5 Sheets—Sheet 1.

C. HÉNARD & E. LASNIER.

Cosmographic-Clock.

No. 200,830. Patented March 5, 1878.

FIG. 5.

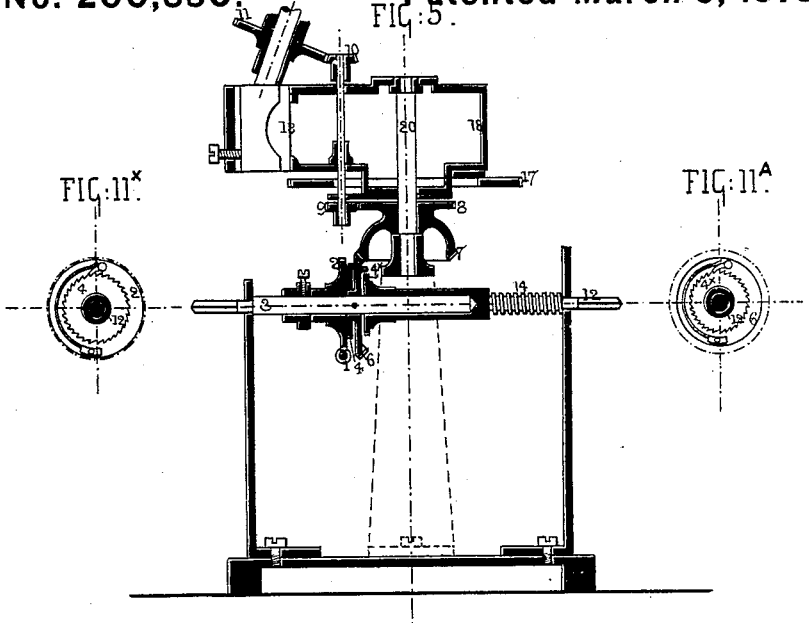


FIG. 11ˣ.

FIG. 11ᴬ.

FIG. 1.

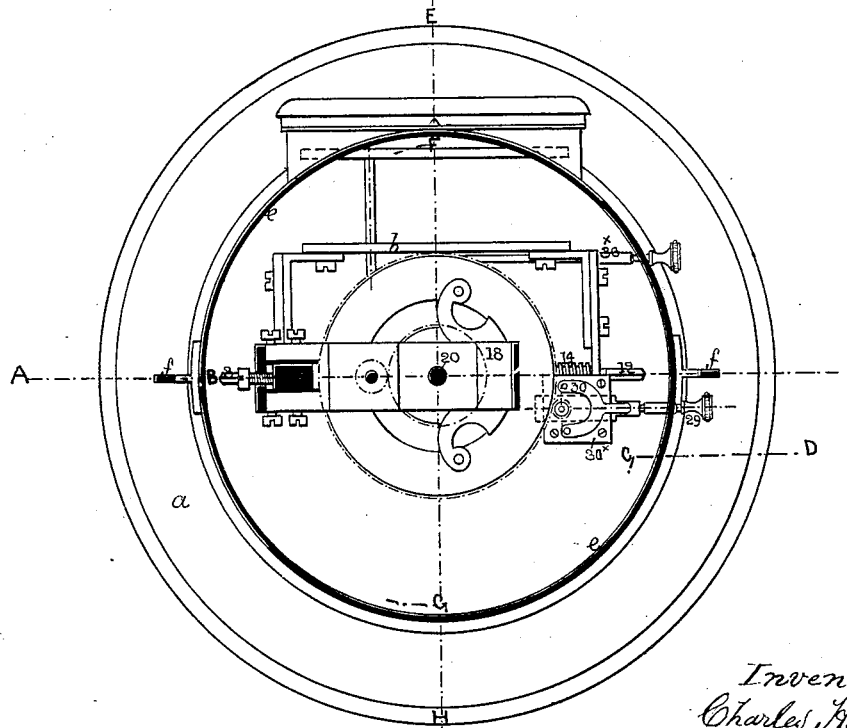
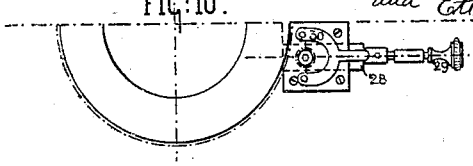


FIG. 10.



Witnesses.
Penn & Halsted
H. H. Doty

Inventors.
Charles Hénard.
and Etienne Lasnier.
by John J. Halsted
their Atty.

5 Sheets—Sheet 2.

C. HÉNARD & E. LASNIER.

Cosmographic-Clock.

No. 200,830. **Patented March 5, 1878.**

FIG. 2.

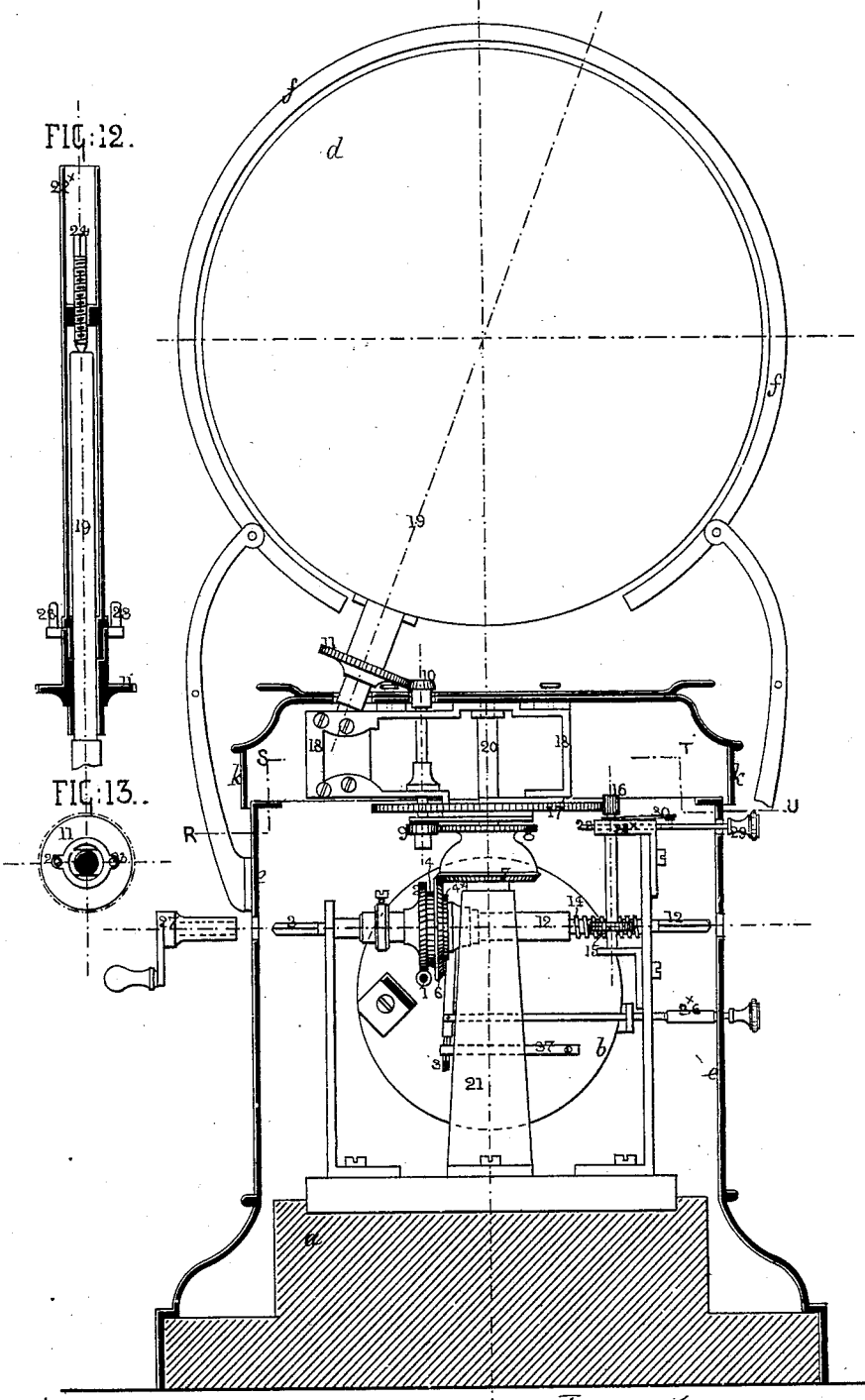


FIG. 12.

FIG. 13.

Witnesses,
Penn^a Halsted
W. A. Daly

Inventors,
Charles Hénard & Etienne Lasnier
by John J. Halsted, Atty.

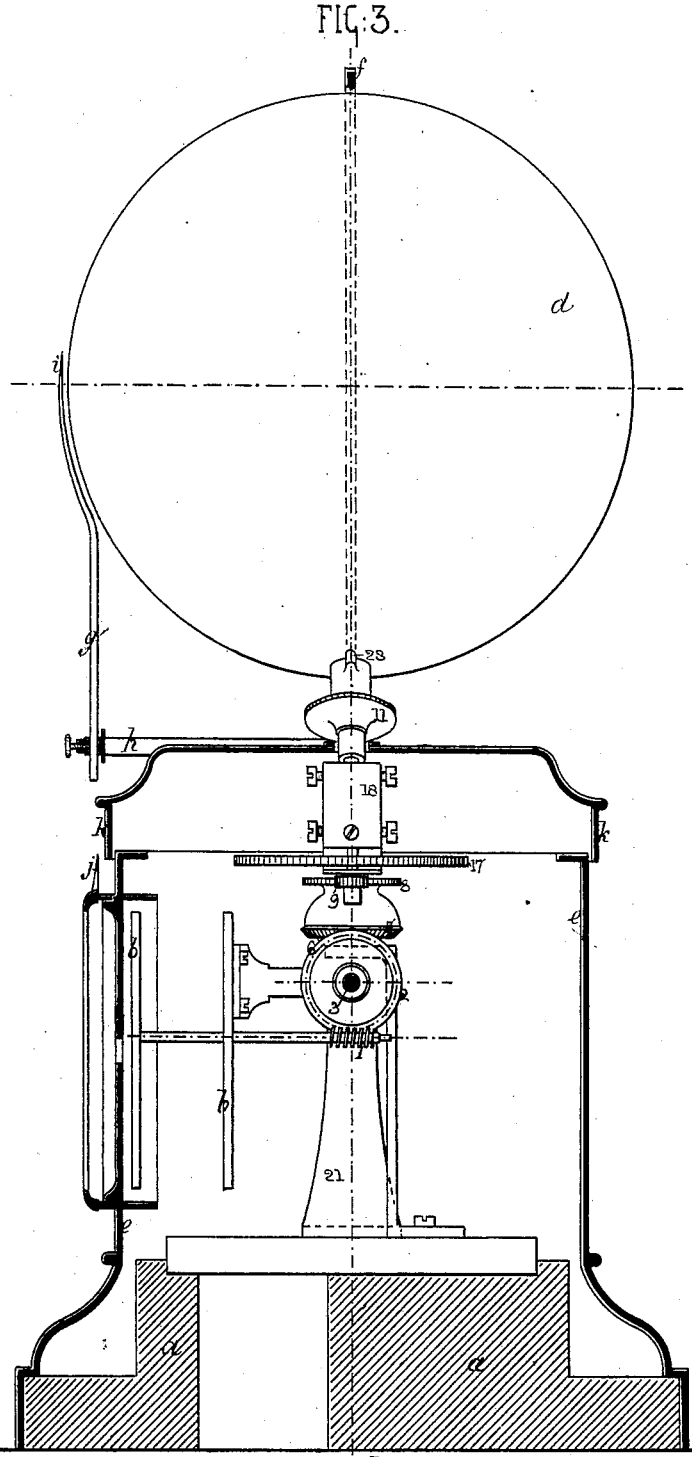
5 Sheets—Sheet 3.

C. HÉNARD & E. LASNIER.

Cosmographic-Clock.

No. 200,830. **Patented March 5, 1878.**

FIG. 3.



Witnesses,
Penn'y Halsted
H. H. Doty

Inventors.
Charles Hénard and Etienne Lasnier,
by John J. Halsted, Atty.

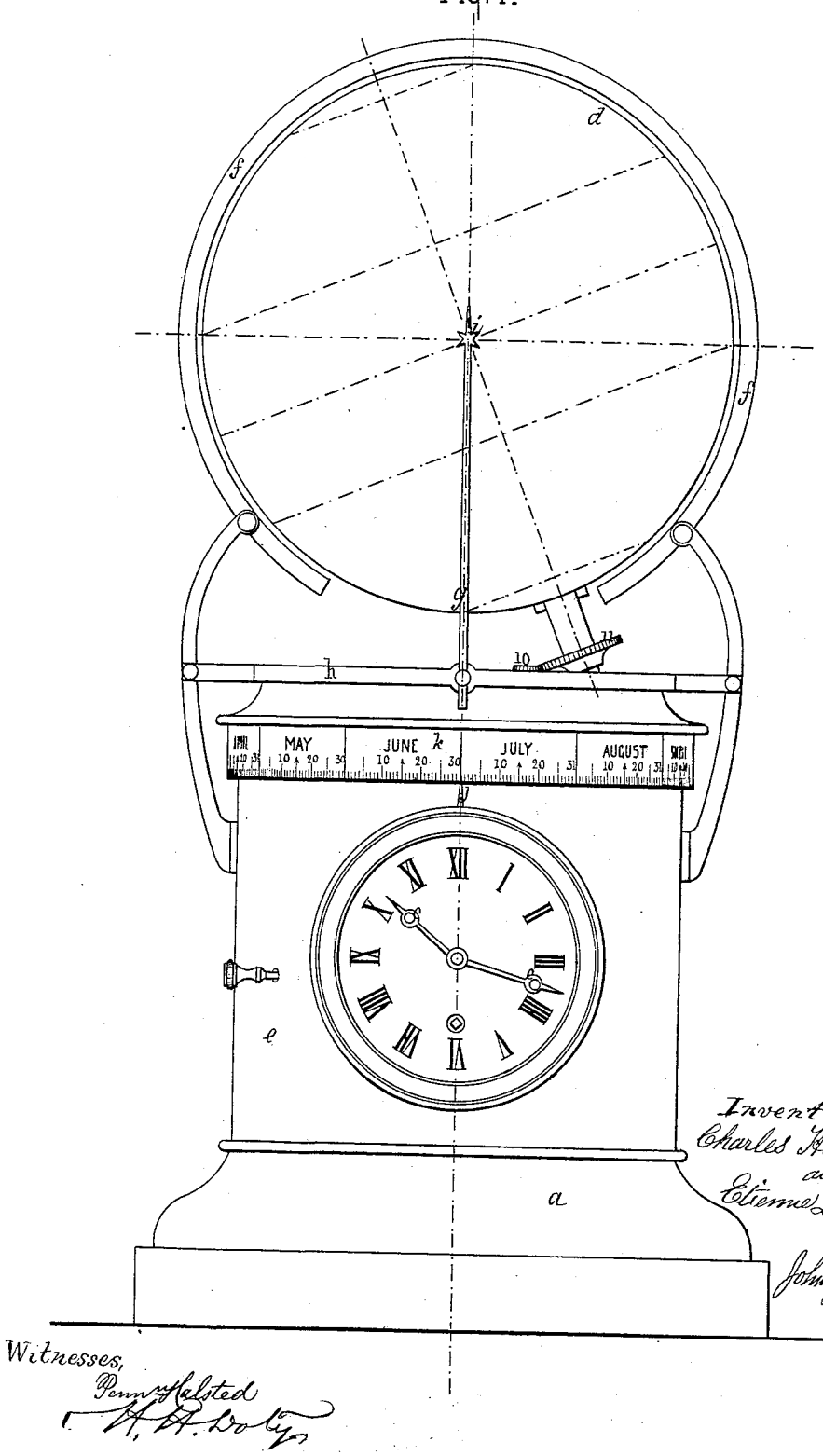
5 Sheets—Sheet 4.

C. HÉNARD & E. LASNIER.

Cosmographic-Clock.

No. 200,830. Patented March 5, 1878.

FIG. 4.



Inventors.
Charles Hénard
and
Etienne Lasnier
by
John J. Halsted
Atty.

Witnesses,
Penn Halsted
H. A. Dodge

5 Sheets—Sheet 5.

C. HÉNARD & E. LASNIER.

Cosmographic-Clock.

No. 200,830. Patented March 5, 1878.

FIG. 8.

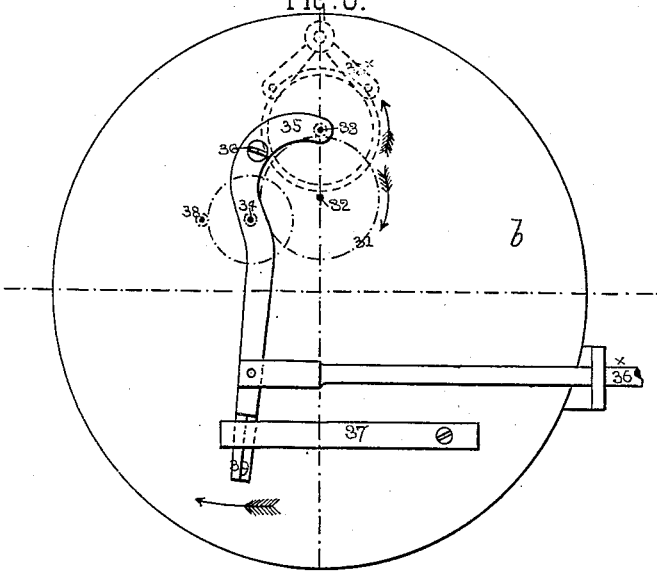


FIG. 9.

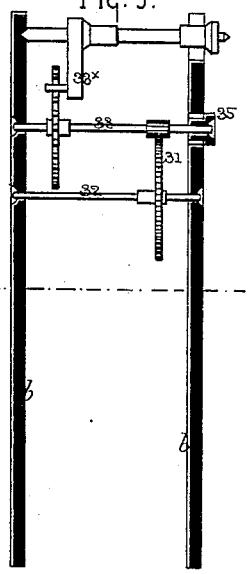


FIG. 7.

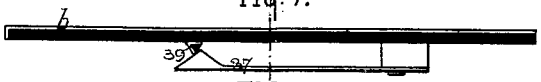


FIG. 6.

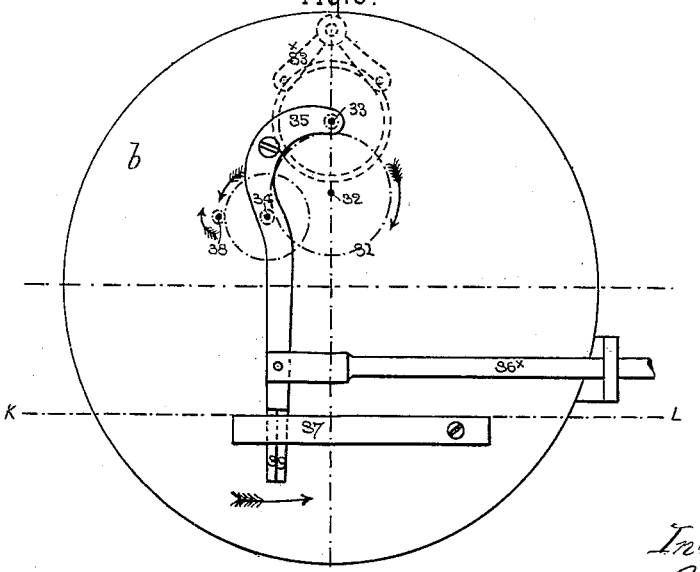
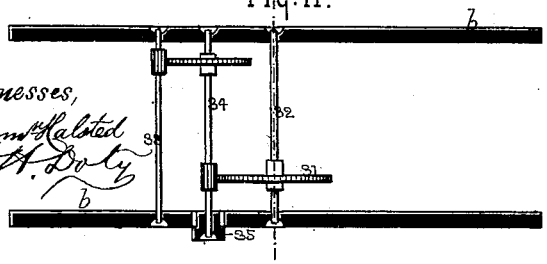


FIG. 11.



Witnesses,
Jam's Halsted
W. H. Doty

Inventors,
Charles Hénard,
and
Etienne Lasnier.
by John J. Halsted.
Atty.

UNITED STATES PATENT OFFICE.

CHARLES HÉNARD AND ETIENNE LASNIER, OF PARIS, FRANCE.

IMPROVEMENT IN COSMOGRAPHIC CLOCKS.

Specification forming part of Letters Patent No. **200,830**, dated March 5, 1878; application filed December 8, 1877.

To all whom it may concern:

Be it known that we, CHARLES HÉNARD, manufacturer, and ETIENNE LASNIER, of No. 1, Rue Laffitte, Paris, France, have invented certain new and useful Improvements in Cosmographic Clocks; and we hereby declare that the following, in connection with the drawings which accompany and form part of this specification, is a description of our invention sufficient to enable those skilled in the art to practice it.

We hereby state and acknowledge that we have applied, February 12, 1877, for a French patent, which was granted to us, May 8, 1877, under the number 117,023, and the title, "A new cosmographic clock," and which is similar to the present invention, save except in such points hereinafter referred to in the claims enumerated below.

Our new cosmographic clock consists, as the title indicates, in a special clock and a terrestrial sphere combined, in such a manner, on the one part, to indicate the hours and minutes as an ordinary time-piece, and on the other part to impart to the sphere its double motion or astronomical life, second by second—that is to say, at each beat of the pendulum its double motion of rotation and of translation. Therefore the earth is moved directly by the pendulum within sight of the sun, and rendered lifelike to our eyes as in nature. This arrangement is completed by the adjunction of two stationary hands or indicators, one of which indicates, on a horizontal rotating dial, at all times, the days and the months of the year, and the other the vector radius or imaginary line, starting from the sun and directed constantly to the center of the earth; further, an arcade, surrounding diametrically the earth, is arranged in such a manner with respect to the hand of the vector radius as to indicate constantly and with precision the hemisphere which is lighted by the sun, and the one which remains in darkness.

For the practical adaptation of our invention, we have imagined several mechanical arrangements, devices, and forms, which each have their importance individually and collectively, and which we will describe in detail conjointly with the fifteen figures of the accompanying drawings, in which we have represented one of our cosmographic clocks under different aspects, as well as its principal parts detached.

In these views, Figure 1 is a plan of our cosmographic clock in section through R S T U, Fig. 2. Fig. 2 is a rear elevation in section through A B C D, Fig. 1; Fig. 3, a lateral elevation of the same in section through E F G H, Fig. 1; Fig. 4, a front elevation; Fig. 5, a back elevation, partially in section, of the mechanism by means of which we impart by hand, and that rapidly compared to the clock-work, either the rotative motion or the translative motion of the earth, or both these motions simultaneously. Fig. 6 is a rear elevation; Fig. 7, a plan in section through K L, Fig. 6; Fig. 8, a rear elevation similar to Fig. 6, but with the parts in a different position; Fig. 9, a lateral elevation, partly in section, and Fig. 11, a plan of the mechanism serving to impart to the clock-work, as well as to the sphere or globe, a rapid motion engendered by the clock-work; Fig. 10, a detached plan of a disengaging-gear; Figs. 11^{x} and 11^{a}, two elevations of part of the mechanism for imparting motion to the apparatus by hand; and Fig. 12, an elevation, and Fig. 13 a plan, showing the mode of attachment of the globe to the mechanism that drives it.

General arrangement.—In the above-mentioned figures, *a* represents the stand of the apparatus; *b b*, the plates containing the clock-work, which may be of the ordinary description, serving to drive the hands *c c* of the clock, and which at the same time imparts the double rotary motion to the sphere *d*. *e* is a casing of metal or other appropriate material, which surrounds and completely protects the internal mechanism; *f*, an arcade mounted on this casing, and which encircles diametrically the sphere, dividing the same clearly in two hemispheres, the one lighted by the sun and the other in darkness; *g*, a vertical rod, fixed to the cross-bar *h* attached to the arcade, the hand *i* of which represents, on the sphere, the point struck by the vector radius, while a lower hand, *j*, fixed to the facing of the clock-dial, indicates on the dial *k*, which is rotated by the sphere, the days and months of the year, and has also marked on it the signs of the zodiac, as well as the principal stars and

constellations of the planetary system, which latter, however, are not figured in the accompanying drawing.

Gearing and motion.—The clock-work fitted between the plates *b b* is of any usual make, and it drives the hands indicating the hours and the minutes in the usual manner. It imparts rotary motion to the sphere *d* by means of the driving-worm 1, which gears in the worm-wheel 2 running loose on the spindle 3. On the face of the wheel 2 is a ratchet, 4, which drives the bevel-pinion 6, keyed to the spindle 3 by means of a pawl attached on its outer face. (More clearly shown in the detached Fig. 11×.) This bevel-pinion 6 drives the sphere by means of the gears 7, 8, 9, 10, and 11. At the same time it imparts simultaneously the translative motion to the sphere by means of the spindle 12, which is partly passed over the spindle 3, and which is driven by means of a ratchet-wheel, 4×, and a click adapted on the face of the bevel-wheel 6. This partly-hollow spindle 12 is provided with a worm, 14, which, by means of the worm-wheel 15, the pinion 16, and the gear 17, rotates at the requisite slow speed the cage 18, in which is fixed, at the proper angle, (see Fig. 2,) the axis 19 of the sphere, and these same parts impart simultaneously to the dome or cap *l* the same rotary motion. A vertical spindle, 20, fixed in the pillar 21, serves as a rotating center to the parts above mentioned, which communicate the translative motion to the sphere.

Mode of fixing the sphere.—We insert in the axis of the sphere a central stationary pipe, and over the spindle of the sphere a loose pipe, 22×, which fits within the socket of the bevel-gear 11, and the bottom shoulder of which rests within the socket of the bevel-gear 11, and outside this socket we fix two vertical pins, 23, which fit into two holes pierced in the sphere. In this manner the globe can be mounted instantaneously, according to one or other of its phases, diurnal or nocturnal, and it is not possible to mount it in any other position. We prefer suspending the globe on the point of a screw, 24, capable of adjustment, as shown in Fig. 12.

Regulation, adjustment, and manipulations.—When the cosmographic clock has been regulated and the mainspring wound up like that of an ordinary clock, the above-described motions will be imparted to the two parts of which it is composed, and they will continue regularly until the spring is paid out, on which, being rewound, the same action will be continued. In order to regulate the position of the globe with reference to the clock, it is necessary to be able to impart by hand the rotary and translative motions to the sphere either simultaneously or one or other of these two motions separately. To this effect we have adapted to our instrument the following mechanism: The extremities of the spindles 3 and 12 are filed square, so as to receive (one or the other) a handle, 27. (See Figs. 2 and 4.) When it is necessary to impart by hand to the sphere its two motions, this handle is fitted on the square of the spindle 3, which is rotated in the same direction as it would be by the clock-work, but at a more rapid speed. When, under these conditions, the bevel-wheel 6, which is fast to the spindle 3, is caused to rotate, the ratchet 4 with the wheel 2 remains stationary, since the pawl turns round on the teeth of this ratchet without imparting any motion to the said ratchet, and consequently to the wheel 2, which is loose on the spindle 3, while, on the other hand, the pawl on the inner face of the wheel 6 imparts similar motion to the ratchet 4× fitted on the extremity of the partly hollow spindle 12. When the motion to be imparted to the globe is limited to its rotation on its own axis, the pinion 16 is disconnected from the wheel 17 by the withdrawal of the plate 28 by means of the external button 29 into the position indicated in the detached plan, Fig. 10. In order to regear these parts together, it is merely necessary to push back the plate 28 to the position indicated in Figs. 1 and 2. A spring, 30, Figs. 1, 2, and 10, attached by one extremity to the bearing 30×, is provided at its other extremity with a pin projecting downward, and which enters automatically in a hole pierced in the plate 28 when such plate is driven home, and thus maintains the parts in their normal working position, yet, being slightly tapered, admits of the plate being at all times readily drawn out for the purpose above stated. When, on the contrary, it is desired merely to impart the translative motion to the sphere, the handle 27 is placed on the square of the spindle 12, and turned in the same direction as that imparted by the clock-work. In this case the teeth of the ratchet 4× slide over the click fitted on the face of the gear 6 without hindering in any way the rotary motion on its axis imparted to the globe by the clock-work.

In order to demonstrate more clearly and to render more apparent the motions of the globe and of the clock, it is advisable to accelerate the work of the instrument, although still driven by the clock-work. To this end we have made a small addition to the wheel-work of the clock, which consists in a means for liberating the spring-barrel from the control of the pendulum and in controlling the action of its unwinding by means of a mechanical agent presenting less resistance—such, for instance, as a fly. This arrangement of parts is shown in Figs. 6, 7, 8, 9, and 11; and it consists in mounting the outer extremities of the two spindles 33 and 34 on a fork, 35, hung on a fulcrum, 36, in the plate *b*, and susceptible, by traction on the rod 36×, of assuming two positions limited by the action of the spring 37 on one or other of the triangular faces of the arm 39 projecting from the fork 35. It is the wheel 31 on the spindle 32 by which the barrel-spring is made to gear either with the pendulum-escapement 33×, for the normal working of the clock-work, as

shown in Figs. 8 and 9, or with the spindle 38, (on which is mounted an ordinary clock-work fly,) as shown in Figs. 6 and 11, for the more rapid working of the apparatus. When this rapid motion is arrested, and it is desired to return to the working of the apparatus by the clock-work, it is necessary, as will be understood, to swing the pendulum by hand, as in ordinary clocks.

With reference to the above-mentioned French patent, the ratchet 4 and its pawl mentioned in the second claim are replaced by a volute spring and a pin. The pinion 16 in the third claim is raised bodily with a ratchet-clutch closed by a spring. The suspending-screw 24 in the fourth claim is not included in such French patent.

We claim as our invention—

1. The arrangement of the gears and other parts 1, 2, 3, 4, 6, 7, 8, 9, 10, and 11, for rotating the globe on its own inclined axis, substantially as shown and described.

2. The combination of the gears and other parts 6, $4^{\times}$, 12, 14, 15, 16, 17, 18, 10, and 11, for imparting to the globe its translative motion.

3. The combination, for adjusting the globe on its axis, of the central pipe, the loose piece $22^{\times}$, the hollow in socket of the gear 11, and the vertical pins 23, attached outside of the said socket.

4. In combination, the loose pipe $22^{\times}$, socketed bevel-gear 11, pins 23, and adjustable screw 24, substantially as shown and described.

5. The spindles 3 and 12, handle 27, bevel-wheel 6, ratchets 4 and $4^{\times}$ with their pawls, for the purpose of imparting rapid rotary motion to the entire mechanism by hand.

6. The arrangement of the pinion 16, the worm-wheel 15, disengaging-plate 28, button 29, spring 30, and handle 27, for disconnecting the mechanism and imparting to the globe simply rotary motion on its own axis.

7. The arrangement of the spindle 12, of the ratchet $4^{\times}$ with its click, the gear 6, and the handle 27, for imparting to the globe merely its yearly travel.

8. The lever 35, the rod $36^{\times}$, the arm 39, the spring 37, the spindles 33 and 34, the pendulum-escapement $33^{\times}$, the spindle 38 with its fly, as shown in Figs. 6, 7, 8, 9, and 11, for the purpose of driving, at will, the clock and the globe either at their regular slow speed or at an accelerated speed, for the purpose of demonstration or otherwise, but in both cases by means of the clock-work.

CHARLES HÉNARD.
ETIENNE LASNIER.

Witnesses:
ROBT. M. HOOPER,
D. H. BRANDON,
1 *Rue Laffitte, Paris.*