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(April 23, 1929)

SUNDIALS

One of the earliest methods of determining time was by observing the position of the shadow cast by an object placed in the sunshine. As the day advances the position of the shadow changes and its position at any instant gives a rough indication of the time. The relative length of the shadow at mid-day can also be used to indicate the season of the year. It is thought that the great pyramids of Egypt were built for the purpose of indicating the time of day and the progress of the seasons.

The sundial, in its usual form, consists of two essential parts, a straight edged indicator or gnomon, for casting a shadow, and a suitably graduated dial on which the shadow is cast.

Sundials indicate true local sun time which differs from mean solar time by varying amounts throughout the year. It is therefore necessary to apply to indications of a sundial a variable correction known as the equation of time. It is also necessary to apply a further correction because of the fact that in most localities standard time, rather than local time, is used. This correction is constant and depends upon the difference in time, or longitude, of the standard meridian of the time zone in which the sundial is to be located and that of the particular place of location. This correction can be calculated on the basis of 15° longitude difference being equivalent to a time difference of one hour.

The standard meridians of the various time zones of the United States are as follows:- eastern, 75th; central, 90th; mountain, 105th; Pacific, 120th. The longitude and time correction for any given locality can be obtained from any map on which longitudes are accurately shown.

Today sundials are used largely for decorative purposes in gardens or on lawns, and many inquiries have reached the Bureau of Standards regarding the construction and erection of such dials. To meet this demand for information, a partial list of reliable references on sundials is given below. There is also a table showing the equation of time corrections throughout the year to the nearest half minute and a drawing showing a layout for a sundial.

References on Sundials

The following are the oldest known books on sundials:

1. Vitruvius, "De Architectura"

2. Ptolemy, "Almagest"

The following treat of sundials in general and are all later than 1875:

3. Britten, F. J., "Old Clocks and Watches and Their Makers", (Pages 5-9 treat of sundials) London, 1922.

4. Dawbarn, "The Sundial", London, 1891.

5. Dyer, Walter A., "Sundials in Modern Gardens", Country Life in America, March, 1906.

6. Earle, Alice Morse, "Sundials and Roses of Yesterday", New York, 1902.

7. Gatty, Mrs. Alfred, "The Book of Sundials", London, 1889.

8. Henslow, Thomas Geoffrey Wall, "Ye Sundial Booke", London, 1914.

9. Hogg, Warrington, "The Book of Old Sundials - Their Mottoes", London, 1917.

10. Jacoby, Harold, "Astronomy", New York, 1913.

11. Spackman, Henry Spencer, "The Timepiece of Shadows, A History of the Sundial", New York, 1895.

The following contain many mottoes which have been used on sundials:

12. Hyatt, Alfred H., "Book of Sundial Mottoes", London, 1903.

13. Rawlings, Alfred, "Book of Sundials and Their Mottoes", 1915.

14. Spackman, Henry Spencer, "The Timepiece of Shadows".

The following deal with the construction of sundials:

15. Brown, F. Willard, "A Simple Method of Laying Out a Sundial", Scientific American, Vol. 101, p. 355.

16. Crehore, A. C., "A Scientific Elucidation of Sundials",
         Jewelers Circular, June 5-26, 1907.

17. Heath, Charles, "How to Make a Horizontal Sundial",
         The Keystone, February 15, 1912.

18. Hirsberg, Leonard K., "A Pocket Sundial", Scientific
         American, August 10, 1912.

19. Jacoby, Harold, "Practical Talks by an Astronomer",
         (Pages 69-80), New York, 1902.

20. Mitchell, J. E., "How to Lay Out a Sundial", The Keystone,
         April, 1911.

21. Pettit, Edison, "A Method of Finding the Meridian by
         Shadows and Mechanically Graduating a Sundial",
         The Keystone, January, 1911.

22. Reinecke, H., "Sundials that Beautify the Landscape",
         Jewelers Circular, June 30, 1909.

23. Spackman, "The Timepiece of Shadows".

24. "Sundials and Dialing", American Jeweler, July, 1917.

The following is the most reliable table for the equation
of time:

25. The American Ephemeris and Nautical Almanac, prepared by
         the U. S. Naval Observatory.

EQUATION OF TIME

The values given below are to be added algebraically to the reading of the Sundial to obtain Mean Solar Time. Values are given to the nearest half minute.

Day of Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	+3½	+13½	+12½	+4	-3	-2½	+3½	+6	0	-10	-16½	-11
2	+4	+14	+12½	+3½	-3	-2½	+4	+6	0	-10½	-16½	-10½
3	+4½	+14	+12	+3½	-3	-2	+4	+6	-½	-11	-16½	-10
4	+5	+14	+12	+3	-3½	-2	+4	+6	-1	-11	-16½	-10
5	+5½	+14	+11½	+3	-3½	-2	+4½	+6	-1	-11½	-16½	- 9½
6	+6	+14	+11½	+2½	-3½	-1½	+4½	+6	-1½	-11½	-16½	- 9
7	+6½	+14½	+11	+2½	-3½	-1½	+4½	+5½	-2	-12	-16½	- 8½
8	+6½	+14½	+11	+2	-3½	-1	+5	+5½	-2	-12½	-16	- 8
9	+7	+14½	+10½	+1½	-3½	-1	+5	+5½	-2½	-12½	-16	- 7½
10	+7½	+14½	+10½	+1½	-3½	-1	+5	+5½	-3	-13	-16	- 7½
11	+8	+14½	+10	+1	-4	-½	+5	+5	-3½	-13	-16	- 7
12	+8½	+14½	+10	+1	-4	-½	+5½	+5	-3½	-13½	-16	- 6½
13	+8½	+14½	+ 9½	+½	-4	-½	+5½	+5	-4	-13½	-15½	- 6
14	+9	+14½	+ 9½	+½	-4	0	+5½	+4½	-4½	-14	-15½	- 5½
15	+9½	+14½	+ 9	0	-4	0	+5½	+4½	-4½	-14	-15½	- 5
16	+10	+14	+ 9	0	-4	+½	+6	+4	-5	-14½	-15	- 4½
17	+10	+14	+ 8½	-½	-4	+½	+6	+4	-5½	-14½	-15	- 4
18	+10½	+14	+ 8	-½	-4	+1	+6	+4	-5½	-14½	-15	- 3½
19	+11	+14	+ 8	-1	-3½	+1	+6	+3½	-6	-15	-14½	- 3
20	+11	+14	+ 7½	-1	-3½	+1	+6	+3½	-6½	-15	-14½	- 2½
21	+11½	+14	+ 7½	-1½	-3½	+1½	+6	+3	-7	-15½	-14	- 2
22	+11½	+13½	+ 7	-1½	-3½	+1½	+6½	+3	-7	-15½	-14	- 1½
23	+12	+13½	+ 6½	-1½	-3½	+2	+6½	+2½	-7½	-15½	-13½	- 1
24	+12	+13½	+ 6½	-2	-3½	+2	+6½	+2½	-8	-15½	-13½	- ½
25	+12½	+13	+ 6	-2	-3½	+2½	+6½	+2	-8	-16	-13	0
26	+12½	+13	+ 6	-2	-3	+2½	+6½	+2	-8½	-16	-12½	+ ½
27	+13	+13	+ 5½	-2½	-3	+3	+6½	+1½	-9	-16	-12½	+ 1
28	+13	+12½	+ 5	-2½	-3	+3	+6½	+1½	-9	-16	-12	+ 1½
29	+13		+ 5	-2½	-3	+3	+6½	+1	-9½	-16	-11½	+ 2
30	+13½		+ 4½	-3	-2½	+3½	+6½	+1	-10	-16	-11½	+ 2½
31	+13½		+ 4½		-2½		+6½	+½		-16½		+ 3
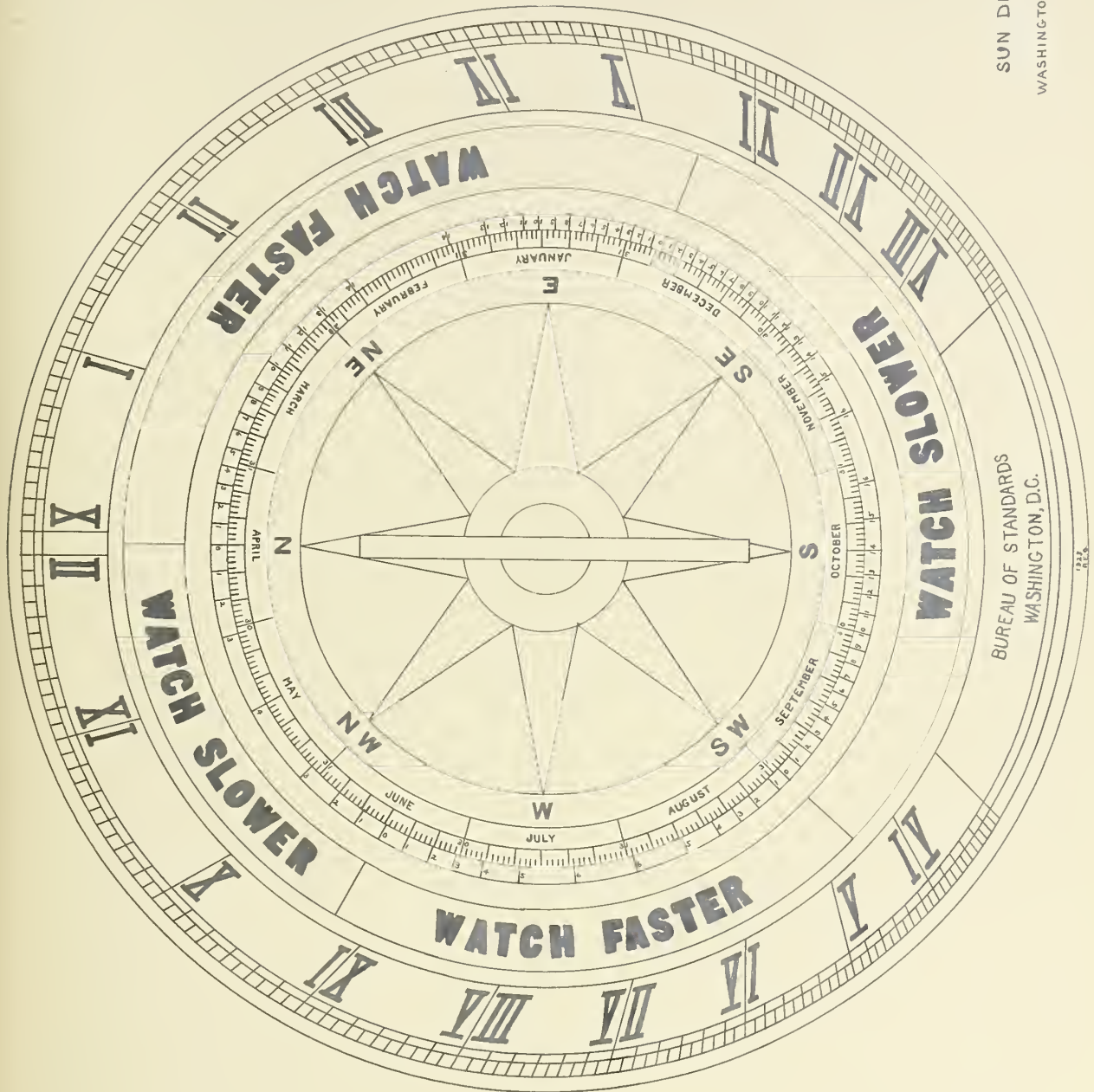
SUN DIAL
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