L. MIFFLIN.

Sun Dial.

No. 64,892. Patented May 21, 1867.

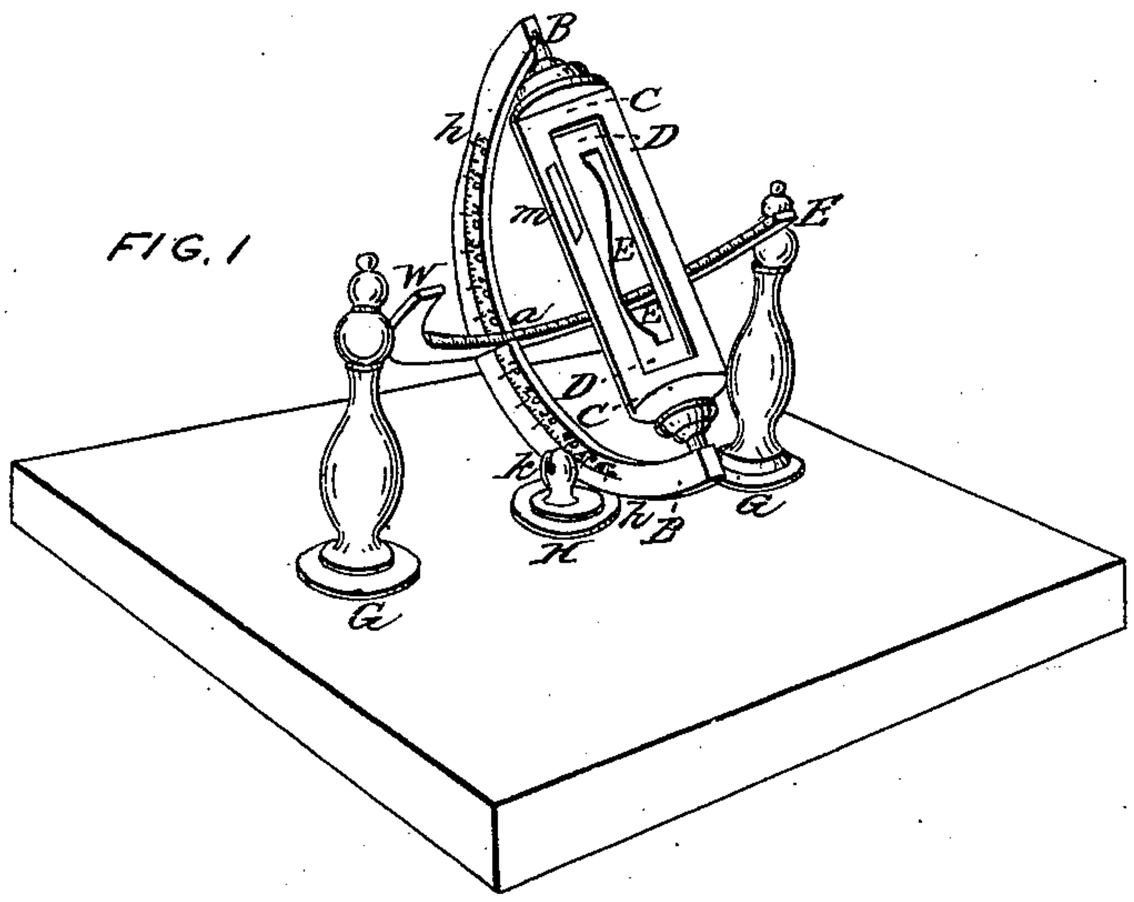
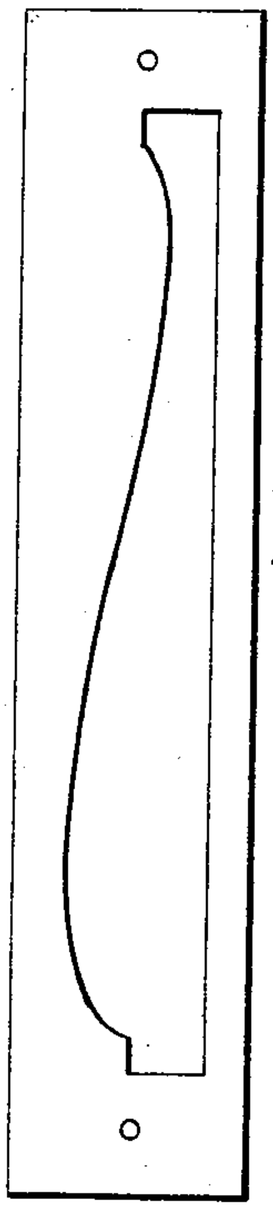


FIG. 1



No. 3

FIG. 3

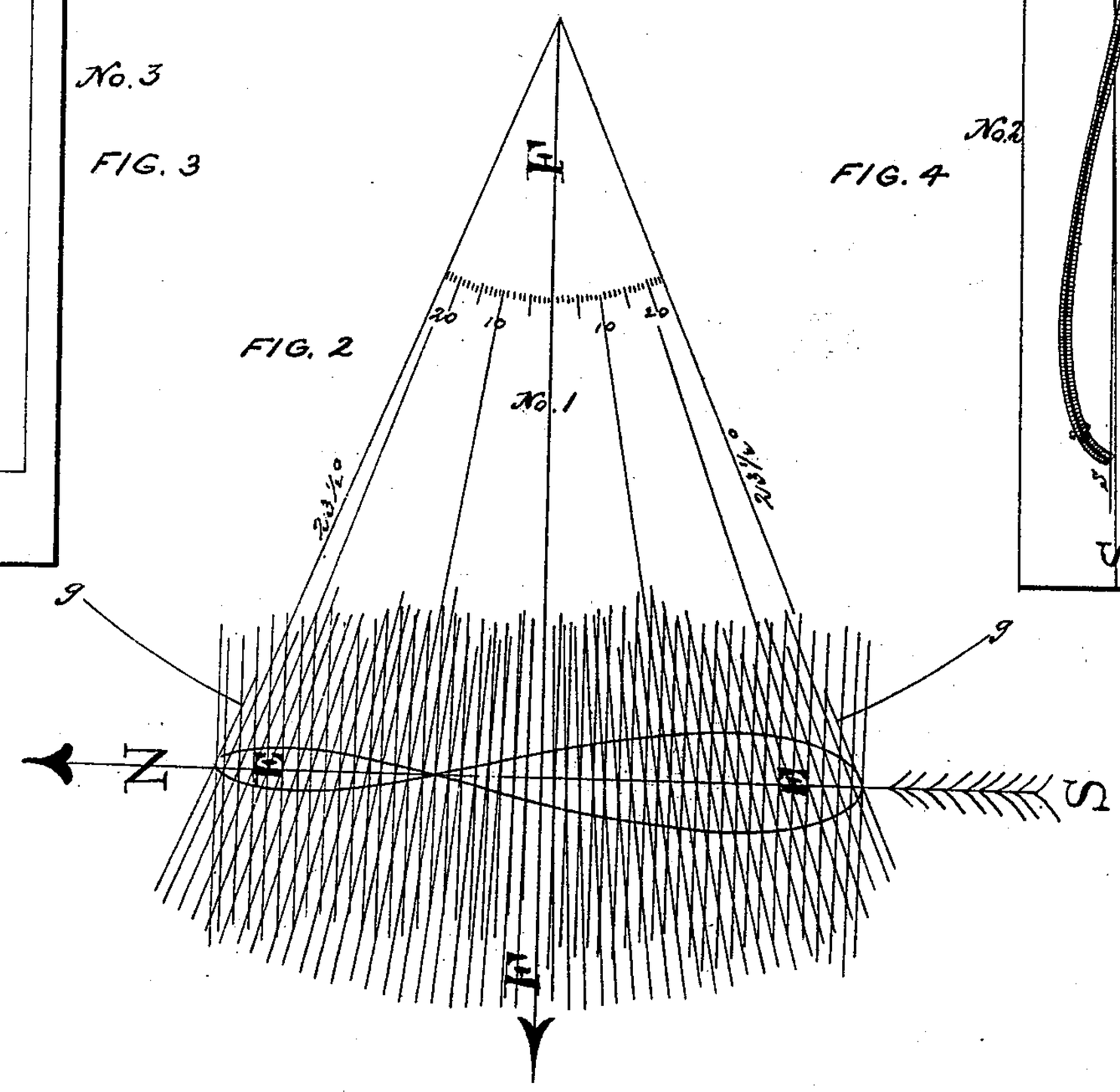
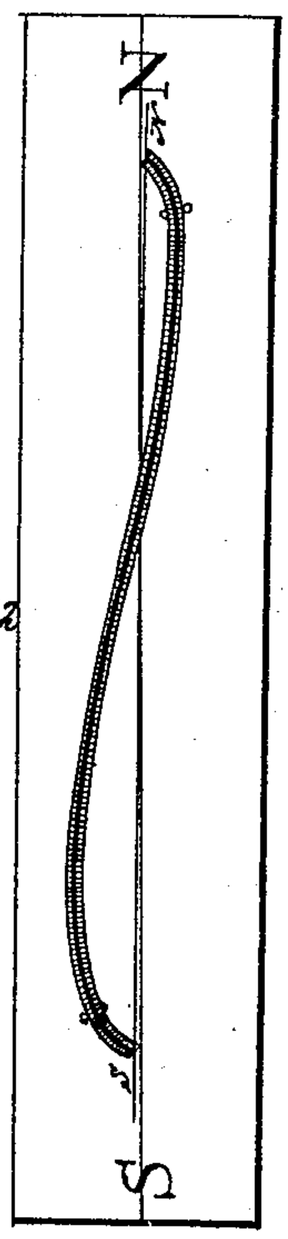


FIG. 2



No. 2

FIG. 4

WITNESSES:
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LLOYD MIFFLIN, OF GERMANTOWN, PENNSYLVANIA.

Letters Patent No. 64,892, *dated May* 21, 1867.

IMPROVEMENT IN SOLAR CHRONOMETERS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, L. MIFFLIN, of Germantown, Philadelphia, in the county of Philadelphia, and State of Pennsylvania, have invented an Equating Solar Chronometer; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of the chronometer.

Figures 2 and 3 views of the gnomon attached to the chronometer; and

Figure 4, plan showing manner of constructing opening through gnomon.

Similar letters of reference indicate like parts.

The object of the equating solar chronometer embraced in this invention is to exhibit the mean or clock time of day in lieu of the solar time; and the said chronometer consists of two semicircular arcs of brass or other suitable metal or material, with an interior diameter of twelve or more or less inches each. These semicircular arcs are "joggled" and brazed together at a point midway between the two ends of each, so as to form right angles, with their inner surfaces flush with each other.

One (marked W *a* E in the drawings) of these semicircular arcs is supposed to represent the equator, and is the time scale, its inner surface being divided into hours, and smaller divisions or parts of the same, at the rate of fifteen degrees to the hour, commencing at six o'clock a. m. at its left or "western" extremity, and ending at six o'clock p. m. at the right or "eastern" extremity; this graduation or division being so modified as to countervail the slight deflection of the sun's rays at the varying angles of obliquity, which deflection is greatest at sunrise and sunset, and least or reduced to nothing at twelve o'clock m. The other semicircular arc, marked B B in the drawings, is supposed to represent the meridian, and it supports a frame, C C, in which the gnomon D D is placed. This frame C C has a journal at each end, which turns in a socket at the respective ends of the semicircles B B, and it has also a rectangular-shaped opening extending lengthwise through the middle, to be about seven inches in length and one and one-half inch wide, the inner edges having ledges on which the gnomon rests. The gnomon D D is made of a plate of brass or other suitable metal or other material, with an opening, E E, through it equal in length to the distance between the points corresponding with the sun's extreme declination north and south. To project the form of the opening in the gnomon, first draw a line through the centre of the plate in the direction of its length, representing the meridian, marked N S, fig. 2. Cross this line N S at right angles through its centre by another, marked F F, fig. 2; the latter line, when the gnomon is in place, coinciding with the plane of the equator or time scale, fig. 1, W E. From the intersection of these lines mark on the meridian the degree of the sun's declination north and south respectively, observing that these two portions of the meridians are tangents to a circle, fig. 2, *g g*, of six inches radius, and that the graduations of the degrees of declination north and south from the equator must be regulated accordingly. Now, cross the meridian at right angles by lines through the degrees thus marked on it, (or more frequently, if desired,) and mark on these lines, measuring from the meridian, the extent of the variation of the solar from the mean time at the respective degrees of the sun's declination. When it is "fast," the variation is marked to the left or western side of the meridian, and when slow to the eastern side. (The variation is measured on a scale of fifteen degrees to the hour, the same as the "time scale.") Then connect the points of variation thus marked by a line through the whole series. This line will form a figure somewhat resembling two slender pears of very unequal sizes connected at the stem ends; and this is the form of the said opening, fig. 2, E E, cut out of the gnomon, through which the sun's rays are admitted to the time-scale, and by which the shadow is thrown backward or forward just as much as the sun is too fast or slow, thus always showing the mean or clock time. A gnomon of another form may be made thus on a plate of brass or other suitable metal or material, similar to the plate used for the previous gnomon: Draw a central line representing the meridian, fig. 4, N S. To the surface of this plate transfer an exact copy of the figure traced upon and cut out in the former gnomon. One half only of this figure is to be used. Thus from the point on the curved line at which the sun attains its extreme northern declination, which will be a little east of the meridian, fig. 4, N, trace strongly either of the lines which proceed thence to the point on said curved line a little west of the meridian, fig. 4, S, at which the sun attains its greatest southern declination. On each side of this "strongly-traced" line, and from end to end, cut an opening, (fig. 4,

o o o o,) through the plate one-twentieth of an inch wide, leaving a space about one-thirtieth of an inch wide between them, through the middle of which runs the "strongly-traced" line aforesaid, fig. 4, N S. The portions of sunlight thrown through these openings widen so much in their passage to the "time scale" as almost to join each other, thereby reducing the shadow of the solid line between them to a sharply defined thread without penumbra. This thread coincides with the said "strongly-traced" line which is the true line of the gnomon. This gnomon, by reversing the position of its surfaces, answers for the whole year: Thus, for the six months from the summer to the winter solstice, turn that surface upward which throws the large curve westward of the meridian. Then for the six months from the winter to the summer solstice turn up the other surface, which turns the large curve eastward of the meridian. (This is gnomon No. 2.) A gnomon of another form may be made thus, fig. 5: From a brass plate, prepared as for gnomon No. 2, cut out a portion bounded by the said "strongly-traced" curved line on one side, and on the opposite side by a line parallel to the axis of the gnomon, leaving a margin of any width deemed of sufficient strength for the purpose. This is gnomon No. 3, and will be used in the same manner as No. 2, both of them being what I call reversible gnomons. The axis common to all the gnomons diverges slightly from parallelism to the meridian. The "equating solar chronometer" must be set firmly on a permanent base, the plane of the semicircle representing the meridian being made to coincide with the meridian of the place, and the gnomon being elevated to the latitude of the place. The time-scale is suspended by pivots or "journals" about an inch below its east and west ends to the two parts G and G. The lower edge of the semicircular meridian, N S, is widened in accordance with the segment of a circle whose centre is midway on a line through the points of suspension. This segment *h h* passes between the jaws of the supporter H, in which there is a screw, K, to secure the gnomon in its adjustment to the proper degree in the scale marked on the side of the semicircular meridian. When looking for the time of day the gnomon must be turned into such a position as will throw the widest light upon the "time scale." The attainment of this position is shown when the shadow of the wire staple *m*, fig. 1, which is parallel to the meridian, coincides with the line drawn through its feet in the frame of the gnomon. During the six months from the summer to the winter solstice the time is shown in the "time scale," where it is crossed by the shadow of the line whose larger and southernmost portion runs on the west side of the meridian. The shadow of the other line, whose southernmost and larger portion runs on the east side of the meridian, shows the time during the six months from the winter to the summer solstice. It will be observed that the daily progress of the sun northward through one half of the year, and southward through the other half, enables me to cross the "time scale" by the shadow of different portions of the gnomon from day to day, keeping pace continually with the progress of the variation from mean time, and as continually correcting it.

What I claim as new, and desire to secure by Letters Patent, is—

A gnomon so formed as to throw the shadow backward when the sun is "fast" and forward when it is "slow," to an extent equal in each case to its variation from mean or clock time, so that the shadow of the gnomon will always cross the "time scale" at a point indicating mean time, substantially as described.

I also claim correcting the variation from the mean or clock time by the use of the sun's motion in his declination north and south.

LLOYD MIFFLIN.

Witnesses:

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J. H. MIFFLIN.