O. OHLSON.
DECLINATION GEAR FOR AZIMUTH INSTRUMENTS.
APPLICATION FILED MAY 20, 1912.

1,182,405. Patented May 9, 1916.

2 SHEETS—SHEET 1.

Witnesses:

Inventor:

Olof Ohlson

THE COLUMBIA PLAINOGRAPHY CO., WASHINGTON, D. C.
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OLOF OHLSON

By Knight, Auwa, Lundy, and Atlee.

THE COLUMBIA PLAINDEED CO., WASHINGTON, D. C.
To all whom it may concern:

Be it known that I, Olaf Ohlson, a citizen of the United States, and resident of West Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Declination-Gear for Azimuth Instruments, of which the following is a specification.

This invention relates to azimuth instruments in which a sighting means is caused to move in correspondence with the apparent motion of the heavenly body upon which it is directed, that is, to instruments of the type of the Butterfield azimuth chronometer disclosed in the application filed by Horace S. Butterfield, March 30, 1912, Serial No. 687,325, and consists in a gear or attachment, by adjustments of which the motion of the sighting means or member may be so varied as to correspond accurately with the peculiar motion of the heavenly body due to its declination. The particular device hereinafter described and illustrated in the accompanying drawings is designed for use in connection with the instrument shown and described in the application aforesaid, and is calculated to influence the motion of the sighting means in accordance with the declination of the sun, but the principles of the invention are of broader application than this and accordingly are not to be understood as limited to the particular combination and use indicated.

In its broadest aspect my invention comprises an attachment or adjunct for an instrument having a chronometrically moved sighting means, by which the mechanism for moving such sighting means may be adjusted in accordance with the declination of the sun or any other heavenly body so as to designate the true bearing of such body at all times of the day and for all days in the year.

In explaining the principles of my invention and the mode in which the same is employed, I will make reference first to the specific embodiment of the invention shown in the drawings accompanying this application, but without thereby intending to limit these principles to that particular embodiment.

In these drawings, Figure 1 is a vertical cross section of an instrument in which one particular embodiment of my invention is incorporated. Fig. 2 is a sectional plan view of a portion of the same on line 2—2 of Fig. 1. Fig. 3 is a sectional elevation of parts at the left on line 3—3 of Fig. 1, the supporting arms being omitted for the sake of clearness. Fig. 4 is a detail elevation of the declination gear as seen from the left of Figs. 1 and 2.

Like reference characters represent the same parts in all the figures.

The instrument as a whole is the same as that illustrated in the Butterfield application above noted, and so also are the details except for such modifications as are necessary to accommodate the feature in which my invention particularly resides; therefore, I will not describe the instrument as a whole with any great fullness of detail, but will content myself with a detailed description of only the features in which my invention particularly resides, making brief reference to the features common to this instrument and to that shown in said application.

In the drawings 2 and 5 represent rings connected by pivots 6 and 7 and providing pinial joints for supporting a pelorus or dial 11 in a horizontal plane. A rigid bar or bow 12 hangs from the under side of the pelorus and supports the curved plate 14, having ears 15 embracing the barrel and carrying divergent arms 16 supporting the clock or other uniform motion motor 17. Springs 20 engage the outer side of the curved bar 12, and bear on the pinion shaft 21, carrying a pinion 23, which meshes with teeth 22 on the bar, and is rotated by means of a head 24 on the shaft 21, to adjust the motor and the parts associated therewith for latitude.

25 is a hollow shaft having a bearing in the frame of the motor, which shaft is secured and carries a frame or hemispherical shell 26, having teeth 28 on its periphery and forming what I may term a "spherical gear", upon which the teeth are located in approximately an equatorial circle.

29 is a pinion meshing with the teeth 28 and carried by a shaft 30, which is driven by the motor 17, and having such a gear ratio with respect to the spherical gear as to drive the latter once around in twenty-four hours.

A stud 32, rotatably supported upon a ball bearing 33 in the axis of the pelorus 110.
11, carries a frame or arms 34 in a plane parallel to the pelorus, and said arms carry the sighting members 35 and 36. Also secured to the stud 32 is a yoke or guide having arms 42 and 43 in which is a guideway 44.

All the parts thus far described are constructed, arranged, and combined substantially as described in the Butterfield application aforesaid, to which reference may be had for a fuller description and explanation.

Surrounding the spherical gear 28 and the motor 17 is a ring or band 45, which is made as the zone of a sphere and is concentric with the spherical gear. It is pivotaly connected to the latter at opposite ends of an equatorial diameter of the gear upon trunnions or pivot pins 46 and 47, said pivot pins entering brackets 48 secured on the exterior of the spherical gear. Said band 45 carries driving elements in the form of studs 49 and 50 adapted to enter the guideway 44 in turn, and of which one or the other is always in such guideway. Between the band 45 and the spherical gear is a shell 50 which also is the zone, and includes the pole of a sphere concentric with the spherical gear and with the band. Said shell 50 is secured to one end of a shaft 51, which is contained and rotatable within the tubular shaft 25 of the spherical gear and is held therein by a collar 52 so arranged on its end as to overlap the end of shaft 25. In the outer face of the shell 50 is a cam groove 53 which is entered by a stud 54 carried by the band 45 on a lug 56 which projects from the band toward the pole of said spherical shell and converges to a point 57, which serves as an index presently to be described. The peripheral edge of the spherical shell 50 is provided with ratchet teeth of which the number is the same as the number of days in the year, a few of which are shown at 58 in Fig. 2, and with which engages a driving pawl 59 pivoted upon a pawl carrier 60 which has an oscillating mounting by means of a pin or rock shaft 61 in the spherical gear. A spring 62 connected at opposite ends to pins mounted to the pawl and pawl carrier, respectively, holds the pawl yieldingly in constant engagement with the teeth 58. Secured upon the rock shaft 61 inside of the spherical gear is an operating arm or actuator 64, which is normally held against a stop pin 63 by a spring 66 which acts against the pawl carrier. Said actuating arm has cam or wedge surfaces 66 and 67 which are inclined to the direction in which the arm is carried by rotation of the spherical gear, and one or the other of these surfaces is brought, in the rotation of the spherical gear, against a relatively stationary stud 68 on the case of the motor, such stud being shown in dotted lines in Fig. 2 and in full lines in Fig. 3. At one point in the daily rotation of the spherical gear, the actuator thus engages the stud and is caused to act through the pawl 59 to move the shell 50 through the space of one of the teeth 58. There are three hundred and sixty-five of these teeth, hence, if the mechanism is kept in constant operation, the shell is given one complete rotation in the course of a year. The shell may, however, be set by hand, and in that case the point 57, previously mentioned, is an indicator serving with reference to a series of graduations 69, showing days of the year, to indicate the correct setting.

The purpose of the pivoted band 45 is to enable the planes of rotation of the studs 49 and 50 to be altered without changing the axis about which they rotate, and the shell 50 with its cam groove 53 is provided to effect this change in accordance with the declination of the heavenly body upon which observations are to be taken with the aid of this instrument. The particular instrument here illustrated is designed for taking azimuths of the sun, hence the cam groove is so designed as to shift the studs 49 and 50 in one direction or the other out of the equatorial plane of the spherical gear by angular amounts equal to the sun's declination, each point in the cam being located according to such declination on a certain day of the year. The date graduations 69 show the points in the cam groove which will place the studs in correspondence with the sun's declination on days corresponding to such date indications. The cam groove therefore has its greatest eccentricity to the axis of its rotation greater by forty-seven degrees than its least eccentricity.

In using the instrument it is so placed that the pelorus 11 is horizontal and the axis of the stud 32 vertical; then the frame or arms 34 bearing the sighting means rotates in a horizontal plane. The axis of the stud lies in the plane established by the curved bar 12 and passes through the center of curvature of the bar. The common axis of the shafts 25 and 31 also lies in the plane of the bar 12 and intersects the axis of stud 32 at the same center, while the diameter or axis of the pivot pins 46 and 47 of the band 45 passes through this center and rotates about the same. The driving studs 49 and 50 are on a diameter of the band 45 which is perpendicular to the axis of pins 46 and 47, is in the same plane with said axis, and therefore intersects said axis at the same center. When the plate 14 is moved by adjustment along the curved bar 12 the entire motive mechanism swings about this center, or common point of intersection in the plane of the bar. Said plate has an index mark 70 and vernier graduations, which in connection with a scale of
annular degrees 71 on the curved bar, enable the apparatus to be adjusted to an inclination corresponding to the latitude of the place in which it is used. In the adjustment herein represented the setting is for the earth's equator, the index 70 being beside the zero mark of the scale 71. The declination gear is set for the winter solstice, as indicated by the pointer 57 and scale 69. For use in latitudes north of the equator, the slide 14 is adjusted to the left of the position shown, and it can be thus adjusted as far as latitude 90°. Adjustments for the southern hemisphere can be made in the opposite direction as far as permitted by the supporting arms 16 and the yoke arms 42 and 43. These arms will interfere if the adjustment is carried more than forty-five degrees to the right of the position shown in Fig. 1, and so for the higher latitudes, I provide a means for effecting reversed rotation of the sighting means without requiring the index 70 to be moved to the right of the zero of scale 71. This means consists of a second pinion 72 engaged with the spherical gear 28 and mounted on a shaft 73 in continuation of the shaft 30 and adapted to be rotated in the same direction. Both these shafts are connectible with the same arbor or shaft of the motor by couplers 74 and 75 as shown in Fig. 3, and either of these couplers may be connected while the other is disconnected to cause rotation of the spherical gear in one direction or the other. Regardless of what this direction may be, however, the declination adjuster is operated by engagement of one of the cam faces of the actuating arm 64 with the pin 68 to rotate the cam 50 one tooth space in each twenty-four hours. As the cam is accessible it may be rotated by hand, if necessary, to set the declination band in case the motor should have been stopped.

This instrument is adapted to serve all the uses of the azimuth instrument described in the Butterfield application hereinbefore noted and to be used in the same way, as already previously intimated. It differs from that instrument essentially only in the addition of the means hereinbefore particularly described for giving its indications with absolute accuracy at all hours of the diurnal period in any day of the year. Thus the instrument equipped with this declination gear, when the timepiece has been set for local time and the axis of the spherical gear has been placed parallel to the earth's axis will show the true bearing of the sun or of any other celestial body with which the sighting means has been alined, at all times throughout the twenty-four hours of the day, not only at the time of the equinoxes or such times as the celestial body is in the equatorial plane of the earth, but through-out all other days as well, so long as the timepiece is kept running at the correct rate, and as long as the instrument remains in one place. The same thing is true when the axis of the spherical gear is set perpendicular to the earth's axis, as for use in latitudes south of the equator, as described, provided the connections between the timepiece and the spherical gear are arranged, also as previously described, to produce reversed rotation of the spherical gear. As the setting of the driving studs for declination, causes such studs to be placed at one side or the other of the equatorial plane of the spherical gear, that is, the plane perpendicular to the axis of the spherical gear which passes through the point of intersection of said axis with the axis of the sighting means, such studs are thereby caused to rotate in planes parallel to such equatorial plane, and bearing exactly the same relation to such equatorial plane that the path of apparent motion of the sun, or other celestial body with reference to which the instrument is set, bears to the equatorial plane of the earth. When the declination of the celestial body is other than zero, the planes in which the studs rotate do not include the common center of the various elements of the mechanism, but are laterally removed from such common center, and so modify the character of the variable rotary motion which is given to the sighting means.

The fact that, in addition to one driving stud which is shifted for declination in the same direction as the declination of the celestial body, there is a second stud which is equally and oppositely shifted at the same time does not affect the proper working of the instrument or introduce any error, because the second stud merely supplements the action of the first stud and acts to rotate the sighting means when the first stud is out of action, in the same sense or character of rotation given the sighting means by the first member. If it were physically possible to make the yoke so that it could entirely surround the driving mechanism and maintain contact with the one stud 49 in all positions of the stud, there would be no necessity of the second stud 50 and the movement of the sighting means would be effected wholly by the stud 49, in exact synchronism with the change of bearing of the celestial body. But as it is not physically possible to make the yoke in this manner and at the same time support the driving mechanism independently thereof, it has been necessary to carry the yoke through only about half a circumference and to provide the second stud 50. The result with the abbreviated yoke and the two studs 49 and 50 is exactly the same as would be secured with a continuous yoke and a single stud.

It having been understood from the fore-
going explanation that the true bearing may be shown continuously at all times, it will be equally well understood that when any of the factors in the use of the instrument is known, the other factors may be determined at any hour of the day or night on any day of the year, whenever the sun or any other celestial body of which the declination is known is visible.

It will be readily understood that the instrument may be used for taking azimuths of other heavenly bodies of which the declinations may be different from that of the sun, by merely substituting another cam member 50° having a groove of which the eccentricity at various points corresponds to the declinations of the particular heavenly body on the several days of the year, and properly setting such cam member for the day of use, or without such substitution, by setting otherwise the same and operating in the same way.

In some of the appended claims I include the guide 12, 43, and 44 and the stud or studs 49, 50 as elements. I desire here to state that the term “guide”, “guide way”, or “guiding element”, and the term “stud,” are descriptive terms and not limiting terms, within which I intend to include all mechanical equivalents for the specific devices described by those terms and shown in the drawings. For instance, the term “stud” is not necessarily limited to a pin, or to a roll mounted upon a pin or screw as here shown, but may be anything in the nature of a slide adapted to be connected with one of the rotating parts and to have sliding engagement with the guide member carried by the other part. For instance, I should consider a block or shoe swiveled upon the band 45 having a sliding engagement in the guide groove 44 to be one such mechanical equivalent, and to be embraced by the term “stud” in the generic meaning with which I have used it in the claims. In fact any element capable of serving the same end as does the studs 49, 50 is intended to be described by the term used. The term “spherical gear” is also a term of description applied simply to the embodiment of the invention shown in these drawings, without limiting significance. For mechanical convenience, and in order to accommodate a clock or watch, in the center of the mechanism, it is more feasible to make the gear as a spherical zone, or as a skeleton of such zone (in the manner shown in the Butterfield application) than in any other way; but a gear of any other construction, provided it is arranged to rotate about an axis in the plane of the bar 12 crossing the center of curvature of such bar, and provided, also, it is equipped to retain the pivots of the band 45 in a line passing through the same center and perpendicular to such axis, will answer the purpose of the particular gear referred to, and is intended to be included with the meaning of the term “spherical gear” in the following claims. The term “equatorial plane of the spherical gear” is another descriptive term applying to the particular instrument illustrated and is used to define the plane, perpendicular to the axis of the spherical gear, which passes through the common point of intersection of the several axes referred to in the foregoing description. A plane answering this definition in any instrument, however constructed, capable of serving the purposes of the instrument herein described, is within the meaning of such term whether or not it is actually in the equator of a gear element corresponding to the spherical gear of this instrument. The term “driver” hereinafter used as an element of the claims may be defined as including the spherical gear 26 and the motive mechanism for operating it, or any members and mechanism equivalent to such gear and mechanism. The term “driving element” may be defined as meaning either the stud 49 or the stud 50 or both said studs, or any equivalent for such studs.

I claim:

1. An azimuth instrument comprising a sighting means adapted to be aligned with a celestial body arranged to rotate about a vertical axis, a rotating driver moving at uniform speed and adjustable to place its axis of rotation parallel to the earth’s polar axis, an engaging element on said driver in sliding engagement with a part of said sighting means, and means for automatically placing and holding said element throughout the diurnal period in a plane of rotation parallel to the plane of apparent motion of such heavenly body.

2. An azimuth instrument comprising a sighting means adapted to rotate about a vertical axis, a driver adjustable to rotate about an axis parallel to the axis of the earth and intersecting the axis of said sighting means, a connecting member carried by said driving member and engaged with said sighting means, and a cam adjustable angularly about the axis of said driver for adjusting said connecting member in a meridional plane of the driving means through an angle equal to the declination of the heavenly body.

3. In an azimuth chronometer having a direction indicator rotatable about a vertical axis, a uniform speed motor, a rotary member actuated by said motor to turn about an axis intersecting that of the direction indicator, said member and indicator being connected by means including a guide element concentric with the intersection of these axes and a stud or the like, in combination with automatic means operated by said rotary member in its movement for
changing the relative positions of the guide element and said in accordance with the declination of the heavenly body.

4. An azimuth instrument comprising a rotatable direction indicator, a driver rotating about an axis intersecting that of the direction indicator, a guide element connected with the direction indicator and concentric with such point of intersection, a stud or the like carried by the driver and engaging said guide element, and being independently adjustable angularly about such point of intersection and in a plane including the axis of the driving member, and a cam concentric with and adjustable about said last-named axis and engaged with said stud to adjust the same.

5. In an azimuth instrument including a sighting indicator rotating about a vertical axis, a driver rotatable about an axis intersecting that of the indicator, said driver being adjustable about an axis perpendicular to the axis of the indicator, a guide element connected to the sighting indicator and curved concentrically with the common intersecting point of the aforesaid axes, a stud carried by said driving member engaged with said guide element and adjustable about an axis perpendicular to the axis of said driving member and passing through the same point of intersection, and mechanism operated by said driver for so adjusting said stud by successive increments.

6. An azimuth instrument comprising a rotatable direction indicator, a guide element in the plane of said direction indicator and curved circularly about a center lying in the axis of rotation of said indicator, driving means including a uniform motion motor located at such center and a spherical gear surrounding and driven by said motor and rotating about an axis passing through the said center, said driving mechanism being also adjustable about an axis perpendicular to that of the direction indicator and passing through the same center, and an element engaging said guide member and carried by the driving mechanism in a manner permitting its adjustment angularly about an axis passing through the same center and perpendicular to the axis of the driving member.

7. An azimuth instrument comprising a rotatable sighting means, a chronometric motor, a spherical gear mounted upon surrounding and driven by said motor about an axis intersecting the axis of the sighting means, means for supporting said motor with provision for adjustment about an axis passing through the same point of intersection and extending perpendicularly to the axis of the sighting member, a stud or pin located outside of the circumference of said spherical gear and adjustably connected thereto to shift about an axis passing through the same point of intersection and perpendicular to the axis of said gear, and a guide member with which said stud is engaged, connected to the sighting means and curved concentrically with the same point of intersection.

8. An azimuth instrument comprising a rotatable sighting means, a chronometric motor, a spherical gear mounted upon surrounding and driven by said motor about an axis intersecting the axis of the sighting means, means for supporting said motor with provision for adjustment about an axis passing through the same point of intersection and extending perpendicularly to the axis of the sighting member, a stud or pin located outside of the circumference of said spherical gear and adjustably connected thereto to shift about an axis passing through the same point of intersection and perpendicular to the axis of said gear, a guide member with which said stud is engaged, connected to the sighting means and curved concentrically with the same point of intersection, and means for shifting the stud about the last named axis through angles corresponding with the declination of the body under observation.

9. In an azimuth instrument having means for automatically driving a sighting member at a rate corresponding to the change in bearing of a heavenly body, a mechanism for automatically modifying the position of said sighting member in accordance with the declination of the heavenly body.

10. In an azimuth instrument having a sighting means, a chronometric driver and connecting means between said driver and sighting means adjustable for latitude whereby to cause said sighting means to change its direction in accordance with the change in bearing of a heavenly body of which the declination is zero, a cam for shifting said connection and modifying the movement of the sighting means in accordance with declinations other than zero of the heavenly body.

11. In an azimuth instrument having a sighting means, a chronometric driver and connecting means between said driver and sighting means adjustable for latitude whereby to cause said sighting means to change its direction in accordance with the change in bearing of a heavenly body of which the declination is zero, a means for shifting said connection and modifying the movement of the sighting means in accordance with declinations of the heavenly body, and means for automatically actuating said means in accordance with the daily changes in declination of the heavenly body.

12. In an azimuth chronometer of the character described having a rotating spherical gear, a sighting means rotating about an
axis intersecting that of the spherical gear, a guide member connected with the sighting means and curved concentrically with such point of intersection, a stud connected adaptably with the spherical gear and angularly adjustable about the point of intersection in a plane including the axis of the spherical gear, and a cam element mounted upon the spherical gear and rotatable about the axis of the latter, said cam element being connected with the stud and adapted to adjust the latter.

13. In an azimuth chronometer of the character described having a rotating spherical gear, a sighting means rotating about an axis intersecting that of the spherical gear, a guide member connected with the sighting means and curved concentrically with such point of intersection, a stud connected adaptably with the spherical gear and angularly adjustable about the point of intersection in a plane including the axis of the spherical gear, a cam element mounted upon the spherical gear and rotatable about the axis of the latter, said cam element being connected with the stud and adapted to adjust the latter, and the cam element having various eccentricities corresponding to the declination of the heavenly body upon certain days of the year.

14. An azimuth instrument including in its construction a rotatable driver, a driven member having a guide portion curved circularly about a point in the axis of the driving member, a stud adaptably mounted upon said driving member and movable angularly about an axis including the center of the guide portion and parallel to the axis of the driven member, a cam rotatably connected with the driving member to turn about the axis thereof, said cam being engaged with the stud and operative to adjust the same, and mechanism for shifting said cam by relatively slight increments in the course of said rotations of the driving member.

15. An instrument of the character described comprising in combination a rotatable driven member, a rotatable driver, said driver being arranged with its axis intersecting the axis of the driven member and being adjustable into various angular relations with the latter axis, and said driver and driven member having interengaging sliding transmission members for transmitting movement from one to the other, arranged so as to make interengagement in all adjustments of the driver, and means connected to operate said driver, having provisions for imparting reversed rotation to the driver while itself moving in the same direction.

16. An azimuth instrument comprising a sighting means adapted to rotate about a vertical axis, a driving member rotating about an axis intersecting the axis of said sighting means, a support wherein said driver is adjustable about such point of intersection whereby the axis of the driver may be brought parallel or perpendicular to the earth's axis, motion transmitting means between said driver and driven member, a motor geared to said driver for moving the latter, and means for imparting reversed rotation from said motor to the driver while the driver remains the same, whereby the axis of the driver may be placed perpendicular to the earth's axis and driven with reverse rotation with the same effect as though placed parallel to the earth's axis and driven in the normal direction.

17. In an azimuth instrument a timepiece, a driving gear connected revolvably to said timepiece and partially surrounding the same, a driven member rotatable about an axis intersecting that of said gear, a yoke connected to said driven member and curved about said point of intersection, having a continuous guideway crossing the axis of the driven member, a band or ring surrounding said timepiece and gear and pivotally connected to the latter on an axis intersecting and perpendicular to the axis of the driven member, a projection carried by said band adapted to fit and travel in the guideway of said yoke, and means for adjusting said band angularly about its pivotal connection with said gear.

18. An azimuth instrument comprising a driver and a sighting means rotatable respectively about axes which pass through a common point, a support on which said driver is mounted with its axis occupying a predetermined relation to the axis of the earth, a cam revolvably mounted to turn about the axis of said driver and having an eccentric cam portion which lies in a surface having a spherical relation to said common center, a driving element pivotally connected with said driver on an axis perpendicular to the axis of the driven member and passing through said common point, said driving element being engaged with the cam portion of said cam and being adjustable thereby, and a transmission member connected to said sighting means and engaged with said driving element.

19. In an azimuth chronometer, the combination with a sighting means rotatable about a vertical axis, a driver rotatable about an axis passing through a point in the axis of the sighting means, means for rotating said driver, a driving element connected pivotally with said driver on an axis passing through the point common to the previously named axes and perpendicular to the axis of the sighting means, a cam formed as a segment of a sphere concentric with the same common point and mounted to rotate about the axis of the driven mem-
ber and having an eccentric portion engaged with said driving element, and a yoke secured to the sighting means and curved concentrically about the same common point, having a guide portion in which said driving element is slidably engaged, said guide portion lying in a plane which passes through the axis of the sighting means.

20. In an azimuth chronometer, a self-contained timepiece, means for supporting said timepiece, a driver rotatably mounted on said timepiece, a sighting means rotatable about an axis which passes through a point in the axis of said driver, a yoke or transmission device connected to said sighting means and embracing the timepiece, said transmission member having a guide portion concentric with the common point of the axes of the driver and sighting means, lying in a plane which passes through the axis of the sighting means, a driving element contained slidingly in said stud, and a holder for said driving element surrounding the timepiece and pivoted to the said driver on an axis passing through the common point and perpendicular to the axis of the sighting means, said holder being adjustable about its pivotal axis to adjust said driving element in accordance with the declination of a celestial body.

21. In an azimuth chronometer a self-contained timepiece, means for supporting said timepiece, a driver rotatably mounted on said timepiece, a sighting means rotatable about an axis which passes through a point in the axis of said driver, a yoke or transmission device connected to said sighting means and embracing the timepiece, said transmission member having a guide portion concentric with the common point of the axes of the driver and sighting means, lying in a plane which passes through the axis of the sighting means, a driving element contained slidingly in said stud, and a holder for said driving element surrounding the timepiece and pivoted to the said driver on an axis passing through the common point and perpendicular to the axis of the sighting means, said holder being adjustable about its pivotal axis to adjust said driving element in accordance with the declination of a celestial body.

22. In an azimuth chronometer of the character described, a declination cam formed as a spherical member having an axis and having a cam element, said cam element being eccentric to the pole of such axis at various points by amounts corresponding to declinations of a selected celestial body.

23. In an azimuth chronometer of the character described, a declination cam formed as a spherical member having an axis and having a cam element, said cam element being continuous and its successive portions corresponding in eccentricity from the pole of such axis to the declinations of a selected celestial body on all the consecutive days of the year.

24. In an azimuth chronometer of the character described, a declination cam formed as a spherical member having an axis and having a cam element, said cam element being continuous and its successive portions corresponding in eccentricity from the pole of such axis to the declinations of a selected celestial body on all the consecutive days of the year, and the cam bearing indications beside such cam portion which show the amounts of declination of such body on such days.

25. An azimuth instrument comprising sighting means rotatable about a given axis, a driver rotatable about an axis intersecting the axis of the sighting means, means for mounting the driver with provision for adjustment to place its axis at various inclinations to the axis of the sighting means, a chronometric motor for actuating said driver, said driver including a stud adjustable about an axis perpendicular to the axis of rotation of the driver and passing through the aforesaid point of intersection, a cam adjustable by rotation about the axis of the driver and having a cam portion lying in the surface of a sphere of which said point of intersection is the center, and being engaged with said stud, said cam having a series of ratchet teeth, a pawl mounted on the driver in position to engage said teeth, and a pawl actuator connected with the pawl and arranged for actuation upon each rotation of the driver to shift said cam.

26. In an azimuth instrument, a rotatable driving gear, a declination cam mounted to turn about the axis of said gear and having a series of ratchet teeth, a pawl mounted on the gear adjacent to said ratchet teeth, a pawl actuator, and means for operating said actuator upon each rotation of the gear to shift the declination cam.

In testimony whereof I have affixed my signature, in presence of two witnesses,

OLOF OHLSON.

Witnesses:
E. BATCHELDE, P. W. PEZZETTI.
It is hereby certified that in the grant and in the heading to the printed specification of Letters Patent No. 1,182,405, granted May 9, 1916, for an improvement in "Declination-Gear for Azimuth Instruments," the name of the patentee was erroneously written and printed as "Olaf Ohlson," whereas said name should have been written and printed as Olof Ohlson; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of May, A. D., 1916.

[Seal.]

J. T. NEWTON,
Acting Commissioner of Patents.