tion which will nearly coincide with that of January 1st. The distance between the two positions is that traversed in seven-tenths of a day. The dates given without the orbit, are those which belong to the more advanced positions of the first revolution of the planet; those within the orbit apply to the second revolution. Since the eccentricity of the orbit is very small, Venus moves at a velocity which does not vary much from 22 miles a second.

MARS.

With an eccentricity less than that of Mercury's orbit, the plane of Mars's orbit is inclined at an angle of 1.85 deg. But owing to the increased diameter, the distance from the sun to *c*, the center of the orbit, is over 13 million miles. The length of the major axis is 283 million miles; i. e., the mean distance from the sun is 141.5 million miles, which is diminished by 13 million at perihelion (*P*), and increased by the same distance at aphelion. The mean velocity of the planet is 15 miles a second. That part of the orbit which is above the plane of the ecliptic is represented by a full line; and the part below that plane, by a dotted line.

The point where the planet passes from the space below the plane of the ecliptic to that above is the ascending node *N*; and the point where it passes from the space above to that below is the descending node *N'*. The line joining these points is the intersection of the plane of the orbit with that of the ecliptic. This line is not fully shown in the plot except in the case of Mercury's orbit.

THE MAJOR PLANETS.

The diameter of Neptune's orbit is thirty times that of the earth; therefore it is obviously impossible to include the orbits of all of the planets advantageously in one plot within the limits of this page. In Plot 2 the orbits of Jupiter, Saturn, Uranus, and Neptune are shown on a very much reduced scale. The earth's orbit is included, and its axis produced, to establish the relation between the two plots; and also to show the continuity of the solar system. The position of each planet is plotted for January 3rd and December 29th. In Plot 1 the larger scale makes it possible to exhibit the positions as seen from the sun at shorter intervals of time. Jupiter's positions in the heavens are indicated by arrows at regular intervals of 20 days; Saturn's, 60 days; Uranus's, 120 days; and Neptune's, 180 days. Intermediate positions and dates are easily interpolated by subdivisions.

Jupiter's velocity at a mean distance of 483.3 million miles from the sun is a little over 8 miles a second. His orbit is inclined at an angle of 1.3 deg. The distance from the sun to the center of the orbit is more than 23 million miles.

Saturn's orbit is inclined at an angle of 2.5 deg., and the planet's velocity is 6 miles a second at a mean distance of 886 million miles. The distance from the sun to the center of the orbit is nearly 50 million miles.

The velocity of Uranus is nearly 4¼ miles a second at a distance of 1,782 million miles; and the distance from the center of the orbit to the sun is 82.5 million miles. The orbit is inclined at an angle of a little over ¾ deg.

Neptune, the outermost planet, has a velocity of 3.4 miles per second; and an orbit which is inclined at 1.78 deg. The distance from the sun is 2,791.6 million miles; and the center of the orbit is only 25 million miles from the center of our system.

Plot 1 is the fourth of a series showing the positions of the terrestrial planets for the years 1906, 1907, and 1908; published in the Scientific American on March 17th, February 9th, and February 15th of those years. During this period of four years Mercury makes 16½ revolutions around the sun; Venus, 46½ revolutions; Mars, nearly 2⅛; Jupiter, nearly 1/3; Saturn, between 1/7 and 1/8; Uranus, less than 1/20; and Neptune, 1/40 of a revolution.

As previously explained in articles on this subject, the morning and evening stars for any day in the year may be ascertained by holding the page in a position when the earth in Plot 1 at the assigned date is between the reader and the sun. The date attached to each of the terrestrial planets may then be read without turning the head; and the planet's position will indicate whether it rises before or sets after the sun, i. e., whether it is morning or evening star. For example, the page should be turned about one-fourth of the way around until the earth is between the reader and the sun on January 6th, the date of the opposition of Neptune. Since the earth rotates in the direction of the arrow (see January 1st) Mercury, which was not far from superior conjunction, evidently set very soon after the sun; and was therefore an evening star. On the same day Venus and Mars rose before the sun, and were morning stars. Neptune was above the horizon before and after midnight; and was both morning and evening star.

The page should now be turned round for the date February 28th, when Jupiter came to opposition, and was both morning and evening star. On this day Mercury, Venus, and Mars were morning stars. The date of the opposition of Uranus will be July 11th, when the planet will be both morning and evening star. On this day Mercury will be morning star; and Venus evening star. On September 23rd Mars will be at opposition, and Mercury and Venus will be evening stars. Saturn will come to opposition on October 13th. Mercury will be very near inferior conjunction, and will be morning star. Venus will be evening star. Prior to conjunction a major planet is evening star; and after conjunction it is morning star. Conjunctions occur in the following order: Uranus on January 7th, Saturn on April 3rd, Neptune July 9th, and Jupiter September 18th. When a planet is near conjunction, while it is either morning or evening star, it is too near the sun for observation, because it is lost in the sun's rays. The directions in which the major planets are seen at the dates of opposition are shown by arrows which are longer than those to which the dates are attached.

THE RECENT SUBSIDENCE OF NIAGARA FALLS.

BY ORRIN E. DUNLAP.

On February 14th, 15th and 16th, 1909, an east wind blew up Lake Erie and drove the water far back up the lake, greatly reducing the amount which it was possible for the lake to discharge into the Niagara River channel. This condition lasted for a longer period than ever before known; and the failure of Lake Erie to discharge its accustomed flow into the river channel, combined with great fields of ice previously carried down toward the Falls and left to settle on bars and rocks, resulted in Niagara's experiencing what will long be recalled as a truly remarkable spectacle. The ice above Goat Island on the New York side of the river shut off the water supply of the American channel between Goat Island and the New York mainland. This rendered the channel, usually the scene of a frightful battling and tossing of chaotic waters, practically dry. As little or no water passed through the channel, the American Fa'' with its precipice face 1,000 feet wide was also left dry.

Except for a few struggling rivulets here and there, none were of sufficient quantity to prevent men from walking across the channel from the mainland to Goat Island in rubber boots. Others crossed the channel above the Goat Island bridge, and from Goat Island to the mainland, making their way upstream toward the power intakes. The Horseshoe Fall resembled anything but the robust flood so much admired. Its quantity was reduced by half, and this when it was catching all the water diverted from the American channel. Down in the gorge below the Falls, rocks were bared which had never appeared above the surface before. The Whirlpool rapids and Whirlpool suffered from the holdback of the lake flow, so that all the way from Lake Erie to Lake Ontario the people stood amazed at the strange scene developed by robbing the river of a portion of its flow.

In 1848, on March 29th of that year, it is recorded that a somewhat similar condition existed at Niagara, but words afford the only comparison, for no pictures were handed down from that time. On March 22nd, 1903, crowds hurried to the river to see the American channel dry, while the American Fall was in very similar condition to what it was during the few days in February this year.

For practically half a week the unusual conditions prevailed, and during that time Niagara was only half herself. A change in the wind drove the water back down Lake Erie, and the overflow to the river was increased. This overflow grew in quantity, but the restoration was not immediate, for days went by before the American Fall was anything like its former self.

The power companies on both sides of the river were hampered by the dry spell.

Death of Carroll D. Wright.

Dr. Carroll D. Wright, well known to political economists as a statistician, died February 20th at Worcester, Mass., at the age of sixty-nine.

Dr. Wright began his career with the Massachusetts Bureau of Statistics of Labor in 1873. In 1885 he investigated the public records of towns, parishes, counties, and courts, and was appointed United States Commissioner of Labor. That office he held for twenty years, filling it ably. In addition to his duties as Commissioner of Labor, Dr. Wright took an active interest in the eleventh census, of which he had charge. His economic knowledge proved of service to his country when he acted as chairman of the United States commission which investigated the Chicago strike difficulties in 1894. Political economists regarded as authoritative his works "The Factory System of the United States," "Relation of Political Economy to the Labor Question," "History of Wages and Prices in Massachusetts," "The Industrial Evolution of the United States," "Outline of Practical Sociology," and "Battles of Labor." He wrote many special reports for the United States Department of Labor, as well as pamphlets and monographs on commercial and economical topics.

UNITED STATES LIFE-SAVING STEAMER "SNOHOMISH."

The discovery of the mineral wealth of Alaska led immediately to a large development of the coastwise trade along the northwestern seaboard of the United States, and particularly in Puget Sound. Navigators are familiar with the unusual hazards of wind, currents, and fog encountered in this locality. The entrance to Puget Sound through the Straits of Juan de Fuca is for six months of the year obscured by fogs and haze which, combined with the erratic and but-little-understood currents, render these waters particularly difficult of navigation. Deep-water soundings extend close inshore, so that the lead cannot be depended upon to indicate a near approach to land; yet it is a fact that this is the most important entrance on the Pacific coast, the amount of shipping that passes through it annually being reckoned at six million tons. During the past fifty years, nearly 700 lives and many millions of dollars' worth of property have been lost in the Straits and in their immediate vicinity. The greatest disaster of all occurred in a dense fog on the night of January 22nd, 1906, when the coastwise passenger steamer "Valencia" overran her distance, failed to pick up the lights at the entrance to the Straits, and went on the rocks at the foot of the high cliffs of Vancouver Island. Although the ship did not go to pieces for a day and a half after she struck, 136 lives were lost, there being no life-saving station within reach and vessels being unable to approach her because of the heavy sea that was running. Immediately after this disaster, President Roosevelt appointed a commission to investigate the circumstances of the wreck and recommend some means whereby passengers might be saved under similar difficult conditions. After mature consideration the Board, in addition to suggesting the provision of additional lightships, coastwise telegraph and telephone lines, fog signals, wireless telegraph, etc., recommended that "a first-class ocean-going life-saving steamer, or tug, be constructed and stationed at Neah Bay, the only available harbor within five miles of the entrance to the Straits, and that the steamer be equipped with the best possible appliances of surf boats and lifeboats, and with a wireless telegraph apparatus." Congress appropriated $200,000 and provided that the life-saving tug should be constructed and operated by the revenue cutter service. In the design of the boat the following conditions were fulfilled:

1. The vessel must be sufficiently large to be seaworthy under all conditions of weather.

2. An ample coal supply must be furnished to enable the vessel to keep the sea for a number of days, as it is presumed that she will be quite often called upon to search for missing vessels.

3. Every known provision must be fitted to equip her for life-saving in the open sea, and for rescuing persons from wrecks on the shore.

The new life-saving vessel, which is enrolled in the revenue cutter service, and has been named the "Snohomish," was built by the Pusey & Jones Company, of Wilmington, Del. In her general design she resembles the numerous first-class tugs which are to be found on both the Atlantic and Pacific coasts; and as Neah Bay, the headquarters of the new craft, is a most dreary and unattractive place, considerable attention was given to providing as comfortable living quarters for the officers and crew as could be fitted in the limited space available.

The "Snohomish" is 152 feet in length over all, 29 feet in breadth, and her displacement on a mean draft of 12 feet 4¼ inches with 125 tons of coal and 11,000 gallons of water on board is 795 tons. She is built of mild steel, with an inner bottom extending the length of the boiler space; the scantlings are heavy throughout, and the hull is divided into several watertight compartments.

She is driven by 1,200-horse-power engines at a speed of between 13 and 14 knots, and her coal capacity will enable her to steam for 3,000 miles at a speed of 12 knots. She carries a crew of sixteen men. The vessel has two self-baling and self-righting lifeboats and a life-raft, besides her regular boats. She is equipped with wireless telegraphy, with the Ardois system of night signaling, and with two searchlights. She also carries wrecking apparatus for pumping out vessels, and a fire-fighting outfit.

The most interesting and novel equipment of the "Snohomish" is the special marine cableway designed for taking passengers and crew from a wrecked ship which it is impossible to approach by lifeboats. It will be seen from the description and from the accompanying illustrations that the apparatus, which was designed by the Lidgerwood Manufacturing Company, is nothing more nor less than the breeches buoy apparatus modified to meet the special conditions of its use between two ships in a seaway.

The "Snohomish" will steam to within life-line distance of the wrecked vessel and fire a line across the

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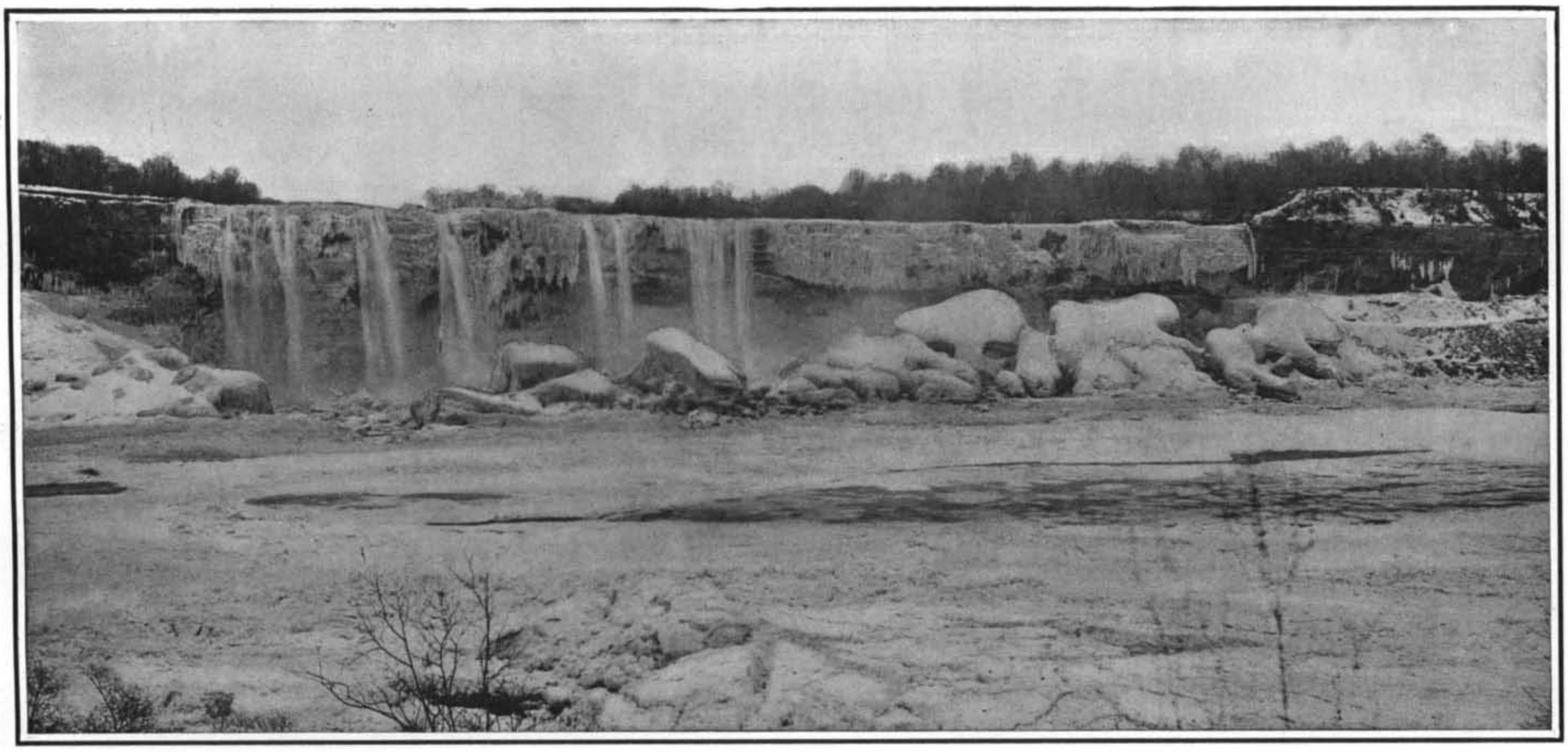

The drying up of the American Falls due to the backing of the water of Lake Erie. An east wind blew up the lake and drove the water back so that the amount ordinarily discharged into the channel which feeds Niagara Falls was greatly reduced. An ice jam helped to dam the flow.

The American Falls when the flow is normal.

THE RECENT SUBSIDENCE OF NIAGARA FALLS.—[See page 187.]