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PROVISIONAL SPECIFICATION.

Improvements in Sun-dials.

I, JOHN RYDER OLIVER, of No. 25, Gwendwr Road, West Kensington, in the Administrative County of London, C.M.G. and Major General Retired List, late Royal Artillery, do hereby declare the nature of this invention to be as follows :—

This invention relates to improvements in sun-dials and it consists in the combination of an arc or circle upon which the hours are marked and a gnomon of a special contour. The arc in question is an equatorial one, and in respect of the relative positions of it and the gnomon, the axis of the latter bisects the centre of the former and is perpendicular to its plane. The hours are marked upon the concave face of the arc (which is of the length necessary for that purpose), and are indicated upon it by the passage of the edge of the shadow of the gnomon across an equatorial line marked upon the said arc.

The contour of this gnomon may be described as the result of the revolution of a certain curve about a polar axis. This curve is obtained by setting off along a straight line, in both directions from an equatorial zero, series of abscissæ, and laying off ordinates at right angles thereto. These abscissæ are found for certain dates at given intervals by multiplying the length of the radius of the equatorial arc or circle by the tangent of the sun's declination for the particular date in question. The ordinates are found by multiplying the same radius by the tangent of the angular value of the equation of time. The curve is then drawn through the series of points so found.

Perfect accuracy demands the use of two distinct gnomons, one for use from the winter to the summer solstice, and the other for the following and equal term. But if a single gnomon of mean contour be used, the error produced is so minute that it is practically inappreciable.

The sun dial constructed as above described indicates true local mean time, but the hour arc may be set to indicate time according to any standard meridian required.

Dated this 27th day of January 1892.

PHILLIPS & LEIGH,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in Sun-dials.

I, JOHN RYDER OLIVER, of No. 25, Gwendwr Road, West Kensington, in the Administrative County of London, C.M.G. and Major-General, Retired List, late Royal Artillery, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to improvements in sun dials, and it consists in the combination of an arc or circle upon which the hours are marked and a style of a special contour. The arc in question is an equatorial one and, in respect of the relative positions of it and the style, the axis of the latter biscets the centre of the former and is perpendicular to its plane. The hours are marked upon the concave face of the arc (which is of the length necessary for that purpose) and are indicated upon it by the passage of the edge of the shadow of the style across an equatorial line marked upon the said arc.

The contour of this style may be described as the result of the revolution of a

certain curve about a polar axis. This curve is obtained by setting off along a straight line in both directions from an equatorial zero, series of abscissæ, and laying off ordinates at right angles thereto. These abscissæ are found for certain dates at given intervals by multiplying the length of the radius of the equatorial arc or circle by the tangent of the sun's declination for the particular date in question. The ordinates are found by multiplying the same radius by the sine of the angular value of the equation of time. The curve is then drawn through the series of points so found.

Perfect accuracy demands the use of two distinct styles, one for use from the winter to the summer solstice, and the other for the following and equal term. But if a single style of mean contour be used, the error produced is so minute that it is practically inappreciable. The style may be furnished with a flange or be marked to show which side of the shadow is to used.

The sun dial constructed as above described indicates true local mean time, but the hour arc may be set to indicate time according to any standard meridian required.

In order that my invention and the best means of carrying it into practical effect as well as of using it successfully may be thoroughly understood I will now describe it and them in detail, referring in so doing to the accompanying figures which are to be taken as part of this Specification and read therewith.

Figure 1 is a side elevation of an improved sun dial constructed according to my invention.

Figure 2 is a front elevation corresponding therewith.

a is the base of the instrument. It is preferably rectangular in shape to facilitate its being placed in the necessary position for the instrument to act properly.

b is a vertical pillar fast to the base, the two constituting the stand of the instrument. The sides of the pillar are shewn as parallel with the sides of the base. The necessary position for it to occupy is one due north and south.

c is a latitude arc and *d* is the style which is supported between the ends of the said arc in the relative positions already specified. Provision for setting the axis of the style at an angle with the horizontal plane equal to the latitude of the spot where the dial is to be used, is made as follows. *e*, *f* are a pair of cheeks. These are attached to the pillar *b* in such a way as will allow of a little play on each side of the latter. The upper portions of their opposite faces are cut with grooves of the same radius as the latitude arc, and these form a slot in which the latter rest steadily in the vertical plane or can be moved therein about the centre of the circle of which it is an arc. *g* is a concentric groove in one side of the latitude arc, and g^1, g^1 are two guiding pins. *h* is a screwed pin. One end of it is fixed fast in the cheek *f*. It passes through the other cheek *e* and carries, on the projecting end, a milled head *i*. Screwing the latter along the pin *h* in the direction of the cheek *f* holds the two cheeks rigidly to the sides of the pillar, and the latitude arc between them. The latter is graduated right and left from its centre—the graduations are not shewn in the drawings—and a vertical line *j* is set out on the cheek *e* to prevent error in the setting of the arc.

The small end of the style must point to the north, and for use in the northern hemisphere, it will be uppermost, *i.e.*, in the position illustrated in the figures. The instrument is set for use south of the equator by putting the thick end uppermost.

The contour of the style and how it is to be obtained has been already specified.

k is an equatorial or hour arc divided, say, to spaces of 5 minutes.

Four times a year, the equation of time vanishes, and at those times the style would intersect its own axis. To allow for the necessary thickness of the rod carrying the style, a slight adjustment of the hour arc must be made at each time. Provision is made for effecting such adjustment as follows. The arc *k* lies in a groove cut across the latitude arc in which it is held in the desired position by a pair of clamps *l*, *l*, one on each side of it. *m*, m^1 are two marks upon the arc *k*, and the latter is to be clamped with one of them coinciding with the edge of the clamp.

The left hand or west mark m is used from about the 15th of April to the 21st of June, and from about the 25th of August to the 21st of December. At other times, the 12 o'clock line must coincide with the right hand or east mark m^1. When the said line coincides with the mark m (looking north), the left hand edge of the shadow d^1 is the one which indicates the time. When the right hand mark is used, the right hand edge of the shadow is the indicating edge. Thus, the 12 o'clock line must be shifted from one mark to the other four times a year, *viz.*, about April 15th, June 21st, August 25th and December 21st. It is not of any consequence if the adjustments are not made exactly on the dates specified.

I do not confine myself to the exact details specified above for guiding the adjustment of the hour arc but may vary them. For instance, the marks m, m^1 may be upon the clamp, and the 12 o'clock line be used in combination with them instead of the edge of the clamp.

The local mean time is shewn by the point at which the indicating edge of the shadow d^1 intersects the central line k^1 on the hour arc. Thus the time by the dial illustrated in Figure 2 is 2.25 p.m. on some day between April 15th and June 21st or between August 25th and December 21st, or it may be 2.36 p.m. on some day outside these limiting dates.

If the instrument is wanted to indicate a certain standard time instead of local mean time, the hour arc is shifted through the arc corresponding to the difference of longitude.

Thus if it is in Dublin, and London time is wanted, the 12 o'clock mark is moved 24 minutes to the west, because Dublin is 24 minutes west of London.

The dial can always be set with the latitude arc in the plane of the meridan by means of a watch which gives true local time.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be carried into practical effect, I declare that what I claim is :—

1. In a dial, a style of the contour ascertained as hereinbefore set forth.
2. The combination of style as claimed in the preceding claim and an adjustable latitude arc.
3. The combination of style of a contour ascertained as hereinbefore set forth and an hour arc adjustable transversely of the latitude arc.
4. The general construction of my improvement in sun dials as hereinbefore set forth with reference to the accompanying drawings.

Dated this 3rd day of October 1892.

PHILLIPS & LEIGH,
No. 22, Southampton Buildings, Chancery Lane, London, W.C.,
Agents for the Applicant.

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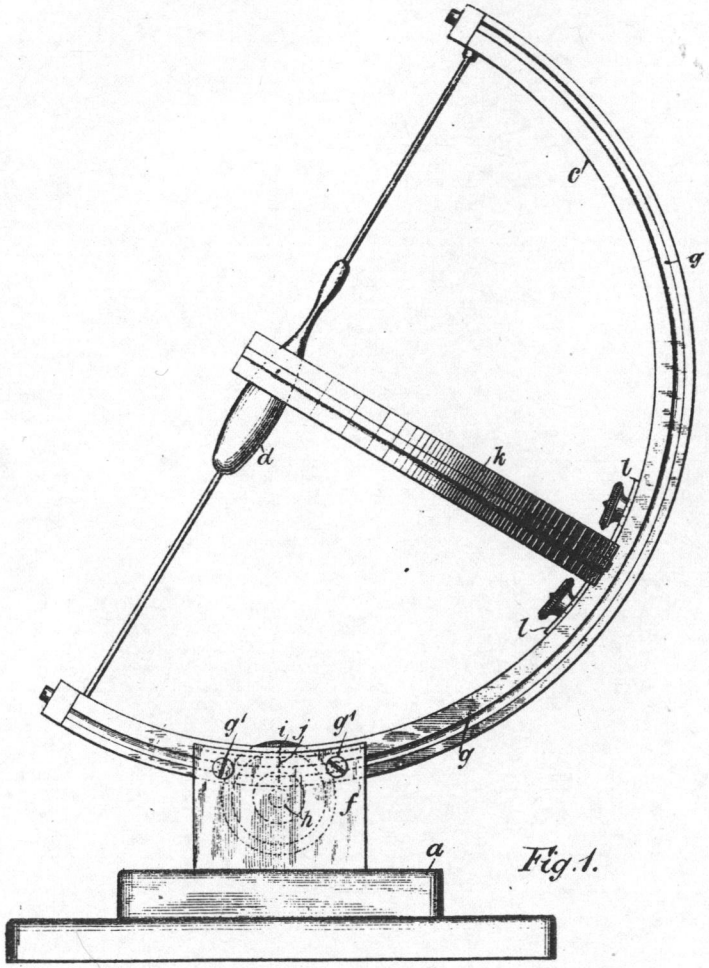

Fig. 1.

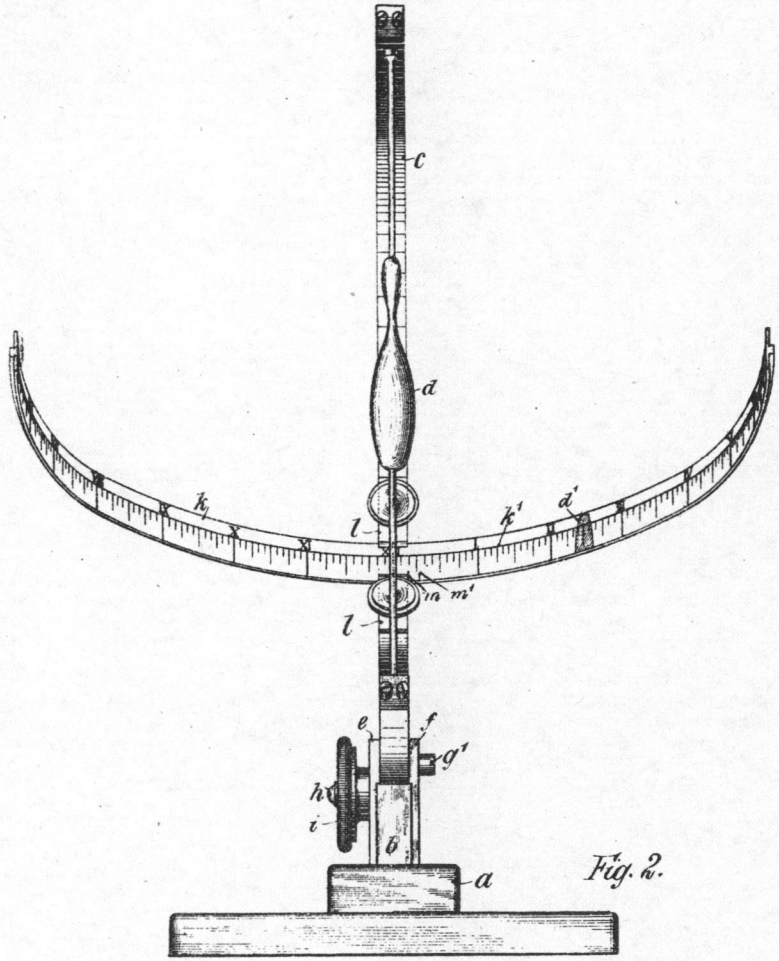

Fig. 2.

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