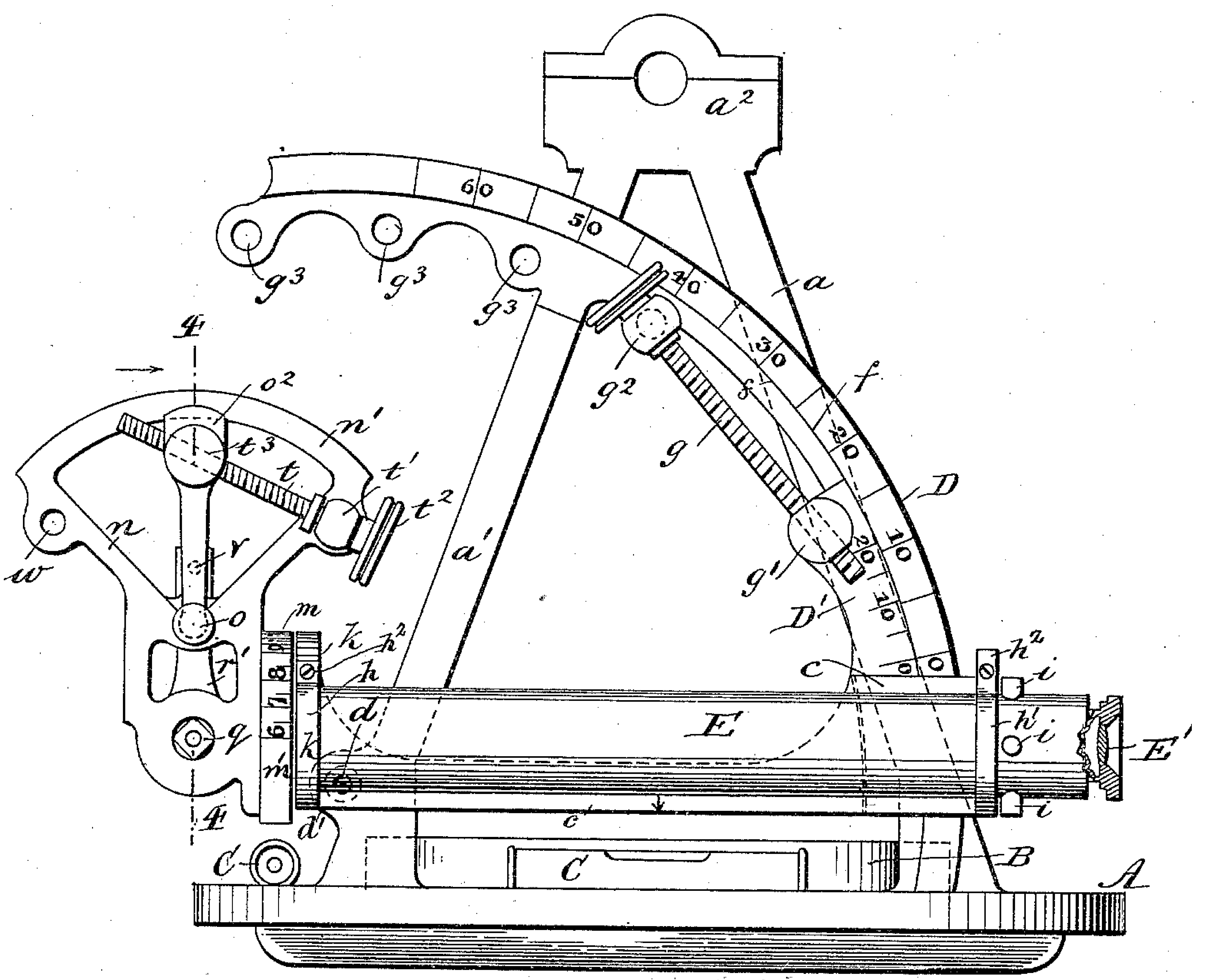
(No Model.) 2 Sheets—Sheet 1.

W. SCOTT.

SOLAR ATTACHMENT FOR TRANSIT INSTRUMENTS.

No. 431,286. Patented July 1, 1890.

Fig I



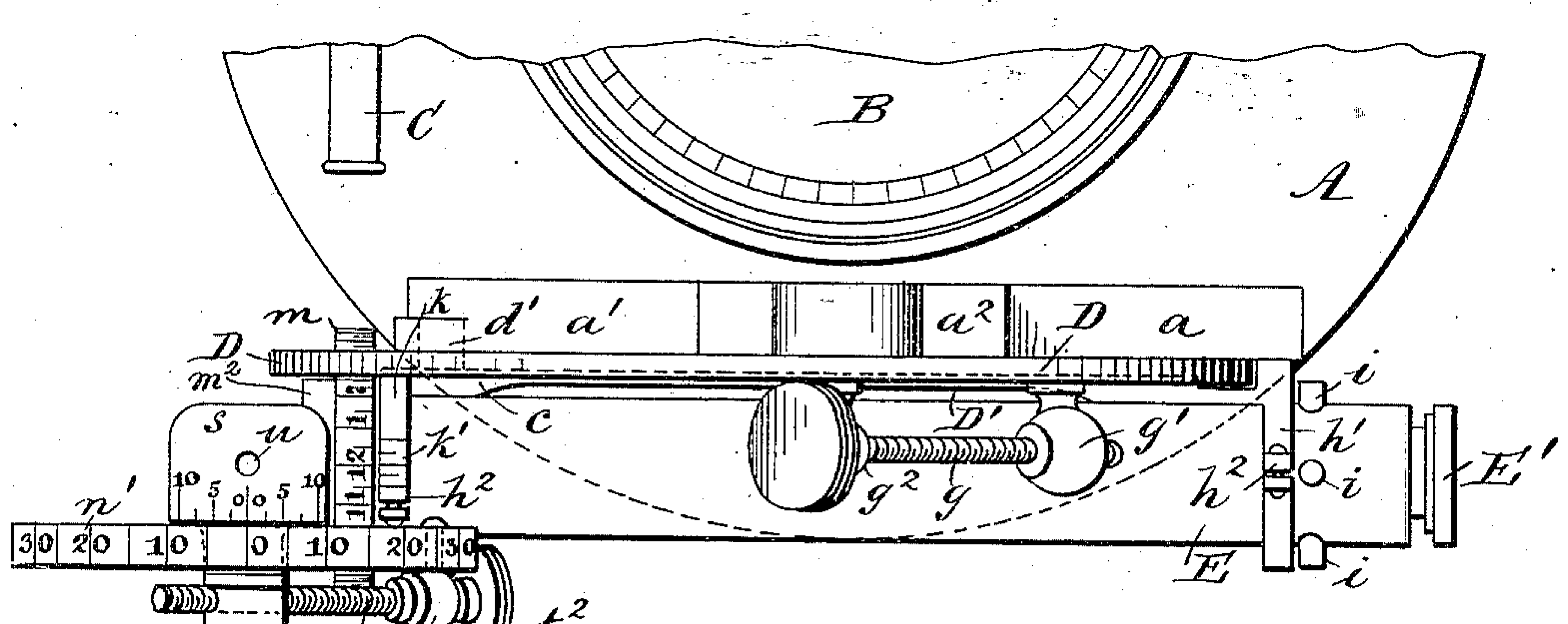


Fig 2

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INVENTOR:

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(No Model.) 2 Sheets—Sheet 2.

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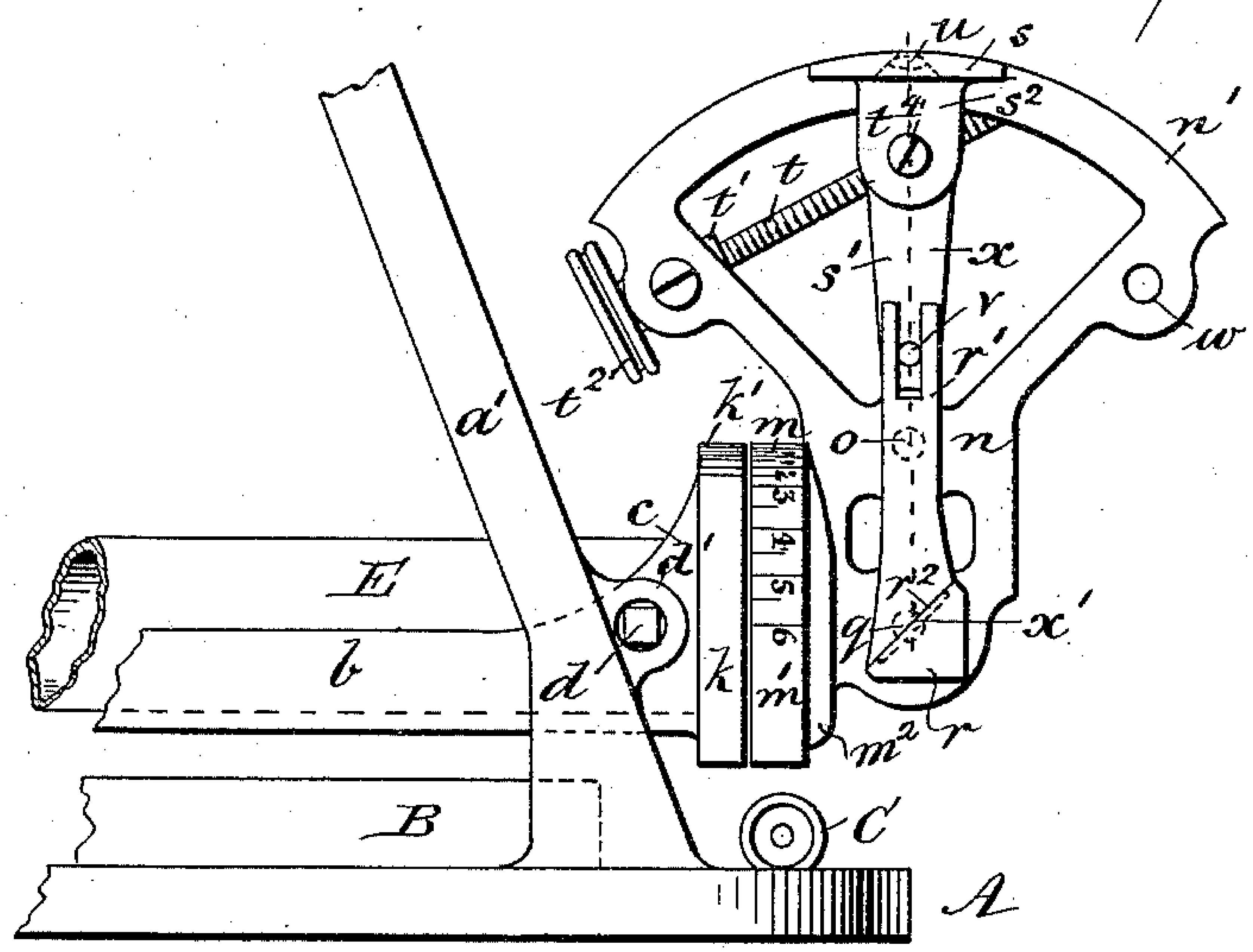
Fig. 3



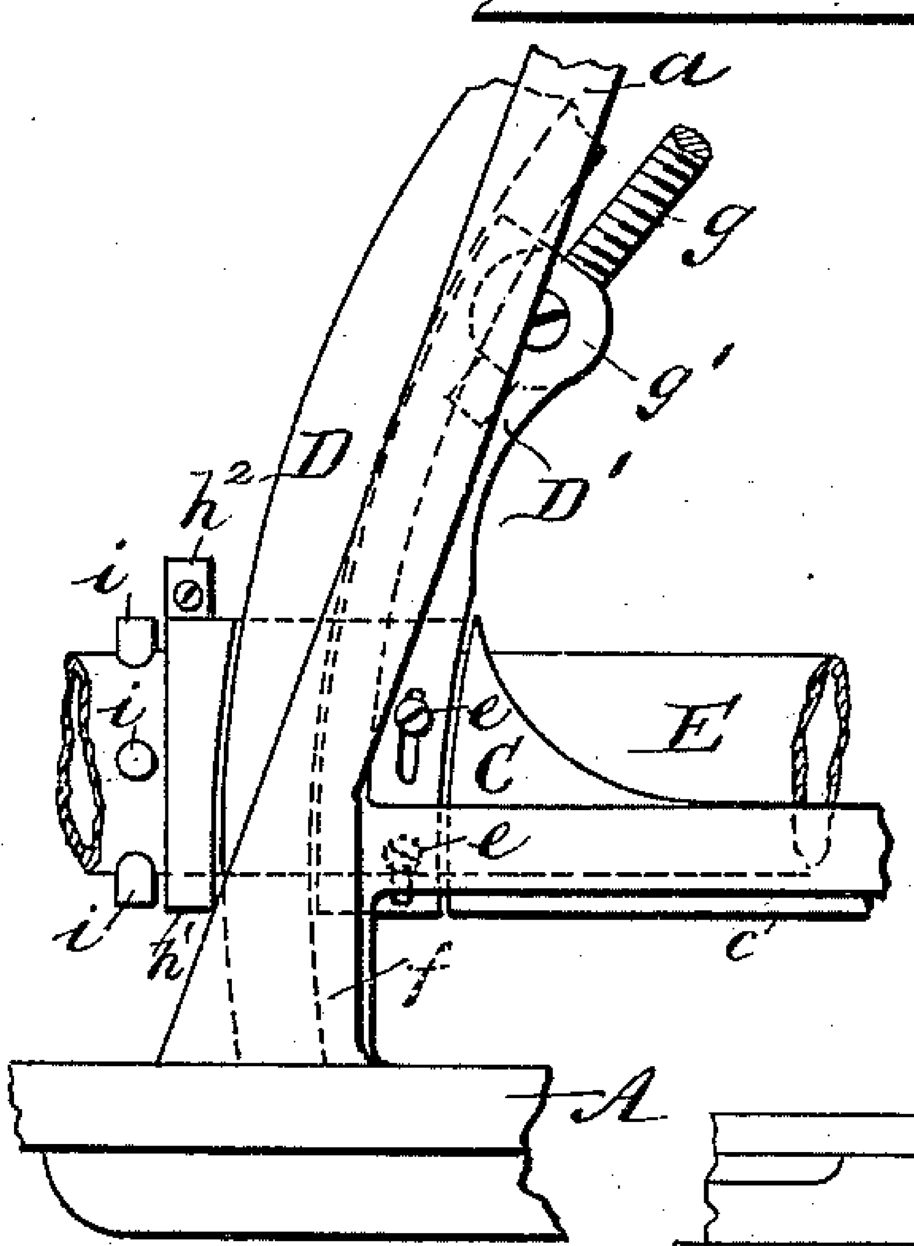


Fig. 6

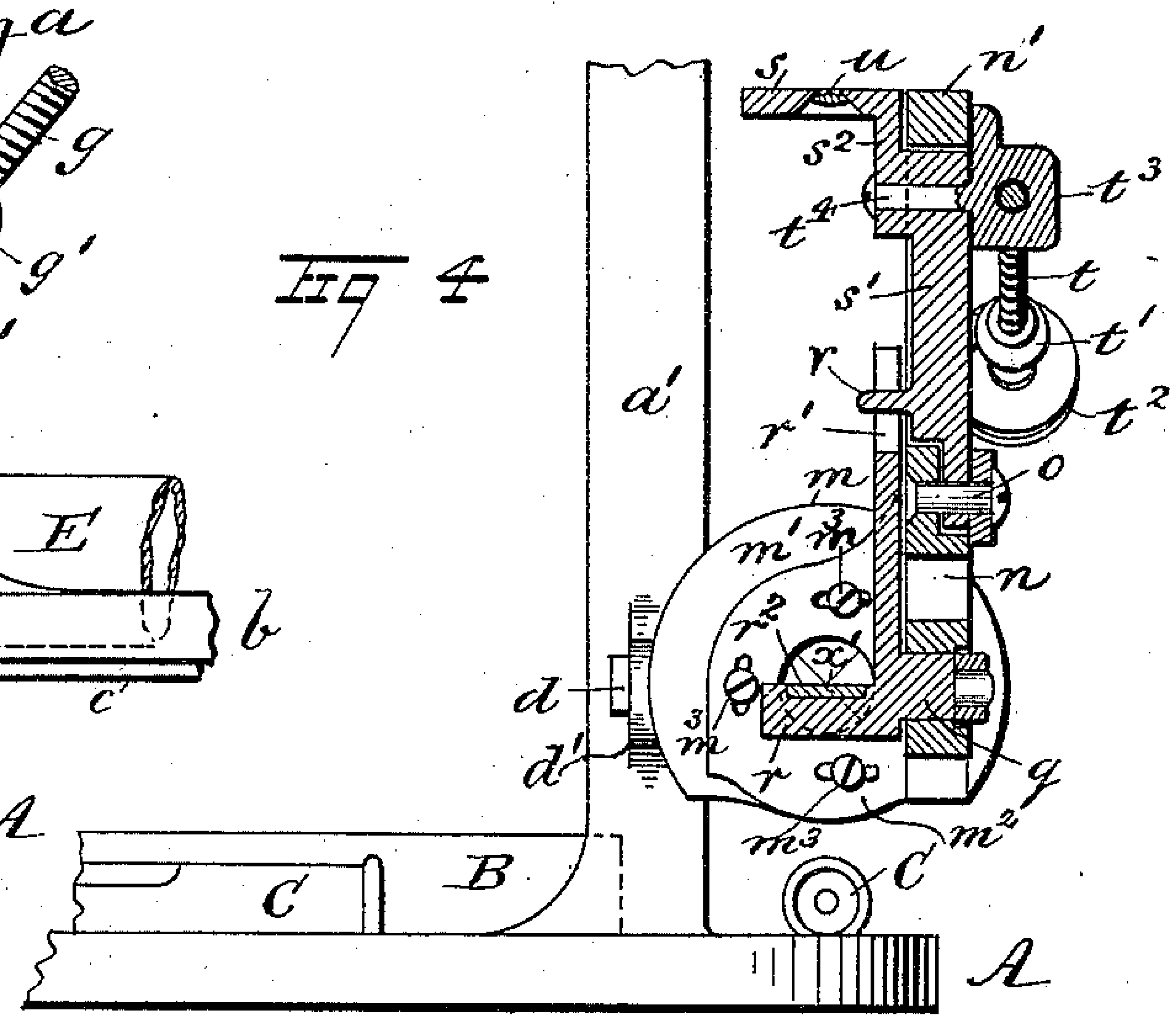


Fig. 4

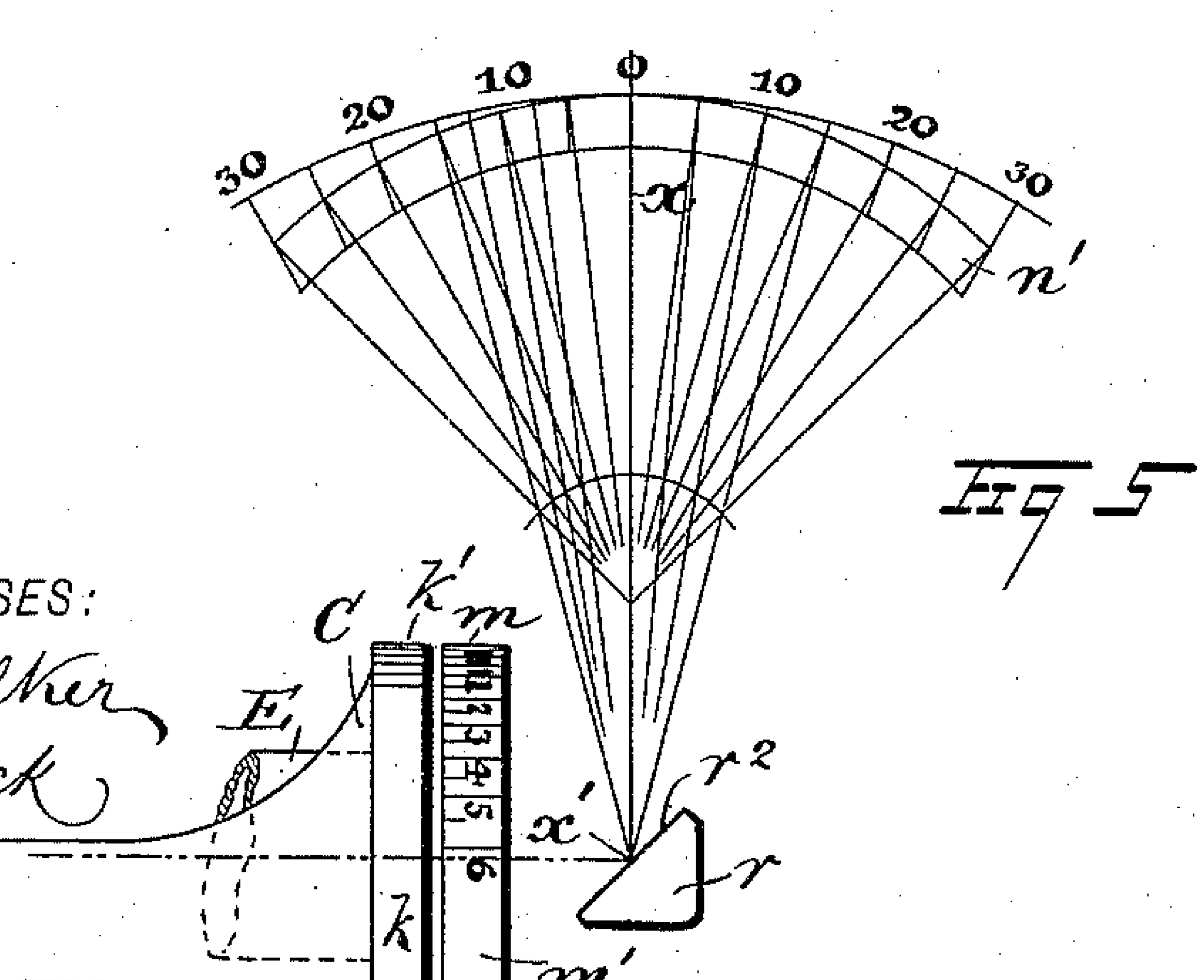


Fig. 5

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

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SOLAR ATTACHMENT FOR TRANSIT-INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 431,286, dated July 1, 1890.

Application filed January 8, 1890. Serial No. 336,240. (No model.)

To all whom it may concern:

Be it known that I, WALTER SCOTT, of Hot Springs, in the county of Fall River and State of South Dakota, have invented a new and useful Solar Attachment for Engineer's Transit-Instruments, of which the following is a full, clear, and exact description.

My invention relates to an improvement in solar attachments that are conjunctively used with an engineer's transit-instrument, whereby the operator is enabled to determine latitude, longitude, the hour of the day, and the meridian by the indicated declination of the sun and co-operating means.

Heretofore instruments of the type named have been secured upon the barrel of the transit-telescope, and generally were specially constructed to suit particular forms of transit-instruments which debarred their general application to various styles of transits that afford good results in use.

The object of my invention is to provide a device of simple construction, compact form, and exact operation, which may be readily and removably secured to any approved form of engineer's transit and act conjunctively therewith, furnishing means to obtain the true meridian, solar time, and latitude and longitude of the locality where observation is taken by usual methods from the data furnished by the instrument.

To this end my invention consists in the construction and combination of parts, as herein set forth, and indicated in the claims.

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

Figure 1 is a side elevation of the solar attachment in position upon the base-plate of a "transit," portions of said base-plate, telescope-supports, compass, and levels being also shown. Fig. 2 is a top plan view of the device in place upon the base-plate of a transit-instrument. Fig. 3 is a rear side elevation of important parts of the solar attachment, portions of the same being broken away from it, and the transit-instrument on which the solar attachment is mounted. Fig. 4 is a transverse section in elevation of the solar attachment, taken on the line 4 4 in Fig. 1. Fig. 5 is a rear elevation of the time-indicating device, a solar-ray reflector, and a diagram in elevation, indicating the different angles of incidence and reflection produced by the concentrated rays of the sun when directed on the reflector through the lens of a vernier attachment to the declination-arc, (not shown;) and Fig. 6 is a rear elevation of a portion of the vertical latitude-arc, its vernier, a portion of the sight-tube and its carriage, and parts of the transit-frame, showing means of connecting the vernier to the sight-tube carriage.

A represents the revoluble horizontal base-plate on a transit-instrument of any approved form of construction, the leveling mechanism below the plate A being omitted from the drawings, as is also the tripod on which the entire instrument is mounted, these parts being of well-known construction.

Upon the base-plate A the theodolite compass B and spirit-levels C are secured. These being features of an ordinary transit are not described.

The equally-inclined standards a a' form one side of the ordinary frame provided to sustain the transit-telescope, (not shown,) pedestal-boxes a^2 being formed at their junction for reception of laterally-projecting journals, which are located oppositely on the telescope-barrel, thereby permitting its vibration in a vertical plane between the supporting-frames.

At a proper point on the inclined standards a a' the cross-bar b is formed on or attached thereto, having its top and bottom edges parallel to the surface of the base-plate A. Upon the outside surface of the standards a a', opposite the cross-bar b, the flat plate c is adjustably secured, said plate constituting the main portion of a carriage that supports the entire solar attachment.

On the plate c at one end a perforation is made laterally in it, which is threaded for reception of a threaded end on the shouldered screw d, that is inserted in a perforated boss d', which projects sidewise from the frame-standard a' on the left side of the frame, said screw d serving to hold the carriage-plate c, secured at this end of the same, while it affords a pivot-point whereon the carriage may be rocked vertically. Near the opposite end of the carriage-plate c, to the frame-standard a, the vertical arc plate D is attached by its lower end. The opposite end of said arc plate, projecting beyond the other inclined standard a', is thereto secured. The arc plate D is designed when set to indicate by degree-graduations on its face the latitude of the locality where the observation is made, and to facilitate said operation a vernier scale-plate D′ is furnished. The inner curvature of the vertical arc plate D represents a portion of a circle having a radius equal in length to the distance between the center of the screw-bolt d, whereon the plate c is pivotally supported, and the outer edge of the vernier scale-plate D′, which latter is secured adjustably on the carriage-plate c by set-screws e, which are therein inserted, passing first through the elongated holes in the vernier-plate, as shown in Fig. 6, thus providing for the initial adjustment of the arc plate and its vernier to make their zero-points align.

A rabbet is formed at f on the vertical arc plate D, its shouldered edge defining the inner edge of the graduated scale of the arc, and, as shown in Fig. 1, the vernier scale-plate D′ is seated in the shallow recess afforded, having its outer edge in sliding contact with the shoulder f, so that said vernier-plate will be properly supported and be free to travel on the reduced portion of the arc plate D.

A tangent-screw g is provided for the critical adjustment of the vernier plate D′ on the vertical arc plate D, whereby the proper inclination to suit the latitude of the locality is given to the solar instrument. The threaded portion of the tangent-screw g is made to engage the swivel-nut g', which is loosely secured near the upper end of the vernier-plate D′, projecting laterally therefrom, the opposite end of the screw, near its head, being adapted to rotate in the swivel-block g^2, that is adjustably fastened to the lower edge portion of the arc D. To permit the position of the vernier to be changed on the arc D, several perforations g^3, are made in the latter at intervals for reception of the movable swivel-block g^2, which being changed will alter the travel of the vernier-scale D′ to another part of the latitude-arc D.

The truly-cylindrical and axially-bored piece E is the barrel of a sight-tube, through which observation of the sun is had, as will be further explained. Said tube is mounted on the carriage-plate c by provision of the laterally-projecting bands h h', which are formed on the plate c at its ends, each band being slotted through the radial ears h^2 formed on them, these ears being furnished with compression-screws that by proper adjustment clamp the bands onto the barrel of the sight-tube E and retain it at any point of rotary movement afforded by suitable manipulation of the radial knobs i on the tube. A portion of the clamping-band h is made solid as a radial flange k, projecting from the end of the carriage-plate c, and on the peripheral edge of said flange portion of the clamping-band a vernier-scale k' is graduated.

A solar-time circle m is formed on the peripheral edge of the radial flange m', that is integrally projected from the end of the sight-tube E, and on the outer face of the flange m', concentric to the bore of the sight-tube, an apertured flange m^2 is adjustably fixed by screws m^3, which pass through slots in the flange m^2 into tapped holes in flange m', so that the vertical skeleton frame n, carried by the flange m' and whereon the declination-arc n' is formed, may be properly adjusted upon the end of the sight-tube E, and rock therewith longitudinally and laterally.

From the relative positions given to the time-circle m and its vernier-scale k' their zero-marks will normally align, which adjustment will be effected when the skeleton frame n is located in a vertical plane. The skeleton frame n is widened from a central point o to produce inclined standards, which afford support to the arc plate n', on the peripheral edge of which suitable graduations are formed that increase by degrees and fractions thereof on each side of a central zero-mark, which is located in a vertical plane at right angles to the longitudinal axis of the sight-tube E when the skeleton frame n is perpendicularly adjusted. In a rounded aperture laterally formed at q in the lower part of the frame n there is inserted and vibratorily secured the rounded journal end of a reflector-supporting block r, to which an upwardly-extending arm r' is affixed. The reflecting-mirror r^2 is secured to the face of the block r, that is sloped at an angle of forty-five degrees to a vertical plane, (represented by the dotted lines x in Figs. 3 and 5,) and it should be understood that the longitudinal axis of the sight-tube E will be coincident with the axial center of the pivot-support for the block r, so that a rocking movement of the block will reflect a beam of light projected on the mirror at x' in Fig. 5 through the tube E and central to its bore. At the point o on the skeleton frame n the lower end of the limb s' is pivoted, said limb being a depending portion of the vernier arc plate s, which is projected laterally therefrom at its upper end and adapted to conform with the peripheral surface of the declination-arc n' when rocked on its pivoted support. A tangent-screw t is revolubly attached to the side edge of the skeleton frame n by means of the swivel-block t', that is loosely secured to the frame-standard and is apertured for the reception of the screw-body, a thumb-piece t^2 on the latter serving to hold the screw in place and afford means for its rotary movement. The rocking nut t^3 is perforated and threaded for engagement of the tangent-screw t, and is secured by a screw t^4 to the depending flange s^2 of the vernier arc plate s and upper end of the limb s', by which provision the vernier arc plate just mentioned may be critically adjusted on the pivot o. At a point u, representing the center of the vernier-plate s, an aperture is made, wherein is fixed a convex lens, the center of which is in the plane x when the vernier arc is adjusted at zero, as shown in Fig. 2. A stud v projects from the rear surface of the depending limb s', which stud engages loosely a longitudinal slot made in the upper portion of the arm r', wherein the stud may slide, and it is apparent that when the tangent-screw t is adjusted revolubly the vernier-plate s and reflecting-mirror r^2 will be correspondingly rocked, so as to maintain the same relation between the convex lens u and point x' on the mirror r^2 wherever said lens may be moved by the screw t.

When the vernier-plate s has to be moved from zero-point toward the opposite edge of the declination-arc, this may be effected by shifting the swivel-block t' into the hole made for its reception in the ear w. The screw t will then be oppositely inclined and adapted to draw the vernier-plate and its lens u toward the point w from a central zero-point.

At the outer end of the sight-tube E an adjustable eye-piece E′ is introduced, the lens being of smoked glass to protect the eye of the observer from injury when looking through the tube, and the usual cross-webs are provided, as shown in Fig. 4, for indicating the exact axial center of the tube E.

In use the bed-plate A of the transit-instrument is leveled and the entire device placed at right angles to the magnetic poles of the earth by rotary movement of the bed-plate and observation of the compass B, the solar device having been previously secured in proper position on the bed-plate A by clamping its carriage-plate to the standard a' at the screw-connection d, the adjustment of the vernier-plate D′ having also been accurately effected to suit the latitude of the locality. The skeleton frame n, attached time-indicating circle m, and sight-tube E are rocked in the clamping-bands $h\ h'$, and the lens n, moved by the vernier-screw t until the concentrated rays of the sun will be directly in alignment with the point x' on the reflecting-mirror r^2, which beam of light will be projected axially through the sight-tube E and be seen by the observer at E′.

In Fig. 5 a diagram is shown of the direction of the rays of light, which, when the parts are moved, as previously stated, will be always focused at x', and projected on the line of collimation represented by the web-cross and eye-piece of the sight-tube E, it being understood that the degrees on the declination-arc plate n' are indicated by radii from the center of reflection on the mirror r^2.

When the parts are correctly adjusted, the degrees and minutes of the sun's declination may be read on the arc plate n and vernier scale-plate s, from which data, with the solar time shown on the circle m and its vernier, the true meridian may be calculated by the usual methods, as well as the longitude of the locality.

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

1. The combination, with a transit bed-plate, the inclined standards of a transit-frame secured vertically on the bed-plate, a latitude-arc secured on the vertical side of the standards, and a vernier-scale therefor which is adapted to move vertically, of a carriage for a solar attachment that is pivoted to the side of a frame-standard by one end, and a horizontal sight-tube bearing an hour-circle on one end, which sight-tube is clamped to the carriage so as to be revolubly adjusted thereon, substantially as set forth.

2. The combination, with an independent sight-tube, a carriage for the sight-tube pivoted by one end on a transit-frame, and a vertical latitude-arc also secured on the transit-frame, of a vernier-scale for the latitude arc, a tangent-screw supported on the latitude-arc to work its vernier, a time-indicating circle attached to the sight-tube, a vernier for the time-indicating circle secured to the carriage, and a sun-declination indicator secured to the end of the sight-tube, substantially as set forth.

3. The combination, with a transit-frame, of a pivoted carriage which is adapted to receive and revolubly support a sight-tube, a sight-tube having an eye-lens at one end and a web-cross at the other end, a time-indicating device secured to the end of a sight-tube, a declination-arc, its vernier, a ray-lens, and a reflector, all supported on the solar-attachment carriage, substantially as set forth.

4. The combination, with a declination-arc mounted on a frame, a vernier scale-plate therefor, and a depending limb attached to the vernier-plate and pivoted on the declination-arc frame at the radial center of said arc, of a ray-lens set in an aperture formed in the vernier scale-plate at its zero-center, an inclined mirror-supporting block pivoted below the vernier-limb in the same vertical plane, a mirror set in the block at an angle of forty-five degrees, an upwardly-projecting arm affixed to the mirror-block and loosely engaging the depending limb of the vernier-plate, and a sight-tube supported to receive a light-beam from the mirror, substantially as set forth.

5. The combination of a skeleton frame having a declination-arc and a time-indicating circle secured thereto in different planes, a vernier scale-plate pivoted by its depending limb to the skeleton frame at the radial center of the declination-arc, and a ray-concentrating lens secured at zero in the vernier scale-plate, of a mirror set at an angle in a block which is pivoted to the skeleton frame below the radial center of the declination-arc, an arm upwardly extended from the mir-

ror-carrying block and loosely engaging the depending limb of the vernier-plate, and a tangent-screw which is adapted to move the vernier scale-plate and rock the mirror-block, substantially as set forth.

6. The combination, with a sight-tube, a carriage therefor pivoted by its end on a frame-standard of a transit-instrument, and a time-indicating device secured on the end of the sight-tube, having a vernier which is mounted on one of the clamps of the sight-tube carriage, of a skeleton frame, a declination-arc thereon, a vernier scale-plate for the declination-arc, a ray-concentrating lens in the vernier scale-plate, and a reflecting-mirror pivotally supported on the skeleton frame and adapted to move in unison with the lens in the vernier-plate, substantially as set forth.

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Witnesses:

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