N° 10,787 A.D. 1906

Date of Application, 8th May, 1906

Complete Specification Left, 8th Nov., 1906—Accepted, 14th Feb., 1907

PROVISIONAL SPECIFICATION.

"Improvements in Apparatus for Indicating Mean Solar Time."

I, GEORGE JAMES GIBBS, of Brownedge, Bamber Bridge, near Preston, in the County of Lancaster, Engineer, do hereby declare the nature of this invention to be as follows:—

This invention relates to instruments by means of which standard mean solar time may be obtained at any place by a simple observation so long as the sun shines. Such instruments I call heliochronometers. By means of a heliochronometer constructed according to my invention I can for instance readily ascertain Greenwich mean time at any place in Great Britain no matter how remote from Greenwich.

The instrument is preferably constructed as follows, a circular disc is mounted on a base ring or other support firmly fixed to some convenient pedestal or foundation in such a position that its axis is parallel to the earth's axis or in other words the plane of the disc is parallel to the plane of the earth's equator. The disc can be turned in the ring about its axis.

Normal to the surface of the disc and rising therefrom are two screens or flat plates of metal situate towards the extremities of a diameter of the disc and approximately at right angles thereto. The arrangement therefore is such that the disc can be turned on its axis until the sun as it shines casts the shadow of one of these screens centrally onto the other screen; the first of them I call the index screen and the other I call the shadow screen.

The circumference of the disc is divided into twenty four equal parts each of which is again subdivided into say thirty parts. On some adjacent and convenient part of the base ring a reference mark is made which serves to indicate the amount of turning of the disc. By turning the disc so that the shadow of the index screen is cast and maintained central on the shadow screen the lapse of time can be observed by noting the divisions on the disc as they pass the reference mark; the primary spaces represent hours and the secondary spaces intervals of two minutes each. If the reference mark be placed opposite one of the hour marks when the sun is exactly on the meridian and that hour mark be distinguished by the number 12 the remaining hour marks being numbered backwards and forwards therefrom as is customary on clock faces then the instrument, used as described, would indicate local apparent solar time but would be of little or no practical use.

To make it useful corrections are required for the equation of time and for longitude east or west of Greenwich when the instrument is fixed at any place in Great Britain. The correction for longitude is applied by displacing the reference mark backwards or forwards so that 12 o'clock is indicated when the sun is actually crossing the meridian of Greenwich and not when the sun is on the local meridian.

The correction for the equation of time is applied by displacing the index screen sideways in its own plane or approximately therein so that its shadow is thrown backwards or forwards across the shadow screen by an appropriate amount as determined with reference to the astronomical tables of the equation of time.

To obtain this displacement I preferably employ a circular plate of metal divided round its circumference into 365 parts indicating days and months of

[*Price 8d.*]

the year and rigidly attach to it a cam whose circumference at any point is distant radially from a convenient base circle by an amount proportional to the deviation of mean solar time from apparent solar time. This plate is attached to any convenient part of the disc above mentioned and can turn about the centre of the base circle which is made to coincide with the centre of the circular plate. A pointer or mark is fixed on the disc close to the edge of the circular plate serving to indicate the date. Suitable links and connecting pieces are arranged between the cam form and the movable index screen so that when the pointer indicates on the circular the existent month and day the index screen will have been displaced sufficiently to cause the reference mark to show Greenwich mean time by the hour and minute marks on the circumference of the disc when the disc is turned to bring the shadow of the index screen centrally on the shadow screen.

Dated this 7th. day of May 1906.

For the Applicant;
WM. P. THOMPSON & Co.,
6, Lord Street, Liverpool.

COMPLETE SPECIFICATION.

"Improvements in Apparatus for Indicating Mean Solar Time."

I, GEORGE JAMES GIBBS, of Brownedge, Bamber Bridge, near Preston, in the County of Lancaster, Engineer, 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 instruments by means of which standard mean solar time may be obtained at any place by a simple observation so long as the sun shines. Such instruments I call heliochronometers. By means of a heliochronometer constructed according to my invention I can for instance readily ascertain Greenwich mean time at any place in Great Britain no matter how remote from Greenwich.

The invention will be understood from the following description, reference being had to the accompanying drawings, in which

Figure 1 is a sectional elevation of the heliochronometer, the section being taken along the line X Y (in Figure 2) which line represents the plane of the local meridian;

Figure 2 is a plan with section through Z Z, Figure 1;

Figure 3 is an elevation of the screen E;

Figure 4 is a view of the instrument as fixed on a stone pillar, drawn to a smaller scale.

B is a circular disc mounted on the base ring A, which is firmly fixed to any convenient support, such as a stone pillar 14 so that the plane of the disc B is parallel to the plane of the earth's equator or so that the axis N S, Figures 1 & 4 is parallel to the axis of the earth. The disc B can turn round the axis N S by sliding in the ring A being guided by the lip C.

D and E are two screens standing normal to the plane of the disc B so that the sun when it shines casts the shadow of D upon E and when it is desired to ascertain the time the disc B is turned round in the ring A until the shadow of D is cast centrally upon E; to render this operation more definite I pierce a small hole F through D on the vertical centre line thereof and mark a corresponding vertical centre line G upon the face of E, Figure 3, then when the beam of sunlight shining through the hole F casts

a spot of light upon the line G the shadow of D is thrown centrally onto the screen E. The lines 10, 11 and 12, 13 in Figure 1, represent the path of the small beam of light cast by the sun through the hole F at the winter and summer solstices respectively.

According to my preferred construction the screen E is rigidly fixed to the upper face of the disc B and the screen D is attached to the arm H which is pivoted to the disc B by means of the screw J. The arm H is for convenience carried beneath the disc B and the piece K formed on the arm H carries the screen bracket D, a hole L being cut through the disc B to give room for the movement described hereafter, a pin M projects from the arm H upwards through the hole W in the disc B into the cam groove O formed in the underside of the circular plate P which is pivoted to the disc by the pin Q and can turn thereon. The pin Q is in the centre of the plate P. The circumference of the plate P is divided and marked to represent months and days of a complete year as partly shown for December in Figure 2, and the proper position of the plate P for any month and day is indicated by the pointer R the plate being shown in position for December 25.

The actual position of the arm H and consequently of the index screen D is determined by the pin M in the cam groove O.

The edge of the disc B is also divided into 24 equal parts to represent hours and again subdivided to represent smaller divisions of hours as shown or as may be convenient according to the dimensions of the disc B. T is the reference mark which indicates the time by the division marks round the disc B. In Figure 2, the instrument indicates XII o'clock. It is obvious that so long as the arm H and screen D are maintained in the positions shown in Figure 2, the instrument can only show local apparent solar time but if the instrument is to show mean solar time on any given day of the year it must be adjusted according to the equation of time for that date. The mechanism for this adjustment is preferably constructed and arranged as follows, in reference to Figure 2; 1, 2, 3, is a base circle described about Q the centre of the plate P and the cam form is derived from the base circle as follows;—On December 25th, the equation of time is nil and consequently the cam form and base circle coincide or in other words the pin M, arm H and screen D are not displaced from the normal position shown in Figure 2. On any other date *e.g.* November 1st, the cam deviates from the base circle by the amount 4.5. so that when the plate P is turned until the pointer R indicates November 1st, which occurs when the mark 6 is against the pointer R the pin M is displaced into the position M^1 moving the arm H on the pivot J and setting the screen D in the position D^1 (shown by dotted lines). The shadow D is now cast centrally upon the screen E when the sun is sixteen minutes past the meridian as shown by the line 7G, sixteen minutes being the equation of time for the 1st November. The angles MJM^1, XG7 and X89 are all equal and represent the magnitude of the apparent angular motion of the sun from the plane of the meridian XY in sixteen minutes of time the actual rate of motion being one degree in four minutes. The angle MJM^1 for November 1st, is therefore four degrees and the distance 4.5. is equal to the distance of the centre of M^1, from the centre of M. By the same geometrical construction in conjunction with the astronomical tables of the equation of time the deviation of the cam from the base circle can be obtained for all other days of the year.

In those cases when a heliochronometer being situate at any place away from the meridian of Greenwich should indicate Greenwich mean time, I set the reference mark T away from the line XY by an amount proportional to the longitude of the position of the instrument.

If the longitude be west of Greenwich, I set the mark T towards the hour mark I, or if the longitude be east of Greenwich I set it towards the hour mark XI; for instance, for a place situate on a meridian ten minutes west of

Greenwich I place the mark T in the position T^1 ten minutes from the position of the mark T, the distance being measured by the divisions marked round the edge of the disc B. To permit of the movement of the mark T it is made on the upper surface of the strip or block "*a*" Figures 1 and 2, which is attached to the base ring by means of the screws 16 and slotted holes 17 shown in Figure 2.

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

1. In instruments for obtaining mean time by solar observations, a cam and date circle for applying the necessary correction for the equation of time, substantially as described.

2. In instruments for obtaining mean solar time by observations, the combination comprising an hour disc, two screens standing normal to the plane of the hour disc which can be turned so that when the sun shines a shadow of one is cast upon the other, a date circle pivoted to the disc so that it can turn thereon, a cam on the date circle, a pivoted arm carrying one of the screens, and arranged to be moved by the cam in such a manner that the turning of the date circle will apply a movement to the screen, substantially as and for the purpose described.

3. In instruments for the purpose specified, the combination with the hour disc or dial, of a pointer or reference mark for indicating time by the division marks round the said disc, said pointer being made movable or adjustable circumferentially so that it can be moved or set in either direction, to enable Greenwich mean time to be indicated when the instrument is fixed on some meridian other than the meridian of Greenwich, substantially as described.

4. The apparatus for indicating mean solar time, constructed, arranged and operating substantially as described with reference to and shown in the drawings annexed.

Dated this 7th. day of November 1906.

For the Applicant:
WM. P. THOMPSON & Co.,
6, Lord Street, Liverpool, &
322, High Holborn, London, W.C.,
Chartered Patent Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1907.

A.D. 1906. May 8. N° 10,787.
GIBBS' Complete Specification.

[3 SHEETS.]
SHEET 1.

FIG. 1.

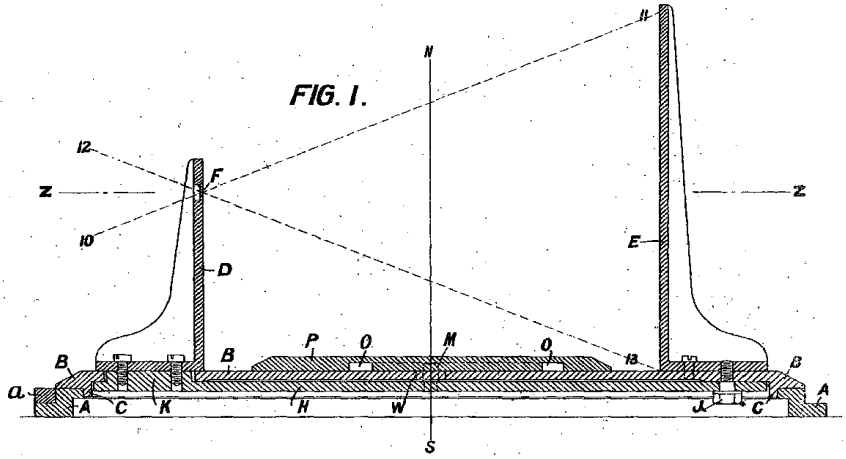

FIG. 3.

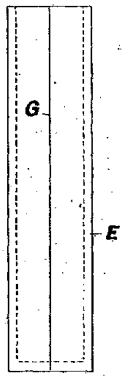

FIG. 4.

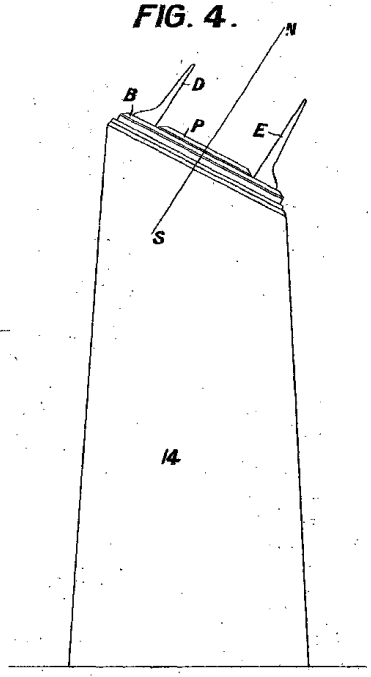

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FIG. 1.

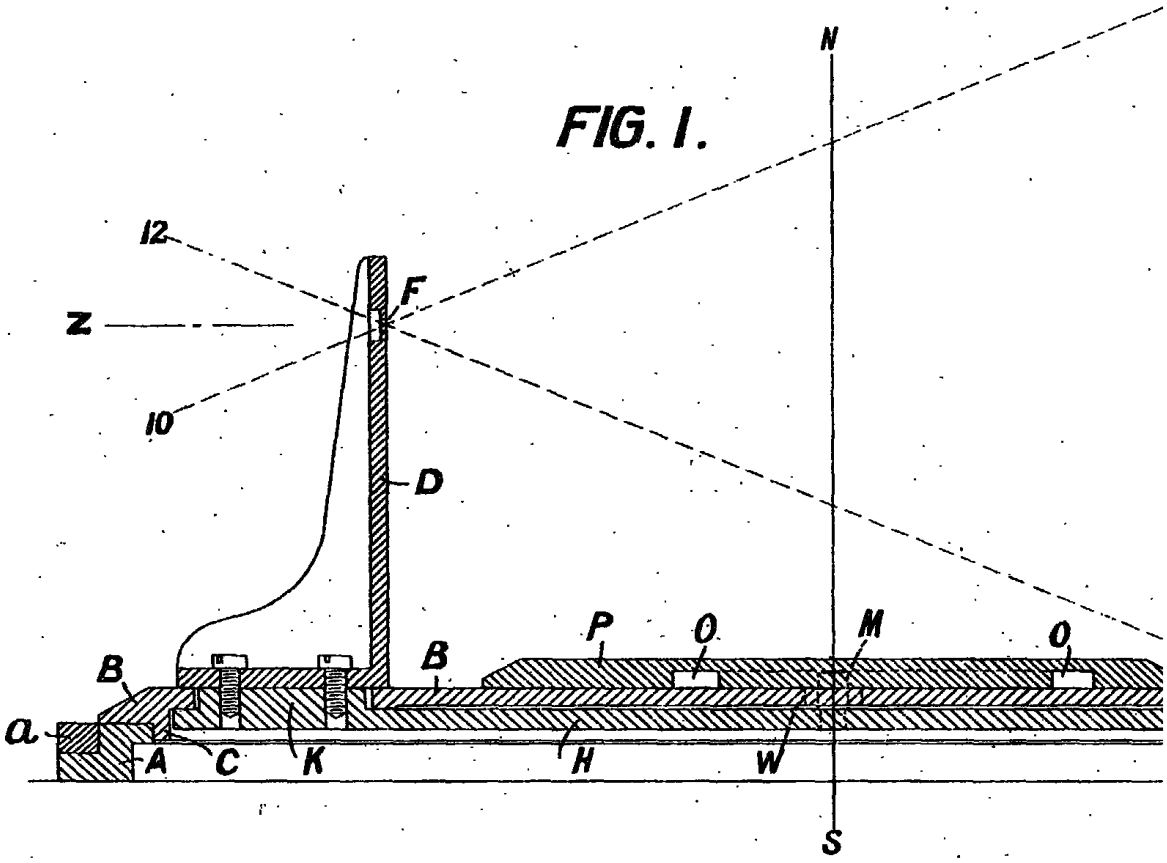
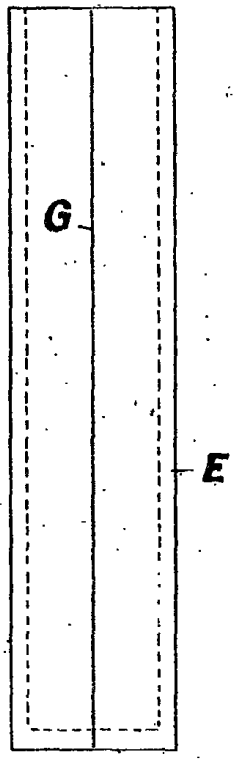


FIG. 3.



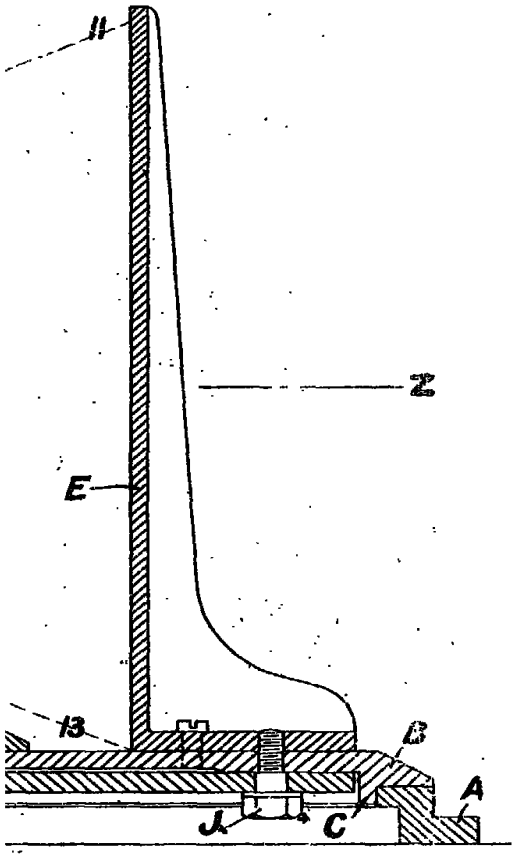
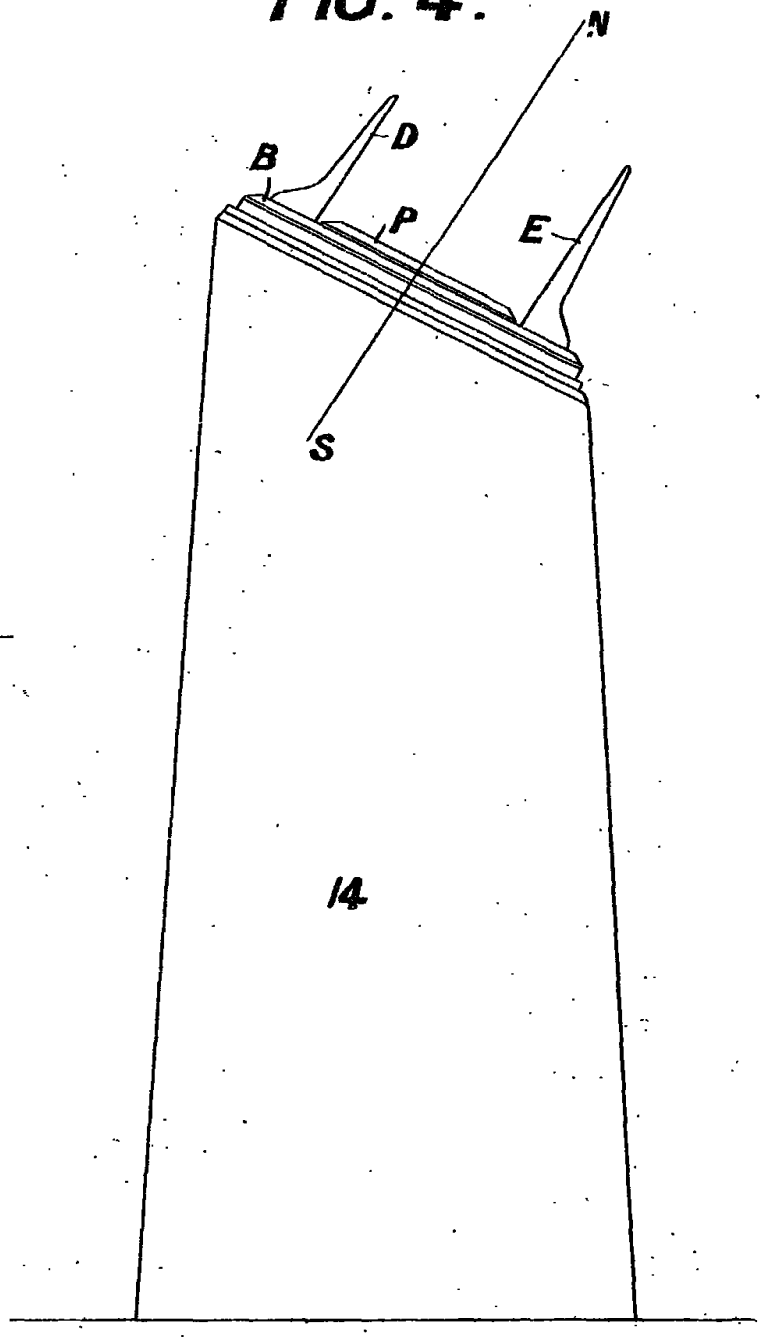


FIG. 4.



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A.D. 1906. MAY 8. N.º 10,787.
GIBBS' COMPLETE SPECIFICATION.

(2 SHEETS)
SHEET 2.

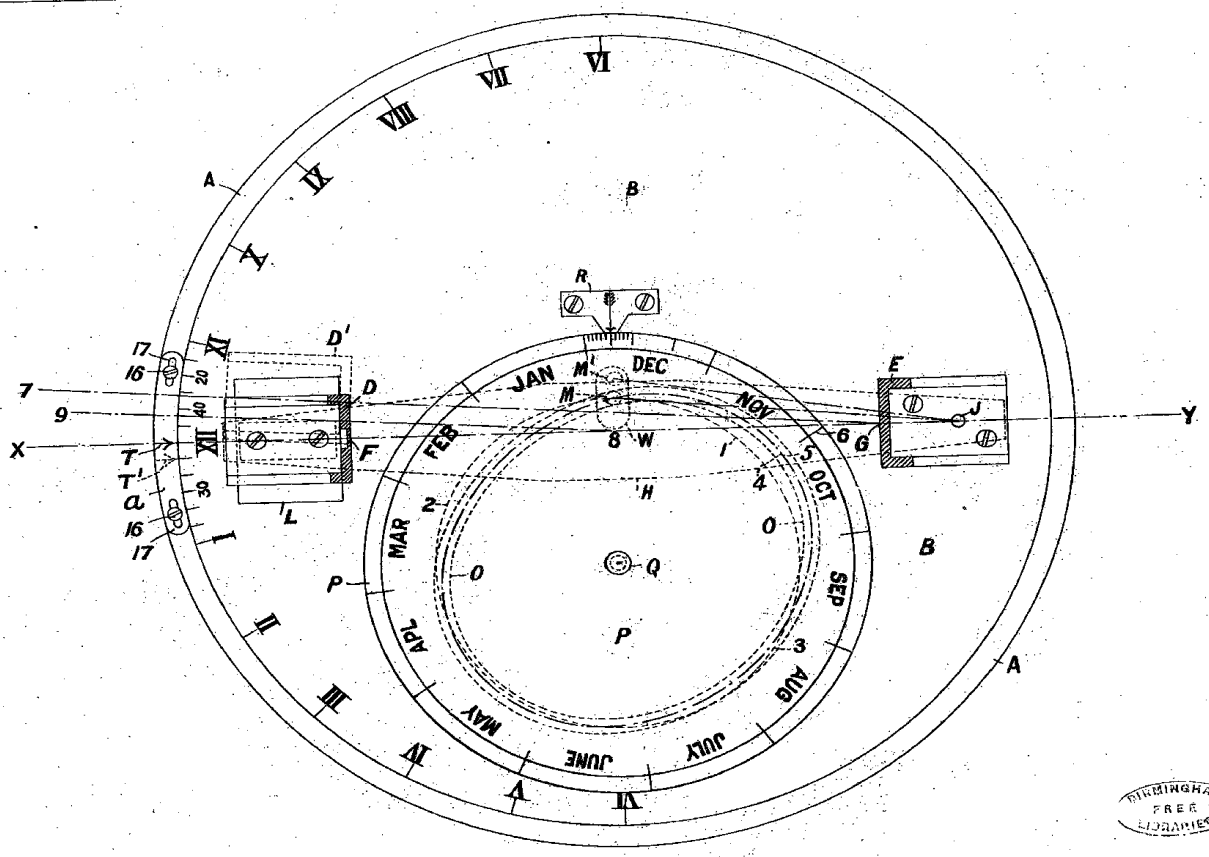

FIG. 2.

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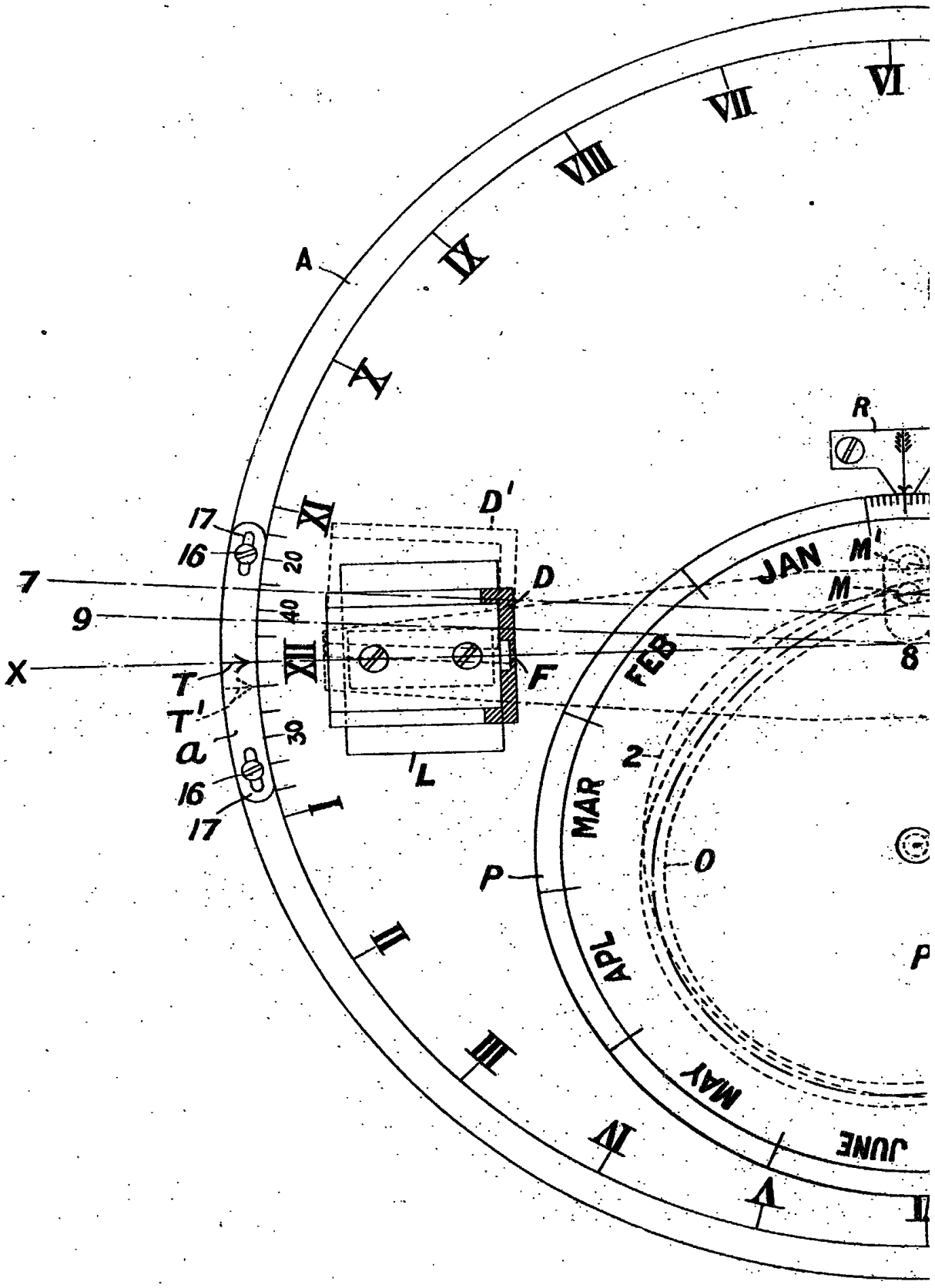
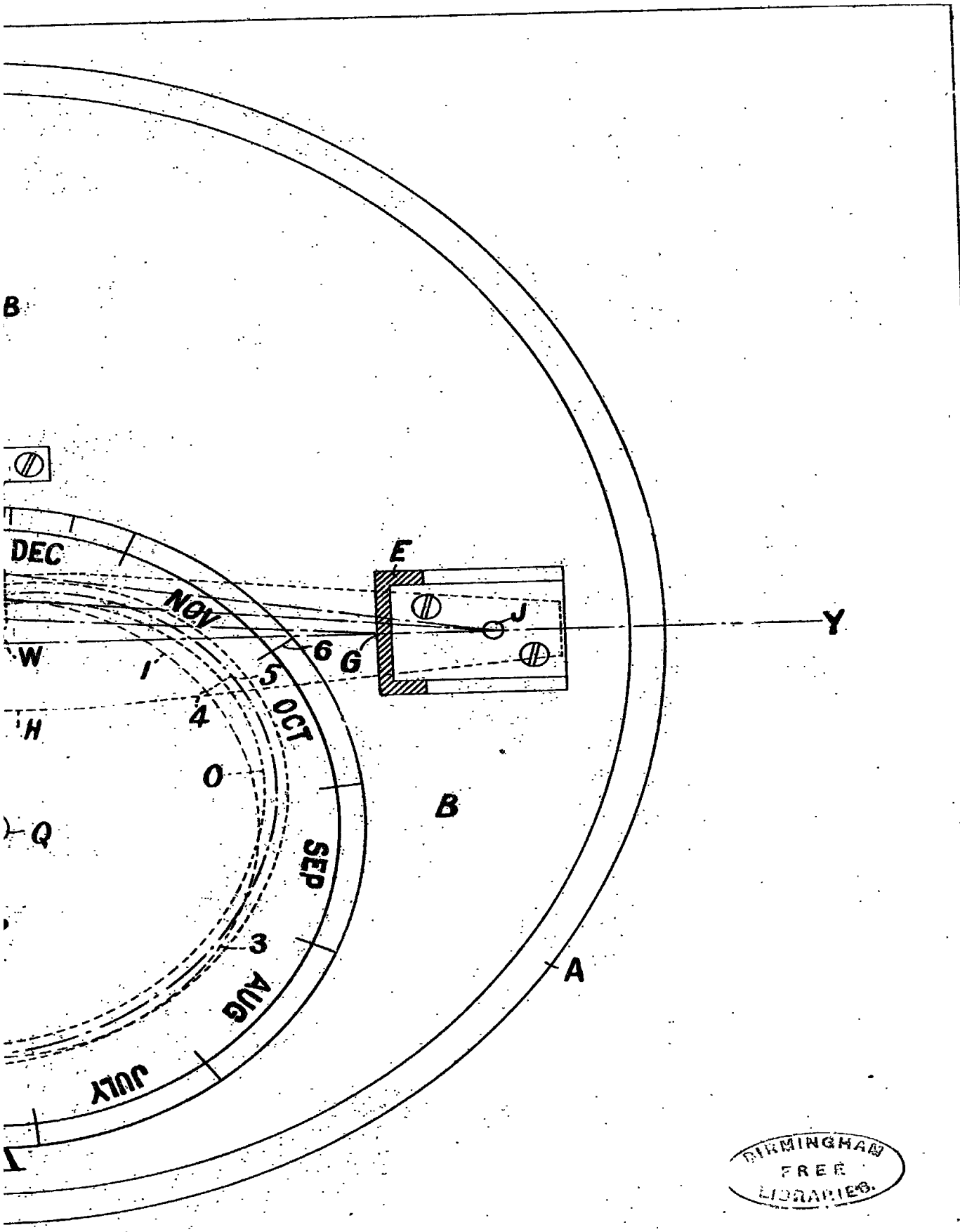
[This Drawing is a reproduction of the Original on a reduced scale.]



FIG



g. 2.

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