National Bureau of Standards Commemorative Sundial

National Bureau of Standards Welfare Association

[Editor's Note: This article reproduces the booklet published at the time of the dedication of the commemorative sundial at the U.S. National Bureau of Standards in 1948. A copy of the booklet and the photos reproduced here were kindly provided to us by Karma Beal, Archivist in the Office of Information Services at the National Institute of Standards and Technology, the successor organization to the National Bureau of Standards.]

National Bureau of Standards
Commemorative Sundial
Erected August, 1949

Dr. Lyman James Briggs retired in 1945, after having served as Director of the National Bureau of Standards since 1933. A desire to mark the occasion arose in the hearts and minds of his colleagues, whose love and esteem he had so completely won. We immediately discussed the matter with Dr. Briggs, who expressed the request that no ceremony of any kind be held in connection with his retirement. We learned, however, that Dr. Briggs had for some time cherished the idea that a sundial be erected on the grounds of the Bureau as a memorial to its first two Directors, Dr. Samuel Wesley Stratton and Dr. George Kimball Burgess. This gave us the needed clue, and we decided to erect a sundial in honor of Dr. Briggs on the terrace east of the Chemistry building. Furthermore, this sundial would commemorate the services to the National Bureau of Standards of its first three Directors - Doctors Stratton, Burgess, and Briggs.

Plans were developed to obtain a sundial of unusual design and of as high a degree of accuracy as could be obtained without the use of adjustments. An authority on sundials was engaged to design and supervise the construction. After numerous delays, due to postwar conditions, the sundial was set in place on August 13, 1948.

The sundial was very favorably located on the main road into the Bureau grounds. Each day it reminds those who had the pleasure of working with Dr. Briggs of his exemplary character and of the high esteem in which he is held. In addition, it will perpetuate the remembrance of the contributions that our first three Directors made toward bringing the National Bureau of Standards into world fame. A detailed description, by the designer, of the commemorative sundial and of its use is given on the following pages.

Commemorative Sundial and Its Use

Our sundial is composed of three principal parts: 1. the base, 2. the dial plate, and 3. the analemma.

Base

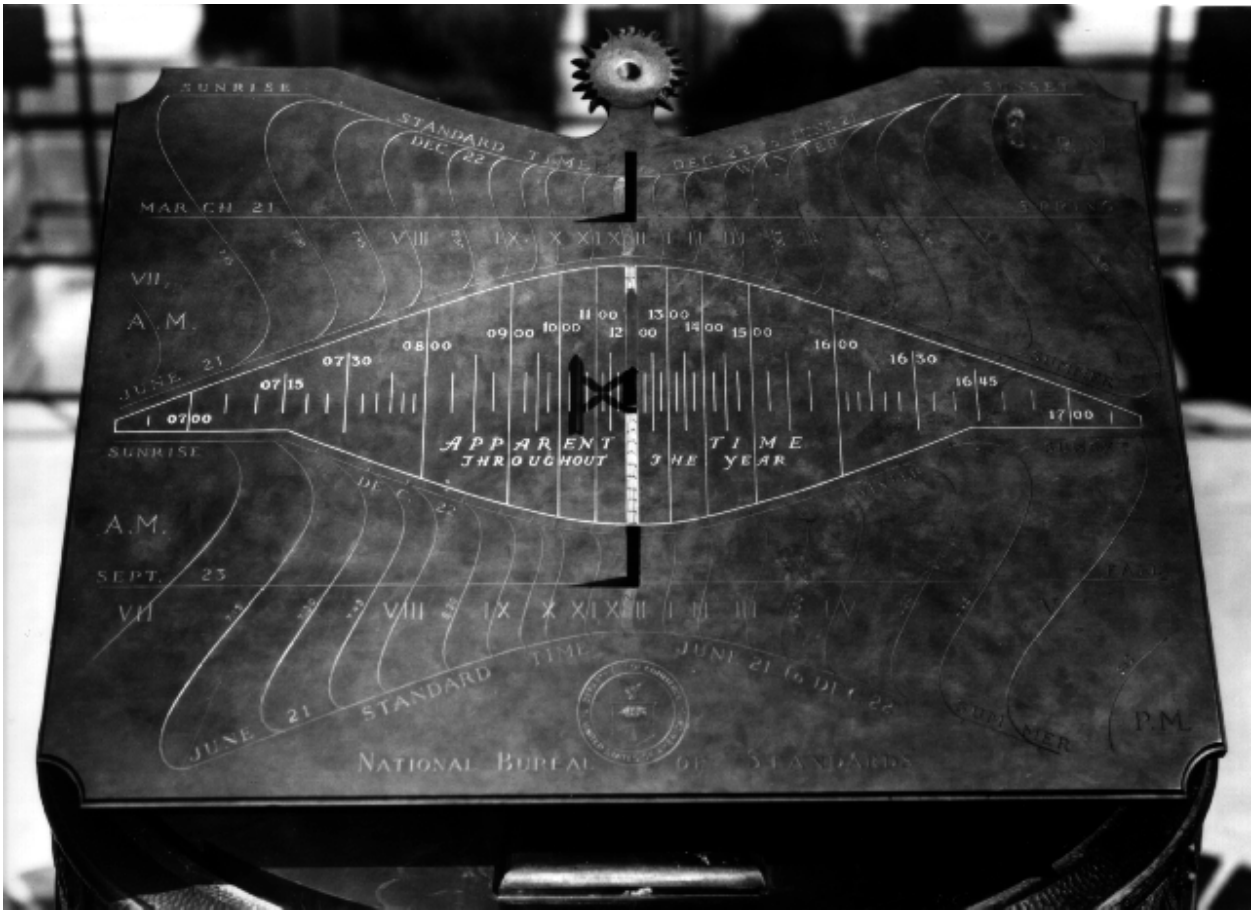
The bronze ring around the pedestal commemorates the Bureau's three former directors. The base plate bears an inscription to Dr. Briggs, as follows: "*Erected in 1948 by the members of the staff of the National Bureau of Standards in honor of their third Director, Lyman James Briggs, who retired on November 5, 1945*."

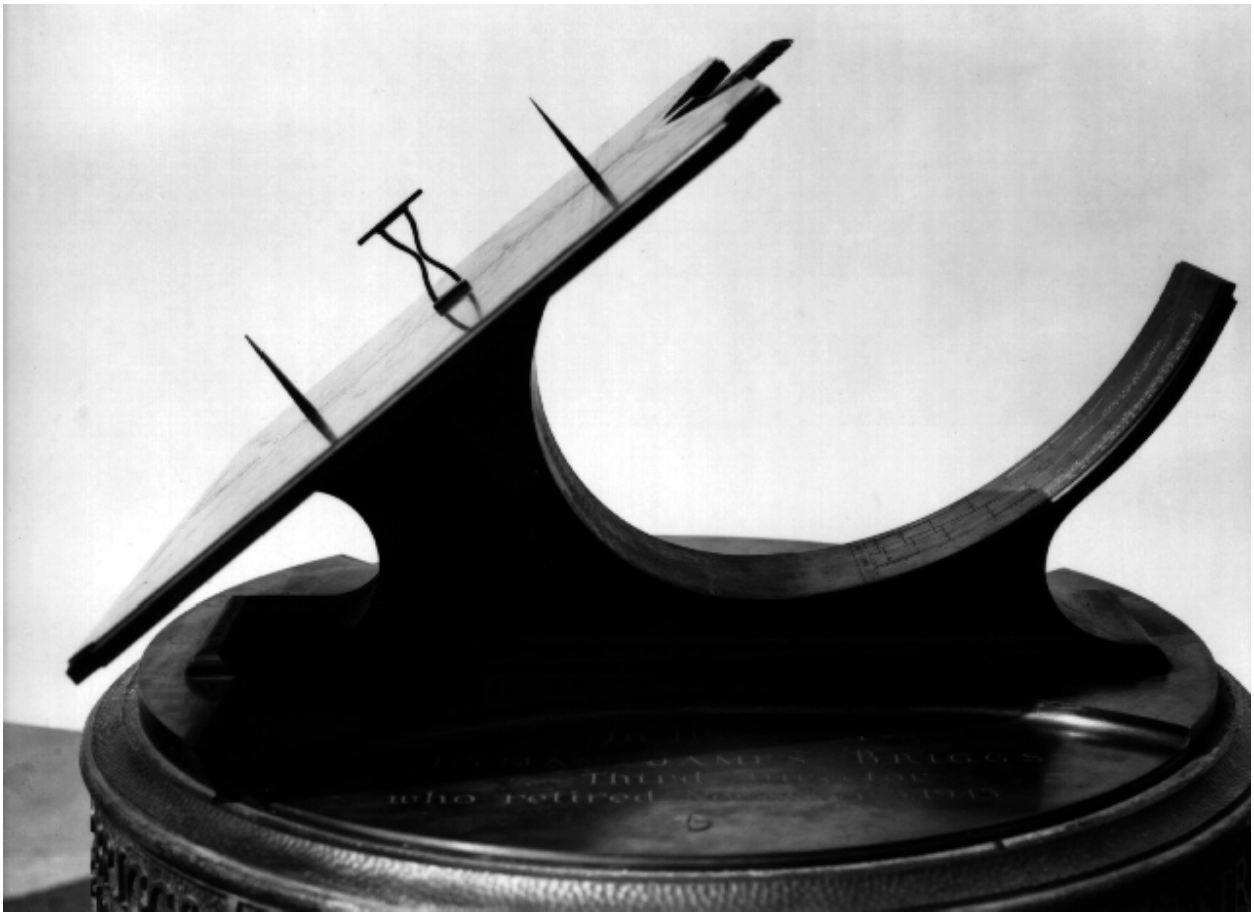
Dial Plate

The hour lines for telling time are inscribed on the dial plate, which reclines from the observer. Three sets of hour lines are used. Each has its own gnomon to cast a shadow, which is used to indicate the time.

The upper and lower gnomons point out Eastern Standard Time every day throughout the year. The middle gnomon resembles an hour glass with a bar across the top, it indicates local apparent time (sun time) throughout the year.

Two sets of hour lines are used to show standard time in order to avoid confusion in reading the time. If the position of the shadow of the upper edge of the pyramidal gnomons is plotted for each hour standard time throughout the year, a series of overlapping figure eights will result; to avoid this overlapping on our dial plate, that portion of the figure eight representing the period from December 22 to June 21 is separated from that portion representing the period from June 21 to December 22. This produces two sets of deformed


SUNRISE
STANDARD TIME
MARCH 21
VII
A.M.
JUNE 21
07 00
07 15
07 30
08 00
09 00
10 00
11 00
12 00
13 00
14 00
15 00
16 00
16 30
16 45
17 00
APPARENT TIME
THROUGHOUT THE YEAR
SUNRISE
A.M.
SEPT. 23
VII
VIII
IX
X
XI
XII
I
II
III
IV
JUNE 21 STANDARD TIME
JUNE 21 to DEC 22
P.M.
NATIONAL BUREAU OF STANDARDS



hour lines that do not overlap and makes it possible to read standard time directly and easily.

The deformation in the hour lines occurs because a correction has been applied to the hour lines as they appear in the middle or apparent time dial. This correction is the sum of two factors - one variable, the other static.

The first factor is applied to change the local apparent time hours to local mean time hours. This factor is variable and represents the equation of time, which is the difference between mean time and apparent time. It is this application of the equation of time that produces the deformed lines, or figure eights.

The second factor is the difference in longitude, expressed in time, between the sundial's position and the standard time meridian, which in this case is the 75th. This factor is static and remains the same throughout the year; therefore it is applied to adjust the figure eights or deformed lines of local mean time to positions where they become Standard Time hour lines. This adjustment takes place in a lateral direction east or west of their normal position on the dial plate, as the sundial is located east or west of the Standard Time meridian. In this manner the lines are brought into the proper position to indicate standard time without the use of tables or mental arithmetic.

Analemma

At the top center of the dial plate there is a sculptured sun, in the center of which there is a very small hole. This hole lies in the plane of the true meridian and is used to allow the rays of the sun to pass through to the arc in back of the dial plate. The spot of light thus formed points out noon Eastern Standard Time and noon local apparent time. On this arc may be seen the full figure eight, or analemma. If this were a local mean time analemma it would cut the meridian line four times and would appear symmetrical with respect to the meridian line.

The correction for longitude difference causes this analemma to be moved bodily to the west or left of the meridian as explained above. The standard time hour lines on the dial plate are just a smaller edition of this full analemma.

Also inscribed on this arc are several facts concerning the position of the sun and calendar references, which are indicated by the spot of light.

Use of the Sundial

An instrument of this kind, which has been constructed carefully, is much more than a time-telling device. It can be used to demonstrate certain well-known and accepted facts about the sun and it can be used to make clear other facts that are not always quite obvious. For example:

1. The irregular apparent motion of the sun can be observed by watching the position of the shadows of the gnomons change from day to day with respect to the hour lines. This irregular apparent motion of the sun is very clearly shown by the analemma.

2. Whether the sun is "slow" or "fast" can be determined easily by comparing the time indicated on the various dials on the dial plate.

3. The difference between apparent and Standard Time can be obtained.

4. When the shadow of the gnomons reaches the central horizontal line on the standard time dials, the sun is on the celestial equator.

5. When the shadows travel along the upper curved lines of the standard time dials, the sun has reached its greatest southern declination and winter begins; likewise when the shadows reach the lower curved lines, the sun has reached its greatest northern declination, and summer begins.

6. The upper and lower horizontal lines at the left and right of each standard time dial indicate the time of sunrise and sunset.

7. The day of the year can be determined when the spot of light is on the analemma.

8. When the spot of light appears on the meridian line, the sun has reached its greatest height above the horizon on that day. The meridian height or altitude of the sun can be obtained in degrees from the right hand column or scale.

9. When the spot of light is on the meridian line, it signifies that the sun lies in the plane of the true meridian at that moment, and the sun is due south.

10. The sun's declination (number of degrees north or south of the celestial equator) can be obtained from the left column or scale when the spot of light is on the meridian line.

11. The horizontal lines cutting the analemma, in addition to indicating the day of the year, serve to show which side of the analemma should be used for the spot of light to indicate noon Eastern Standard Time.

12. Another purpose of including the analemma is to provide a larger and more accurate hour line by means of which an observer can set his watch correctly at noon.

13. The analemma disproves the usual belief that the sun agrees with the clock four times a year. Note that the analemma cuts the meridian only twice at Washington. Only when the sundial is on or very close to a standard time meridian will it agree with the clock four times a year. In some localities, Boston for example, the apparent time sundial never agrees with the clock.

General Facts

The plane of the dial plate lies parallel to the earth's axis; therefore its surface, if extended infinitely, would cut the celestial pole (not the north star).

Because of the position of the dial plate, the sundial is technically referred to as a Polar Sundial.

The bar across the top of the hour glass gnomon points to the celestial pole.

The apparent-time Polar Sundial is one of the easiest and simplest to construct, yet very few have been made.

There are three ways of telling time by the sun - 1. by shade, 2. by light, and 3. by a magnetic needle. Our dial makes use of two of these methods - shade and light. The hours on the dial plate are indicated by a shadow, and the time and other data on the analemma are indicated by a spot of light. The combination of light and shade indicators on the same dial is not often seen, but it adds interest to the instrument.

There are three methods of telling time by the sun:

a. By measuring the hour angle of the sun from the meridian.

b. By measuring the sun's altitude.

c. By measuring the sun's azimuth.

Our dial makes use of the most common method - that of measuring the hour angle of the sun, just as does the ordinary garden variety of horizontal sundial with its sloping gnomon.

Sundials can be made to serve a particular place or places, to serve anywhere (universal), or to serve some specific purpose such as a noon mark. Our dial is made for one place - the latitude and longitude of the Bureau's grounds. It cannot be set up in New York, Philadelphia, Chicago, or any other place off its meridian and be made to tell the correct time of the locality. Also, insofar as the analemma is concerned it is made for a specific purpose - to show Apparent Time and noon Eastern Standard Time.

The arrangement of words, numerals and other data has been designed to be self-explanatory so that an observer will not require a book of instructions.

Color-Scheme

All incised-lines, numerals and figures have been filled with color to make the instrument more interesting and easier to read.

On both the analemma and the dial plate all lines referring to Standard Time have been filled with bright red; all references to apparent time are shown in white; and all references to the calendar are indicated in blue.

Because apparent time is almost always given in the 24-hour system, the apparent time lines on the dial are indicated that way, in Arabic figures; therefore, 3:00 P.M. apparent time is shown as 1500.

Standard Time is the time shown by watches and clocks and their dial faces usually display 12 hours; therefore, the Standard Time hours on our dial are marked in the same system in Roman numerals.

Acknowledgments

We are especially indebted to Mr. R. Newton Mayall, who designed and supervised the construction of our sundial. The Colonial Brass Company fabricated the parts. Mr Frederick Bagshaw did the engraving. The pedestal for the sundial was made by the Earley Studio. The bronze ring around the top of the pedestal was cast in our Bureau foundry.

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