Aug. 25, 1953 | L. E. BRAYMER | 2,649,791

TELESCOPE

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Fig. 3.

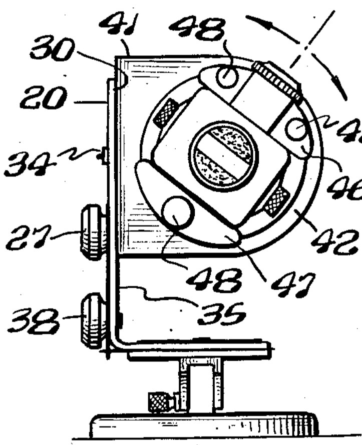
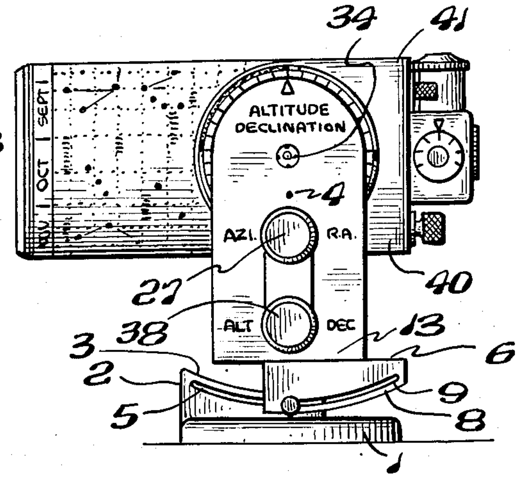


Fig. 2.



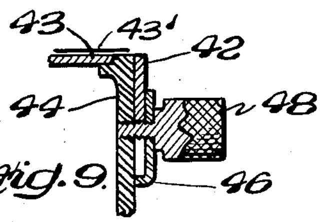


Fig. 9.

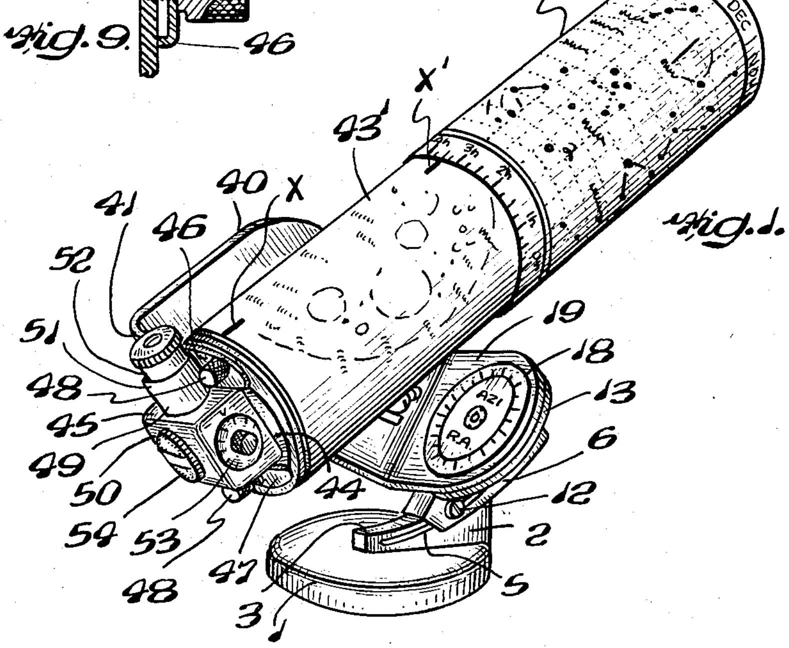


Fig. 1.

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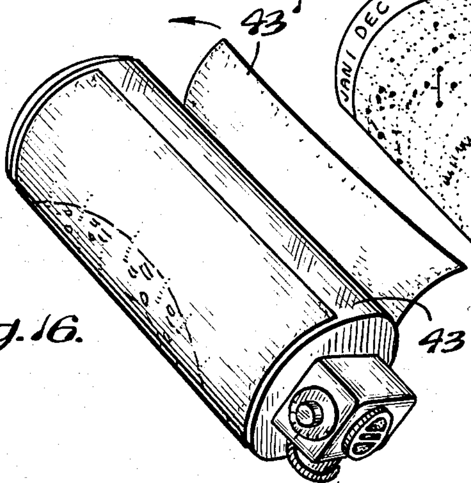

Fig. 16.

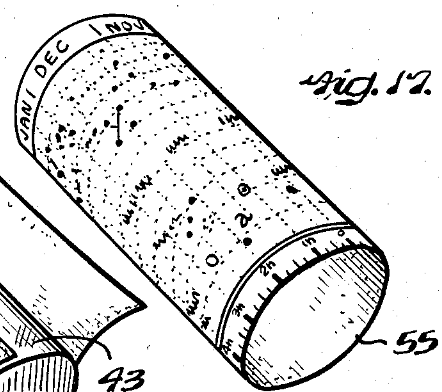

Fig. 17.

Fig. 15.

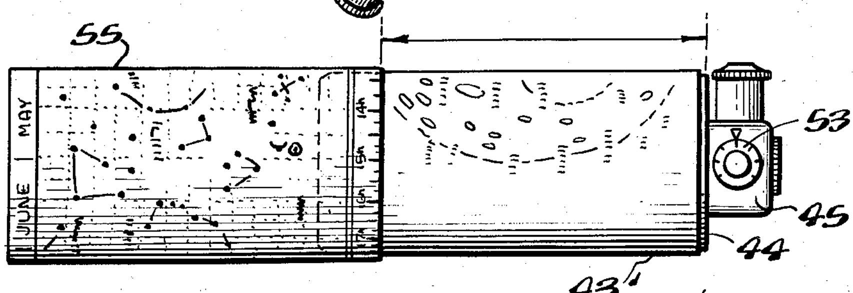

Fig. 4.

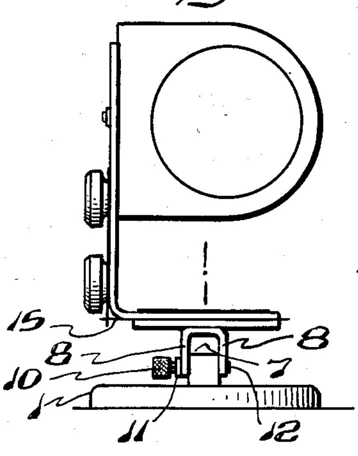

Fig. 5.

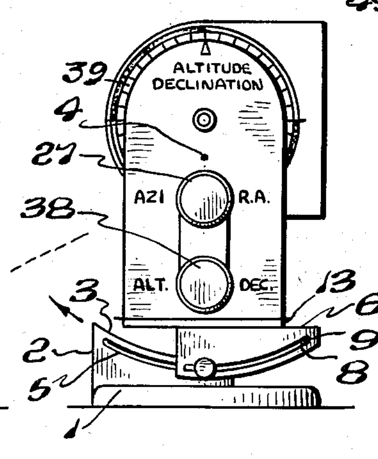

Fig. 10.

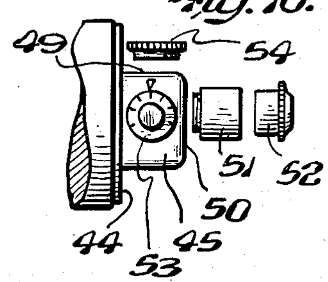

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Fig. 7.

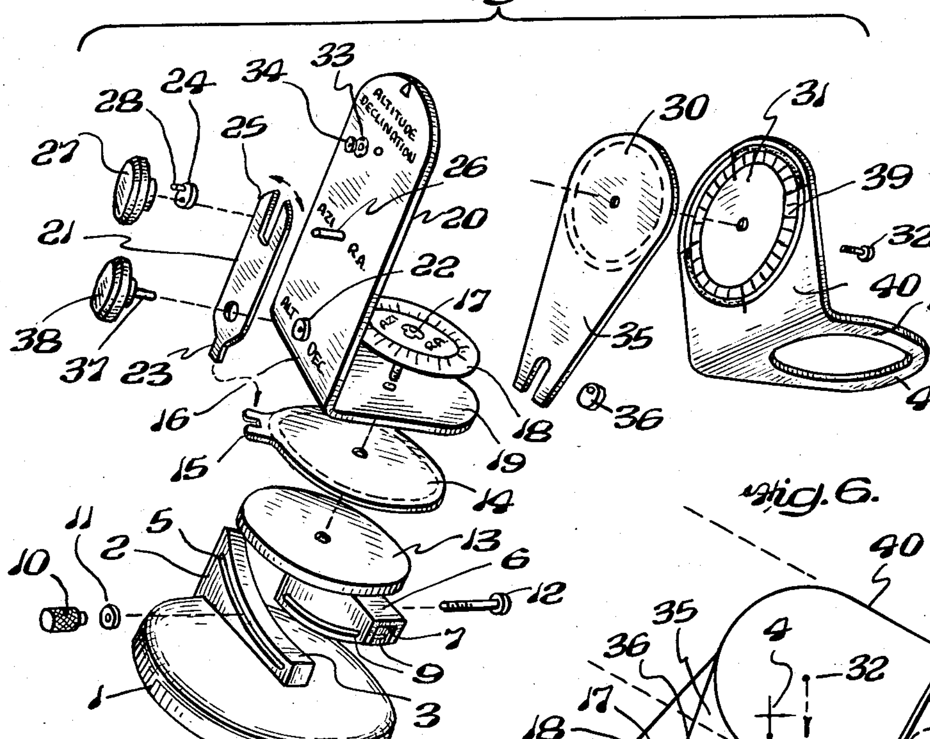


Fig. 6.

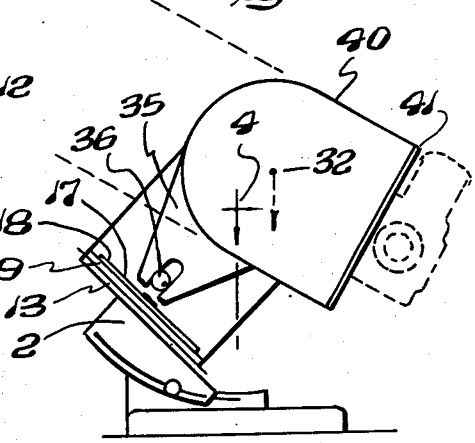


Fig. 8.

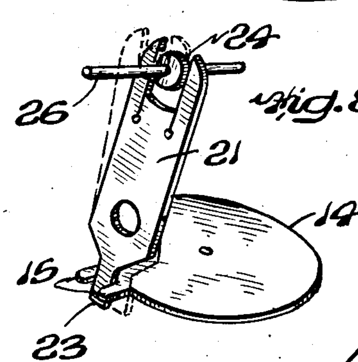
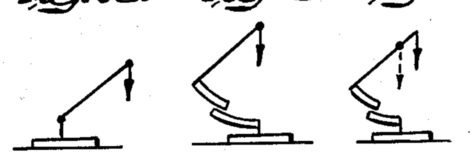


Fig. 12. Fig. 13 Fig. 14.



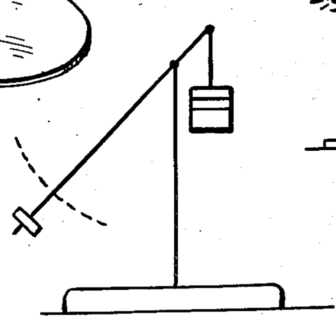


Fig. 11.

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Fig. 18.

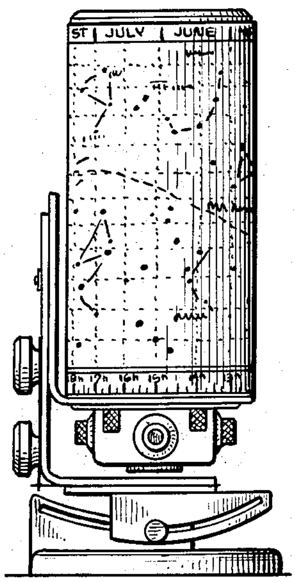


Fig. 19.

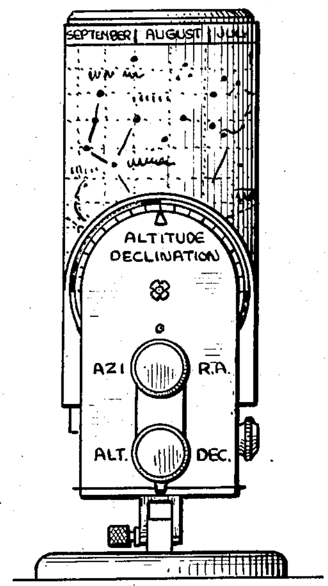


Fig. 20.

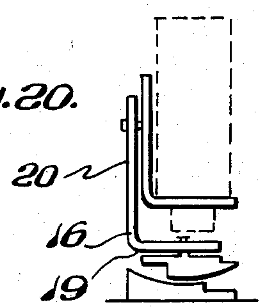


Fig. 24.

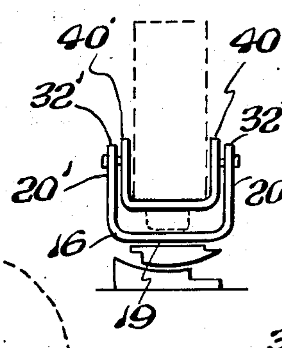
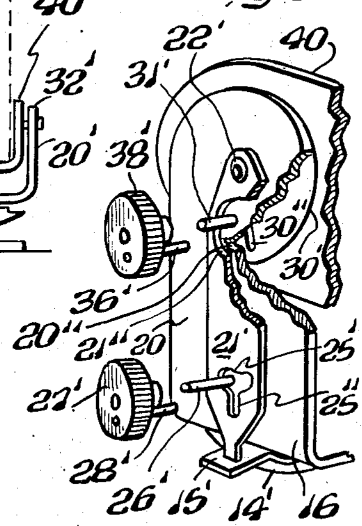


Fig. 25.



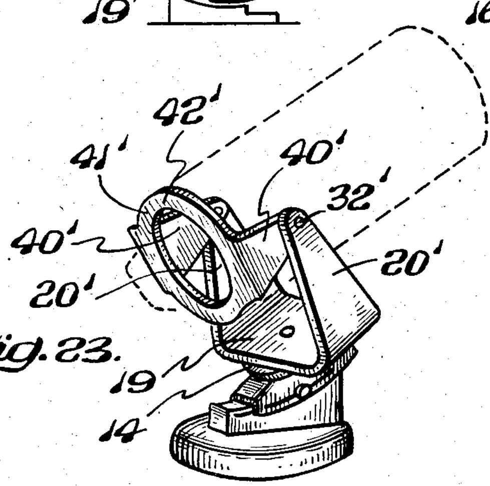


Fig. 23.

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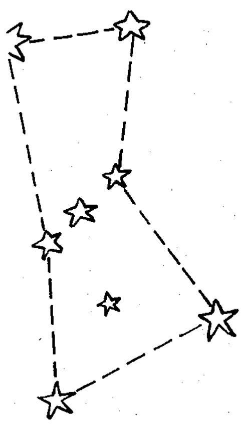
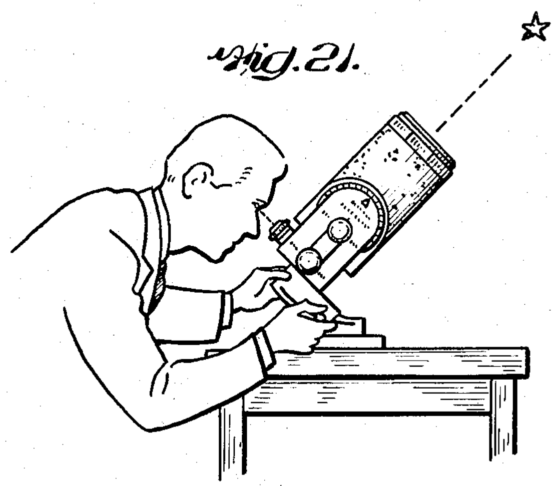


Fig. 21.



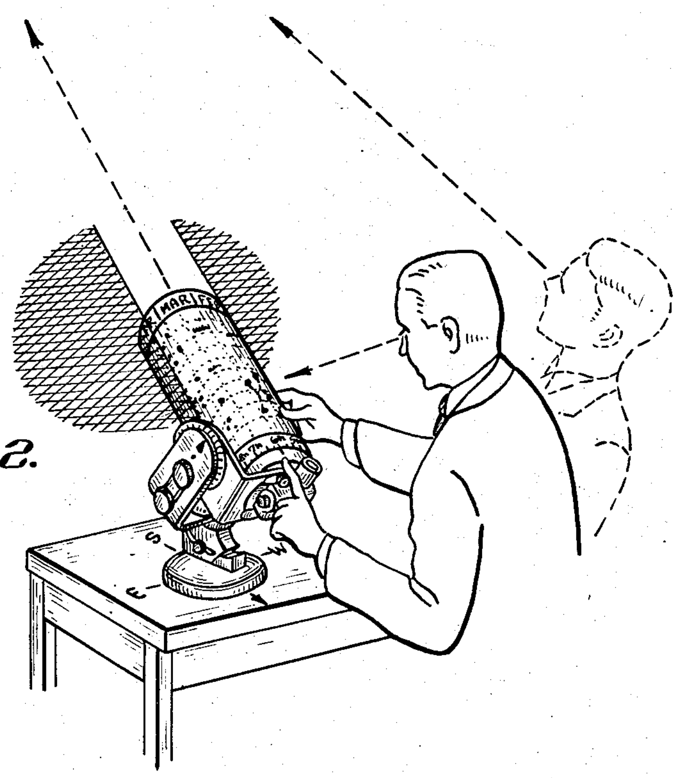


Fig. 22.

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Patented Aug. 25, 1953 2,649,791

UNITED STATES PATENT OFFICE

2,649,791

TELESCOPE

Lawrence E. Braymer, Lahaska, Pa.

Application June 16, 1948, Serial No. 33,320

20 Claims. (Cl. 35—43)

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My invention relates to telescopes, and particularly to a portable telescope having its barrel supported on a base through adjustable mounting members permitting the instrument to be used as an equatorial telescope or for azimuth-altitude observation. In the preferred embodiment of my invention, the barrel of the instrument is supported at one end thereof by a bracket having broad bearings at right angles to one another, and with one of which the barrel is connected, preferably so as to be rotatable about its optical axis. The other of the bracket bearings is pivotally connected with a complementary broad bearing of a somewhat similar bracket which has a second broad bearing projecting at right angles to the first and beneath the barrel. Such projecting bearing is pivotally connected with a seat having a broad bearing surface beneath the barrel and which may be fixed in a horizontal plane or may be tilted at an angle to the horizontal by moving the seat relatively to a base about a horizontal axis which extends in a direction parallel to the axis of rotation of the first bracket on the second bracket and preferably lies in a plane between the latter axis and the base.

When the seat lies in a horizontal plane, the instrument may be used for altitude observation by turning the barrel about the then horizontal axis formed by the pivotal connection between the first bracket and second bracket and may be used for azimuth observation by turning the barrel about the then vertical axis formed by the pivotal connection between the second bracket and the seat.

When the instrument is to be used as an equatorial telescope, the seat is tilted so that the axis of rotation of the second bracket thereon is inclined and points toward the celestial pole. In this position the barrel may be turned on the axis formed by the pivotal connection of the brackets to bring any visible heavenly body into alignment with the optical axis or line of sight, and by then turning the barrel about the axis formed by the pivotal connection between the second bracket and seat there may be traced upon the celestial sphere a circle corresponding to that in which the selected heavenly body appears to move and hence the latter may be retained under observation by a single simple movement. Coarse adjustments of the barrel about the two axes may be effected by grasping the barrel or brackets, but for fine adjustments of the barrel about these axes I preferably provide adjusting devices for shifting one bracket relative to the other and the latter relative to its seat.

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The selection and location of a heavenly body is facilitated by celestial charts such as a hemacylindrical lunar chart fixed to the upper surface of the barrel tube and by a cylindrical stellar chart telescoped on the barrel tube to form a dew cap or light shield. These charts are preferably formed of sheet material of low thermal conductivity, and since the tube is unobstructed throughout its length, they may cover the entire cylindrical surface of the tube to minimize radiation of heat and avoid distortion of the mirrors or lens by sudden change of temperature.

My invention provides a simple and compact instrument whose parts may be folded so that all lie substantially within the circumference of the base and form a shield protecting the end of the barrel and control mechanisms mounted thereon during transportation or storage, but which, in all operating positions thereof will be substantially vibrationless due to the rigidity of the members and the broad bearing surfaces between them, and will be stable due to the disposition of the parts so that the center of gravity will fall within the area of the base regardless of any slant imparted to the seat or any turning of the mounting brackets.

My invention further provides a portable instrument in which an observer may view the image in inverted position by looking directly along the optical axis, or, by the interposition of a prism in the optical axis as shown in my application Serial No. 787,995, an erected image may be seen by looking down through an ocular extending radially of the barrel or the barrel may be rotated on its axis to permit observation of the image from any convenient angle.

My invention further provides an instrument in which the altitude-declination axis is adjacent to the longitudinal center of gravity of the barrel, but the cylindrical external surface of the tube is unobstructed throughout its length to permit its encirclement by one or more sleeves for minimizing precipitation, and one of which may be used as a dew cap, light shield and a celestial chart rotatable in conformity with the celestial hemisphere visible at any time.

The principles and further advantages of my improvements will further appear from the following description of the best modes in which I have contemplated applying such principles and the accompanying drawings in illustration thereof:

In the drawings, Fig. 1 is a perspective view of a telescope embodying my invention in polar-equatorial position; Fig. 2 is a side elevation of the instrument in an altitude-azimuth general purpose position; Fig. 3 is a rear end view of the telescope with its tube partly rotated about its optical axis from the position shown in Figs. 1 and 2; Fig. 4 is a somewhat diagrammatic rear end view of the telescope mount with the barrel removed but indicating the optical axis of the barrel with the axis of the pivotal connection between the seat and bracket in vertical position; Fig. 5 is a side elevation of the mount taken from the left side of Fig. 4; Fig. 6 is a somewhat diagrammatic side elevation looking from the right side of Fig. 4 but with the parts positioned to permit use of the instrument as an equatorial telescope; Fig. 7 is an exploded view of the parts of the mount in their proper relative positions but spaced from one another; Fig. 8 is a perspective, detached view of orienting control parts shown in Fig. 7 for effecting fine adjustments of the main bracket on its seat; Fig. 9 is a detached, fragmentary view illustrating the attachment of the telescope barrel to the auxiliary bracket; Fig. 10 is a detached, fragmentary view of the end of the telescope barrel and of an ocular and cap applicable thereto; Figs. 11 to 14 are diagrams illustrative of the principles involved in providing a stable instrument; Fig. 15 is a side elevation of the telescope barrel with sleeves thereon forming celestial charts, dew cap and a light shield; Fig. 16 is a perspective view of the barrel with a sleeve being wrapped thereon; Fig. 17 is a perspective view of a detached cylindrical stellar chart; Figs. 18 and 19 are elevations, taken at right angles, and Fig. 20 is a diagrammatic view, of the instrument shown in Fig. 1 with the parts folded to packing or carrying position; Fig. 21 is a perspective view illustrating the shifting of the seat to incline the axis of rotation between the seat and the bracket resting thereon toward the celestial pole or Polaris; Fig. 22 is a perspective view illustrating the use of the instrument in locating and observing stars adjacent to the celestial equator while the axis of rotation of the bracket on the inclined seat is directed at the celestial pole; Fig. 23 is a diagrammatic view of a modified form of mounting positioned for use as an equatorial telescope at a different terrestrial latitude; Fig. 24 is a diagrammatic view showing the parts of the telescope shown in Fig. 23 folded for transportation or storage; and Fig. 25 is a broken perspective view showing a modified slow motion mechanism for fine adjustments of the instrument on its azimuth-right ascension axis and on its altitude-declination axis.

In the drawings, I have shown an instrument embodying my invention and comprising a circular base or pedestal 1 having a radial web 2 formed or fixed thereon to provide a standard or sector having a concave upper face or tread 3 forming a surface of revolution about a horizontal axis 4 which is used as an axis of rotation of the mounting members as a unit. The radius of curvature of the surface 3 is preferably no greater than the diameter of the base so as to permit a major adjustment of the angular position of the mounting without impairing the equilibrium of the instrument. An arcuate slot 5 is cut through the web and has the same curvature as the face 3.

A carriage 6 has a convex lower face or tread 7 conforming with and slidable along the face 3 and also has parallel flanges 8 overlapping the sides of the web 2 and containing arcuate slots 9 having the curvature of and registerable with the slot 5. The movement of the carriage 6 along the web turns it around the axis 4 so as to adjust the mounting elements to desired equatorial positions consonant with the latitude of the place where the instrument is located. The profiling and proportioning of the relatively slidable surfaces 3 and 7 as shown in the drawings permits the conversion of an altitude-azimuth mount into a stable polar equatorial mount suitable for latitudes above or below the 25° parallels from the earth's equator and this range may be varied by varying the ratio between the diameter of the base and the radius of rotation of the carriage 6 about the axis 4. The carriage 6 map be clamped in desired positions by tightening up a thumb nut 10 and spring washer 11 on the headed bolt 12 passing through the slots 5 and 9.

A plate 13 is formed on or fixed to the top of the slidable carriage 6 and provides a seat for a rotatable friction disk 14 which has a yoke 15 projecting radially from the periphery thereof.

A main bracket or turntable 16 is rotatable on and by the disk 14, and is pressed against the disk by a spring-headed bolt 17 which passes through a dial 18 (which is graduated to indicate azimuth and right ascension), through the turntable 16, through the friction disk 14 and is threaded into the plate 13. The pressure imposed by the spring-headed bolt 17 upon the parts is adjusted to permit rotation of the turntable 16 on the disk 14 when the latter is held and to cause rotation of the turntable 16 when the disk 14 is rotated about the shank of the screw 17. The members 14 and 16 are thus rotatable together, and the member 16 is rotatable individually about an axis which is concentric with the screw 17; is perpendicular to the axis 4, may be positioned vertically when measuring azimuth; may be appropriately inclined, by tilting the carriage 6, when measuring a right ascension or using the instrument as an equatorial telescope; and may be appropriately designated the azimuth-right ascension axis. The bracket 16, rotatable about such axis, may be correspondingly deemed the azimuth-right ascension element of the mounting.

The bracket 16 comprises a platform 19 with one or more arms projecting from the edge thereof parallel with, but spaced substantially from the azimuth-right ascension axis. As illustrated in Figs. 1 to 22, the platform 19 may be provided with a single, broad surfaced arm 20 forming therewith a rigid L-shaped bracket, or, as illustrated in Figs. 23 and 24, the platform 19 may be provided with parallel arms 20′ and forming therewith a rigid U-shaped bracket. The bracket may be further stiffened by suitable ribs or webs (not shown).

A lever 21 is fulcrumed on a boss 22 on an arm 20 and has a bottom tongue 23 seated in the notch of the yoke 15 so that the rocking of the lever 21 turns the disk 14 about the azimuth-right ascension axis. The lever 21 may be rocked by the rotation of an eccentric cam 24 in the bifurcated upper end 25 of the lever. The cam 24 is journalled on a stud 26 projecting from the arm 20 and is rotatable by a knob 27 journalled on the stud 26 and connected with the cam 24 by a pin 28 thereon.

A friction disk 30 and an auxiliary bracket or turntable 31 are pivotally connected with the arm 20 by a bolt 32, spring washer 33 and nut 34; the friction disk being interposed between the arm 20 and turntable 31 and sufficient pressure being applied to the assembly by the bolt, washer and nut to permit the rotation of the turntable on the disk when the latter is held but to effect the rotation of the turntable by the disk when the later is turned about the bolt 32.

The members 30 and 31 are thus rotatable together, and the member 31 is rotatable individually, about an axis which is concentric with the bolt 32; is perpendicular to the azimuth-right ascension axis; is positioned horizontally and parallel to the axis 4 but preferably spaced therefrom; forms an axis of oscillation when measuring altitude or declination; and may be appropriately designated the altitude-declination axis. The auxiliary bracket 31, oscillatable on such axis, may be correspondingly deemed the altitude-declination element of the mounting.

The altitude-declination element of the mounting may be stiffened by ribs or webs (not shown) and, like the azimuth-right ascension element may be either L-shaped as shown in Figs. 1 to 22 or U-shaped as shown in Figs. 23 and 24. An arm 40 may project from a platform 41 of the L-shaped bracket 31 to form a broad bearing surface complementary to the broad bearing surface of the arm 20 to which it is pivotally connected, or arms 40′ may project from the bight or platform 41′ of a U-shaped bracket to form bearing surfaces complementary to bearing surfaces of arms 20′ to which they are respectively pivotally connected by bolts 32′.

Oscillation of the altitude-declination element may be effected through a lever or yoke 35 projecting radially from the periphery of the disk adjacent to the arm 20. The bifurcated lower end of the yoke 35 embraces, and is oscillatable by, a cam 36 fixed on a shaft 37 journalled in an aperture in the hub 22 and provided with a knob 38.

As illustrated in Fig. 25, the relative positions of the knobs for operating the main bracket 16 and auxiliary bracket 31 may be reversed so that the main bracket is oscillatable by turning a lower knob and the auxiliary bracket is oscillatable by turning an upper knob. In this modified construction, the main bracket 16 is pressed against and operable by a friction disk 14′ having a peripheral, apertured lug 15′ engaged by the lower end of a lever 21′ fulcrumed on a stud 22′ projecting from the upper portion of the arm 20. A knob 27′ is journalled on a stud 26′ which passes through an arcuate slot 25′ in the lower end of the lever 21′ and is fixed to the lower portion of the arm 20′. An eccentric pin 28′ projects inward from the inner face of the knob 27′ and is engaged in a radial slot 25″ in the lever 21′. The turning of the knob 27′, causes its pin 28′ to rock the lever 21′ and thereby turn the friction disk 14′ and the bracket 16 on their common axis.

A knob 38′ is journalled on a stud 37′ projecting from the upper portion of the arm 20 and through an aperture 21″ in the upper part of the lever 21′. An eccentric pin 36′ projects from the inner face of the knob 38′, through the aperture 21″ and through an arcuate slot 20″ in the arm 20, into a radial slot 30″ in the friction disk 30′. The turning of the knob 38′ causes its pin 36′ to turn the friction disk 30′ and the auxiliary bracket 31 on their common axis.

An altitude and declination scale 39 is formed on or attached to the arm 40 and a datum mark complementary thereto may be provided at the top of the arm 20 or vice versa.

The platform 41 or 41′ is apertured to form a ring 42 or 42′ for supporting the barrel of a telescope.

The telescope barrel carried by the turntable 31 may be of any desired type but is preferably of the Maksutov-Cassegrain or Maksutov-Gregorian type such as described in my copending application Serial No. 787,995, filed November 27, 1947, and which has its rear mirror axially adjustable for focusing the instrument.

Such a telescope is of short tube length proportionately to its focal length and comprises a cylindrical tube 43 having a front lens carrying an auxiliary mirror, a rear primary mirror (not shown) and a rear closure 44 to which is fixed a housing 45. The closure 44 is rotatably secured to the face of the ring 42 (Figs. 3 and 9) as, for instance, by a pair of clamps 46 and 47 bearing against the back of the ring 42 and having lips bearing against the closure 44. The clamps and closure are secured together, to form an annular channel for the ring 42, by a set of triangularly arranged thumb screws 48 whose shanks engage the inner periphery of the ring and guide the rotation of the barrel around its optical axes.

The housing 45 contains a plurality of apertures 49 and 50 disposed transversely to one another and having threaded walls for receiving any desired accessory, such as the threaded end of a sleeve 51 in which the tube 52 of an ocular makes a close slip fit. Any desired number of tubes 52 may be provided having oculars of various focal lengths and magnification and may be positioned at various heights in or out of the tube 51 as may be convenient to an observer, but such adjustments are not designed to materially effect the principal focusing of the instrument, and hence the long sliding tube, spiral focusing sleeves or rack and pinion device commonly used are not required.

The principal focusing of the instrument is effected through focusing knobs 53 at the sides of the housing 45.

A tube 51, with an ocular or other accessory therein, may be mounted in each opening 49 or 50, or either of these openings may be plugged by a threaded cap 54.

The unobstructed cylindrical surface of the tube 43 has fixed thereon a sleeve 43′ bearing a selenographic, lunar map and datum marks X, X′ on the upper portion thereof, and a sleeve 55 is rotatable on the sleeve 43′ and may be fully telescoped thereover or may be partly projected from the front end of the tube 43. The sleeve 55 bears a stellar map and data complementary to the datum marks X, X′ on the sleeve 43′.

The sleeves 43′ and 55 are of low thermal conductivity and may be conveniently made of metal foil with the maps and data imprinted thereon in noctilucent or phosphorescent pigments. The printed foil is externally covered with a thin transparent sheet of plastic such as cellulose acetate (cellophane) and is internally lined with velour or flocked paper, so that the weight of the tube is minimized and does not materially affect the center of gravity of the instrument even when the sleeve 55 is projected to its maximum position to form a dew cap or light shield.

The sleeve 43′, and the sleeve 55 when retracted, tend to prevent rapid change of temperature of the barrel sheathed thereby and of the optical elements in the barrel, and hence minimize distortion of the optical elements.

When the instrument is to be packed, stored or carried, the altitude declination bracket is turned on the altitude declination axis until the platform 41 lies parallel with the platform 19, and these platforms, together with the arm 20 form a housing or shield around three sides of the control end of the instrument. When yoke shaped brackets are used, the control end of the instrument is shielded on four sides thereof by the platforms and arms of the brackets.

The sector 6 is fixed to the sector 2 so that the azimuth right ascension axis is vertical. In this position of the parts, they are all substantially within the area of the base. There is no problem of instability, and the instrument may be easily packaged and carried.

When the instrument is to be used for azimuth altitude observations, the barrel is moved by oscillating the arm 41 on the arm 20 and by oscillating the platform 19 on the seat 13. The barrel is supported wholly from its end but its longitudinal center of gravity is adjacent to the altitude declination axis concentric with the bolt 34, and in this position the instrument is stable, since the center of gravity lies within the base, as diagrammatically indicated in Fig. 11.

When the instrument is used as an equatorial telescope, in a known latitude, the sector 6 may be shifted on the sector 2 to tilt the seat 13 to a predetermined position commensurate with the latitude. If, however, the latitude of the place is unknown, the seat 13 may be given the approximately proper inclination by setting the barrel so that its optical axis is normal to the seat 13 (as indicated in Figs. 18 and 19). The altitude right ascension element 16 is then turned through forty-five degrees on its axis from the position shown in Fig. 18 and the sector 6 is shifted on the sector 2 until the pole star is aligned with the optical axis as indicated in Fig. 21. This alignment may be readily effected by using an ocular of low power. When the alignment has been attained, the sector 6 is secured in position by tightening up the nut 10.

Despite the slight displacement of the pole star from true North and despite any slight departure of the supporting surface from true horizontal, the mounting will be so positioned as to permit following a heavenly body for several hours by turning the azimuth right ascension element on its axis without requiring further adjustments of the altitude declination element after its initial setup.

As indicated in Fig. 22, the initial adjustment of the altitude declination bracket on its axis to select the desired heavenly body may be facilitated by turning the sleeve 55 until the visible section of the stellar map thereon synchronizes with the visible section of the celestial sphere, and the stellar configuration on the map matches the stellar configuration overhead. The barrel may be manually turned to bring its optical axis into alignment with a visible star, and fine adjustments to center the star may then be effected by turning the knob 38. The star may be then followed in its circle across the heavens by turning the bracket 16 either manually or by turning the knob 27.

When the instrument is pointed at a given star, the sidereal time is shown by the hour angle scale at the bottom of the sleeve 55 and the datum mark X on the sleeve 43'. The month or season is indicated by the monthly or seasonal scale on the forepart of the sleeve 55.

The true declination and right ascension of the stars shown on the sleeve 55 are indicated by the vertical and circumferential lines thereon, and invisible objects, indicated on the map in their true relative positions, may be located by setting the bracket 31 to the proper declination by means of the declination dial, and then sweeping the adjacent heavens by turning the bracket 16 on its azimuth right ascension axis. Since the stellar map is a fair representation in miniature of the segment of the celestial sphere in sight, and the remaining stars on the map are rendered invisible by being directed beneath the barrel, just as invisible stars are beneath the earth, an observer may readily co-relate the visible stars on the map with the visible stars in the sky.

The lunar chart facilitates the location and identification of characteristic features of the moon, and the rotatability of the barrel, with the lunar chart fixed thereon, makes it possible to turn to the top any desired section of the lunar map.

When the sleeve 55 is in the retracted position shown in Fig. 22, it serves as a thermal insulater upon the barrel as well as a stellar chart, and when it is in the advanced position shown in Fig. 1 it serves as a dew cap and light shield, as well as a stellar map having an hour angle band with which the datum X' then co-operates. In all positions of the sleeve, of the barrel and of the mounting the instrument is stable since the composite center of gravity is within the base. Such stability is unattainable when a mount is supported on a base by a vertical stem and it is attempted to convert the mount from an altitude azimuth to a polar equatorial mount by inclining the mount at some point along the stem, for, as indicated in Fig. 12, the center of gravity of the barrel and the mount would be shifted beyond the base unless the latter were extremely large. If it were attempted to bring the optical axis to polar pointing position by turning the base about the altitude declination axis, the center of gravity coincident with the altitude declination axis would lie about the center of the base, but the center of gravity of the shifted elements of the mounting would lie beyond the edge of the base on one side thereof as indicated in Fig. 13, and there would be no counter-balance on the opposite side of the center of the base.

But by shifting the center of gravity of certain elements of the mounting to one side of the center of the base, and shifting counterbalancing elements of the mounting and the tube to the opposite side of the center of the base, as indicated in Fig. 14, and by providing a base having a diameter equal to the radius about which the seat is shifted, as illustrated in Fig. 14, the instrument is rendered stable without increasing the diameter of the portable base beyond the overall width of the mounting and barrel when they are in vertical position.

My application of the principle of counterbalancing thus achieves two objects, for not only is the general center of gravity held substantially to the center of the base, but the shorter radius of curvature of the slidable surfaces 3 and 7 permits adequate inclination for changes in latitude without making these arcuate members so large that they project beyond the area of a base of desirable size. The short-radius arcs of Fig. 14 provide the same inclination as the longer arcs of Fig. 13, which not only render the instrument unstable but project beyond the base and would prevent the compact folding of the instrument to the compact form illustrated in Figs. 18, 19 and 20.

My improvements provide a stable, short tube, light weight, high power instrument which is readily portable and adjustable, for use as an altitude-azimuth instrument or as a polar-equatorial instrument over many degrees of terrestrial latitude to locate and follow heavenly bodies without the need for extraneous data and without discomfort. The instrument may be used visually by one person or by two persons, concurrently, or it may be used as a telephoto lens for photographic work, either concurrently with or independently of visual observation in darkness or in light without blurring by extraneous light or distortion due to thermal shock. The images may be viewed in either erect or inverted position.

Having described my invention, I claim:

1. A telescope comprising a base, a support carried by said base and oscillatable about a substantially horizontal axis, a bracket oscillatable on said support and having an arm spaced from but substantially parallel to its axis of rotation, a second bracket oscillatable on said arm and having an arm spaced from but substantially parallel to the axis of oscillation of said second bracket, and a telescope barrel mounted on said last named arm and overlying said base in all positions thereof.

2. A telescope as set forth in claim 1 wherein the barrel has a center of gravity adjacent to the axis of oscillation of said second bracket.

3. A telescope mount comprising a base having a bearing surface curved about a horizontal axis, a support movable about said axis and having a member complementary to said surface and lying between said surface and said axis for varying the plane of said support, a member oscillatable on said support on an axis substantially perpendicular to said first named axis, and a member oscillatable on said second named member.

4. A telescope comprising a base, a seat movable on said base about a horizontal axis spaced above the top of said base and on a radius no greater in length than the diameter of said base, a main bracket oscillatable on said seat and having an arm parallel with and spaced laterally from its axis of rotation, an auxiliary bracket oscillatable on said arm about an axis spaced further from said seat than the length of said radius, and a barrel mounted on said auxiliary bracket.

5. A telescope comprising a base, a seat movable on said base about a horizontal axis and on a radius no greater in length than the diameter of said base, a bracket oscillatable on said seat about an axis perpendicular to said first named axis, a second bracket oscillatable on said first bracket about an axis perpendicular to said second axis, and a barrel mounted on said second bracket, said second bracket being movable into parallelism with said first bracket, and said seat and first bracket being movable into position with the latter's axis normal to the base and said barrel and brackets when so positions lying within the circumference of the base.

6. A telescope comprising a support, a bracket rotatable on said support and having members extending normally to one another, one of said members overlying said support, a bracket rotatable on the other member of said first bracket and having members extending normally to one another, one of said last named members being parallel to and connected with the second named member of the first bracket, and a barrel connected with the other member of the second bracket, an optical system in said barrel with its optical axis normal to the axis of rotation of said second bracket; said barrel and the member with which it is aligned overlying said support with the optical axis of said system parallel to the axis of rotation of said first bracket when the members of said brackets are aligned with one another.

7. A telescope comprising a base, a mount and a barrel; said mount comprising a pair of L-shaped brackets, each bracket having legs disposed normally to one another and similarly to the disposition of the legs of the other bracket, one of said brackets having one of its legs pivotally connected with the base and the other of its legs pivotally connected with a leg of the other bracket, the other leg of said last named bracket containing an aperture aligned with the longitudinal center line of said barrel, said apertured leg having fixed thereto the end of said barrel and said barrel intersecting the extended axis of the pivotal connection of said pivotally connected legs.

8. A telescope comprising a base, a mount and a barrel; said mount comprising a pair of yoke-like members one of which is pivotally mounted within the other, one of said yokes having a bight pivotally connected with said base, and the other of said yokes having an apertured bight and having an end of said barrel fixed thereto with its longitudinal axis in alignment with the aperture in said bight, said barrel being intersected transversely to its length by an extension of the axis on which one of said members is pivotally mounted within the other.

9. A telescope having a cylindrical barrel of substantially constant diameter and having a substantially unobstructed external periphery; an end closure for and extending transversely to the length of said barrel, a bracket having a leg extending longitudinally of and spaced from said barrel and a leg extending transversely to said first named leg and connected with said barrel in close juxtaposition to said closure, and a support to which said first named leg is pivotally connected at a point along said barrel.

10. A telescope comprising a supporting mount, a barrel having an end piece transverse to the axis of the barrel and connected with said mounting and a cylindrical external surface which is substantially unobstructed, and a cylindrical sleeve of low thermal conductivity covering said external surface extensible forwardly thereof.

11. A telescope comprising a support, a mount having an arm pivotally connected with said support and an arm normal to said first named arm, a rotary cylindrical member supported by said second named arm and extending longitudinally to said first named arm and being intersected by an extension of the axis of said pivotal connection, said cylindrical member having its external surface substantially unobstructed by mounting members throughout its length and having thereon a celestial map, a time scale encircling said rotary member, a datum complementary to said time scale for the coordination of said celestial map and the celestial sphere, and an optical system having its principal optical axis within said rotary member and concentric with the axis thereof.

12. A telescope comprising a support, a mount having an arm pivotally connected with said support and an arm normal to said first named arm, a cylindrical barrel having its end rotatably supported by said second named arm, said

barrel extending longitudinally of said first named arm, said barrel having an external cylindrical surface unobstructed by mounting members substantially throughout its length, a sleeve encircling said barrel and approximating the length thereof, said sleeve having a celestial map thereon, an optical system having its principal optical axis substantially concentric with the center line of said barrel, and an ocular at the end of said barrel adjacent to said first named optical axis, said ocular being rotatable about said first named optical axis.

13. A telescope comprising a mounting, a barrel mounted thereon rotatably about its optical axis, and a sleeve rotatable about the barrel and encircled by a luminous stellar map, said telescope having an optical system with an optical axis concentric with the axis of rotation of said map.

14. A telescope comprising a barrel having thereon a pair of sleeves bearing celestial maps, at least one of said sleeves being rotatable about its axis to synchronize the map thereon with variations in the aspect of the visible section of the celestial sphere.

15. A telescope comprising a barrel having thereon a datum and a sleeve encircled by a celestial map and an hour angle scale, said sleeve being rotatable to co-ordinate a representation of a heavenly body on the map with such heavenly body in the sky in alignment with the barrel to thereby co-ordinate the hour angle scale with the datum to indicate sidereal time.

16. A telescope mount comprising a support, a bracket oscillatable on said support, a cam operatively connected with said bracket to oscillate it on said support, a second bracket oscillatable on said first bracket, and a cam operatively connected with said second bracket to oscillate it on said first bracket.

17. A telescope mount comprising a support, a bracket oscillatable on said support, a lever fulcrumed on said bracket for oscillating said bracket on said support, a bracket oscillatable on said bracket first named, and a lever fulcrumed on said first bracket for oscillating said second bracket on said first bracket.

18. A telescope mount comprising a support, a bracket oscillatable on said support, a friction disc between and engaging complementary surfaces of said support and bracket, and a pivotally mounted actuator engaging said disc adjacent to the periphery thereof for oscillating said disc and bracket.

19. A telescope mount comprising a support, a bracket having a leg oscillatable on said support and a leg normal to said first named leg, a second bracket having a leg oscillatable on the said second named leg, a friction member between said second and third named legs, means including a pivot connecting said third named leg and friction member with said second named leg and about which said friction member and third named leg are movable without axial movement thereof, and a pivotally mounted actuator engaging said friction member independently of said third named leg, for oscillating said friction member and third named leg on said pivot.

20. A telescope mount comprising a base, a support oscillatable on said base about a horizontal axis, a bracket oscillatable on said support about an axis perpendicular to said horizontal axis, said bracket including a member laterally spaced from and parallel to said perpendicular axis, a bracket oscillatable on a member of said first bracket and including a member projecting normally to the member of said first bracket on which it is mounted, said last named member having its axis of oscillation spaced above and parallel with said first named axis of rotation so that the shifting of said support shifts the centers of gravity of said brackets to opposite sides of said first named axis, and a barrel connected with said last named member and having a center of gravity on the opposite side of said second axis from the center of gravity of said brackets.

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