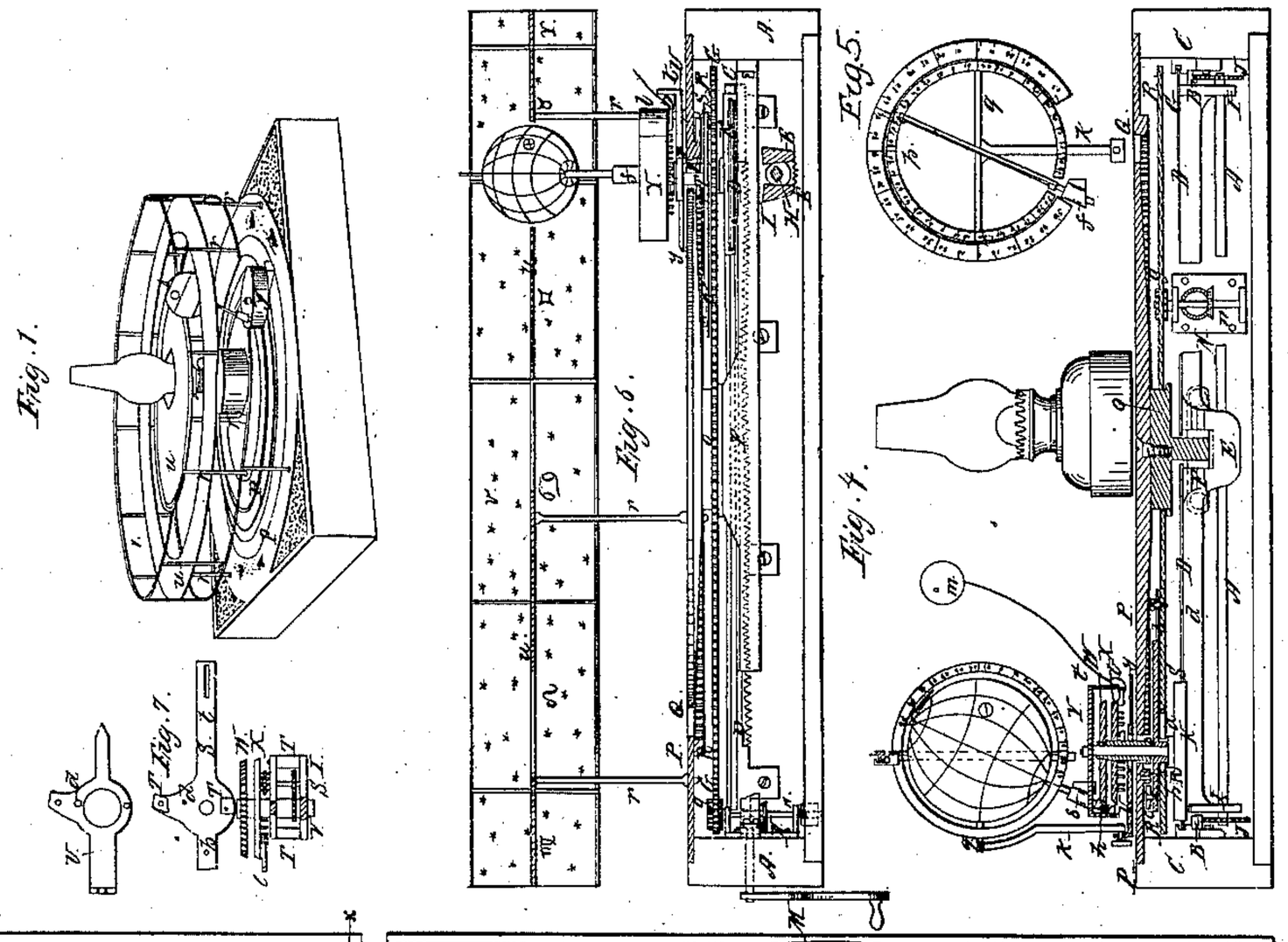
S. P. CAMPBELL.

TELLURIAN.

No. 66,791. Patented July 16, 1867.



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S. P. CAMPBELL, OF BUFFALO, NEW YORK, ASSIGNOR TO HIMSELF AND FRANCIS M. LORING, OF GLOUCESTER, MASSACHUSETTS.

Letters Patent No. 66,791, *dated July* 16, 1867.

IMPROVEMENT IN TELLURIANS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, S. P. CAMPBELL, of Buffalo, in the county of Erie, and State of New York, have invented a new and improved Tellurian, an apparatus to illustrate the movements of the earth; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my apparatus.

Figure 2 is a plan view of the dial of my instrument.

Figure 3 is a plan of one-half of my instrument, the dial being removed, and some of the parts being broken away to render others visible.

Figure 4 is a vertical longitudinal section through the line *x x* of fig. 3, showing the earth and moon in position and the meridian circle in elevation.

Figure 5 is a front elevation of the horizon circle in position.

Figure 6 is a vertical longitudinal section on line *z z*, fig. 3, showing the ecliptic plane in position.

Figure 7 exhibits details of the mechanism by which the movements of the earth and moon are illustrated.

My invention is for the purpose of illustrating to the eye the real and apparent movements of the earth so that the same may be readily comprehended by the young.

That others may understand its construction I will particularly describe the same, and will afterwards point out the operations of my device, and designate wherein this apparatus differs from other devices designed for the same purpose.

My first object is to represent the constancy of the pole during the entire yearly revolution. I therefore attach the part which sustains the axis upon which the globe revolves to a constant plate which has no axial movement while it revolves about the point representing the sun. This result I accomplish as follows: Within the case A, which encloses the mechanism of my apparatus, I place two cog-racks, B B, on opposite sides, and extending nearly the whole width of the said case, (see figs. 3, 4, and 6.) Along the upper edges of the plates forming said racks is a groove, C C, figs. 4 and 6, and within this groove are fitted, so as to slide freely from side to side, the ends of the traveller D. This traveller is strengthened by the rib *d* along its under side, and the bridge E connects the two parts of the traveller, where it is divided at the centre, to span the rod F, which supports the centre around which the grand wheel G revolves. Beneath the traveller D is the shaft H, resting in the lugs I I, and having at its ends the pinions J J, which mesh with the cogs of the racks B B, and insure a uniform movement of the two ends of the traveller. The two edges of the traveller D are parallel, and planed so as to present a dove-tail section, as seen in fig. 6, so that the plate K, which bears the globe, may be fitted thereto, and slide back and forth from end to end freely. From the centre of the plate K is erected the stud L, which carries the mechanism which operates the globe. Now, it is apparent that the combined movements of the traveller D and plate K, at right angles to each other, may produce in the stud L a revolution about a point within the limits of these movements, and that said revolution may be to any degree elliptical; and that to produce a movement of the stud L, having the character of a revolution elliptical in a certain desired degree, it is only necessary to provide suitable guides. The stud L has motion communicated to it by means of the grand wheel G, which is actuated by the crank M through the train N, or by clock-work applied to the shaft *n*, if desired. The wheel G revolves upon the hub O, which is a part of the rod F. Its outer edge is cut into cog-teeth, which mesh with the teeth of the pinion *g* of the train N. One of the spokes of the grand wheel G is provided with a slot, *a*, through which projects the stud L. This slot is not shown in position in fig. 3, as to bring it in proper position would require about one-third of a revolution to the left. The slot *a* is in length correspondent to the difference between the major and minor axes of the ellipse to be described by the stud L during its revolution, so that the said stud may have the required movement within the slot. As the wheel G is revolved it carries the stud L with it, and this in turn causes the plate K to slide upon the traveller D, and this latter to move from end to end of the racks B B.

Above the mechanism above described is the dial-plate P, which is divided into two parts by the elliptical

slot Q, through which the stud L projects, and by which the ellipticity of the movement of said stud is determined. Upon the under side of the dial P, and bordering the outer edge of the slot Q, is the flange R, which forms the particular guide for the stud L. The inner edge of this flange is toothed, so as to form a cog-rack for the purpose of giving motion to the pinion which causes the globe to revolve. This rack conforms to the ellipticity of the slot Q, so that the pinion which meshes with the cogs of R is never out of gear.

I will now describe the particular devices by which the above-described movements are communicated to the globe, and other movements thereof illustrated.

Resting upon the upper side of that spoke or arm of the grand wheel G, through which is the slot *a*, is the plate S, (see fig. 7.) Projecting downward from its under side is a short stud or hub which fits within the slot *a;* and through the centre of said stud is a hole of proper size to admit the shaft of the stud L, as seen in fig. 4. This stud, within the slot *a*, prevents any lateral movement of the plate S, while the length of the slot permits the required longitudinal movement of the said plate. The arm *t* extends along the surface of the spoke of the wheel G, and a screw or pin through the small slot therein forms a guide for the longitudinal movements mentioned. From the upper surface of S are erected the two studs or posts T T, the tops of which, when the plate S is in position, extend a little distance above the level of the upper surface of the dial P. The plate U rests upon the tops of the posts T T, and is secured there by screws. At the point *b* is secured the pivot of a small friction guide-wheel, *c*, which runs upon the outer edge of the flange R; and at the point *d*, fig. 7, is the pivot hole of the pinion which gives motion to the train illustrating the motions of the moon. Over the stud L is slipped the barrel V, having at its lower end a pinion which meshes with the rack on the inner edge of R, and at its upper end the large wheel W. The wheel X is also centred upon it, and rests upon the collar *e*. And to the top of the stud L is firmly and rigidly secured the inverted cup Y, to the upper surface of which is secured a proper bearing, *f*, for the axis of the globe. The cup Y serves also to cover and protect the wheels W and X, and the train which moves the latter. At the lower end of the axis, upon which the globe revolves, is the pinion *h*, which meshes with the wheel W, and receives the motion from it which causes the globe to revolve. The wheel X is revolved by the train *i*, the lower pinion of which meshes with the lower pinion on the barrel V, and the upper pinion with the internal gear of the wheel X. By this combination the moon *m* receives motion. The axis of the globe is set upon the cup Y at the proper inclination to the ecliptic and in the proper polar plane, positions which remain unchanged by the revolution around the central point which represents the sun. The outer end of the plate U is turned upward so as to form an ear to which is secured the standard *k*, to which the horizon circles *p* are attached by the curved arms *q*.

It will be perceived from the above description that while the index *y* of the plate U always points toward the centre of revolution, because it is fixed upon the arm of the wheel G to which the plate S is attached, the plate K always preserves its parallelism with the polar plane, and the cup Y, which is rigidly secured to said plate by means of its attachment to the stud L, participates in that constant position, and consequently the axis of the globe, which bears a fixed relation to this cup, will always preserve its polarity.

To the lower edge of the wheel X is secured a short arm, *l*, which projects beneath and slightly beyond the edge of the cup Y. To this arm is jointed a second arm, *t'*, to the outer end of which is attached a wire which bears at its other end the small globe *m*, which represents the moon. The inner end of the short arm *t'* rests against the under side of a ledge or inwardly projecting flange, *w*, which is secured to the inner side of the vertical portion of the cup Y. The flange *w* is not horizontal throughout its whole extent, but is set oblique to the axis of the stud L; and as the inner end of *t'* is always kept in contact with said flange by reason of the preponderating weight of the outer end, it follows that said outer end is caused to rise and fall as the inner end traverses the oblique plane *w*. The moon *m* participates in these motions, and we have therefore, in addition to a motion of revolution around the earth, an alternate rising and falling in relation to the plane of the ecliptic exhibiting the moon's nodes, and a slight elongation of the path of revolution exhibiting the ellipticity of the moon's orbit. *r r* are posts erected upon the upper surface of the dial P for the purpose of supporting another dial *u* of the same configuration, and elevated above P just far enough to represent the plane of the ecliptic when a small globe ⊕′ is in place, as shown in fig. 6. Around the outer edge of the upper dial *u* is a vertical rim *v* projecting equally above and below the dial *u*. This rim is composed of some transparent or semi-transparent substance, such as glass, mica, &c., and upon its surface are indicated the constellations of the zodiac. The horizon circle *p* is made in two parts, as shown in fig. 5. The outer part is fixed to the arms *q*, and always preserves its position in respect to the plane of the ecliptic. Upon its face are graduations representing celestial latitude. The inner part has a motion in their common plane amounting to about forty-seven degrees, the amount of the extreme movement of the earth's axis. The amount of this obliquity at any day of the year may be ascertained by noting the difference between the zero points of the two circles.

I have now described the construction and mechanical operation of my mechanism. By it may be demonstrated ocularly all of the phenomena attending and consequent upon the movements of the earth in revolving around the sun, including the ellipticity of the earth's orbit; the position of the sun in one of the foci of that ellipse; the constant direction of the pole; the inclination of the pole to the plane of the ecliptic; the apparent movement through the constellations of the zodiac, the phenomena of day and night, sunrise and sunset; the varying declination of the sun; the equation of time; changes of the seasons; motions of the moon, &c., &c.

In operating my instrument for purposes of illustrations it is not possible to use all of the parts herein described at one and the same time; as, for instance, when demonstrating those phenomena which require the use of the horizon and meridian circles, the elevated ecliptical plane *u*, and the zodiacal ring *v*, together with the moon *m* are removed. When phenomena connected with the changes of the seasons are to be explained, the post *k*, with the horizon and meridian rings, are removed, and the globe ⊕′ substituted, and the dial *u* is put in place. To illustrate the motions of the moon the globe ⊕′ and the moon *m* are required without the

dial *u*. A small lamp is used to represent the sun. Upon the dials P and *u* (which are duplicates of each other) are represented the line of apsides; the equinoctial and solstitial lines; the months divided into days; tables of the equation of time; the position of the signs and constellations of the zodiac, and the effect of the precession of the equinoxes.

I am aware that many of the phenomena alluded to above have been illustrated by machinery constructed for the purpose; but I am not aware that any machine has ever been constructed which could exhibit many of the real movements and phenomena illustrated by the mechanism herein shown and described, as, for instance, I am not aware that any tellurian has ever shown the earth moving in an elliptical orbit, nor with the sun stationed in one of the foci of that ellipse. I am not aware of the use of the horizon circle, herein described, in any other apparatus of this description. I am not aware that any machine has hitherto been constructed in which the constancy of the pole is secured by the use of cog-work. I am not aware that any tellurian has hitherto been constructed with a visible ecliptic plane like the dial *u*. I am not aware that any tellurian has been constructed hitherto with a transparent zodiacal ring like *v*. I am not aware that any tellurian has been hitherto constructed with a dial, bearing the marks and designations shown and described, as the dial P or *u*. I am not aware that a tellurian has ever been constructed in which the orbital movement has been produced by a combination of movements at right angles to each other, as herein described; and I am not aware that a tellurian has ever been constructed hitherto in which the rotary movements of the globe, or the globe and satellite, were produced by the operation of a train of gearing receiving motion, being passed along, and in mesh with a stationary elliptical rack like R. I therefore claim as my invention, and desire to secure by Letters Patent—

1. The elliptical guide-way Q, in combination with the stud L and operative mechanism of the instrument, for the purpose of illustrating the ellipticity of the earth's orbit.

2. The horizon circle *p*, constructed in two parts, and graduated as described, in combination with the globe ⊕′ of a tellurian.

3. The traveller D and plate K, having the connection and movements described, in combination with the stud L, grand wheel G, guide-way Q, and cup Y, or its equivalent, for the purpose of giving an orbital movement to the globe ⊕′ without changing the direction of its pole.

4. In combination with the globe of a tellurian the ecliptic plane or dial *u u* constructed with an elliptical channel, as shown and described.

5. The transparent zodiacal ring *v*, as set forth and described.

6. The dial P of a tellurian marked with the line of apsides, the equinoctial and solstitial lines, the months, the table of the equation of time, the signs and constellations of the zodiac, and the effect of the precession of the equinoxes, as set forth and described.

7. The traveller D, provided with the shaft H, pinions J J, and racks B B, or their equivalents, in combination with the plate K, stud L, and guide-way, the whole operating as set forth to produce an illustration of the orbital movement of the earth.

8. The grand wheel G and elliptical rack R, in combination with the barrel V, with its lower pinion and the wheel W at its upper end, for the purpose set forth.

9. The grand wheel G, elliptical rack R, in combination with the barrel V, with its lower pinion and the wheel W secured at its upper end, the train *i*, and moon wheel X, for the purpose set forth.

10. The wheel X with the arm *l*, in combination with the arm *t* and inclined flange *w*.

11. The plate U, provided with the index *y*, in combination with the plate S and grand wheel G, as set forth and described.

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Witnesses:

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