No. 622,857. Patented Apr. 11, 1899.

N. W. HURST & T. O. LINCH.

PLANETARIUM.

(Application filed June 14, 1897.)

(No Model.) 3 Sheets—Sheet 1.

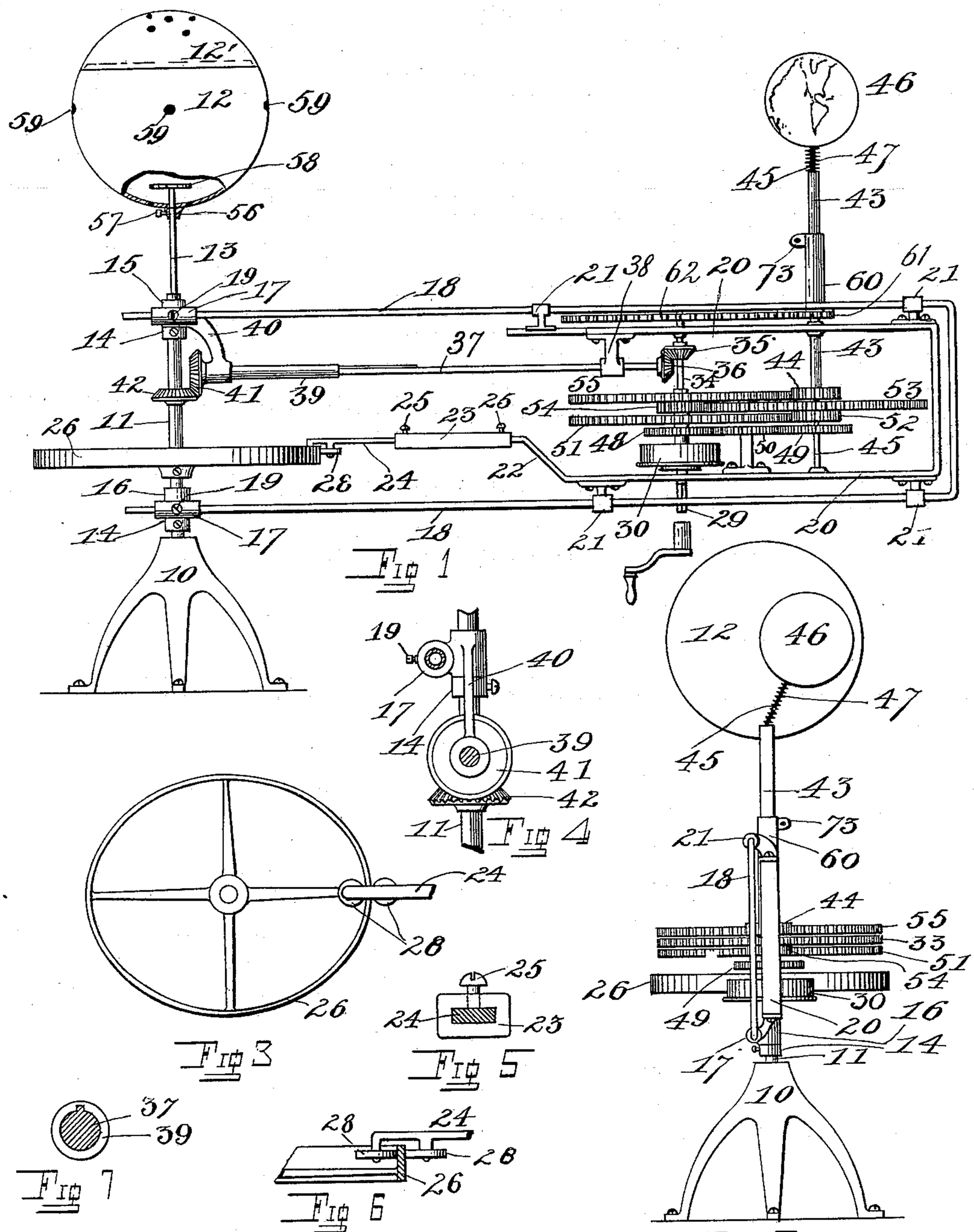

Fig 1

Fig 4

Fig 3

Fig 5

Fig 7

Fig 6

Fig 2

WITNESSES:

T. B. Ford

D. M. Woodward

INVENTORS,

NEEDHAM W. HURST
THOMAS O. LINCH BY

Woodward & Lawrence ATTORNEYS.

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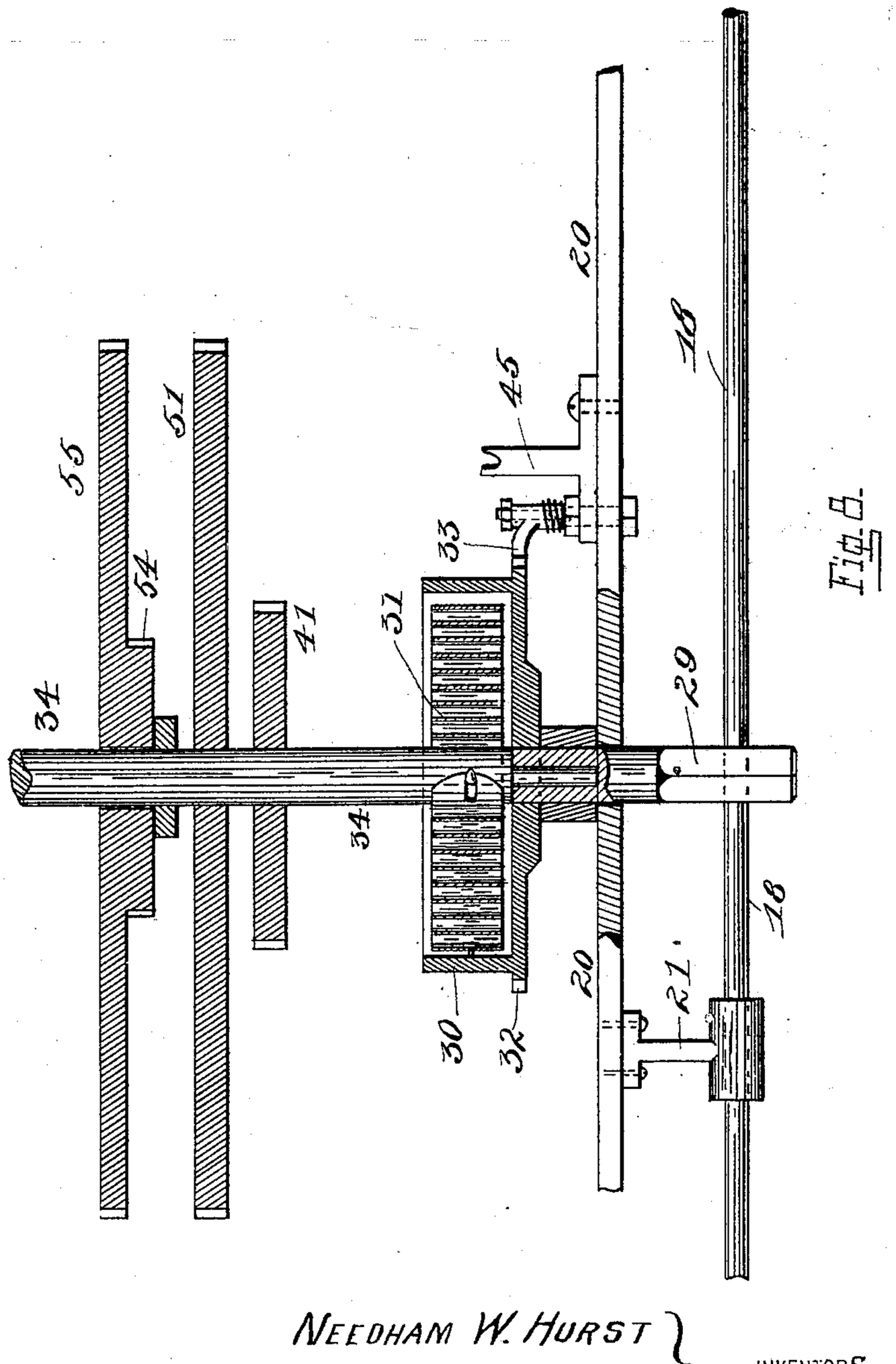

Fig. 4.

WITNESSES

E. P. Wood

L. M. Wood

NEEDHAM W. HURST
THOMAS O. LINCH } INVENTORS

BY

A. A. Woodbury

ATTORNEYS.

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N. W. HURST & T. O. LINCH.

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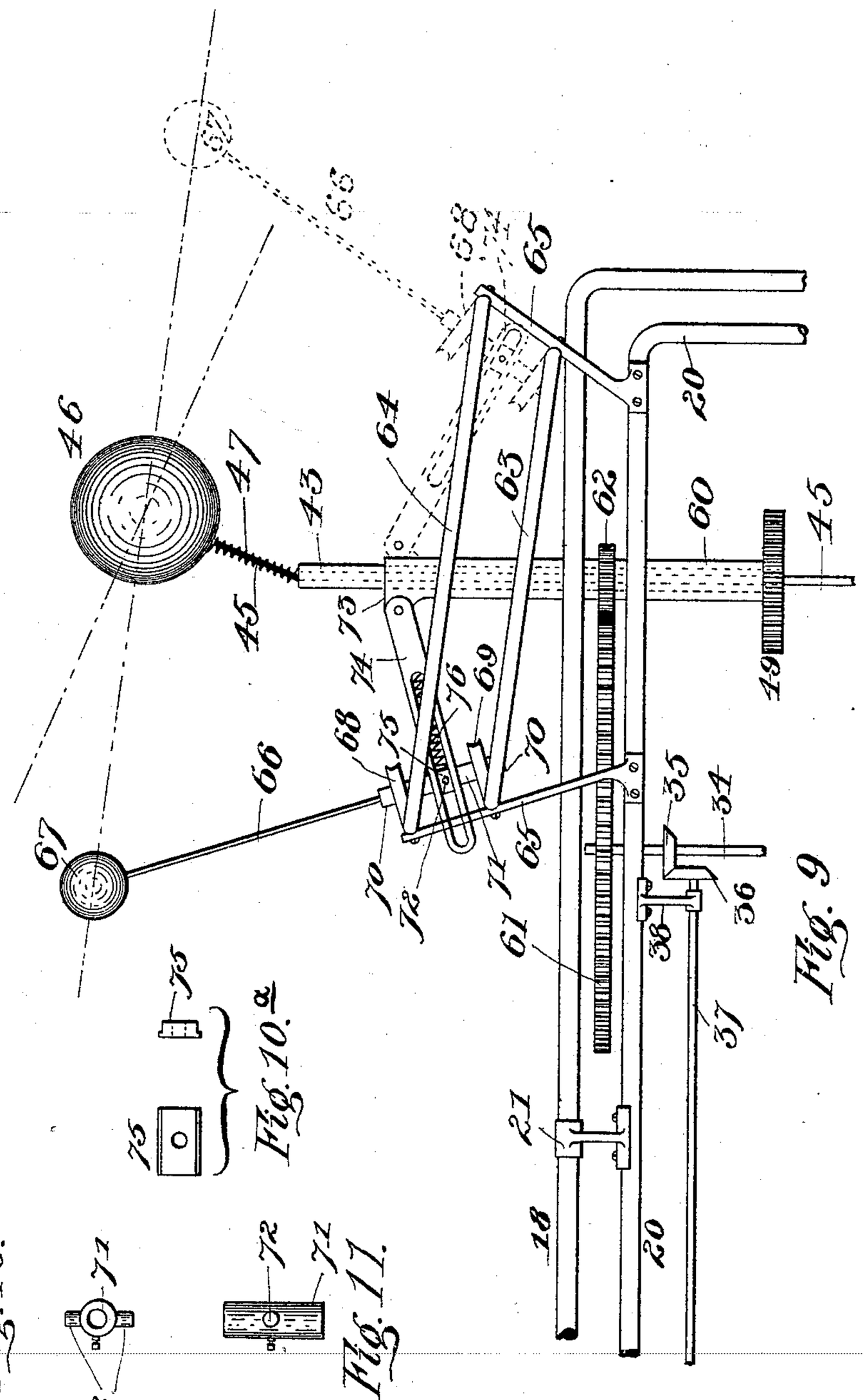

Fig. 9

Fig. 10.

Fig. 10a.

Fig. 11.

WITNESSES

E. P. Wood.

D. M. Wood

Needham W. Hurst
Thomas O. Linch
} INVENTORS,

BY

A. D. Wood & Son

ATTORNEYS

UNITED STATES PATENT OFFICE.

NEEDHAM W. HURST AND THOMAS OSBORN LINCH, OF FLOVILLA, GEORGIA;
SAID LINCH ASSIGNOR TO SAID HURST.

PLANETARIUM.

SPECIFICATION forming part of Letters Patent No. 622,857, dated April 11, 1899.

Application filed June 14, 1897. Serial No. 640,748. (No model.)

To all whom it may concern:

Be it known that we, NEEDHAM WASHINGTON HURST and THOMAS OSBORN LINCH, citizens of the United States of America, and residents of Flovilla, in the county of Butts and State of Georgia, have made a new and useful Invention in Planetariums; and we hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to educational appliances for the purpose of exhibiting the movements of the planets individually and with relation to each other and the phenomena attendant upon same automatically and without further attention from the instructor or lecturer than the mere winding of the device, having for its object the construction of a device of this kind which will be capable of adjustment so as to represent the planetary system on as large a scale as the room at hand will permit.

The invention consists in the device hereinafter specified and which is shown in the accompanying drawings.

In the drawings, Figure 1 is a side elevation of the device. Fig. 2 is an end elevation thereof. Fig. 3 is a plan of the elliptical cam for describing the orbit. Fig. 4 is an enlarged detail of the central shaft and gearing. Fig. 5 is a sectional view of the connecting-rod and its sleeve. Fig. 6 is a detail of the orbit, cam, and said connecting-rod; and Fig. 7 is a view of the extensible shaft. Fig. 8 is a detail in section of the winding mechanism and other details. Fig. 9 is a detail in side elevation of the lunar attachment and means for actuating same. Fig. 10 is a detail of the plan view of the swivel-block secured to the lunar shaft. Fig. 10ª is a detail view showing the sliding block to which the sleeve forming the journal-bearing for the lunar shaft is pivoted, and Fig. 11 is a side and end view of the bearing-boxes for said swivel-block.

In the figures like reference characters are uniformly employed in the designation of corresponding elements of construction in all the views.

10 is a base, which may be of any construction, but should be adapted to be screwed or otherwise secured to a floor or platform, and 11 is a vertical standard set in said base and carrying on its upper end the central planet 12, representing the sun of the particular solar system represented. This sun 12 is carried upon a rod 13, set in the upper end of the standard 11 and preferably vertically adjustable therein. On the standard 11 are collars 14, and loosely mounted on the said standard above said collars are sleeves 15 and 16, having on their sides guides 17, in which are inserted the members of the frame 18, which is preferably a wire of suitable strength and which is adjustable longitudinally through the sockets 17, being held in its adjustment by set-screws 19.

20 is a small supplementary frame mounted, by means of collars 21, on the frame 18, and movable longitudinally thereupon, the collars being so arranged as to prevent any but this longitudinal movement of the frame 18. The arm 22 of the frame 20 extends from the said frame toward the standard 11, where it is provided with a sliding sleeve 23, which receives in its other end the connecting-rod 24, set-screws 25 serving to hold said sleeve in proper adjustment relatively to the arm 22 and the connecting-rod 24 relatively to the sleeve 23.

26 is an annular elliptical cam which is of a peripheral contour approaching as nearly as may be the same form as the path of the subordinate planet around its sun. This cam 26 is mounted on the standard 11 in such a position that certain rollers or engaging lips 28 on the end of the connecting-rod 24 may engage its outer and inner surfaces, which engagement will obviously cause a longitudinal movement of the said engaging rod, and through the sleeve 23 and arm 22 the frame 20 will have imparted to it the aforesaid longitudinal movement. By means of the extensibility of the connection between this said frame 20 and the elliptical cam the position of the subordinate planet radial from its center of revolution may be adjusted.

Rotatably journaled in the lower bar of the frame 20 is a winding-shaft 29, carried on the upper end of which is a drum 30, wherein is attached a spring 31, (see Fig. 8,) and said drum is provided with a ratchet-wheel 32, the teeth of which engage a pawl 33, suitably located. Stepped in a hole in the upper end of the shaft 29 is a shaft 34, to which the other end of the spring 31 is connected and which is journaled at its upper end in the upper member of the frame 20. Obviously the drum 30 will be stationary except during the process of winding. Now upon the upper end of the shaft 29 is a bevel-gear 35, with which meshes the gear 36, mounted on the end of a shaft 37, mounted rotatably in a pedal-block 38 and being connected with a tubular shaft 39 by spline construction, (see Fig. 7,) said shaft 39 being journaled in a bearing on the end of the arm 40, secured to the sleeve 15. On the end of the tubular shaft 39 is a bevel-gear 41, which meshes with a gear 42, secured to the standard 11. By the means just described it is obvious that a rotation of the shaft 34 will revolve horizontal shaft, consisting of the parts 37 and 39, which will cause the bevel-gear 41 to travel around the bevel-gear 42 and swing the frame 18 and its connected parts around the standard 11 in a radial position, and that so long as the bevel-gears are mitered gears the said frame will make one revolution upon the standard 11 to one turn of the said shaft 34, which will cause the subordinate planet to make one yearly revolution or one revolution around its solar point.

43 is a hollow shaft which is rotatably journaled in the upper member of the frame 20 and extends downwardly to half-way across same, carrying on its lower end a pinion 44.

45 is a shaft which is journaled in a stepped bearing, preferably on the lower member of the frame 20, and passes upwardly through the shaft 43, whereby it forms in a manner also a bearing for the said shaft 43 and passes forwardly above the frame 18, where, if the axis of the subordinate planet be inclined to its orbit, said shaft 45 is bent to the proper angle in substantially the manner shown in Fig. 2, and upon its upper end is rotatably journaled the sphere 46, which represents a subordinate planet and in the instance shown the earth. The spring 47 typifies a flexible shaft and is connected at its lower end to the upper end of the tubular shaft 45, while its upper end is connected to the sphere 46, said flexible shaft preferably encircling the shaft 45. The flexible shaft or spring 47 serves to convey motion from the tubular shaft 43 to the sphere 46. When the sphere 46 represents the earth, it is desirable that the axis of the said sphere should be constant in pointing toward Arcturus or an imaginary point representing that star, notwithstanding its revolution and rotation. For this purpose it is necessary to rotate the shaft 45 once in every revolution of the frame 18. This is done by means of a gear 48 on the shaft 34 and another gear 49, secured to and rotating with the shaft 45, and an intermediate gear 50, meshing with both of said gears 48 and 49. Now the gears 48 and 49 being the same size, as are also the bevel-gears 35 and 36 and the bevel-gears 41 and 42, it is obvious that the shaft 45 will make one rotation every time the frame 18 swings once around the standard 11. Carried on the shaft 34 is a spur-gear 51, which meshes with the smaller gear 52, which is mounted on the shaft 45 loosely and carries on its side a spur-wheel 53, which in turn meshes with the pinion 54, mounted loosely on the shaft 34, which carries on its side a spur-gear 55, which meshes with a gear 44 on the lower end of the shaft 43 and rotates the said shaft 43. This train of gears from 51 to 44, inclusive, should be so proportioned as to give three hundred and sixty-five rotations of the sphere 46 to one revolution thereof around the central sun 12. The shaft 43 is connected with the sphere 46 by the spring 47.

60 is a second hollow shaft which is mounted on the shaft 43 so as to rotate freely thereupon and is connected by the spur-gear 61 and the pinion 62 with the shaft 34. The relative dimensions of the gears 61 and 62 are such as to rotate the shaft 60 thirteen and one-half times while the shaft 34 completes one rotation. The purpose of this will be explained farther on. The shaft 60 may extend downwardly over the shaft 43 to the gear 44, as shown in Fig. 9, or it may rest its lower end upon the bearing in the frame 20, as shown in Fig. 1.

63 and 64 are annular tracks approximating in shape as nearly as may be desired the orbit of the moon in its revolution around the earth and are secured, by means of arms 65 of suitable construction, to the frame 20, said tracks lying relatively to the plane of the earth's orbit as does the orbit of the moon to the theoretical orbit. For the sake of convenience the track 64 is of larger diameter or diameters than is the track 63.

66 is the shaft or supporting-arm, carrying on its lower end, preferably, grooved guiding-wheels 68 and 69, running, respectively, upon tracks 64 and 63, being positioned upon the rod 66 by means of collars 70 and a sleeve 71, said sleeve being situated between said wheels and bearing on its sides trunnions 72. Pivotally secured to the lug or lugs 73 on the end of the hollow shaft 60 is an arm 74, which is slotted in its distal extremity to receive bearing-boxes 75, which receive and journal the trunnions 72, a spring 76 in each of said slots serving to keep the bearing-boxes pressed outwardly and the wheels 68 and 69 in contact with their respective tracks. As the shaft 60 is rotated thirteen and one-half times to one rotation of the shaft 34, the sphere 67, representing the moon, will revolve in its orbit around the sphere 46, representing the earth, while the latter revolves once around the sphere 12, representing the sun. These relative movements of the spheres represent ap-

proximately the relative movements of the moon, earth, and sun.

The sun 12, consisting of a spherical receptacle, as hereinbefore specified, is provided at its bottom with a hub 56, through which the rod 13 passes, being held in position thereon by set-screws 57. Carried on the upper end of the rod 13, within the sphere, is a platform 58 or other device suitable for supporting a lamp, while the sphere 12 is perforated in its bottom for the admission of air to supply oxygen to the frame, and the removable upper portion 12′ is provided with other holes, wherefrom the gaseous products of combustion may escape. The ball 12, being of transparent or semitransparent material, will radiate a subdued light in all directions. Now in order to mark the termination of the seasons or other positions of the earth small holes 59 are cut along the equatorial zone of the sun and being small permit the passage of a thin ray of light, which being projected across the earth's orbit will mark divisions thereof, whereby a great brilliant light will be thrown upon the earth as it passes these division limits.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an educational planetary system, a central pivot, a cam mounted on said pivot, a rotatable frame adjustably mounted on said pivot, means for moving said frame around said pivot, a supplementary frame movably mounted in said rotatable frame, and an adjustable arm carried by said supplementary frame and engaging with said cam to move the supplementary frame relatively to the rotatable frame as the said rotatable frame moves around the central pivot.

2. In an educational planetary system, a central pivot supporting a solar center, sleeves rotatably mounted thereon, a supplementary frame secured by its free ends to said sleeves, so as to be movable longitudinally through same, a planet-carrying frame slidably mounted on said frame, an elliptical guiding-cam on said central pivot and an extensible arm projecting from said planet-carrying frame and adapted to engage and follow said cam.

3. In an educational planetary system, a central pivot, a cam mounted on said pivot, a rotatable frame adjustably mounted on said pivot, a supplementary frame movably mounted in said rotatable frame, an adjustable arm carried by said supplementary frame and engaging with said cam, a gear fixed on said shaft, a motor carried by said supplementary frame, a telescoping rod driven by said motor, and a gear carried by said rod and engaging with said gear fixed on said central pivot.

4. In an educational planetary system, a central pivot, a U-shaped frame revolubly mounted on said central pivot, a smaller supplementary frame carrying slides movable longitudinally of said first-named frame a cam on said pivot and an arm connecting said smaller frame with said cam a motor mounted in said smaller frame, a shaft geared thereto and to the central pivot, another shaft carrying a model of a subordinate planet and means for operatively connecting said last-named shaft and said motor.

5. In an educational planetary system, a central pivot, a cam mounted on said central pivot, a rotatable frame adjustably mounted on said pivot, means for moving said rotatable frame around said pivot, a supplementary frame movably mounted in said rotatable frame, an adjustable arm carried by said supplementary frame and engaging with said cam, a support mounted on said supplementary frame, means for rotating said support, a track or guide leading around said support, a carriage mounted on said track, and means for moving said carriage on said track.

In testimony whereof we hereunto affix our signatures in presence of two witnesses.

NEEDHAM W. HURST.
THOMAS OSBORN LINCH.

Witnesses:
W. J. PARTRIDGE,
R. C. GARDNER.