fact you were duly informed by telegraph. It was necessary to commence inflating the balloon at 12 o'clock, midnight. I was on the ground at that time, Sunday night, with the professor, and the fact of its being very dark, with the wind still blowing fresh from the northwest, seemed to justify his decision. Careful comparisons with the several instruments were continued meanwhile, and arrangements made with the observer at Rochester for making synchronous observations while the balloon was up in the air.

I proceeded to Falls Field Tuesday, the 3d of September, and having fixed the instruments in position in the car of the balloon, made continuous observations from 2*h.* 53*m.* 15*s.* p. m., until 4*h.* 30*m.* 10*s.* p. m., when the car was attached to the balloon preparatory to starting. The inflation proceeded slowly until shortly before 5 p. m., when the hose was cast off, and the aeronaut and myself got into the car.



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FT. BENTON
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DULUTH
MARQUETTE
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ESCANABA
BRECKENRIDGE
LOW
ST PAUL
ALPENA
FT. SULLY
MILWAUKEE
GRAND HAVEN
YANKTON
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CHEYENNE
DES MOINES
CHICAGO
DAVENPORT
OMAHA
KEOKUK
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DENVER
INDIANAPOLIS
LEAVENWORTH
SPRINGFIELD
CINCINNATI
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LOUISVILLE
CAIRO
NASHVILLE
SANTA FE
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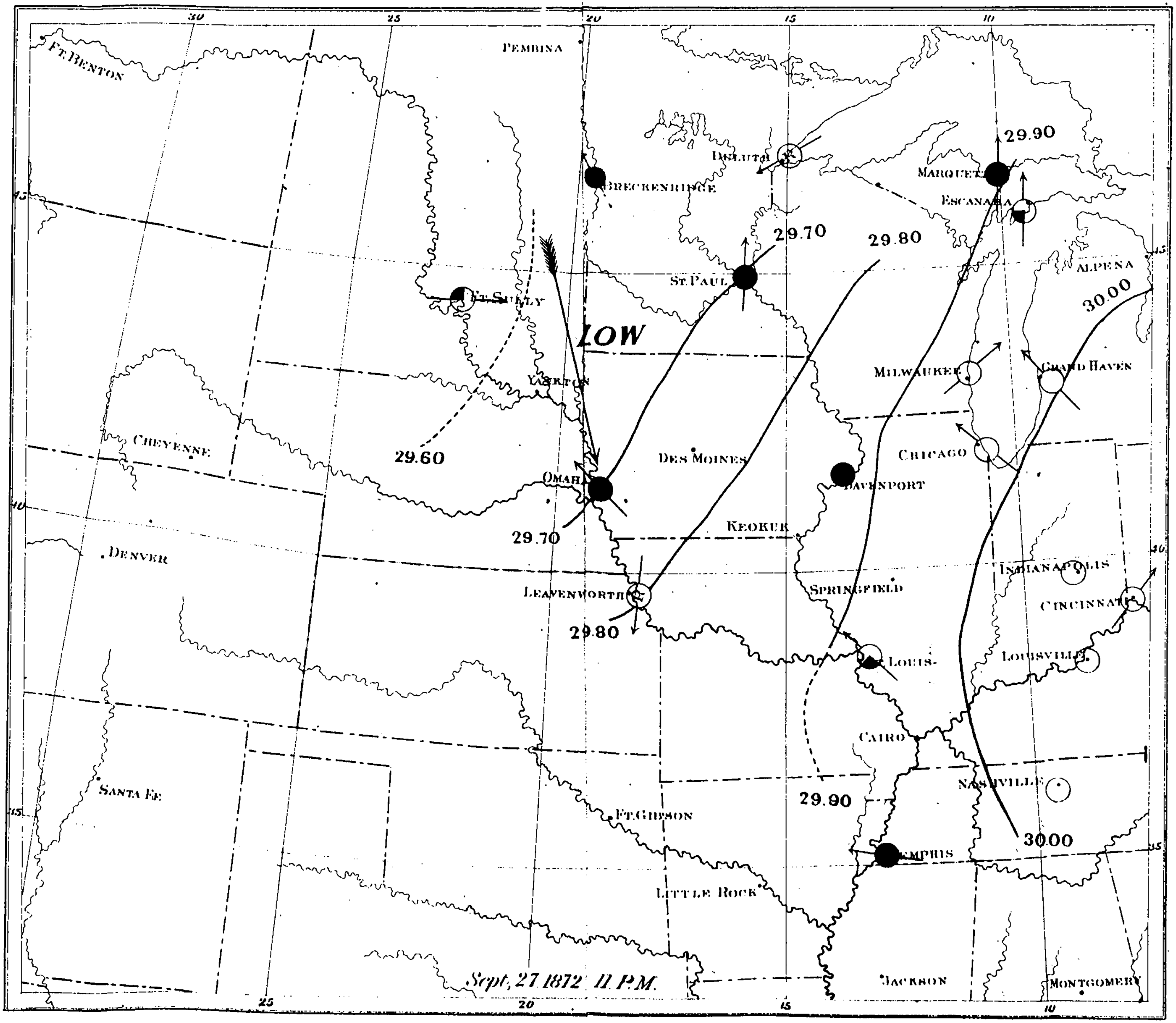
MONTGOMERY
Sept. 27 1872 4.35 P.M.



Ft. Benton
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Breckenridge
Marquette
Escanaba
St. Paul
Ft. Sully
Alpena
LOW
Yankton
Milwaukee
Grand Haven
Cheyenne
Des Moines
Chicago
Davenport
Omaha
Keokuk
Denver
Indianapolis
Leavenworth
Springfield
Cincinnati
St. Louis
Louisville
Cairo
Nashville
Santa Fe
Ft. Gibson
Memphis
Little Rock
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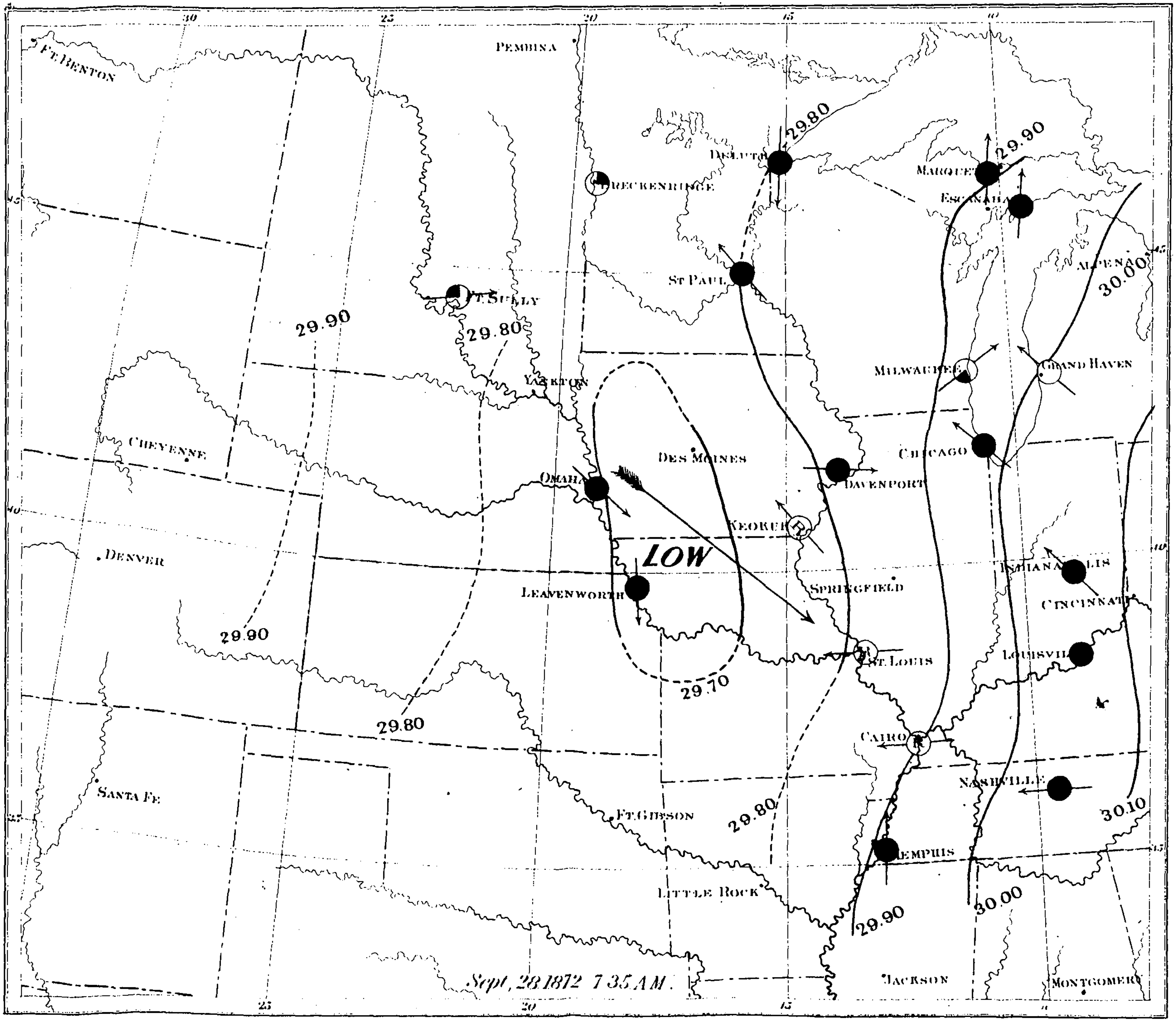
Sept. 27 1872 11 P.M.



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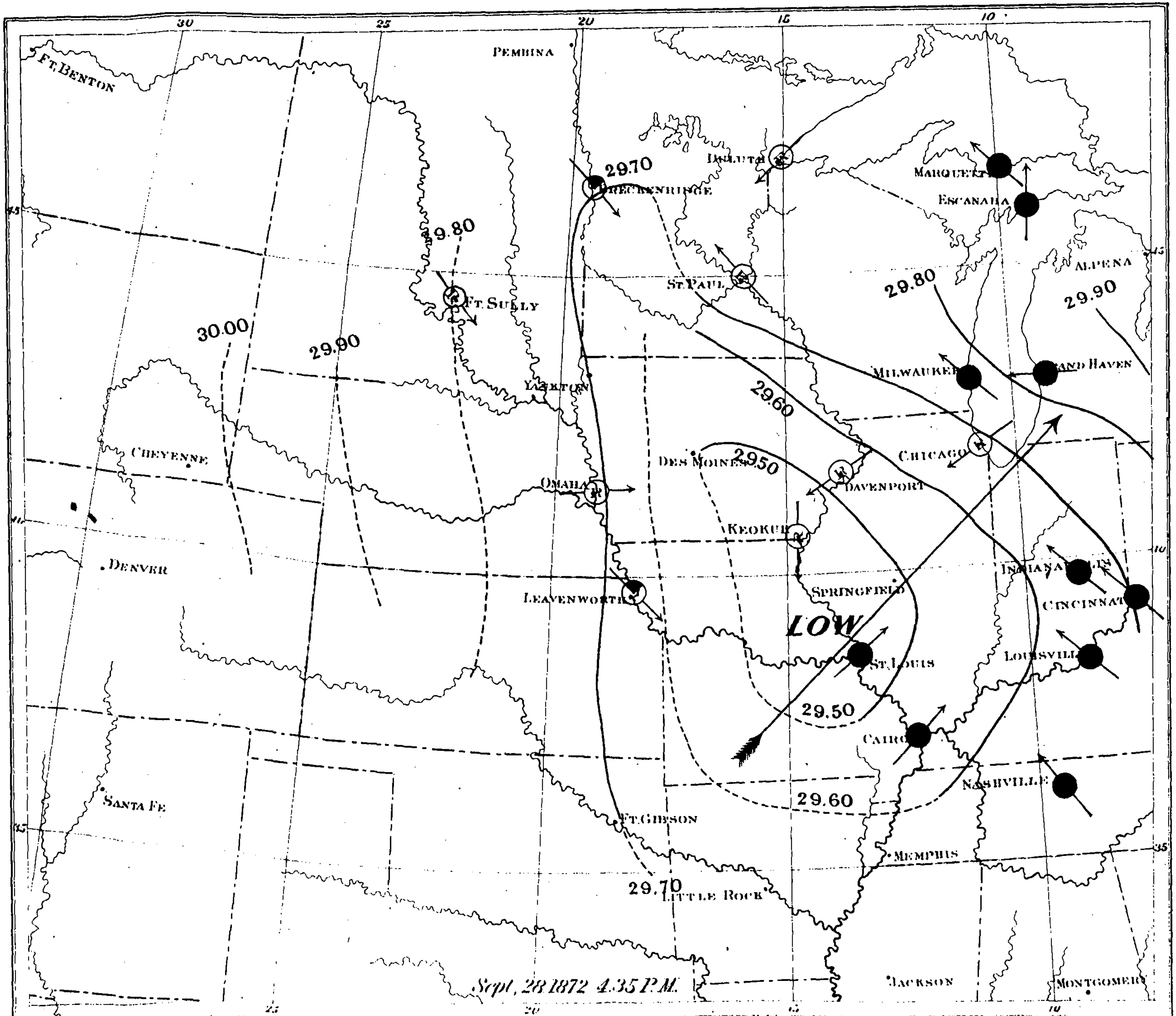
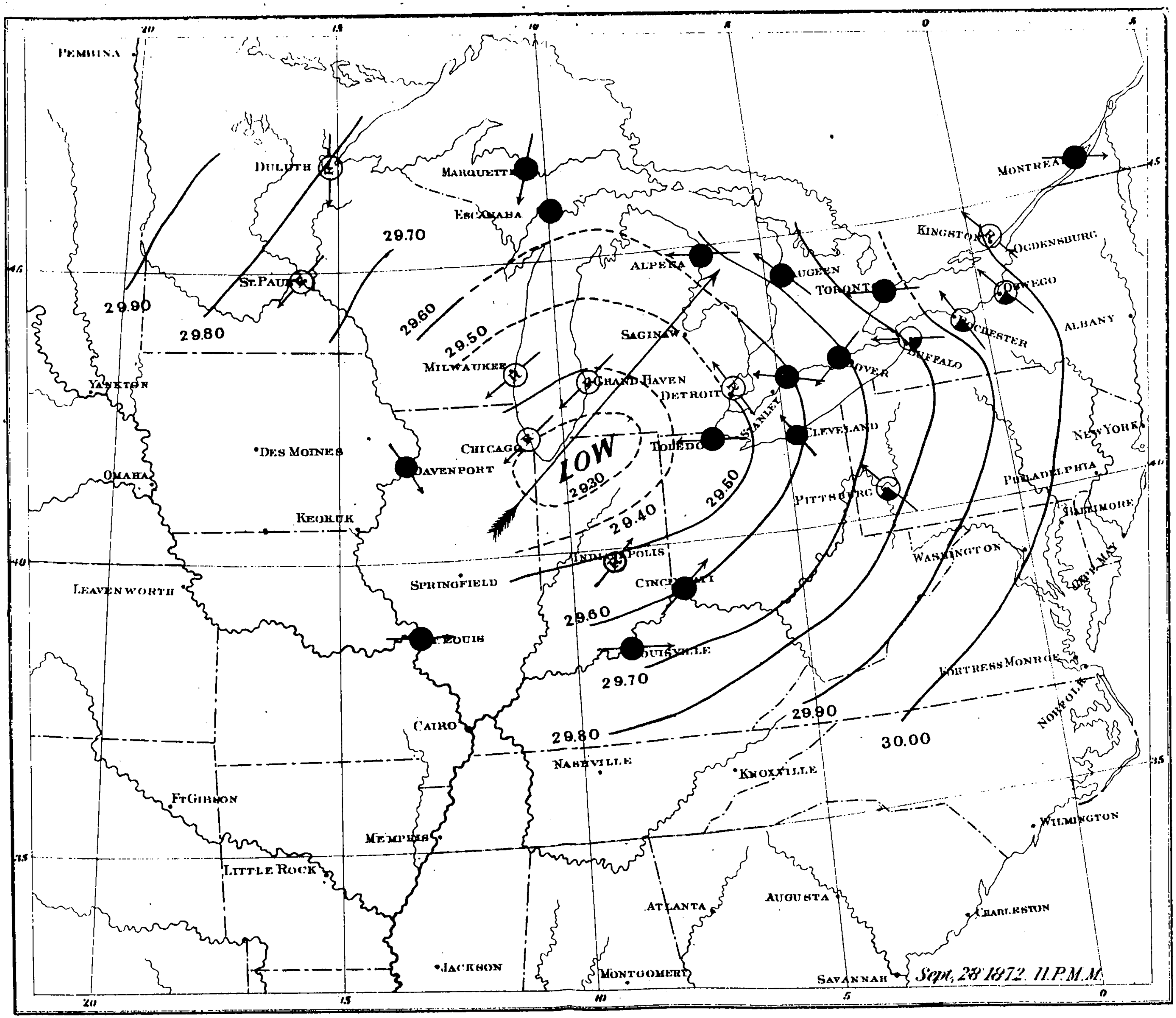
Montgomery
Sept, 28 1872 7 35 A.M.



Sept. 28 1872 4.35 P.M.



LOW
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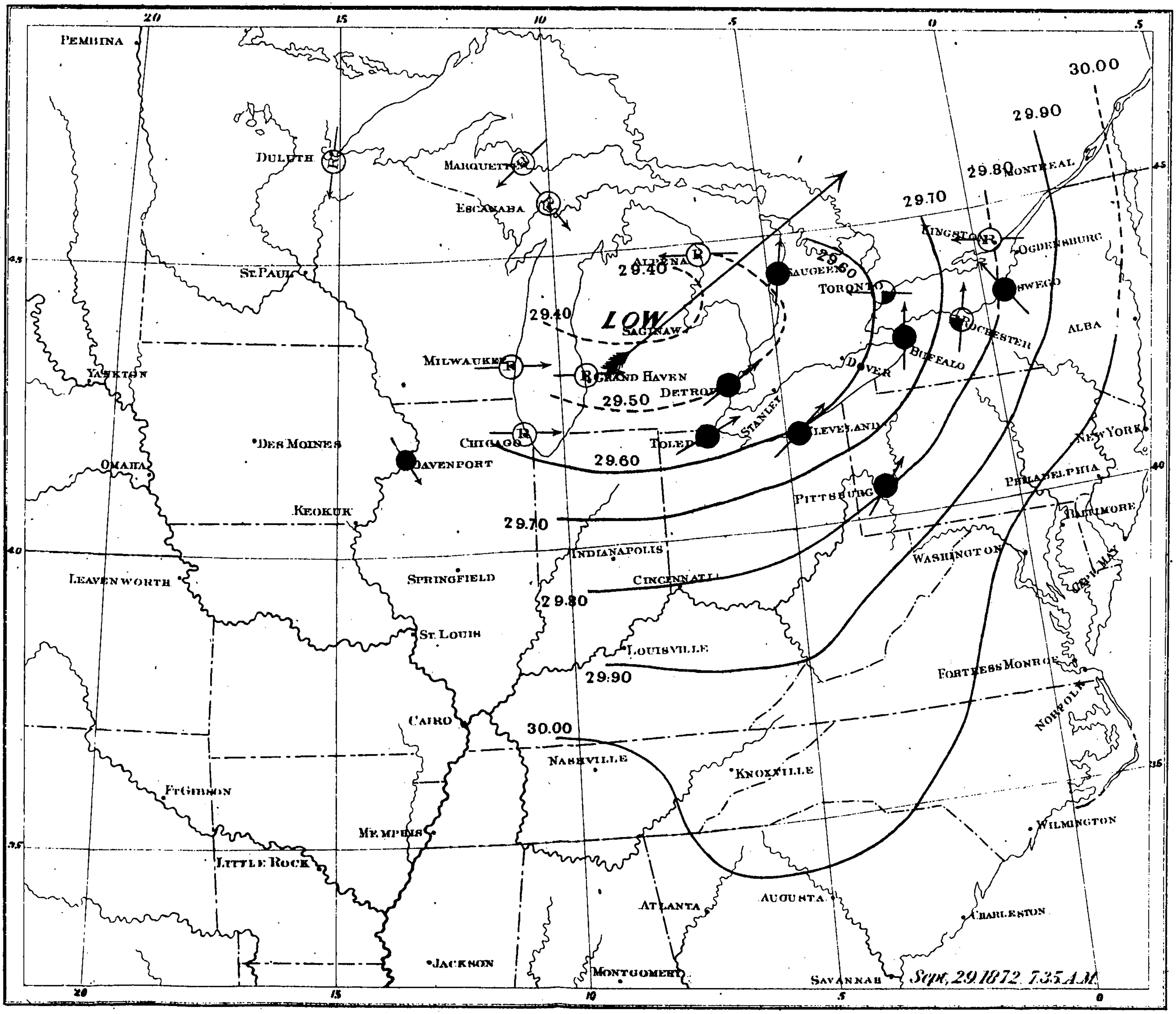
Pembina
Duluth
St. Paul
Marquette
Escanaba
Alpena
Saugeen
Toronto
Kingston
Ogdensburg
Montreal
Oswego
Rochester
Buffalo
Albany
Saginaw
Milwaukee
Grand Haven
Detroit
Port Dover
Stanley
Cleveland
Toledo
Chicago
Davenport
Pittsburg
Des Moines
Yankton
Omaha
Keokuk
Indianapolis
Cincinnati
Springfield
Leavenworth
St. Louis
Louisville
Washington
Philadelphia
New York
Baltimore
Cape May
Fortress Monroe
Norfolk
Cairo
Nashville
Knoxville
Ft Gibson
Memphis
Little Rock
Wilmington
Atlanta
Augusta
Charleston
Jackson
Montgomery
Savannah
Sept. 28 1872. 11 P.M.M.



PEMBINA
DULUTH
MARQUETTE
ESCANABA
ST. PAUL
YANKTON
OMAHA
DES MOINES
DAVENPORT
KEOKUK
LEAVENWORTH
SPRINGFIELD
ST. LOUIS
CAIRO
FT GIBSON
MEMPHIS
LITTLE ROCK
JACKSON
MILWAUKEE
CHICAGO
GRAND HAVEN
SAGINAW
ALPENA
LOW
DETROIT
TOLEDO
STANLEY
CLEVELAND
SAUGEEN
TORONTO
DOVER
BUFFALO
ROCHESTER
OSWEGO
KINGSTON
OGDENSBURG
MONTREAL
ALBA
NEW YORK
PHILADELPHIA
PITTSBURG
BALTIMORE
CAPE MAY
WASHINGTON
INDIANAPOLIS
CINCINNATI
LOUISVILLE
FORTRESS MONROE
NORFOLK
NASHVILLE
KNOXVILLE
WILMINGTON
ATLANTA
AUGUSTA
CHARLESTON
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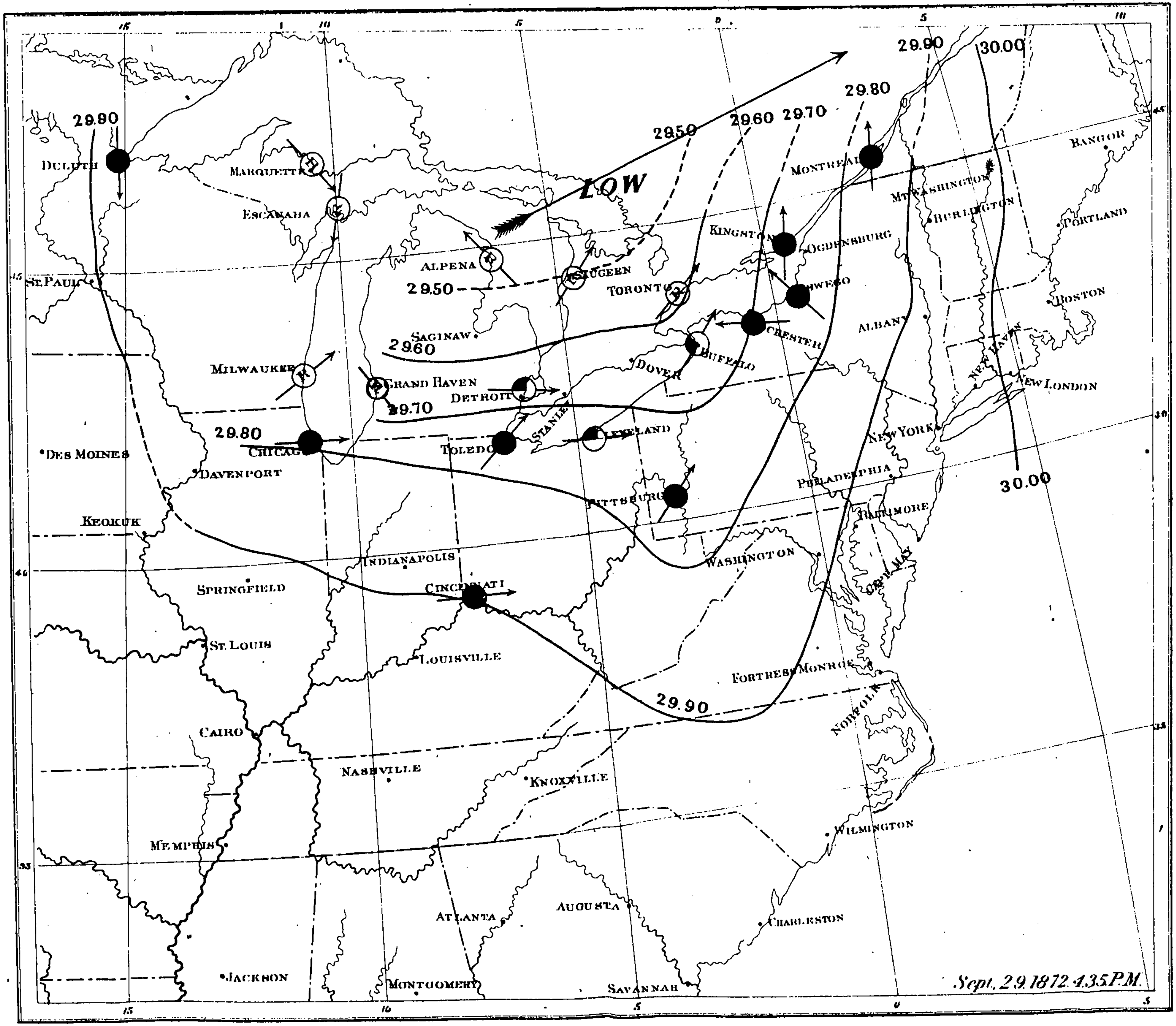
Sept, 29 1872. 7.35 A.M.



LOW
29.50
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29.90
30.00
DULUTH
MARQUETTE
ESCANABA
ALPENA
SAUGEEN
TORONTO
KINGSTON
OGDENSBURG
MONTREAL
MT WASHINGTON
BURLINGTON
PORTLAND
BANGOR
BOSTON
OSWEGO
ROCHESTER
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CAPE MAY
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FORTRESS MONROE
NORFOLK
CAIRO
NASHVILLE
KNOXVILLE
WILMINGTON
MEMPHIS
ATLANTA
AUGUSTA
CHARLESTON
JACKSON
MONTGOMERY
SAVANNAH
Sept. 29. 1872. 4.35 P.M.

After testing the lifting power of the balloon, and getting the car properly ballasted, the last rope was cast off, and we started on our aerial voyage at 5.03½ p. m., Washington time.

I made eighty-two complete sets of readings in the car, resting on the ground, previous to its being attached to the balloon.

After everything was in readiness to start and the ropes all cleared away, I had the instruments handed to me in the car, and began my readings at the instant we started.

I took readings from Green's aneroid barometer, and the dry and wet bulb thermometers of Glaisher's hygrometer, from 5*h.* 3*m.* 15*s.* p. m., the time of starting, at the same time keeping the direction of the balloon in the record, until 6.21 p. m., the time we landed. Tiffany's aneroid barometer was also read from the time of starting until 5.10 p. m., when it ceased to register, owing to the fact of its reading down to 26 inches only.

At 5*h.* 49*m.* 30*s.* p. m., the clock attached to this instrument stopped, and I lost four minutes and a half in getting out my watch.

Tiffany's barometer was read for a few minutes afterward, but the readings were so much out that they were discontinued.

I made, on an average, two observations a minute—sometimes getting three and at others only one a minute.

As the object of this voyage was to ascertain how many observations could be taken in a given space of time, and to see if it was practicable to use the balloon for making meteorological observations with any degree of accuracy and safety, I devoted my attention entirely to this duty, and did not take any time to observe the view of the country over which the balloon was passing, excepting an occasional glance when attention was especially called to anything by the aeronaut.

I made one hundred and fifty-six observations while in the balloon. The following day I made forty-seven observations, at the house of Mr. Timothy Buell, a few rods from where we descended.

Upon my return to Rochester, I renewed the comparison of my instruments with those at the observer's office in that city. Upon returning to the Office of the Chief Signal-Officer I shall again make careful comparisons with the standards. A detailed description of the voyage in narrative form is embodied in my report, as of general interest, and, also, adding to the value of the data obtained.

We left the earth amid the shouts of the thousands of spectators and ascended quite rapidly, moving a little south of east. The temperature decreased considerably as we arose above the earth, falling 20° in ten minutes. The sky was perfectly cloudless, and a light northwest wind prevailed. The aeronaut estimated our speed at about thirty miles an hour. We observed a thick haze in the northward, and also quite a haze in the westward. The view of Lake Ontario was very fine. The country we passed over was highly cultivated, and presented the appearance of one vast garden spread out beneath us. The noise of the crowd below was soon hushed, and for awhile the only sound perceptible was the rumbling of the railroad trains. This soon ceased, and perfect stillness reigned supreme for a short time. broken only by the voice of the aeronaut remarking upon the magnificent view spread out before us. We apparantly passed along for some distance parallel with the New York Central Railroad, for upon the balloon descending a little the roar of the trains was plainly heard. The aeronaut called my attention to a small lake which, from its position, I judged to be Lake Canandaigua. At our greatest elevation the air was quite chilly, the breath being perceptible as in winter, although I did not feel at all inconvenienced by the change, being provided with warm clothing.

Our course changed at 5*h.* 12*m.* 10*s.* p. m. to due east, and at 5*h.* 13*m.* p. m. to southeast, which we kept until 5*h.* 24*m.* p. m. when we moved a little south of southeast until 5*h.* 38*m* 30*s.* p. m.; the balloon then moved south-southeast. We kept this general direction until landing.

After reaching our greatest elevation, and descending again, we moved along at a height sufficiently near the earth to enable us to converse with men at work in the fields. They were apparantly much surprised at our appearance above them, and inquired facetiously where we came from, what we were doing up there, and where we intended going; which interrogatories were answered to their entire satisfaction by Professor King. All the noises incident to farm life were plainly discernible from our elevated position. Passing over a pasture we frightened half a dozen horses very much; they pranced up and down the field, and occasionally glanced upward with much alarm. We were unable to plot our course to any degree of certainty, owing to our ignorance of the country passed over.

Upon my return to Rochester, I obtained a copy of a telegraphic dispatch to the editor of the Union, dated Lima, Livingston County, at 6.20 p. m., New York Central Railroad time—about twelve minutes faster than Washington time—sent by the telegraph-operator, giving at that moment, 6*h.* 8*m.* p. m. of my time, our distance from Lima at about six miles east of there, descending slowly in a southeasterly direction. This coincides with our position, so far as I could ascertain, and can be used to advantage as a check in plotting our course. This dispatch was received by the observer at Rochester at 6.30 p. m., when he discontinued his special observations.

At 6*h.* 2*m.* p. m we hailed a man in the field below us, and ascertained from him that we were passing over the township of East Bloomfield. Soon afterward, the aeronaut let the guide-rope hang from the car, and drag over the ground. While traveling along in this way the balloon came down quite near the earth, so near that as we approached a fence, it seemed as if we would certainly strike against it in our descent. The professor called my attention to this, in order that I might secure the instruments. I got all ready to pick them up in my hand in case we struck. By throwing over a handful of ballast just at the right time, the balloon ascended, and passed over the fence in safety. Just before landing, we saw a large oak tree directly ahead of us. At first there was some danger of the car lodging in the tree, but by discharging a small quantity of ballast, we passed over in safety, the guide-rope barely touching one of the branches.

Professor King finally decided to descend, as it was getting toward night-fall. He requested a man in the field below us to take hold of the guide-rope. The man was then directed to take a turn around the fence with the rope. We were then gradually lowered until the car rested on the ground, touching the earth without any jar to the instruments whatever.

While the car was held down by willing hands, I took the last observation at 6*h.* 21*m.* p. m.

The professor treated as many of our newly made friends, as desired it, to a balloon ride.

The field proved to be on the farm, within a few rods of the house of Mr. Timothy Buell, being about two miles east of East Bloomfield railroad-station, which is a little east of the village of that name, about six miles west of Canandaigua, and some twenty-four miles from Rochester.

After taking one more observation and putting the instruments in a safe position, I drove down to the Western Union telegraph-office, at East Bloomfield, and advised you at once of my arrival on the earth again, and the success of this the first signal-office balloon-ascension for meteorological purposes.

I would mention here the courtesy of Mr. Cheney, the manager of the Western Union Telegraph Company, at Rochester, in putting under my orders one of his messengers, with blanks, &c., so that I could inform you at once of our departure from Falls Field, and also in forwarding my messages to you with all possible dispatch. Upon my return to Mr. Buell's house, I found that the aeronaut had allowed most of the gas to escape from the "Aurora," and had left our aerial carriage and its appendages in the field until daylight.

It would seem from this experiment that there is a reasonable degree of assurance that, with the same amount of care exercised in this ascension, the balloon can be used for making more elaborate meteorological observations without risk to the instruments.

Very respectfully, your obedient servant,

GEORGE C. SCHAEFFER, JR.,
Observer, Signal-Service, United States Army.

Brigadier-General ALBERT J. MYER,
Chief Signal-Officer of the Army, Washington City, D. C.

PAPER N.

STORMS ON THE PACIFIC COAST OF AMERICA.—(Compiled from various authorities.)

The storms of the Pacific coast more nearly resemble those of Western Europe than the storms which frequent the eastern coast of the United States. The latter move littorally, and follow a northerly and easterly course under the thermo-dynamic influence of the Gulf stream, and the mechanical agency of the great southwest equatorial current of atmosphere, which remarkably coincides with the oceanic Gulf stream.

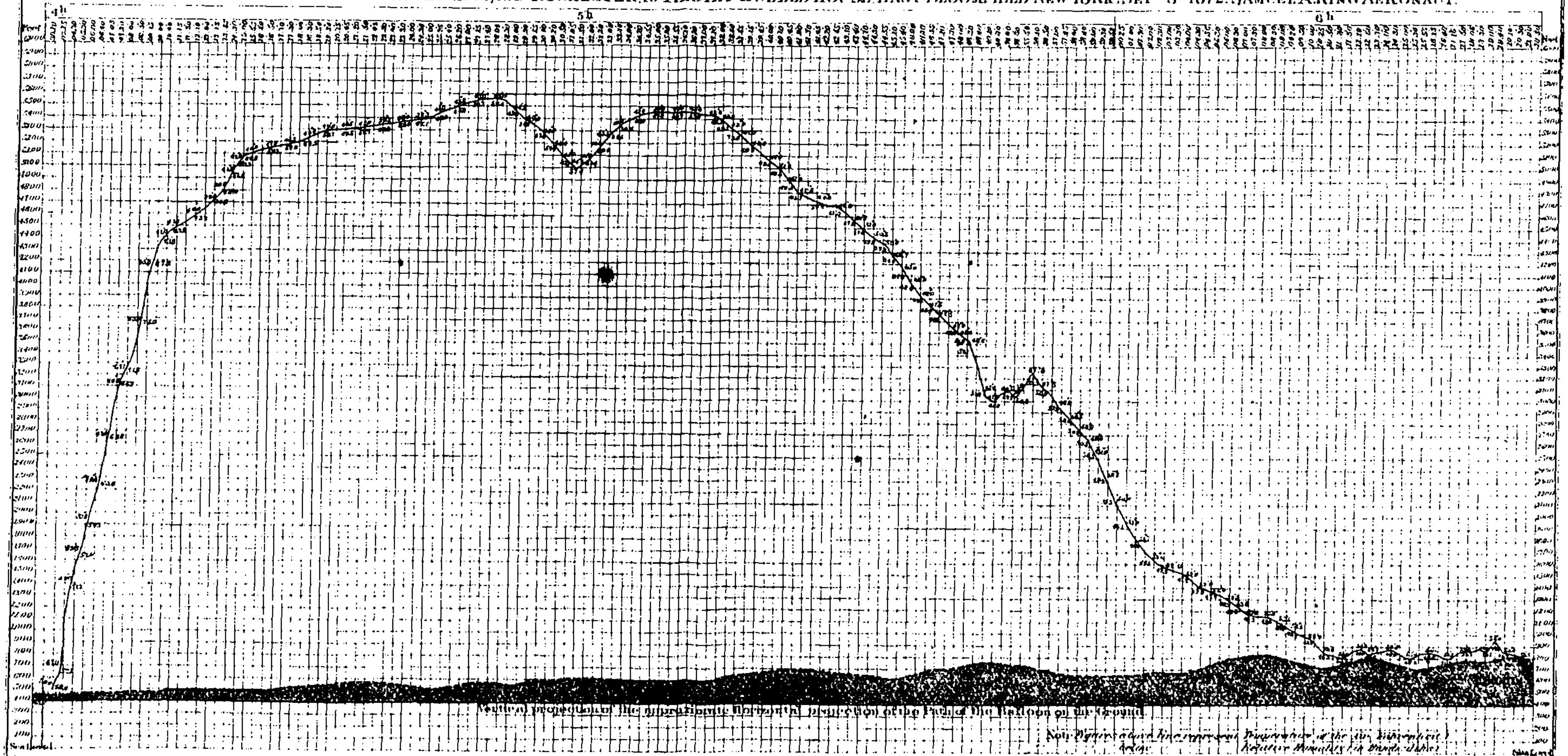
But, on the Pacific side of our continent, the storm-controlling forces act in a direction from west to east, especially upon the coasts of California, Oregon, and Washington. The warm Kuro-Siwo, or Japan stream of the great ocean, after reaching the middle latitudes, on its way toward the Aleutian Islands, is, superficially, brought under the propelling power of the westerly or anti-trade winds; and a large drift of this Pacific gulf stream is borne eastw d, as decidedly marked warm stratum of surface-water, and strikes upon the western shores of America nearly at right angles. This agency, as well as that of the general atmospheric movement on our Pacific coast, serves to give character and direction to the storms and cyclones which reach it, no doubt from the western Pacific Ocean.

1. *From San Diego to the Straits of Juan de Fuca, from December till April, the storms of the Pacific coast set in, with southeasterly winds, veering, as the storm-center progresses, to southwesterly.

The closing winds from the north of west are very severe, and, as they blow on to the lee shore, are to be apprehended by vessels, even though in port.

*Mercantile Marine Magazine, 1858.

PATH OF BALLOON "AURORA" FROM FALLS FIELD ROCHESTER, TO TIMOTHY BUELL'S HOUSE, EAST BLOOMFIELD NEW YORK, SEPT. 3RD 1872. SAMUEL A. KING AERONAUT.



SKETCH OF PORTIONS OF MONROE AND ONTARIO COUNTIES NEW YORK, SHOWING COURSE OF BALLOON.

Instances are not wanting in which vessels have been sunk in the Pacific ports of America by these gales from the west.

2. *These southeasterly gales are more frequent and violent north of San Diego, and thence along the coast to British Columbia; and this can be easily understood from the fact, as established by Blodget, that the humidity and rain-fall of the region stretching from San Francisco northward to Vancouver's Island are nearly three times as great as of that south of San Francisco. Unless forced by other causes to deviate from the regions of greatest humidity, we know, storms seek or are drawn into such regions for their necessary supply of aqueous vapor. On the Pacific coast there are no other known agencies which would cause such deviation.

3. †It follows, therefore, that the ports of San Francisco and Portland, Oregon, and the waters of the adjacent sounds, are more endangered by storms than San Diego, or than points along the coast between San Diego and San Francisco.

In summer the latter port is so far south of the usual storm-track that it is comparatively safe; but it is otherwise from December to April.

4. The northeasterly wind, which on the Atlantic sea-board is often a violent premonitor of a storm, on the California coast, and northward does not precede, but follows the cyclone in its closing northwest quadrant, and is usually of moderate force.

5. After striking the Pacific coast, the storm will generally advance with but little diminution of cyclonic intensity, but with diminished progressive motion, in a direction east-northeast. The violence of the storm will not cease till the center has passed beyond the Coast Range Mountains.

6. The great upper current or stratum of warm and moist equatorial atmosphere, which, in England, has been observed to move in a southwest direction, is, on our Pacific coast, less meridional in its course, and pushes more toward the east, especially north of the parallel of 48° north latitude, where it is favored in this more easterly direction by the orographic features of the continent, which are less elevated and bold than they are south of this parallel.

7. ‡Vessels sailing southward from San Diego to Mexican ports are peculiarly exposed from June to November from severe gales, beginning generally at southeast or southwest. These southeast gales may be looked for in still greater severity and frequency, especially during winter and the equinoctial seasons, all the way from San Diego to the Straits of Juan de Fuca, and attended with thick, rainy weather.

8. Vessels sailing northward to San Diego from Mexican or southerly ports, should they encounter a gale moving up the coast, should stand off on the starboard tack, thus getting the eastward wind of the cyclone, which removes the danger of going ashore.

RECURVATION OF STORM-PATHS IN THE EASTERN PACIFIC.

§Most of the cyclones which I have last described, however, must have recurvated in a more advanced position in the Pacific Ocean; and in their subsequent northeasterly progress they would fall almost perpendicularly upon the coasts of the two Californias, or the more northern Territories. Thus, instead of sweeping a great length of these coasts successively, as happens on our Atlantic border, these cyclones appear more like local storms, and cannot be traced consecutively on the coast line. At the point of intersection with the coast, the first and main portion of the gale will be felt from the southeast, on its center path, or more southerly in its right-hand quadrants. And near the coast, the northeasterly or reflex winds of the cyclone, pertaining to its first left-hand quadrant, will not be strongly developed.

We learn from Lieutenant-Commander Wood, of Her Majesty's ship Pandora, that from Cape San Lucas to San Diego, or from latitude 23° to latitude 32° north, the coast is subject to violent gales from southeast, from November to April, and that they are more frequent as we go toward San Diego. Before their recurvation, these cyclones are likely to have passed westward in lower latitudes than those which fall on the Mexican coast.

From San Diego to San Francisco the coast is subject to southeasterly gales like those of the coast of Lower California, but they are more frequent here, and blow with greater force. These gales, according to Lieutenant Wood, "last from twelve hours to two days, and are accompanied by heavy rain, which lasts till the wind changes, which it often does very suddenly, and blows as hard for a few hours from the northwest, when the clouds clear off, and fine weather again succeeds." This is a clear description of the phenomena of cyclones, as shown on their center paths, while moving in a northeasterly course. The same authority states that from San Francisco to the straits of Juan de Fuca hard gales from all points of the compass may be looked for at all seasons. These begin generally from southeast to southwest, bringing thick, rainy weather with them. After blowing from these quarters for some hours, they fly round to the northward, by the west, with little if any warning, and blow even harder than before. These changes show the observer to have been in the right-hand quadrants of the gale, as most often will happen, and are but counterparts of the changes met with in the cyclones encountered in the same latitudes in the North Atlantic.

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*English Nautical Magazine, 1850.
†Deductions from foregoing.
‡Imray's Sailing Directions for the west coast of North America.
§Mr. William C. Redfield on cyclones on the Western Pacific.

UNIVERSALITY OF THE LAW OF STORMS.

The law of rotation and progression in storms, as developed on the Atlantic Ocean, which was substantially discovered by the present writer in September of the year 1821, is essentially cosmical or world-wide in its origin and application. This soon became apparent in examining the accounts of gales which are found in the voyages of Cook, Vancouver, and others, in the several oceans and climatory zones of our globe. Hence, the polar relations of the phenomena presented are necessarily changed in the southern hemisphere, where, in all our relative comparisons, south must be substituted for north, east and west remaining the same.

PAPER O.

SOME DEDUCTIONS FROM THE TRI-DAILY BAROMETRIC AND THERMOMETRIC MEANS FOR JUNE, 1871.

I. The monthly means of tri-daily barometric and thermometric observations present several interesting and instructive meteorological facts. For the month of June, 1871, it is ascertained that the highest barometric mean is at Pittsburgh, Pennsylvania, and is 30.06, 30.00, 30.06. The lowest barometric mean is at Buffalo, New York—29.90, 29.83, 29.82. The highest thermometric mean is at New Orleans, Louisiana—81, 85, 78. The lowest thermometric mean is at San Francisco—52, 63, 55. The greatest diurnal variations of the barometer is found to take place at Saint Louis, and is .14 of an inch. The least diurnal variation of the barometer is found equally at Grand Haven and Key West, and is 00.02. The variation is nearly as small at Chicago, Escanaba, and San Francisco, being at each of these places only 00.03; at New York, only 00.04. The variations most nearly approximating that of Saint Louis are at Portland, Maine, Cincinnati, Saint Paul, and Washington, at each of which places it is 00.10. The average diurnal barometric variation at all the stations is 00.059.

It appears that the insular and littoral-stations on the sea-coast and Gulf, *e. g.*, Key West, San Francisco, Cape May, Charleston, and New York, have the most uniform pressure and temperature. This uniformity is in a marked degree shared by all the lake stations. Key West has the least diurnal thermometric variation, it being only 1° F.; while Leavenworth has the greatest, 13° F. The average diurnal thermometric variation of all the stations is 9° F. The diurnal barometric variation is directly traceable to the diurnal variation of the thermometer, under the influence of solar heat and nocturnal radiation from the earth's surface.

Thus the fact that the greatest barometric variation (00.14 inch) takes place at Saint Louis is explained by the fact that the greatest thermometric change (13° F.) occurs a little west of it, at Leavenworth, in Kansas. The least diurnal variation of the barometer at Grand Haven and Key West (00.02) is explained by the least diurnal thermometric changes at these places, which are respectively 6° F. and 1° F.(?) The places whose barometric changes most nearly approach these are coast and lacustrine stations, *e. g.*, Chicago, Escanaba, New York, and Cape May, whose thermometric changes are very small. It also appears that stations on or near the same meridian of longitude experience a simultaneous and harmonious variation, *e. g.*, Washington and Charleston.

Stations.	Barometer.	Thermometer.
Washington	30.00, 29.91, 29.99	69°, 79°, 69°
Charleston	30.01, 29.96, 30.01	78°, 84°, 78°

The connection between the barometric and thermometric results has been long since a matter of theory. As the atmosphere becomes warmed by the sun's heat it is expanded and swollen above its nocturnal height, and its upper or intermescent portion will flow off laterally in all directions to places of lower barometer, and the pressure will diminish. When the sun has disappeared the expanded volume contracts, and there is formed a partial depression into which the air from all sides flows in and the pressure is increased. It does not appear that the total lunar aerial tide affects the barometer very sensibly, *i. e.*, to a greater extent than .005 of an inch, a total effect which seems to be only .01 of the diurnal variation, attributed to solar heat. By a simple calculation from the observed average diurnal barometric and thermometric variations, respectively .059 or .06 of an inch and 9° F., we deduce the general law, that for every increase of temperature 1.5 F. the pressure in the mercurial column diminishes .01 of an inch. This, it will be observed, applies in the United States, where most of the stations are not strictly continental, nor insular, but littoral. It appears that the greater the absolute humidity of any station, the greater will be the diurnal oscillation in the barometer, as compared with that in the thermometer, since the sun's rays will cause a greater expansion of aqueous vapor than of dry air. Thus, at Charleston, on the humid sea-coast, we have—barometer, 30.01, 29.96, 30.01; variation, .05 of an inch. Thermometer, 78, 84, 78; variations, 6° F; and at Washington, almost littoral, we have—barometer, 30.00, 29.90, 29.99; variation, .10 of an inch. Thermometer, 69, 79, 69; variation, 10° F. At such stations 1° F. rise in the thermometer nearly represents .01 of an inch barometric fall; but at Memphis, a continental station, it takes a thermometric rise of 12° F. to cause a barometric fall of .05 of an inch, and at Leavenworth, another continental station, it requires a rise of 13° F. in the thermometer, to produce a fall of .04 in the barometer. To arrive at some mean expression for the law of inverse barometric and thermometric variations, we should take the mean difference between the readings for the littoral and continental stations. To give this average in figures corrected for all stations, including such interior stations as the signal-service may hereafter occupy, the approximate expression would be an *inverse variation equal to .01 of an inch in the barometer for every thermometric change of 3° F.*

II. We may also apply these conclusions to the consideration of *annual variation* of temperature and pressure in their relation to questions of climatology and terrestrial physics. It clearly follows from what has been shown, that there is a regular annual variation of the barometer, according with the movement of the sun in declination.

The oceanic surface in the southern hemisphere being much greater than in the northern hemisphere, the evaporation of the southern hemisphere in its summer greatly exceeds that in the northern hemisphere. Hence, the total atmospheric weight is greater at that time. Regarding the constituent of dry air in the earth's atmosphere as a *constant* quantity, we have, from September to March, the additional and excessive evaporation from the southern oceans, which causes the annual variation in the barometric condition of the entire globe to reach its maximum in the winter of the northern hemisphere. The expansion of air in the southern hemisphere in summer must cause a large amount of the superincumbent atmosphere to flow off laterally into the northern hemisphere, and, in a smaller degree, *vice versa.* Contraction of air in the winter of either hemisphere must be followed by a barometric rise, as is seen in the diurnal contraction about 4 a. m.

It follows, also, that the advance of the seasonal isothermal lines, with the motion of the sun in declination, will be accompanied by retrogression of the isobars of highest pressure. The amount of inverse annual barometric variation will be approximately 00.01 of an inch for every thermal variation of 1.5° F.

III. It would also seem that this formula is not inapplicable to the investigation of the law of storms. For, if it be true, it follows that the depression in the center of storms is not due mainly to latent heat evolved by condensation, as Mr. W. Clement Ley says in his work, the latest authority in meteorology would have us believe, but rather to *centrifugal* force of the cyclone. The rise of the thermometer 30° F., which is an extreme increase of temperature in the storm center, would only give a fall in the barometer of .15 of an inch, whereas a fall of 2.00 inches has often been observed.

It should be stated that while these deductions are drawn from the means of June 1871, these means very nearly correspond with those prepared for March, April, and May, of the same year.

Paper P.

ATMOSPHERIC CONDITIONS AND THEIR EFFECTS UPON VEGETATION JUNE 1, 1871, TO MAY 31, 1872.—LEAVENWORTH, KANSAS.—PREPARED BY OBSERVER-SERGEANT GEORGE H. BOEHMER, SIGNAL-SERVICE, UNITED STATES ARMY.

June, 1871.—Although the minimum temperature did not reach that of the corresponding month of last year, it exceeds that of June, 1870, by 8°.5. The mean, too, of this year, was 5° in excess of the average of thirty-four years. These high thermal conditions, with good and timely supplies of rain, have obtained important results in the vegetable kingdom. Corn is beginning to tassel; is of strong, vigorous growth, promising an early and extraordinary crop. So exuberant is the growth, that on well-cultivated farms the original cost of production will not exceed 12½ cents per bushel.

The fruit trees and vines are bending under their load of fruit. Already the market is well supplied with ripe apples, at lower rates than usual. The grapes, thus far, have shown no tendency to disease, and in a few weeks more the ripe fruit will make its appearance in market. From the extraordinary yield in prospect, it may be expected that prices will range low, and this favorite and healthful fruit will come within the reach of all.

River attained maximum height on June 18; after that, falling slowly. From June 9 to 11, the rise was so rapid that it presented a threatening appearance to residents on low bottom lands.

July, 1871.—The temperature was a fraction above the mean of thirty-four years, though we had some oppressive weather, not so much from the high thermal range as the excessive moisture contained in the air.

The rains were abundant, though not copious, except in the first week of the month. Of the heaviest rain of the season, July 5, 1872, Major Hawn writes, (Leavenworth Times, July 7, 1872:) "On Wednesday, July 5, at night, we were visited by one of those peculiarly gentle showers that droughty Kansas is occasionally the recipient of. About sunset a dark and portentous cloud obscured the declining sun. Soon after sunset the rising cloud was permeated with a net-work of chain-lightning that rendered the ponderous mass luminous, in the highest degree brilliant, and often blinding. Soon the distant muttering of thunder added interest to the scene, increasing in tone until it resolved itself into a regular cannonade with a thousand batteries. Anon there was a gentle rustling among the foliage of the trees, then a sweep that made the rickety buildings creak in their foundations, and then Old Boreas came down upon us in rage and fury, while the clouds poured down in breakers of water. The rain lasted during most of the night, interspersed with gusts of wind and constant electrical flashes and deafening thunder, and there fell nearly two inches of water. The wind did some damage in prostrating corn and in dislodging fruit, and occasionally damaging or destroying a tree; but the loss in the vicinity is not material. The storm was anticipated for twenty-four hours. The *signal-service reports* indicated a low range of barometer at this place and Omaha, with a high temperature and a large percentage of humidity."

The season was very favorable for the growth of vegetation and equaled that of spring.

The early planting of corn is nearly all mature now, and will be fit to cut in a week or ten days. It is the heaviest crop ever raised in Kansas or in any of the Western States.

During the month the market was well supplied with apples. Peaches were brought forward on the 18th, and melons on the 20th of July. Grapes were first offered about the 26th of July. Sweet potatoes and nearly every variety of roots and vegetables are unusually fine, and yield largely.

River fell to 9 feet water in channel on the 15th of July, and is still declining, though slowly.

August, 1872.—The temperature of the summer was 4 degrees above the mean, though it did not reach the maximum by 9°. The temperature was uniform without any extreme fluctuations. There was an unusual preponderance of clear sky, though our rains came in gentle showers, well-timed, and in no instance produced a flood.

We were free, too, from those destructive storms which so frequently occurred in different portions of the country.

The summer was but a prolongation of the spring.

September, 1871.—The most prominent feature of the month was the great preponderance of clear sky. There were many consecutive days without a cloud. The temperature of the month was within a fraction of the mean of thirty-four years.

The rains were slight, but the ground was well saturated during the summer. So that, thus far, the lack of moisture has not affected the young plants of the fall sowing.

The clear, dry weather has rendered the vintage rich, with the certainty of high flavored strong wines.

The weather has been very favorable for out-door work, and all the branches of productive industry confined to the open air are in lively progress.

There were two light, white frosts on the 27th and 28th, but no ice has yet been observed.

The last frost in spring occurred on the night of the 11th of April, which was the only frost in that month, leaving an interval of 169 days free from frost.

October, 1871.—This month was peculiarly Italian in temperature. The large preponderance of clear sky, the mild temperature (mean 60°) rendered the season a delightful one.

We had but a few white frosts, but ice did not form until the night of the 31st. The last ice of spring froze in the last week in March, giving us over seven months interval free from a temperature of freezing water.

We had sufficient rain to sustain the vegetation, as the luxuriance of the fields of young grain will attest.

On the 4th of this month we experienced one of the so-called Kansas siroccos, (Major Hawn's description of the same in Leavenworth Times, October 7, 1871.)

November, 1871.—Up to the 19th November, the temperature and other atmospheric conditions, particularly the frequent warm showers of rain, resembled spring more than autumn. Up to that date we had had but three frosts that produced ice since the 28th of March.

The favorable weather brought forward the plants of the prospective grain crops very rapidly, and were deeply rooted at the close of the growing season, and in good condition for the winter season.

The latter portion of the month was unusually severe and cold. The river closed at Atchison on the 28th, and at Kansas City.

December, 1871.—The mean temperature fell 5.51 degrees below the mean of thirty-four years. In fact, winter set in vigorously on the 19th of November, and with the exception of a few days continued sharp to the close of the year.

On two occasions the mercury ranged at 5° below zero, and in some localities 8°; and a few reports are to the effect that the peach-buds were slightly damaged. If this be the case, it must be limited to but few localities. There was but little freezing and thawing during the month, and the wheat plant was covered with snow much of the time, but has sustained no injury thus far.

A friend who has observed the winters here for a long time noticed an article in the Saint Joseph (Missouri) paper, saying that there was a recurrence of the severe winter every seven years, and, turning to his diary of 1864, found as follows:

"*Severe winter.*—Hundreds of Government teams hauling over the ice all winter. Heavy snow-storm November 8; wind blowing; river freezing. On the 22d the ice was running in large quantities. On the 7th December river closed once more; teams crossed till January 17. Began crossing again January 22, continuing till February 10. On 11th of February ice broke up and passed down the current."

This was in 1864, and we have a repetition of the same experience this winter.

Of the storm of the 25th December, 1871, a writer gives the following article in the Leavenworth Times of December 27, viz:

"The late spell of weather is pronounced, by the oldest inhabitants of Kansas, to be the most severe one that visited Kansas since the first settlement of the State. We have frequently had colder weather for a few hours at the time, but for genuine solid winter-wind, snow-drift, sleighing, &c., (all that,) the storm of the past few days was the most severe that ever visited us.

"This occasion afforded the United States signal service an excellent opportunity to show its efficiency, and illustrate its value to the people. The approach of the storm was foretold several days before it came, and those who pay attention to the weather-reports were forewarned and prepared."

January, 1872.—The mean temperature of the month was 2.97 below the mean of thirty-four years.

The winter set in about the 20th of November, and continued, up to the close of the month, with but little intermission. The temperature was uniform, the air dry, without rain, and less than two inches of snow.

The ground was uncovered during the most of the time, and the wheat-fields have a sorry appearance, though the germ of the plant is probably good, as there was but little freezing and thawing.

Some of the peach-buds sustained a slight injury, in the early part of the winter; and as the temperature has not been lower than this, at any time, it is hoped that they are safe. When the wood thaws out it will be ascertained whether they can survive a range of cold from 3° to 6° below zero for four or five consecutive mornings.

February, 1872.—The mean temperature of the winter-months fell but 18° below the mean for thirty-four years, yet it proved to be one of the severest in this region, probably, since 1831. This was not in degree, but from its great duration. Nor did the mercury fall to the minimum, at any one time, by many degrees: but a low mean extended through nearly four months. Nor can we yet write in poetical strains of balmy breezes, for the ground is partially covered with snow, and the frost is still predominant.

During the most of the winter the surface of the ground lay uncovered to the blast, that told legibly on vegetation. The wheat-fields have suffered to a considerable extent, but, as there was but little of alternate freezing and thawing, the probability is that the injury is not equal to appearances now; and, upon the return of warm sunshine and genial showers, the prospects will materially brighten. The reports from different localities are that the peach-buds are damaged, particularly the grafted fruit.

We would look with incredulity upon this being applicable in general results, as the lowest temperature marked only 10°.5 below zero; whereas, in former years, abundant crops were produced after the mercury had descended 14° below zero. It will require a brisk flow of the sap to develop the damage. The amount of snow and ice in the mountains should reasonably make us look for rough and changeable weather until late in the season.

River broke up on the 20th of February.

March, 1872.—The remarks of February (that a cold spring might be expected) were verified in March, the mean temperature being over 5° below the annual mean. The cold weather began in November, and on the 21st of March it was snowing heavily, and as cold as it ordinarily is in the middle of winter; and there does not seem any show yet for a let-up in the weather; and although, for the last two weeks, it has been alternate sunshine and storm, storm seems now to have the ascendency. The prospective wheat-crop has undoubtedly suffered by the winter and spring frosts. To what extent is not definitely known, in the different soils and in the mode of culture. The crops, too, will be late maturing, and be subject to the influences of the June rains and blasts that may follow. The prospect of a heavy crop, of fruit of every species, was never more flattering.

From the 18th of November to the 20th of March, only 2.46 inches of rain fell and 1.59 inches of snow-water.

The ground is opened from the frost, and in good tillable condition. The winter just closed was the longest on record, but not the coldest.

April, 1872.—The mean for the month was below the mean of thirty-four years, and the low temperature caused the vegetation to be twenty days later than last year. Our rains commenced early, and have been copious thus far.

Peach, cherry, and early pear trees were in full bloom on the 25th ; apples followed in a few days.

The wheat has a prospect of making a fair crop, but spring-crops will go in late. Grass is taking a fine start, and will make a heavy crop.

Strawberry-plants were damaged, and the supply of fruit from home will not be equal to the demand.

Vegetation came out late in March. On the 24th of March the peach-buds first evinced a tendency toward development, and came into full bloom on the 25th of April.

May, 1872.—The prominent feature of the month was the excessive rain. The fall was 7.91 inches more than last year, and probably the heaviest in May since 1858. The rains included several copious storms that swelled the streams into floods, and damaged the country largely by washing away bridges, culverts, and rendering roads impassable for a time.

The ground has been saturated with water for most of the month, that materially retarded or suspended most all farm-work. The planting is not all finished, and the corn and other crops that are up suffer from wet, weeds, and a want of culture that cannot be given; and, unless dry weather intervenes immediately, the prospect of the farmer will be anything but flattering.

The wheat-crop, on an average, will not be worth more than the cost of harvesting. Grass was never better. The fruit-crop has not so flattering an aspect as last month. Cherries, pears, and apples did not set well, in some localities, and much of the young fruit has drooped. Various causes are assigned for this, other than temperature, such as imperfect fertilization, caused by high winds, rains, &c.* The peach, however, is an exception, and the trees are bearing a large crop of young fruit.

Strawberries have been in market for several days, but the supply from home-products will not equal the demand, as the plant was materially damaged by the prolonged winter.

PAPER Q.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., ——, 187-.

SIR: By direction of the Chief Signal-Officer of the Army, I have the honor to request that steps be taken in your organization to effect that all propositions, resolutions, or memorials relating to the duties of this Office, as increased by the act of Congress approved June 10, 1872, which may be brought before it, shall be referred to your committee, and that, after such reference, your committee confer with this Office in relation to the matter before it, previous to making its recommendation to the organization, in order, by interchange of opinion and facts, to arrive at a full understanding of them. It is also requested that when any action may be taken by the organization on the above-named subjects, your committee will forward a statement or copy of it direct to this Office.

It is the object of this request to bring the different boards of trade, chambers of commerce, and agricultural societies into perfect understanding with this Office in reference to their views and wishes.

I am, sir, respectfully, yours,

GARRICK MALLERY,
Captain, First Infantry, and Brevet Lieutenant-Colonel, U. S. A.,
Acting Signal-Officer and Assistant.

Mr. —— ——,
Chairman of the Meteorological Committee of the —— ——

* Such defects occurred in some of the indigenous species of fruits. The effects, in some localities, are so abnormal that they cannot be explained on the theory of temperature alone, and involve some intricate questions.

PAPER R.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., July 1, 1872.

SIR: By direction of the Chief Signal-Officer of the Army, I have the honor to inform your society that the powers of this Office have been enlarged by the legislation of Congress at its recent session, in a section, a copy of which is hereto appended. He invites any suggestions or recommendations to perfect the system now established, and to make it more useful to those varied interests for whose benefit it is designed.

It is shown by experience that the best mode in which agricultural and horticultural societies can co-operate with this Office is by the appointment, on the part of each society, of a permanent committee to confer from time to time with the Chief Signal-Officer of the Army, and to take, in conjunction with him, such steps, or to recommend for the consideration of the society such action as may be deemed desirable. A large number of societies have given notice to this Office of the appointment of such committees, with statement of the names and residences of the chairman and members, but your organization has not responded to the suggestion to that effect heretofore made.

It is desired to be understood that no request is presented that the proposed committee shall take meteorological observations or make reports for the signal service, but that it is only designed to obtain practical co-operation, through correspondence and conference.

I am, sir, respectfully, yours,

GARRICK MALLERY,
Captain, First Infantry, Brevet Lieutenant-Colonel, U. S. A.,
Acting Signal-Officer and Assistant.

To ——— ———,
Secretary of the ——— ———.

PAPER S.

THE PRACTICAL USE OF METEOROLOGICAL REPORTS AND WEATHER-MAPS.

The office division of telegrams and reports for the benefit of commerce is organized for the preparation, receipt, and use of these reports.

At every station three observations are taken daily, at the same moment of actual (not ocal) time for all stations, by the observer-sergeants of the signal service. The reports are immediately telegraphed to the office of the Chief Signal-Officer at Washington.

By a carefully arranged system of telegraphic operation, copies of the full reports of all stations thus transmitted to Washington, or of portions of them, are sent at the same time to many of the signal-service stations in principal cities and towns.

At each station so receiving a tabular report, one or more bulletins are published. The observations are made synchronously at the different stations, at the exact hours, 7.35 a. m., 4.35 p. m., and 11.00 p. m., Washington time.

The full reports from all stations are telegraphed to and received at Washington, translated from cipher, and published in the form of bulletins of reports by the hours of 9 a. m., 6 p. m., and 1 a. m., respectively, (Washington time.) The bulletins of reports are designated as follows: That published at 9 a. m., the "morning report;" that published at 6 p. m., the "afternoon report," and that published at 1 a. m., the "midnight report." The bulletins, wherever published, at Washington or elsewhere, exhibit the following particulars, viz: Height of barometer; change since last report; thermometer; change in last twenty-four hours; relative humidity, in per cent.; direction of wind; velocity of wind, in miles per hour; pressure of wind, in pounds per square foot; force of wind; amount of cloud; rain-fall since last report, in inches and hundredths, and state of weather.

The morning and afternoon reports (bulletins) are posted at each of the local signal-service offices, and at a number of other public places in the cities and towns to which they are transmitted.

They are always open for examination. At the more prominent stations, and those in principal cities, large weather-maps are also posted every morning, exhibiting, by means of changeable symbols, the reports of the morning observations at the different stations. The midnight report (bulletin) is gratuitously furnished to every morning newspaper published in the city at which a station of observation may be, which will insert it in its columns. The morning report is also delivered to afternoon papers in time for publication.

The observers at each station are instructed to afford every facility to the press and to the public for the earliest receipt and most extended use of the reports and information at their respective offices.

In addition to the bulletins, a statement of synopses and probabilities is prepared at the office of the Chief Signal-Officer, and thence issued thrice daily. It is immediately furnished to the Associated Press, by which it is telegraphed to all its agencies throughout the country.

The synopses and probabilities, with which the public is familiar through the columns of the different newspapers, are issued from the office of the Chief Signal-Officer at 1 a. m., 10 a. m., and 7 p. m., daily.

In the study of local probabilities the student should make sure that he has before him (as in the columns of the local newspapers) the latest synopses and probabilities issued at Washington. To be sure of such facts, he must notice the hours at which they are dated from the office in Washington. *The midnight reports, dated at 1 a. m. of each day, ought to be found in the morning newspapers of that day. The morning report, dated at 10 a. m. of each day, is furnished in time for the afternoon and evening papers.*

At places where stations are established, the use of the bulletined reports, in the mode suggested in this paper, would often, perhaps, enable the student to make forecasts of the weather with greater local particularity than can be expressed in the "synopses and probabilities" telegraphed to the press, as the latter must, in a limited number of words, give generalizations embracing the whole country; and it is believed that, in many places distant from any station, but on or near the lines of railways or steamers, or with other modes of rapid communication, the bulletins can be utilized in a corresponding manner. IF, AT THE STATION NEAREST TO PERSONS INTERESTED, AS, FOR INSTANCE, THE BOARD OF TRADE, OR CHAMBER OF COMMERCE, OR METEOROLOGICAL COMMITTEE OF AN AGRICULTURAL SOCIETY, OR INDIVIDUALS INTERESTING THEMSELVES IN THE STUDY OF PRACTICAL METEOROLOGY, NO NEWSPAPER PRINTS THE BULLETINS FURNISHED GRATUITOUSLY BY THIS OFFICE FOR THAT PURPOSE, THERE IS A STRONG PROBABILITY THAT, UPON PROPER APPLICATION MADE TO THE EDITORS OR PROPRIETORS, THEY WOULD BE PRINTED, AS OF INTEREST TO THE SUBSCRIBERS AND READERS. In cases where delay would thereby be avoided, arrangements can often be made with the publisher to have copies of the newspaper containing bulletins sent in advance of its delivery by mail. By such means, and others which will suggest themselves, a record of meteorological conditions elsewhere can be obtained in many places within so few hours after the observations are taken at the different stations as to enable a student to make for himself many important deductions. The accuracy of these would be greatly assisted by local observations made at the same time as those of the observers of this division, with similar instruments, and by frequent local observations made during any time at which there is especial interest or anxiety as to the probable weather.

The navigator, the agriculturist, or the student can supplement in this way, by the readings of his own instruments and his local knowledge, the reports and information furnished by the United States, and is fitted to arrive at intelligent conclusions as to the *data* before him.

There is as yet no provision for furnishing instruments. on the part of the United States, to any other than the observer-sergeants, although it is possible that some such authority may hereafter be given. Full information as to the instruments and their use will, however, be furnished to all persons, who may provide them for themselves.

In addition to the weather-bulletins and the "synopses and probabilities," a graphic weather chart or map is issued thrice daily from the office of the Chief Signal-Officer of the Army, at the War Department. To those who know how to use them, all of these publications offer valuable help in estimating the probable character of the weather at any station, or over any district, during the following day, and often for a still longer period. The bulletins and graphic charts, properly filled, convey the same information, with this difference: while the former merely tabulate the reports alphabetically, the latter reveal to a single glance of the eye a synoptic view, at once, of the meteoric conditions at the different stations, and of the deductions thence to be made as to the conditions of the atmosphere then extending over the continent.

The graphic charts are of additional value, from the fact that it is often possible to trace upon them, in lines, the progress of storms, or the change of meteoric condition (as the movement of an area of high or low barometer) from report to report, and thus, by considering the past, and by applying laws and generalizations reasonably well established, to estimate more easily the "probability" of the future.

Those who receive the bulletin through the newspapers, or otherwise, can, if they desire so, easily transfer its information to the blank charts, that the reader is supposed to be in possession of, or familiar with, a series of such weather-maps.*

ABBREVIATIONS USED IN THE PRESS REPORTS.

It may be well to state here, that in the weather synopses and probabilities emanating from the Signal-Office, different parts of the country are thus designated:

Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island, are alluded to as the *New England States* or the *Northeast*, or simply as the *Eastern States*.

* Blank charts on which to enter observations can be obtained from the Office of the Chief Signal-Officer, at Washington, D. C., at actual cost, ($2.75 per hundred,) and will be sent by mail, free of other expense, to applicants.

New York, New Jersey, Pennsylvania, Maryland, District of Columbia, and Virginia as the *Middle States*, or sometimes as the *Middle Atlantic States*.

North Carolina, South Carolina, Georgia, and Northern and Eastern Florida, as the *South Atlantic States*.

Western Florida, Alabama, Mississippi, Louisiana, and Texas as the *Gulf States*.

Sometimes the Gulf States, the South Atlantic, Virginia, Tennessee, Kentucky, and Arkansas are grouped together as the *Southern States*.

The Lower Lakes, when used, mean Lake Erie and Ontario.

The Upper Lakes are Lakes Superior, Huron, and Michigan.

The Northwest, popularly, means the country lying between the Mississippi and Missouri Rivers.

The Southwest means Texas, Indian Territory, and New Mexico.

Pacific Coast or *Pacific States* includes California, Oregon, and Washington Territory.

The *Ohio Valley* includes the belt of country, about two hundred miles broad from Pittsburgh to Cairo.

The *Mississippi Valley* includes a belt, of about the same width, from Vicksburgh to Davenport.

The extensions "from Missouri to Ohio," &c., &c., refer to areas reaching to and including the central portions of the States named. Thus a report "Westerly winds extending from Iowa to Pennsylvania," would signify that those winds would be felt in the interior of those States as well as over the territory lying between them of the respective States.

In "*the Coasts, &c.*," is included the land between the coasts and the parallel range of coast hills or mountains. In Texas, Louisiana, and Northern Florida a belt of land extending a hundred miles inward would be included.

Winds are said to blow from northeast when they are generally included within the quadrant from north to east, &c., and similarly for other directions.

PAPER T[1].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT NO. 1.—CHICAGO AND SAINT LOUIS.

Pacific and Atlantic Telegraph Company.

SAINT LOUIS TO CHICAGO.			CHICAGO TO SAINT LOUIS.
At 7.06 a. m., 4.06 p. m., and 11.06 p. m., Davenport will send—	At 7.03 a. m., 4.03 p. m., and 11.03 p. m., Keokuk will send—	At 7.09 a. m., 4 p. m., and 11.09 p. m., Saint Louis will send reports	At 7.28 a. m., 4.28 p. m., and 11.28 p. m., Chicago will send reports from—
		Saint Louis, Cairo, Leavenworth,	Omaha, Cheyenne, Milwaukee, Cincinnati, Louisville, Memphis, Shreveport, Grand Haven, Cleveland, Buffalo, Saint Paul, Chicago, Indianapolis, Pittsburgh, Nashville, Vicksburg, Denver, New Orleans, Detroit, Toledo, Santa Fé, Fort Benton, Fort Sully,
	Through— Davenport,	*Through*— Cairo, Davenport,	*Through*— Davenport, Keokuk,
To— Chicago.	*To*— Chicago.	*To*— Chicago.	*To*— Saint Louis.

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T^{2}.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 2.—CINCINNATI AND CHICAGO.

Pacific and Atlantic Telegraph Company.

CHICAGO TO CINCINNATI.		CINCINNATI TO CHICAGO.		
At 7.24 a. m., 4.24 p. m., and 11.24 p. m., Indianapolis will send—	At 7.19 a. m., 4.19 p. m., and 11.19 p. m., Chicago will send reports from—	At 7.35 a. m., 4.35 p. m., and 11.35 p. m., Cincinnati		
To— Cincinnati.	Chicago, Davenport, Omaha, Fort Sully, Saint Louis, Saint Paul, Keokuk, Leavenworth, Cairo, Fort Benton, Milwaukee, Detroit, Buffalo, Grand Haven, Toledo, Cleveland, *Through*— Indianapolis, *To*— Cincinnati.	Cincinnati, Pittsburgh, Louisville, Nashville, Shreveport, Memphis, Vicksburg, New Orleans, *Through*— Indianapolis, *To*— Chicago.		

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T^3.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 3.—WASHINGTON AND CINCINNATI.

Pacific and Atlantic Telegraph Company.

CINCINNATI TO WASHINGTON.		WASHINGTON TO CINCINNATI.
At 7.48 a. m., 4.48 p. m., and 11.48 p. m., Pittsburgh will send—	At 7.31 a. m., 4.31 p. m., and 11.31 p. m., Cincinnati will send reports from—	
To— Washington.	Cincinnati, Davenport, Omaha, Fort Sully, Saint Louis, Louisville, Memphis, New Orleans, Saint Paul, Keokuk, Leavenworth, Fort Benton, Cairo, Nashville, Vicksburg, Shreveport, *Through*— Pittsburgh, *To*— Washington.	

NOTES

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[4].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 4.—CINCINNATI AND NEW ORLEANS.

Pacific and Atlantic Telegraph Company.

NEW ORLEANS TO CINCINNATI.				CINCINNATI TO NEW ORLEANS.	
At 7.23 a. m., 4.23 p. m., and 11.23 p. m., Louisville will send—	At 7.22 a. m., 4.22 p. m., and 11.22 p. m., Nashville will send—	At 7.10 a. m., 4.10 p. m., and 11.10 p. m., Memphis will send—	At 7.11 a. m., 4.11 p. m., and 11.11 p. m., New Orleans will send reports from—	At 7.35 a. m., 4.35 p. m., and 11.35 p. m., Cincinnati will send reports from—	
			New Orleans, Vicksburg, Shreveport,	Cincinnati, Saint Paul, Omaha, Fort Sully, Saint Louis, Pittsburgh, Chicago, Davenport, Keokuk, Leavenworth, Fort Benton, Cairo,	
	Through— Louisville,	*Through*— Nashville, Louisville,	*Through*— Memphis, Nashville, Louisville,	*Through*— Louisville, Nashville, Memphis,	
To— Cincinnati.	*To*— Cincinnati.	*To*— Cincinnati.	*To*— Cincinnati.	*To*— New Orleans.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[5].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT NO. 5.—WASHINGTON AND NEW YORK.

Franklin Telegraph Company.

NEW YORK TO WASHINGTON.				WASHINGTON TO NEW YORK.	
At 8.07 a. m., 5.07 p. m., 12.07 a. m., Philadelphia will send reports from—	At 8.04 a. m., 5.04 p. m., 12.04 a. m., Baltimore will send—	At 8.15 a. m., 5.15 p. m., 12.15 a. m., New York will send reports from—		At 8.50 a. m., 5.50 p. m., 12.50 a. m., Washington will send reports from—	
Philadelphia,		New York,	Detroit,		
Cape May,		Boston,	Grand Haven,		
		New London,	Milwaukee,	Washington,	Pittsburgh,
		Portland, Me.,	St. Paul,	Lynchburg,	Cincinnati,
		Burlington,	Du Luth,	Knoxville,	Indianapolis,
		Mt. Washington,	Breckinridg	Norfolk,	Keokuk,
		Oswego,	Escanaba,	Wilmington,	Davenport,
		Rochester,	Marquette,	Charleston,	Omaha,
		Buffalo,	Chicago,	Augusta,	Fort Sully,
		Toronto,	Cheyenne,	Savannah,	Fort Benton,
		Kingston,	Denver,	Lake City,	St. Louis,
		Montreal,	Santa Fé,	Punta Rassa,	Leavenworth,
		Quebec,	Corinne,	Key West,	Cairo,
		Dover,	Virginia,	Jacksonville,	Louisville,
		Stanley,	San Francisco,	Mobile,	Nashville,
		Saugeen,	Portland, O.,	New Orleans,	Memphis,
		Cleveland,	San Diego,	Galveston,	Vicksburg,
		Toledo,		Indianola,	Shreveport,
Through—		*Through*—		*Through*—	
Baltimore		Philadelphia,	Baltimore,	Baltimore,	Philadelphia,
To—	*To*—	*To*—		*To*—	
Washington.	Washington	Washington.		New York.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.

2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.

3. The time given for sending reports is the local time of that particular station.

PAPER T[6].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 6.—NEW YORK AND BOSTON.

Franklin Telegraph Company.

BOSTON TO NEW YORK.			NEW YORK TO BOSTON.
At 8.20 a. m., 5.20 p. m., 12.20 a. m., New London will send—	At 8.25 a. m., 5.25 p. m., 12.25 a. m., Boston will send reports from—		At 8.22 a. m., 5.22 p. m., 12.22 a. m., New York will send reports from—
To— New York.	Boston, Portland, Burlington, Mt. Washington, *Through*— New London, *To*— New York		New York, Oswego, Rochester, Buffalo, Cleveland, Toledo, Detroit, Chicago, Philadelphia, Cape May, Baltimore, Washington, Norfolk, Wilmington, Charleston, Savannah, Jacksonville, New Orleans, *Through*— New London, *To*— Boston.

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T7.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 7.—NEW YORK AND MILWAUKEE.

Atlantic and Pacific and Great Western Telegraph Companies.

MILWAUKEE TO NEW YORK.								NEW YORK TO MILWAUKEE.
At 8.02 a. m., 5.02 p. m., 12.02 a. m., Oswego will send—	At 7.57 a. m., 4.57 p. m., 11.57 p. m., Rochester will send—	At 7.54 a. m., 4.54 p. m., 11.54 p. m., Buffalo will send reports from—	At 7.52 a. m., 4.52 p. m., 11.52 p. m., Cleveland will send—	At 7.45 a. m., 4.45 p. m., 11.45 p. m., Toledo will send—	At 7.48 a. m., 4.48 p. m., 11.48 p. m., Detroit will send reports from—	At 7.30 a. m., 4.30 p. m., 11.30 p. m., Milwaukee will send reports from—	At 7.38 a. m., 4.38 p. m., 11.38 p. m., Chicago will send reports from—	At 8.42 a. m., 5.42 p. m., 12.42 a. m., New York will send reports from—
		Buffalo, Toronto, Kingston, Montreal, Quebec, Dover, Stanley, Saugeen,			Detroit, Grand Haven,	Milwaukee, Saint Paul, Du Luth, Breckenridge, Escanaba, Marquette,	Chicago, Cheyenne, Denver, Santa Fé, Corinne, Virginia, San Francisco, Portland, O., San Diego,	Portland, Me., Boston, Burlington, Mt. Washington, New London, New York, Philadelphia, Cape May, Baltimore, Washington, Norfolk, Wilmington, Charleston, Augusta, Savannah, Mobile, Jacksonville, Key West, Punta Rassa. Lake City, Lynchburg, Knoxville,
	Through— Oswego,	*Through*— Rochester, Oswego,	*Through*— Buffalo, Rochester, Oswego,	*Through*— Cleveland, Buffalo, Rochester, Oswego,	*Through*— Toledo, Cleveland, Buffalo, Rochester, Oswego,	*Through*— Chicago, Detroit, Toledo, Cleveland, Buffalo, Rochester, Oswego,	*Through*— Milwaukee, Detroit, Toledo, Cleveland, Buffalo, Rochester, Oswego,	*Through*— Oswego, Rochester, Buffalo, Cleveland, Toledo, Chicago,
To— New York.	*To*— New York.	*To*— New York.	*To*— New York.	*To*— New York.	*To*— New York.	*To*— New York.	*To*— New York.	*To*— Milwaukee.

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that, when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[8].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 8.—CHICAGO AND SAN FRANCISCO.

Atlantic and Pacific and Great Western Telegraph Companies.

SAN FRANCISCO TO CHICAGO.				CHICAGO TO SAN FRANCISCO.
At 6.44 a. m., 3.44 p. m., and 10.44 p. m., Omaha will send reports from—	At 6.10 a. m., 3.10 p. m., and 10.10 p. m., Cheyenne will send reports from—	At 5.43 a. m., 2.43 p. m., and 9.43 p. m., Corinne will send reports from—	At 5.06 a. m., 2.06 p. m., and 9.06 p. m., San Francisco will send reports from—	
Omaha, Fort Sully, *To*— Chicago.	Cheyenne, Denver, Santa Fé, *Through*— Omaha, *To*— Chicago.	Corinne, Virginia, Fort Benton, *Through*— Cheyenne, Omaha, *To*— Chicago.	San Francisco, San Diego, Portland, O., *Through*— Corinne, Cheyenne, Omaha, *To*— Chicago.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[9].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 1.—MARQUETTE AND MILWAUKEE.

Northwestern Telegraph Company.

MARQUETTE TO MILWAUKEE.		MILWAUKEE TO MARQUETTE.
At 7.10 a. m., 4.10 p. m., 10.34 p. m., Marquette will send reports, through—	At 7.10 a. m., 4.10 p. m., 10.35 p. m., Escanaba will send reports—	
Escanaba *To—* Milwaukee.	*To—* Milwaukee.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[10].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 2.—SAINT PAUL AND MILWAUKEE.

Northwestern Telegraph Company.

SAINT PAUL TO MILWAUKEE.	MILWAUKEE TO SAINT PAUL.
At 6.51 a. m., 3.51 p. m., 10.16 p. m., Saint Paul will send reports from—	
Saint Paul, Du Luth, Breckenridge, *To—* Milwaukee.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T^{11}.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 3.—DU LUTH AND SAINT PAUL.

Northwestern Telegraph Company.

DU LUTH TO SAINT PAUL.	SAINT PAUL TO DU LUTH.
At 6.50 a. m., 3.50 p. m., and 10.15 p. m. Du Luth will send reports—	
To— Saint Paul.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T^{12}.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT No. 4.—BRECKENRIDGE AND SAINT PAUL.

Northwestern Telegraph Company.

BRECKENRIDGE TO SAINT PAUL.	SAINT PAUL TO BRECKENRIDGE.
At 6.31 a. m., 3.31 p. m., and 9.56 p. m., Breckenridge will send reports—	
To— Saint Paul.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER T[13].

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

[Working forms of circuit.]

CIRCUIT NO. 5—FORT SULLY AND OMAHA.

Northwestern Telegraph Company.

FORT SULLY TO OMAHA.	OMAHA TO FORT SULLY.
At 6.15 a. m., 3.15 p. m., and 9.40 p. m., Fort Sully will send reports—	
To— Omaha.	

NOTES.

1. Each station will take down the reports sent by the others, in regular succession, so that when the last one finishes, all of them will have the full reports from the others.
2. Each intermediate station will take down the above reports as they pass over the line. Copies of these reports will be bulletined in the rooms of the different boards of trade, and furnished to the local papers for publication.
3. The time given for sending reports is the local time of that particular station.

PAPER Z.

WEEKLY WEATHER CHRONICLE.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE,
Washington, D. C., October 31, 1872.

GENERAL SUMMARY FOR THE WEEK ENDING THURSDAY, OCTOBER 31, 1872.

Two extensive rain-storms have prevailed during the past week, the one moving northward over the Atlantic States, with very rough weather from Florida to Cape Cod, the other advancing northeastward over Kansas, Nebraska, and Minnesota into Canada, its rain-belts extending far to the southward and eastward.

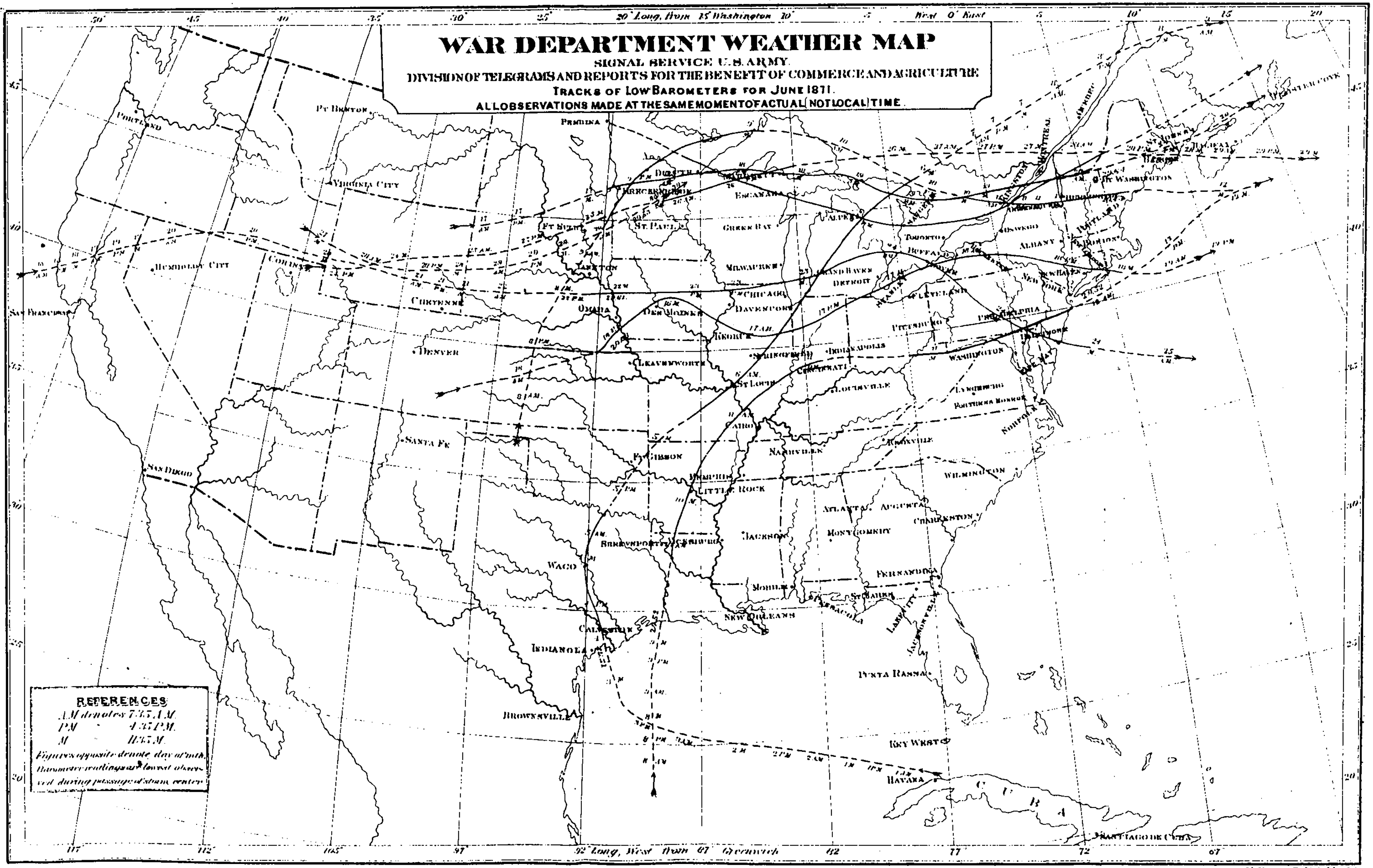
Thursday, 24.—The storm which had advanced from Florida continued central over the eastern portions of the Carolinas, moving slowly northward; brisk northeasterly winds and heavy rains prevailed thence along the coast to Connecticut; increasing cloudiness, followed by light rain, over the Ohio Valley and the Lower Lake region; clear weather from the Missouri Valley to the Upper Lakes.

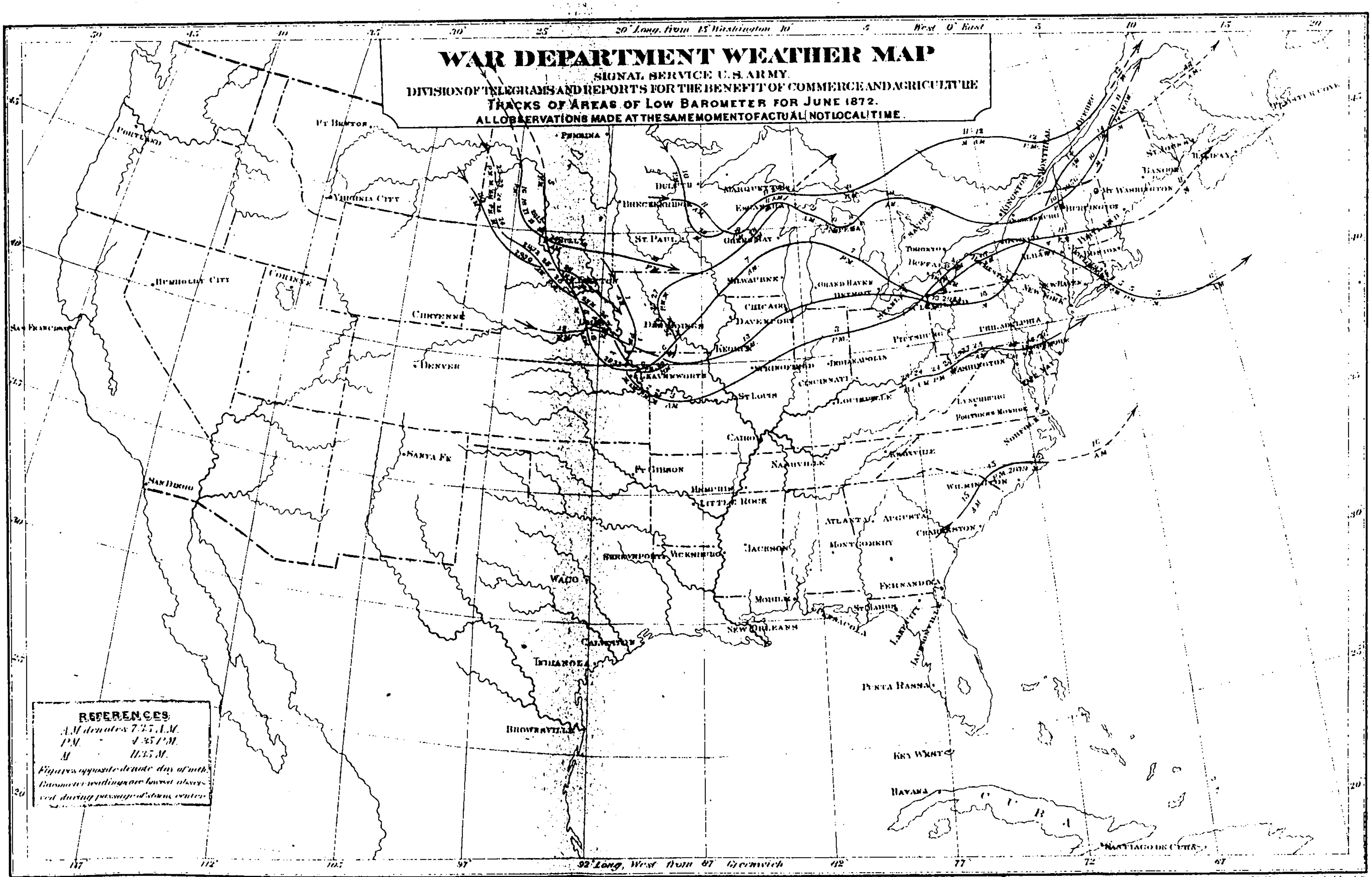
Friday.—The storm slowly continued its northward movement over the eastern portions of North Carolina and Virginia, brisk and high northeasterly winds and heavy rains prevailing thence to New York; cloudy weather, with light rain, from Kentucky to Michigan and the Lower Lakes; continued clear weather from the Lower Mississippi Valley to Lake Michigan and westward; clearing and clear weather over the South Atlantic and Gulf States.

Saturday.—The morning reports locate the storm-center in Pennsylvania, the afternoon in New York, northerly and easterly winds and heavy rains prevailing thence to the New England coast; westerly and northwesterly winds, with light rains, from Michigan to Western Pennsylvania, and with clearing weather from Indiana and Kentucky to Chesapeake Bay; generally clear weather over the Southern States and the Northwest.

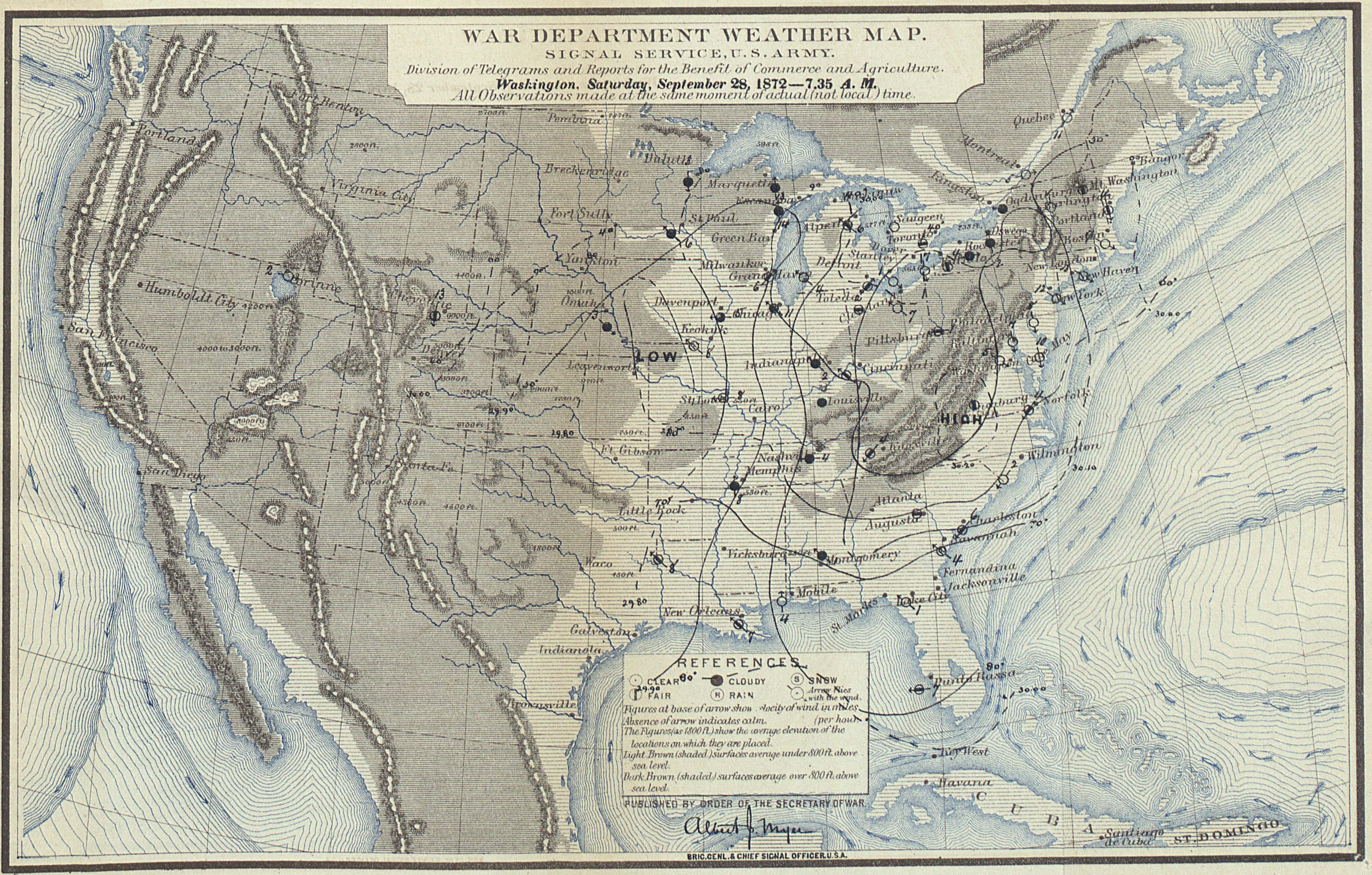
Sunday.—By morning the storm-center had moved eastward to the coast of Maine. Light rains continued over the Lower Lake region and Middle and Eastern States, with brisk northeasterly winds on Lake Ontario, and in the evening on the New England coast, followed at night by rapidly rising barometer and clearing weather.

Monday.—Cloudy weather prevailed from West Virginia to Lake Erie and eastward to the Atlantic, with light rains and brisk northeasterly winds along the coast from North Carolina to Connecticut, succeeded during the evening by clear weather north of Virginia. Clear and

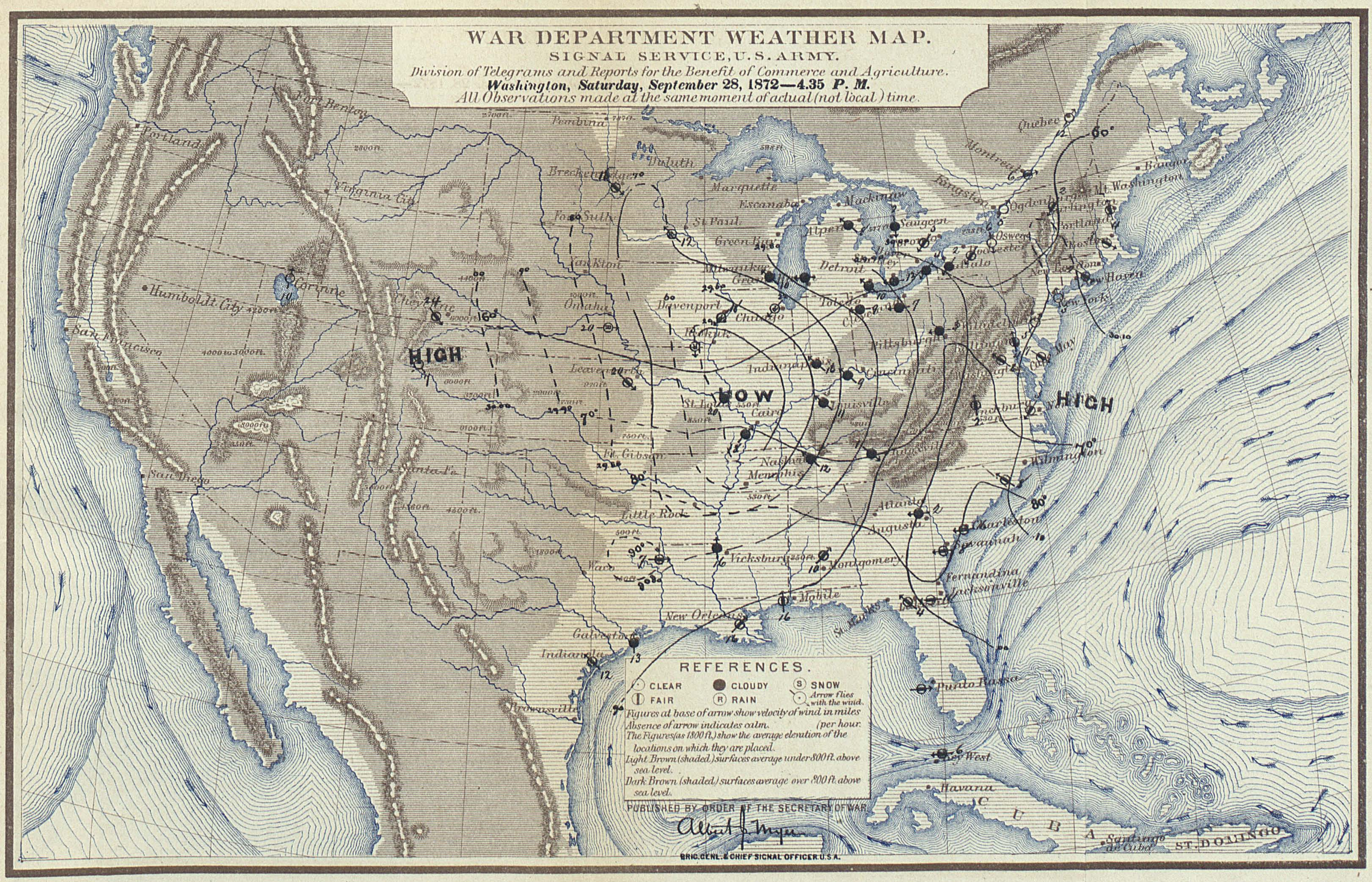

WAR DEPARTMENT WEATHER MAP
SIGNAL SERVICE U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE
TRACKS OF LOW BAROMETERS FOR JUNE 1871.
ALL OBSERVATIONS MADE AT THE SAME MOMENT OF ACTUAL (NOT LOCAL) TIME.
REFERENCES
A.M denotes 7.35 A.M.
P.M " 4.35 P.M.
M " 11.35 M.
Figures opposite denote day of mth.
Barometer readings are lowest observed during passage of storm center
Long. from Washington
Long. West from Greenwich
Portland
Virginia City
Humboldt City
San Francisco
Corinne
Cheyenne
Denver
Santa Fe
San Diego
Omaha
Leavenworth
St. Louis
Chicago
Milwaukee
Davenport
Des Moines
Duluth
St. Paul
Escanaba
Green Bay
Detroit
Cleveland
Buffalo
Toronto
Oswego
Albany
New York
New Haven
Boston
Philadelphia
Baltimore
Washington
Cape May
Pittsburg
Cincinnati
Indianapolis
Louisville
Lynchburg
Portress Monroe
Norfolk
Nashville
Knoxville
Memphis
Little Rock
Shreveport
Jackson
Atlanta
Augusta
Charleston
Wilmington
Montgomery
Mobile
New Orleans
Galveston
Indianola
Brownsville
Waco
Fernandina
Jacksonville
Punta Rassa
Key West
Havana
Cuba
Santiago de Cuba



WAR DEPARTMENT WEATHER MAP
SIGNAL SERVICE U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE
TRACKS OF AREAS OF LOW BAROMETER FOR JUNE 1872.
ALL OBSERVATIONS MADE AT THE SAME MOMENT OF ACTUAL (NOT LOCAL) TIME.
REFERENCES.
A.M. denotes 7.35 A.M.
P.M. " 4.35 P.M.
M. " 11.35 M.
Figures opposite denote day of mth.
Barometer readings are lowest observed during passage of storm center.
Long. from Washington
Long. West from Greenwich
Portland
Virginia City
Humboldt City
Corinne
San Francisco
Cheyenne
Denver
Santa Fe
San Diego
Pembina
Pt Benton
Duluth
St. Paul
Marquette
Escanaba
Green Bay
Milwaukee
Chicago
Davenport
Des Moines
Keokuk
Leavenworth
St Louis
Springfield
Indianapolis
Cincinnati
Louisville
Cairo
Ft Gibson
Memphis
Little Rock
Nashville
Knoxville
Shreveport
Vicksburg
Jackson
Waco
Galveston
Indianola
Brownsville
New Orleans
Mobile
Pensacola
Atlanta
Augusta
Montgomery
Charleston
Wilmington
Lynchburg
Norfolk
Washington
Baltimore
Philadelphia
New York
New Haven
Boston
Albany
Toronto
Buffalo
Detroit
Grand Haven
Pittsburg
Oswego
Kingston
Montreal
Quebec
Burlington
Mt Washington
Portland
Eastport
Halifax
Cape May
Cape Hatteras
Fernandina
St Augustine
Jacksonville
Punta Rassa
Key West
Havana
C U B A
Santiago de Cuba
J.L. Kervand Lith Wash.



WAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE, U. S. ARMY.
Division of Telegrams and Reports for the Benefit of Commerce and Agriculture.
Washington, Saturday, September 28, 1872—7.35 A. M.
All Observations made at the same moment of actual (not local) time.
REFERENCES.
CLEAR
CLOUDY
SNOW
FAIR
RAIN
Arrow flies with the wind.
Figures at base of arrow show velocity of wind in miles (per hour).
Absence of arrow indicates calm.
The Figures (as 1800 ft.) show the average elevation of the locations on which they are placed.
Light Brown (shaded) surfaces average under 800 ft. above sea level.
Dark Brown (shaded) surfaces average over 800 ft. above sea level.
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
BRIG. GENL. & CHIEF SIGNAL OFFICER. U. S. A.
LOW
HIGH
Portland
Virginia City
Humboldt City
San Francisco
San Diego
Santa Fe
Denver
Cheyenne
Omaha
Yankton
Fort Sully
Breckenridge
Pembina
Duluth
St. Paul
Marquette
Green Bay
Milwaukee
Chicago
Davenport
Keokuk
Leavenworth
St. Louis
Cairo
Indianapolis
Cincinnati
Louisville
Nashville
Memphis
Little Rock
Ft. Gibson
Vicksburg
Montgomery
Mobile
New Orleans
Galveston
Indianola
Brownsville
Waco
Atlanta
Augusta
Charleston
Savannah
Fernandina
Jacksonville
St. Marks
Cedar Keys
Punta Rassa
Key West
Havana
CUBA
Santiago de Cuba
ST. DOMINGO
Wilmington
Norfolk
Lynchburg
Washington
Baltimore
Philadelphia
Cape May
Pittsburg
Cleveland
Toledo
Detroit
Alpena
Toronto
Saugeen
Oswego
Rochester
Kingston
Montreal
Quebec
Ogdensburg
Burlington
Mt. Washington
Portland
Boston
New London
New Haven
New York
Bangor
Alpena
Escanaba
Grand Haven
Knoxville


WAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE, U.S. ARMY.
Division of Telegrams and Reports for the Benefit of Commerce and Agriculture.
Washington, Saturday, September 28, 1872—4.35 P. M.
All Observations made at the same moment of actual (not local) time.
HIGH
LOW
HIGH
REFERENCES.
CLEAR
CLOUDY
SNOW
FAIR
RAIN
Arrow flies with the wind.
Figures at base of arrow show velocity of wind in miles (per hour.
Absence of arrow indicates calm.
The Figures (as 1800 ft.) show the average elevation of the locations on which they are placed.
Light Brown (shaded) surfaces average under 800 ft. above sea level.
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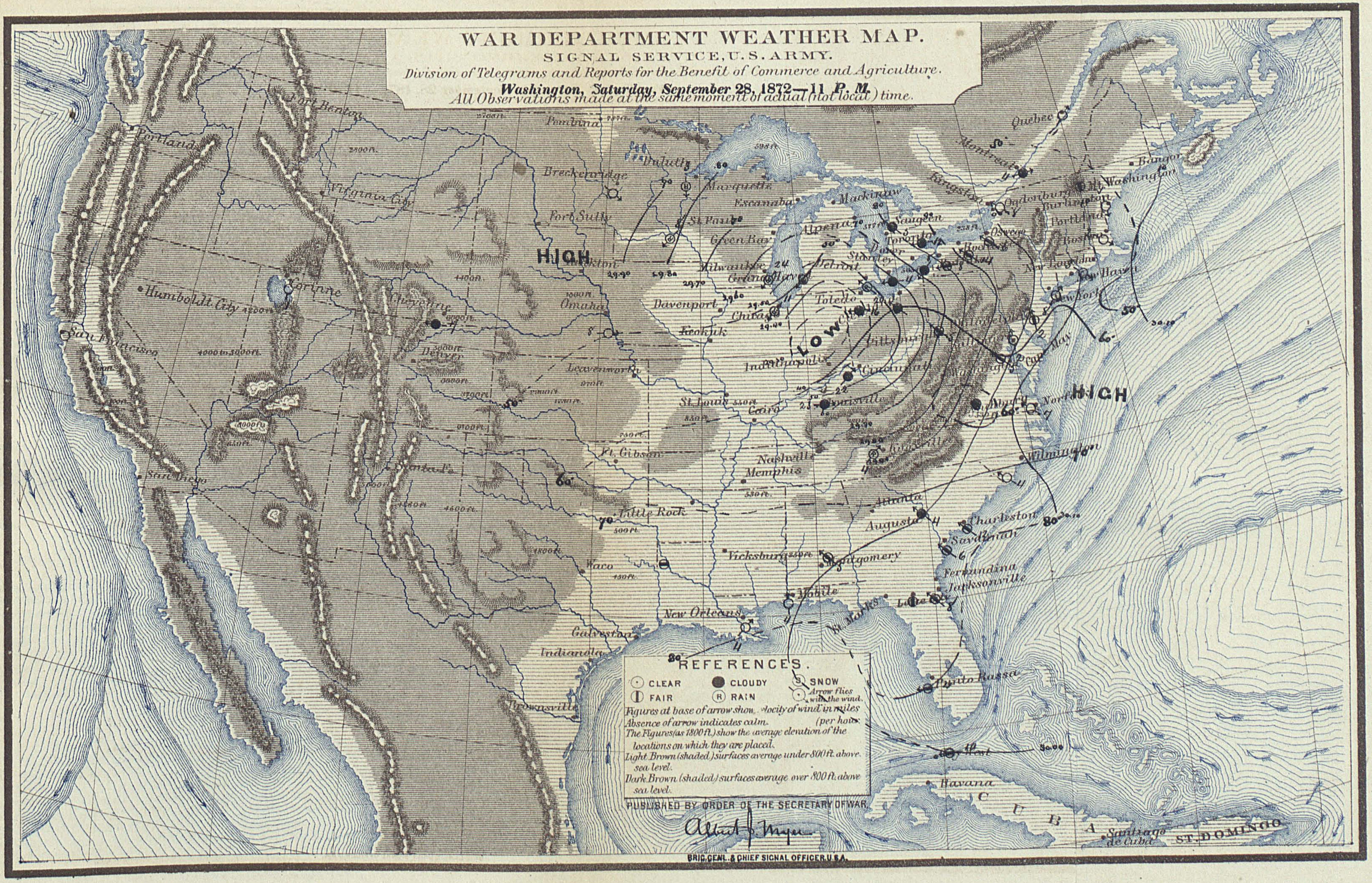
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
BRIG. GENL. & CHIEF SIGNAL OFFICER U.S.A.


WAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE, U. S. ARMY.
Division of Telegrams and Reports for the Benefit of Commerce and Agriculture.
Washington, Saturday, September 28, 1872—11 P. M.
All Observations made at the same moment of actual (not local) time.
HIGH
LOW
HIGH
REFERENCES.
CLEAR
CLOUDY
SNOW
FAIR
RAIN
Arrow flies with the wind.
Figures at base of arrow show velocity of wind in miles (per hour.
Absence of arrow indicates calm.
The Figures (as 1800 ft.) show the average elevation of the locations on which they are placed.
Light Brown (shaded) surfaces average under 800 ft. above sea level.
Dark Brown (shaded) surfaces average over 800 ft. above sea level.
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
BRIG. GENL. & CHIEF SIGNAL OFFICER U. S. A.
Fort Benton
Portland
Virginia City
Humboldt City
Corinne
Cheyenne
San Francisco
Denver
San Diego
Santa Fe
Pembina
Breckenridge
Fort Sully
Yankton
Omaha
Leavenworth
Ft. Gibson
Little Rock
Waco
Galveston
Indianola
Brownsville
New Orleans
Vicksburg
Montgomery
Mobile
St. Marks
Memphis
Nashville
Cairo
St. Louis
Keokuk
Davenport
Chicago
Milwaukee
Grand Haven
Green Bay
Escanaba
Marquette
Duluth
St. Paul
Detroit
Toledo
Indianapolis
Cincinnati
Louisville
Knoxville
Atlanta
Augusta
Charleston
Savannah
Fernandina
Jacksonville
Punta Rassa
Key West
Havana
CUBA
Santiago de Cuba
ST. DOMINGO
Wilmington
Norfolk
Cape May
New York
New Haven
Boston
Portland
Burlington
Mt. Washington
Bangor
Quebec
Montreal
Kingston
Oswego
Rochester
Buffalo
Toronto
Saugeen
Alpena
Mackinaw
Pittsburgh
Washington
Baltimore

cold weather was reported from Northern New York and New England, and generally clear weather from the Southern States; falling barometer, with brisk and high southeasterly and easterly winds and occasional rain from the northwest; heavy snow from Colorado and Wyoming Territories.

Tuesday.—In the morning very high barometer and clear weather, with frosts, prevailed over the Lower Lake region and the Middle and Eastern States; partly cloudy weather in the Southern States, with brisk northeasterly winds on the South Atlantic coast; heavy rains from Northern Louisiana and Texas to Dakota; the storm-center in Kansas and Nebraska moved northeastward during the day and evening to Iowa and Minnesota, preceded by cloudy weather, light rains, and brisk and high easterly to southerly winds thence to the Upper Lakes and Indiana. Clear and cold weather was reported in the morning from the Rocky Mountains, the temperature being 20° at Denver and 17° at Cheyenne.

Wednesday—The storm, in the morning central in Minnesota, continued its northeastward course during the day and evening, passing into Canada. Cloudy weather and rain prevailed from Minnesota and the Upper Lakes to the Ohio Valley and thence southward to the Gulf; clearing and clear weather extending eastward to the Mississippi. Generally clear weather continued over the Middle and Eastern States; prevailing cloudiness over the South Atlantic.

Thursday.—In the morning cloudy and threatening weather, with light rain, was reported from Lakes Michigan and Erie southward to the Eastern Gulf and South Atlantic coasts: cool and partly cloudy weather from the Middle States and New England; clearing and clear weather from the Mississippi Valley and westward.

During the past week rain has fallen at all of the stations, excepting, probably, Southern California and the peninsula of Florida. The largest total amounts reported are: From New York, 1.99 inches; Baltimore, 2.01; Pittsburgh, 2.22; Shreveport, Louisiana, 2.73; Rochester, 2.94; Washington, 3.45; Omaha, 3.80; Philadelphia, 4.13; and Norfolk, 6.58.

Published by order of the Secretary of War.

Furnished for the use of the—

——— ———.

——— ———.

PAPER A[1].—[FORM 15.]

[This official report is furnished the press with the explicit understanding that it shall not be altered or garbled, and that any paper using it at all will follow the precise wording given below the line. There is danger that incorrect or altered reports may greatly mislead the public, and bring discredit upon the service. Editors are requested to insist upon the accurate following of the copy.]

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
Washington, D. C., Friday, September 20, 1872—8. p. m.
Del'd 7.32 p. m.—Craig.

SYNOPSIS FOR THE PAST TWENTY-FOUR HOURS.

The low barometer, which on Thursday afternoon was over Northeastern New York, has moved eastward over and beyond the northern portion of New England, followed by fresh and brisk northwesterly winds from the Lower Lakes to the East and Middle Atlantic coasts. The pressures have diminished north and west of the Ohio Valley, and a second area of low barometer has advanced eastward to, probably, the southwestern portion of Minnesota and western portion of Iowa, accompanied by fresh to very brisk winds. A high northeasterly wind is reported from Escanaba. Clear weather is generally prevailing from the Mississippi to the Atlantic. The temperature has fallen, somewhat, over the South Atlantic States, but decidedly risen from Tennessee and Kentucky to the northwest.

PROBABILITIES.

For the New England and Middle States, on Saturday, clear weather and rising temperature, with westerly and southwesterly winds over the former, and southerly and southeasterly winds over the latter. For the South Atlantic States, clear weather and easterly to southerly winds. For the Gulf States, southerly winds and generally clear weather. From Tennessee to Lake Erie and Lower Michigan, increasing southerly winds and cloudiness, and probably threatening weather. Southerly gales are probable for Lake Michigan to-night, shifting to northwesterly during Saturday morning. Brisk and very brisk southerly winds for Lakes Erie and Huron during Saturday, and for Lake Ontario, probably, Saturday evening. For the Northwest, on Saturday, northerly to westerly winds and clearing weather.

WARNING-SIGNALS ORDERED.

Cautionary signals are ordered for Milwaukee, Chicago, and Grand Haven.

PAPER B[1].—FORM 4.

WAR DEPARTMENT, SIGNAL-SERVICE UNITED STATES ARMY,
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

Meteorological record for the week ending ——, 187–.

Day and date of observation	Time of observation.	Barometer.	THERMOMETER.		Corrected barometer.	HYGROMETER.		Relative humidity.	WIND.				LOWER CLOUDS.		UPPER CLOUDS.			RAIN OR SNOW.		Amount of rain or melted snow.	Change in river, (+ or —)	Maximum and minimum thermometer.	MEAN.		REMARKS.
			Attached.	Exposed.		Dry bulb.	Wet bulb.		Direction.	Velocity per hour.	Pressure per sq. foot.	Daily velocity.	Kind.	Amount.	Kind.	Amount.	Direction, (moving from—)	Commenced.	Ended.				Barometer.	Thermometer.	
Sunday	a. m.																								
	p. m.																								
	m.																								
Monday	a. m.																								
	p. m.																								
	m.																								
Tuesday. ..	a. m.																								
	p. m.																								
	m.																								
Wednesday.	a. m.																								
	p. m.																								
	m.																								
Thursday ..	a. m.																								
	p. m.																								
	m.																								
Friday	a. m.																								
	p. m.																								
	m.																								
Saturday...	a. m.																								
	p. m.																								
	m.																								

Station ——, ——.

——————, *Observer.*

PAPER C[1].—FORM 5.

WAR DEPARTMENT, SIGNAL-SERVICE UNITED STATES ARMY,
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE.

Report of observations taken at ———, on ———, at ———.

1						
2						

Received at ——— M.
Sent at ——— M.

——— ———,
Observer.

——— ———,
Operator.

NOTE.—All reports on this form will be made in two lines of five words each, except the *afternoon* reports from river-stations, which will be in two lines of six words each. Operators will send only the matter inside the heavy lines, without address or signature.

PAPER D[1].—FORM 24.

Record of bulletins, maps, and press reports, issued during the week ended ——, 1872, at ——.

Day.	Number of bulletins.			Number of maps.	Number of press reports.			Remarks.
	Morning.	Afternoon.	Midnight.		Morning.	Afternoon.	Midnight.	
Sunday								
Monday ...								
Tuesday ...								
Wednesday.								
Thursday ..								
Friday.....								
Saturday...								
Total								

—— ——,
Observer.

PAPER E[1].—FORM 25.

WAR DEPARTMENT, SIGNAL SERVICE UNITED STATES ARMY,
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE,

Telegram.] ——, ——, 187–, ——*m.*

——, ——.

CHIEF SIGNAL-OFFICER,
Washington :

NOTE.—Only the matter between the heavy lines to be transmitted.

PAPER F[1].—FORM 26.

OFFICE OF OBSERVATION, SIGNAL-SERVICE, UNITED STATES ARMY.

Daily report of the stage of water, with changes in the twenty-four hours ended 3 p. m. ———— ————, 187-.

	Above low water.		Changes.			
			Rise.		Fall.	
	Feet.	*Inches.*	*Feet.*	*Inches.*	*Feet.*	*Inches.*
Saint Paul						
Fort Benton						
Omaha						
Davenport						
Leavenworth						
Keokuk						
Cairo						
Saint Louis						
Pittsburg						
Cincinnati						
Louisville						
Memphis						
Vicksburg						
Shreveport						
Nashville						
New Orleans						

———— ————,

Observer, Signal-Service, United States Army.

PAPER G¹.—FORM A.

WAR DEPARTMENT, OFFICE OF THE CHIEF SIGNAL-OFFICER,
DIVISION OF TELEGRAMS AND REPORTS FOR THE
BENEFIT OF COMMERCE AND AGRICULTURE.

Report of Government messages refused by ——— Telegraph Company during the week ending ———, 187 , at ———.

Date.	Time of tendering message.	Nature of message.	Name of operator refusing message.	Remarks.

I certify that the above statement is correct, and that the messages were tendered by me and refused at the hours named.

——— ———,
Observer, Signal-Service, U. S. A.

PAPER H[1].—FORM B.

MESSAGES SENT AND RECEIVED.

OFFICE OF THE CHIEF SIGNAL-OFFICER,
———, ———, 187–.

MESSAGES RECEIVED.					MESSAGES SENT.			
Date.	From—	Line rece'd by.	Time received.	No. of words.	To—	Line sent by.	Time sent.	No. of words.

——— ———, *Observer.*

All messages sent and received will be entered in Form B, except ordinary telegrams to the Chief Signal-Office. The account will be kept *by messages*, whether they contain one weather report or more, from one or more stations. Returns to be made *weekly* to Signal-Office. Original received messages will accompany the form.

PAPER P.—FORM C.

SIGNAL-SERVICE, UNITED STATES ARMY,
Observer's Office, ——, ——, 187–.

To —— ——,
Manager of the —— *Telegraph Company at* ——:

SIR: As an agent of the War Department for the purpose of taking meteorological observations, in pursuance of the laws of the United States, and of preparing telegraphic communications relating thereto, and of presenting the same for transmission to telegraph companies, I have the honor to give notice hereby that, in accordance with orders received by me to that effect, I will present at the office of the above-mentioned telegraph company at this place, severally, at the times hereinafter mentioned, certain official communications from myself, in my official capacity, and addressed as specified, viz:

One communication will be presented at —— o'clock —— minutes —— m. of —— the —— day of ——, 1872, addressed to —— ——.

One communication will be presented at —— o'clock —— minutes —— m. of —— the —— day of ——, 1872, addressed to —— ——.

One communication will be presented at —— o'clock —— minutes —— m. of —— the —— day of ——, 1872, addressed to —— ——.

I have the honor to request that the communications above referred to may be received and transmitted telegraphically by the said company to their respective addresses at the times above mentioned, at which they will severally be presented for that purpose.

I am, sir, respectfully, yours,

—— ——,
Observer-Sergeant, Signal-Service, U. S. A.

PAPER J[1].

Station: ——————————.

Date: ——————————, 187–.

Observations.		Local, (local time)	7 a.m.	2 p.m.	9 p.m.
		Telegraphic (Washington time)	a.m.	p.m.	p. m.
Barometer.		Observed height			
		Attached thermometer			
		Correction for temperature			
		Barometer: Corrected for temperature			
		Correction for elevation			
		Barometer: Corrected for elevation			
		Instrumental error			
		Barometer corrected			
Hygrometer.		Dry bulb			
		Wet bulb			
		Relative humidity			
Thermometer.		Exposed			
		Maximum			
		Minimum			
Wind.		Direction (from) and character			
		Anemometer, 1st reading			
		Anemometer, 2d reading			
Clouds.	Upper.	Kind			
		Amount in fourths			
		Direction (from) and velocity			
	Lower.	Kind			
		Amount			
		Direction and velocity			
Weather.	Began, ended, and amount in inches. Washington time.	Rain			
		Hail			
		Snow			
		Sleet			
River-gauge.		Observed height			
		Change in 24 hours			

57