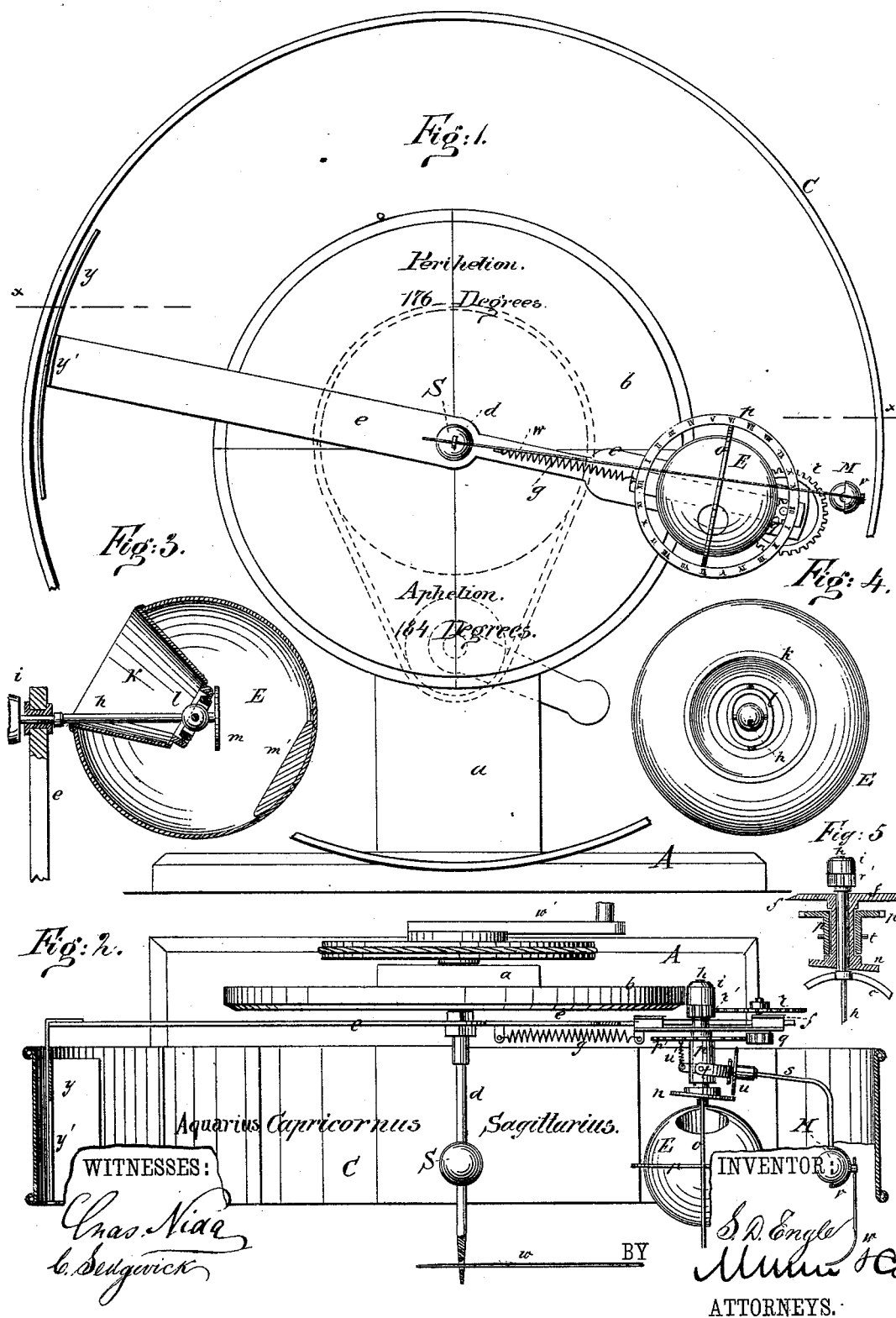


S. D. ENGLE.
Tellurian.

No. 218,509.

Patented Aug. 12, 1879.



UNITED STATES PATENT OFFICE.

STEPHEN D. ENGLE, OF HAZLETON, PENNSYLVANIA.

IMPROVEMENT IN TELLURIANS.

Specification forming part of Letters Patent No. **218,509**, dated August 12, 1879; application filed June 14, 1879.

To all whom it may concern:

Be it known that I, STEPHEN D. ENGLE, of Hazleton, in the county of Luzerne, State of Pennsylvania, have invented a new and Improved Tellurian, of which the following is a specification.

My improvements relate to apparatus for the use of schools in teaching the science of astronomy; and the object of my invention is to furnish a simple and inexpensive apparatus adapted for presenting in a manner that may be readily understood by the pupil the various phenomena connected with the movements of the earth and moon in relation to each other and around the sun, such as the recurrence of day and night, the changes of the seasons, the eclipses, the elliptic orbit of the earth, and the passage of the sun through the signs of the zodiac, &c.

The invention consists in certain novel features of construction and combination, which will be described in connection with the accompanying drawings, wherein—

Figure 1 is a front elevation of the apparatus. Fig. 2 is a horizontal section on line *x x* of Fig. 1. Fig. 3 is a section in larger size of the earth and its supporting-arm. Fig. 4 is an elevation of the earth, looking at the north pole.

Similar letters of reference indicate corresponding parts.

As shown, the apparatus is in portable form, adapted for setting upon a table; but with permanent apparatus the parts will be attached to a side wall or other surface, with the zodiac represented by a broad ring painted or otherwise put on the wall.

In the drawings, *A* is a base; *a*, a standard rising from the base and supporting an eccentric ring or disk, *b*, the longer diameter of which is vertical. The periphery of the disk *b* represents the eccentricity of the earth's orbit. *c* is a wide ring or band affixed to base *A*, and surrounding the orbit of the earth. This ring *c* represents the zodiac and ecliptic, and has marked upon its inner surface the twelve signs of the zodiac.

Upon the standard *a* and disk *b* is fixed a horizontal shaft, *d*, projecting in front, and carrying the sun *S*. Projecting from the shaft *d* is a radial arm, *e*, which is formed with a

radial slot in its outer end, in which is fitted a slide, *f*. *g* is a spiral spring attached to slide *f* and arm *e*, and tending to draw the slide inward. *h* is an arbor fitted in slide *f*, parallel with shaft *d*, and projecting at the front and back of the slide. *E* is the earth, attached upon the forward end of arbor *h*. *i* is a friction-roller fixed on *h* behind the slide *f*, and bearing upon the periphery of the disk *b*. The contact of *i* with *b* is maintained by the spring *g*, so that as shaft *d* is revolved the arm *e* carries *E* around in an eccentric orbit conforming to the edge of disk *b*, and the revolution of *E* axially is also obtained, it being understood that the shaft is fitted at the proper focus of the ellipse, and the signs of the zodiac in their proper position with relation to *E* and *S*. Instead of a friction-roller, the edge of *b* may be formed with cogs, and a small pinion used in place of *i*.

The earth *E* is connected to its supporting-arbor *h* by a universal joint at the center of *E*. (See Figs. 3 and 4.) *E* is recessed at the north pole, or with a hollow globe, as shown, a hollow cup, *k*, is inserted, and the arbor *h* is connected to the bottom of the cup by gimbals *l*. At the inner end of *h* is a disk, *m*, that, by contact with the bottom of cup *k*, limits the movement of *E* on the arbor, or, in other words, the inclination of the axis of *E*, so that while the axial movement of *E* is maintained the south pole always drops downward by gravity. Within the globe at the south pole a weight, *m'*, is fitted to insure the movement described. By this means the inclination of the earth's axis to the sun is shown for every month in the year, and the changes of the seasons graphically illustrated. Around the arbor *h* is a sleeve that is attached to the slide *f*, and is fitted at its outer end next the earth *E* with a disk, *n*. To the disk *n* is attached a ring, *o*, which I term a "horizontal ring," that extends around *E* in a plane parallel with the arbor *h*, which ring indicates the dividing-line between day and night on the earth's surface, and may be used to illustrate the length of the day at any point and the changes of the seasons upon the different portions of the earth's surface.

Attached to the ring *o*, and at right angles thereto, is a second ring, *p*, called a "time-

ring," which surrounds the earth on the ecliptic, and has marked upon one side the twenty-four hours of the day. This ring indicates the portion of the earth's surface upon which the direct rays of the sun fall at any season of the year, and the hour of the day or night at any place, and may be used to illustrate the difference between real and apparent time or the equation of time.

Around the sleeve which carries the disk *n* is loose sleeve *p*, (see Fig. 5,) carrying a gear-wheel, *p'*. The slide *f* is fitted with an arbor, carrying a pinion, *q*, that meshes with gear *p'*, and also a gear-wheel, *r*, that meshes with a pinion, *r'*, that is fixed on arbor *h*. The sleeve *p* carries a bent arm, *s*, to which the moon *M* is attached, and the gearing will be in such proportion that while the annular and diurnal movements of *E* take place, as described, the moon *M* revolves around the earth *E* in proper time, while it also goes with *E* around *S*.

To obtain the proper inclination of the moon's orbit to the ecliptic and her north and south ascension and declination, the arm *s* is forked to pass at each side of the sleeve *p* and is attached by pivots *t*. The arm *s* is also fitted with a friction-roller, *u*, which is kept in contact with the side of disk *n*, before mentioned, by a spring, *u'*. This disk *n* is fixed at an inclination to the axis of sleeve *p*, so that arm *s* is thereby swung on its pivots *t*, and moon *M* caused to cross the plane of the earth's orbit twice during every revolution of sleeve *p*. The phenomena of eclipses and their magnitude may be thereby lucidly explained. The changes of the moon may also be readily understood; and to illustrate such changes more clearly, a hemispherical hood or cup, *v*, is hung upon the arm *s* and incloses one-half the surface of moon *M* at its dark side, so that the extent of illuminated surface to be seen from any point on *E* is clearly defined. To retain the hood *v* in its position, always covering the side of the moon turned from sun *S*, the hood is hung loosely on arm *s* and is attached rigidly to a bent arm, *w*, that passes loosely through an aperture in shaft *d*. The rotation of the moon *M* on her axis and the reasons why the same portion of her surface is always presented to the earth are clearly shown by these devices.

The inner surface of the zodiacal band *c* is marked to indicate the autumnal and vernal equinoxes by a line representing the equinoctial and crossing the ecliptic at an angle corresponding with the equator of *E*. The arm

c, carrying *E*, is extended from the opposite side of shaft *d* to the inner surface of ring *c*, and is fitted at that end with a curved plate, *y*, which covers the zodiac to the extent of thirty-six degrees or more. This plate *y* is slotted at *y'* midway of its length to indicate when the sun *S* enters the signs of the zodiac. The plate *y*, at each side of the slot *y'*, covers those portions of the constellations which are rendered invisible from the earth during the progress of the sun.

The shaft *d* is fitted with a pulley and a crank arranged in any desired manner, as at *w'*, whereby rotation may be given to the shaft.

A more extended description of the uses of the apparatus in the study of astronomy is not here required. I have indicated these sufficient features and operations, which, it will be seen, are accomplished by simple and inexpensive mechanism.

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

1. In a tellurian, the combination of the fixed eccentric disk *b*, revolving shaft *d*, slotted arm *e*, slide *f*, spring *g*, earth-carrying arbor *h*, wheel *i*, and universally-jointed globe *E*, substantially as described and shown, and for the purposes set forth.

2. In combination with the revolving arm *e* and revolving earth-carrying arbor *h*, the sleeve *p*, geared from the arbor *h*, the moon-carrying arm *s*, hung upon sleeve *p*, the friction-roller *u*, spring *u'*, and fixed and inclined disk *n*, arranged for operation substantially as and for the purposes set forth.

3. In a tellurian, the globe *E*, formed with a cavity at one side and connected at its center to a revolving support or arbor, *h*, by a universal joint, substantially as and for the purposes set forth.

4. In a tellurian, the combination, with the hollow globe *E* and arbor *h*, united by the gimbals *l*, of the fixed disk *m* and weight *m'*, substantially as and for the purposes set forth.

5. In combination with the central arbor, *d*, earth *E*, and moon *M*, arranged for planetary movement, substantially as described, the hood or cap *v* and arm *w*, substantially as and for the purposes specified.

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Witnesses:

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H. E. SUTHERLAND.