(No Model.)

H. G. CHRISTIAN.

SUN DIAL.

No. 303,118. Patented Aug. 5, 1884.

Fig. 1.

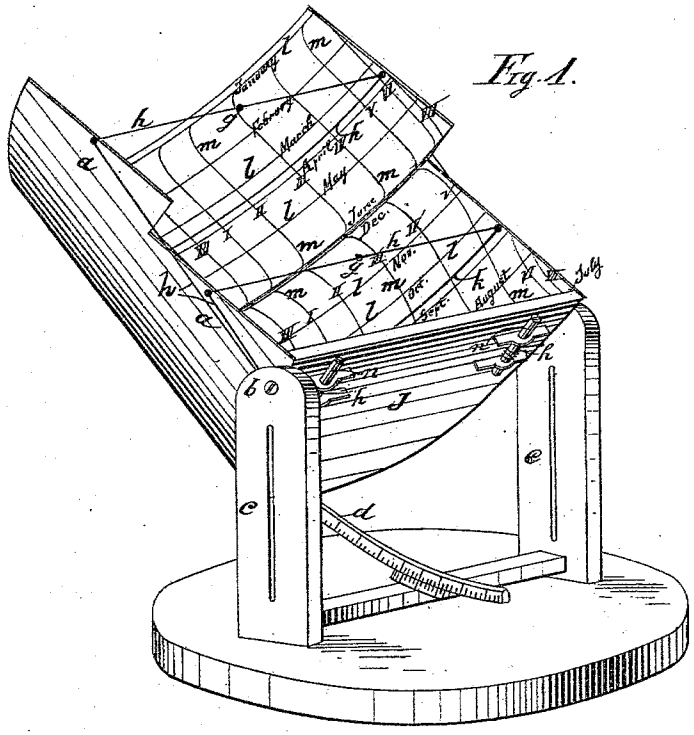
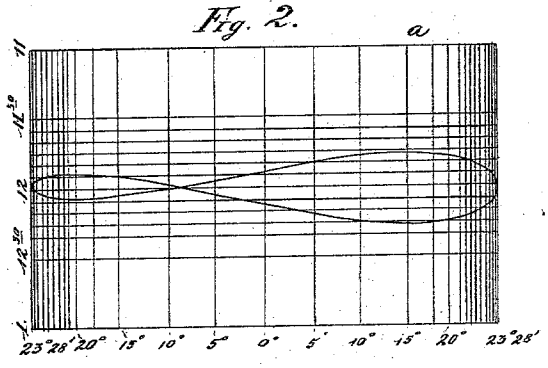


Fig. 2.



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SUN-DIAL.

SPECIFICATION forming part of Letters Patent No. 303,118, dated August 5, 1884.

Application filed October 16, 1883. (No model.)

To all whom it may concern:

Be it known that I, HUGH GRANT CHRISTIAN, of Chagrin Falls, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Sun-Dials, of which the following is a full, clear, and exact description.

This invention relates to sun-dials or solar compasses, in which a semicircular portion of a ring having longitudinal lines of declination and transverse lines for hour-marks is used in connection with a ball for casting the shadow, and an adjusting device for adapting the dial to different latitudes. The principle upon which such sun-dials operate is as follows: Supposing the earth to be a transparent globe with a ball placed in the center, then the shadow of the ball would travel around the globe once in twenty-four hours; and if the sun's declination was south, say, ten degrees, the shadow of the ball would be ten degrees north of the equator. If we then take that portion of a globe lying twenty-three degrees and twenty-eight minutes on each side of the equator—the extent of the sun's declination—with a ball in the center and the upper half cut away, it would form a semicircular structure, on which, if suspended parallel to the equator, the shadow of the ball would travel as on the earth. If we make said half-ring flat, it will be the tangent of a globe of the diameter of the whole ring, and if tangent lines of declination are drawn on this semicircular ring, with a ball suspended in the center, the shadow of the ball will travel along the line of declination all the day if the half-ring is suspended parallel to the equator—that is, with an angle from the vertical equal to the latitude of the place.

Heretofore in sun-dials of this description the hour-lines on the inner surface of the dial have been equidistant straight ones, which do not provide for giving the correct time without having resort to tables for the sun's declination and apparent slowness and fastness. This my invention obviates by using curved hour-lines, substantially as hereinafter described; and my invention consists of a semicircular portion of a ring corresponding to twice that portion of the globe upon which the shadow of a ball located at the earth's center would travel, supposing the earth to be transparent, arranged in connection with two balls and an adjusting device, and having longitudinal lines of declination of the sun out of parallelism with the equator on the dial, to provide for the perceptible declination of the sun during the day, and transverse lines for hour-marks of a peculiar curvature, forming semi-analemma, giving mean solar time at early morning and late in the evening. These curved lines, when continued throughout a year, if arranged in reverse pairs one over the other upon a single scale, would form an elongated figure 8, or complete analemma. It is preferred, however, for reasons hereinafter given, to arrange these curved lines or hour-marks in the form of semi-analemmas—half on one scale or dial for determining the time from June 21 to December 22, and half on another adjacent scale or dial for determining the time from December 22 to June 21.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 represents a perspective view of my improved sun-dial, having two scales arranged one below the other, with semi-analemmas for the hour-marks and two balls for casting the shadow—that is, one scale and one ball for each six months of the year, as specified. Fig. 2 represents a section of the half-ring when laid out flat, and showing a complete analemma for the hour-marks.

In Fig. 1 of the drawings, J indicates a semicircular structure or half-ring, as hereinbefore referred to, and which may be suspended on pivots *b*, supported by any suitable uprights, *c*, and is provided with an adjusting-arc, *d*, or other adjusting means to set it for latitude. Said half-ring has two interior scales upon it, arranged one below the other, the upper scale taking in the first six months of the year, and the lower one the last six months thereof. These scales virtually make of the whole two half-rings, *a a*, each constituting an independent dial. Set in the centers of these two dials are the balls *g*, for casting the shadows, which balls may be supported by threads *h*, regulated by screws *n*, or any other suitable means.

l represents the declination-lines marked with the several months of the year, and *m*

are the hour-lines, as marked, and of curved form, each constituting a semi-analemma, as hereinbefore described, and by which the correct time may be obtained direct from the dial without the aid of tables for the sun's declination and apparent slowness and fastness, and which cannot be done when the hour-lines are equidistant straight ones, as in other sun-dials of similar description. These hour-lines should not be exactly the same from year to year; but if they be drawn from observation and calculation based upon the second year after leap-year they will be correct enough for all practical purposes; or they may be made anew for each year. The same, too, may be slightly altered to provide for refraction—that is, as the rays of light are bent by the atmosphere, so that the sun's shadow does not give the true solar time either on this or ordinary dials, they may be altered so as with the dial complete, notwithstanding the refraction, it will give correct mean solar time when allowance once is made for barometrical pressure.

In Fig. 2 a ring-section is represented as laid out flat and as divided into five-minute marks, which would show solar time. When the ball and half-ring are in position, instead of the shadow at noon being cast on a straight line, as heretofore, at mean solar noon it will always strike on a curved hour-line or analemma, as shown. This it will do at all times of the year; but as it would confuse to have two lines to denote the same time on the same scale it is preferred to separate them and use curved hour-lines of half-analemma form on two separate scales, as in Fig. 1.

By a suitable modification of parts similar curved lines may be used with an equatorial dial, if desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The combination of the two half-ring dials *a a*, marked with longitudinal lines *l* and transverse lines *m* of semi-analemma form, and the two balls *g g*, said dials being jointly supported on pivots, and being provided with means for jointly adjusting them to adapt the whole dial to different latitudes, substantially as specified.

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Witnesses:
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