PART THREE
EDITORIAL
PAGES ONE TO SIX

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MAGAZINE
PAGES ONE TO SIX

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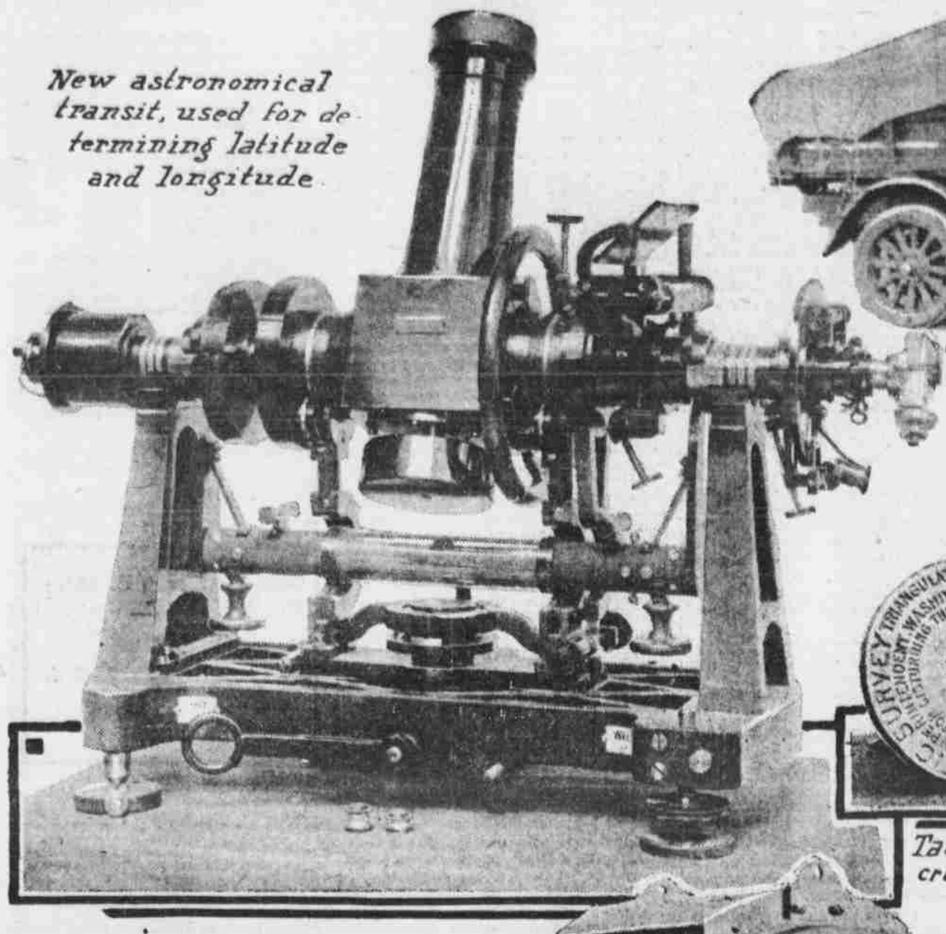
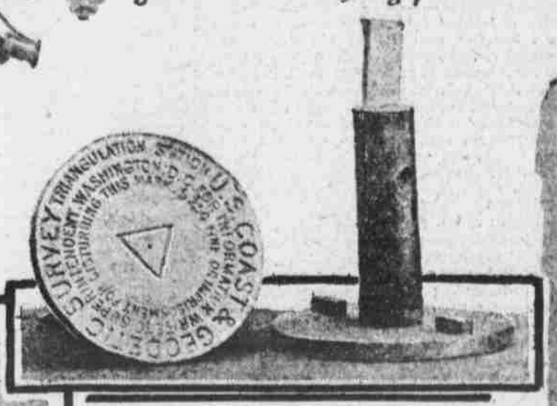
Locating Omaha's Spot Under the Sun

How the Precise Place on the Earth's Surface is Found

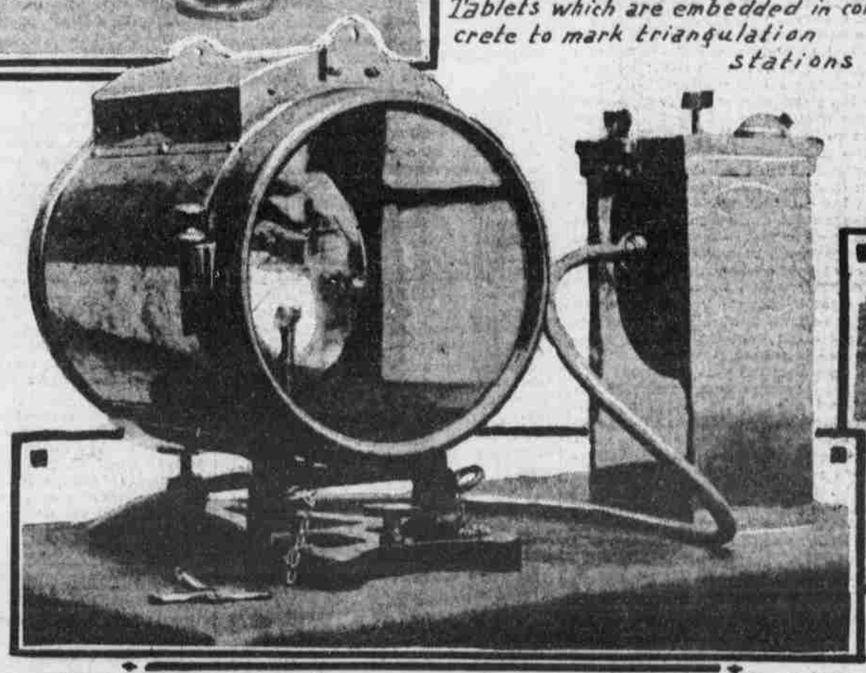


New astronomical transit, used for determining latitude and longitude

Automobile truck for transporting geodetic surveying parties

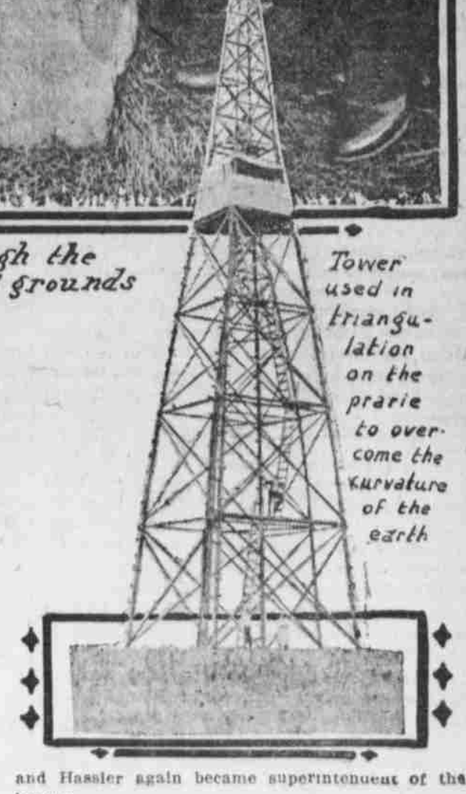


Tablets which are embedded in concrete to mark triangulation stations



Acetylene signal lamp used in triangulation

Where the meridian passes through the Omaha High School grounds



Tower used in triangulation on the prarie to overcome the curvature of the earth

By EDGAR C. SNYDER,
Washington Correspondent of The Bee.

DO YOU KNOW just where Omaha lies on the surface of this terrestial globe that we call the earth?

Certainly, you say, it lies on the banks of the Missouri river, at the eastern border of the state of Nebraska.

But that reply is merely relative. It doesn't fix the position of Omaha in accurate scient'fic terms.

This scientific fixing of Omaha has been done by means of such wonderful instruments as the "astronomical transit," the process of "triangulation" and by the most careful and minute measurements, made by the United States Coast and Geodetic survey.

Up on the high school grounds you can see, probably have seen, two stone pillars set side by side like Druidical ruins.

These are the stones on which the instruments of the Coast and Geodetic survey rested when the scientists determined the exact position of Omaha. And from this spot, as a starting point, the surveys for mapping all of eastern Nebraska and western Iowa were extended, the location of every township and section line and farm "quarters," "eighty" or "forty" was determined.

The location of those two parallel stones on the high school grounds is 95.56 degrees longitude west and 41.16 degrees of latitude north.

That is to say, Omaha is located 95.56 degrees of longitude west of Greenwich. Greenwich is a big observatory near London, England, which is set as the mark from which all places in the world are measured as regards their longitude. The earth is divided into 360 degrees, measuring 180 degrees from Greenwich west and 189 degrees from Greenwich east.

Latitude means the distance of any point in the world north or south of the equator which is marked zero. Omaha is 41.16 degrees of latitude north of the equator. The north pole is ninety degrees north of the equator. Omaha, therefore, is not quite half way between the equator and the north pole.

Interesting Process of Exact Accuracy

The process by which Omaha's position was accurately determined was explained to me by the superintendent of the United States Coast and Geodetic survey.

The locating of any point on the earth's surface depends on two elements, namely time and the position of some certain heavenly body, either the sun or some star. And the most perfect accuracy is requisite in making the observations.

It is evident that at any instant of time the position of the sun in the heavens is different at two different points. Thus, when it is 9 a. m. in San Francisco the sun is at the noonday zenith in New York. The mariner out at sea determines his position by this same method. On every ship the chronometer is a most important instrument. By means of it and the sextant the captain can determine just where he is in the great watery desert.

The chronometer is a clock of supreme accuracy. It is kept in a case in the chart room of the ship. It marks Greenwich time. When the captain wants to determine his position, he takes an observation of the sun with the sextant. One of the other officers keeps an eye on the chronometer. At the precise instant when the captain gets the position of the sun the other officer notes the time on the chronometer. These two observations enable them to determine their position

The same method was followed in determining the position of Omaha when, in 1869, the government undertook to link the charts of the Atlantic and Pacific coasts of this country with a series of longitude determinations at points stretching across the continent.

Triangulation of the Short Cut

The station at Harvard university, Cambridge, Mass., was used as the initial one in comparing time at all points in this survey. (The position of the Cambridge station had been accurately determined by means of astronomical observations and time flashes over the Atlantic cable with the Greenwich station in England. And so Omaha's position was determined by astronomical observations on hign school hill and telegraphic flashes for time, with Cambridge. A star was used as the basic heavenly body in determining Omaha's position.

It is too tedious and expensive to determine the position of all points on the earth's surface by this method and therefore another method called "triangulation" is used.

This is based on the simple mathematical fact, which you learned in high school, that "given one side and two angles of a triangle, the other two sides and the third angle can easily be determined.

In this process a base line is measured with supreme accuracy along the ground. Long nickel steel tapes are used for this work and the lines measured vary, usually, from four to ten miles in length. So carefully are these lines measured that the error is rarely greater than quarter of an inch in a mile. The necessity for this extreme accuracy is apparent when it is remembered that whatever inaccuracy may be in this line is multiplied as the triangulation process is carried further.

From this primary base line the triangulation advances to as great lengths as the nature of the country permits. In a country like Nebraska sides of triangles twenty-five to forty miles in length are attained. In mountainous regions they sometimes have a side as great as 100 miles. This is possible because the observers can take their observations from great altitudes, thus overcoming the cutting off of their range of vision by the curvature of the earth. In the California triangulation is a triangle whose sides measure 133, 167 and 190 miles in length. Towers were used on the Nebraska prairies by the observers to overcome the earth's curvature.

The visibility of stations in such long lines is effected by means of small mirrors reflecting the solar rays toward the observer. Such a signal may be seen in the telescope, showing like a star of the second magnitude when the outline of the mountain from which it is seen is indistinguishable.

When the largest class of instruments is used in this work the error of the result is reduced to one-fourth of a second. Each angle is measured at least twenty-five times and readings are taken with micrometer microscopes.

An arc of triangulation was extended through Nebraska along the ninety-eighth meridian about sixteen years ago and its results have been used by map makers for controlling their work in a large part of the state. The Coast and Geodetic survey will do more triangulation in the state as soon as funds are made available by congress.

Measuring Elevation Above Sea Level

The elevation of Omaha above the sea was determined also by the survey and this work has been supplemented by lines of precise levels run by other government organizations, notably the Missouri River commission.

Several "bench marks" are located in Omaha, one on the old postoffice building at Fifteenth and Dodge streets, which marks 1,041 feet above sea level. From this one has been run to the present location of the weather bureau in the new postoffice building.

Omaha's height above sea level, therefore, is about equal to three times the height of the Woodmen of the World building.

The government's oldest scientific bureau—the Coast and Geodetic Survey—will celebrate, April 5 and 6, the 100th anniversary of the beginning of its field work. President Wilson, cabinet ministers and the country's most eminent scientists will make addresses. A practical exhibition of the Survey's work will be a leading feature.

Story of the Coast Survey

The Survey was established by Thomas Jefferson in 1811 and a noted Swiss scientist, F. R. Hassler, was its first superintendent. Hassler was driven from his native country by the Swiss revolution and for a time after his arrival in the new republic was professor of mathematics at West Point. The story of his life was one of untiring quest for knowledge and indefatigable labors in its application. When 21 years of age, in co-operation with Trailes, one of the first mathematicians of the day, he began a geodetic survey of Switzerland, bearing the expense of the survey by himself at first until his work was recognized by the Helvetic government.

It is an interesting coincidence that the introduction of the first geodetic survey in the ancient republic of Switzerland should be due to the scientist who was to be first to introduce the accuracy and refinements of its methods in the first republic of the New World.

Hassler reached American shores in 1805 at the head of a colony of 120 persons organized by himself and three friends for settlement in South Carolina. Failure to receive any return for advances of funds for transportation and purchase of lands put him in financial straits and the scientist was reduced to great hardships. Two years later he accepted the place as instructor at West Point.

When in 1811 provision was made for instituting the Coast and Geodetic Survey Hassler was designated to proceed to London for the purchase of instruments. His mission also was to design the appliances. The war of 1812 caught him in England and throughout the conflict he was held as an alien enemy. It was not until four years after his arrival that he returned to America and started the next year the work of the Survey.

Soon to Celebrate Centenary of Bureau

The first operations of the survey were in New York bay and its approaches. Here the main forces of the bureau were engaged until in April, 1818, it was suspended abruptly by a short-sighted spasm of economy that in 1825 drew from Jefferson this: "I regret much that the Survey was not carried into execution. It would have procured safety for the navigation of our coast. It would have been an honorable monument of the state of science at this early period of our history."

The rapid growth of American commerce could not be menaced long, however, by dangers which made navigation of the coast and waterways uncertain to sailor and shipowner and in reply to an imperative demand congress on July 10, 1832, decided that the coast survey should be resumed, and Hassler again became superintendent of the bureau.

Besides directing the Survey, Hassler was put in charge at this time of the newly created office of weights and measures, necessity for which had become apparent by his examination of standards used in the country's customs houses. This relation between the two bureaus remained unbroken until the present Bureau of Standards was established fourteen years ago.

Expansion of geodetic operations of the survey into the interior, made in compliance with acts of Congress of 1872 and 1878, has brought to completion a big network of primary triangulation, which is the foundation for satisfactory demarcations of political boundaries and the preparation of accurate national, state and county maps.

For a study of the law controlling the operations of the magnetic needle with its importance to the mariner and every landowner in the states formed since the American revolution the Survey has carried its investigations along the coasts and adjacent waters, in every state and territory of the union and in all the island possessions under the United States flag except Guam and Samoa. Stations, at which components of the magnetic force have been observed, now number 5,000.

Dr. E. Lester Jones, present head of the Survey, who is arranging the centennial celebration, plans to have the Swiss minister, Dr. Paul Ritter, take a prominent part in the exercises because of Hassler's connection with its early history.