No. 705,647. Patented July 29, 1902.

F. M. CLARK.

CONICAL PENDULUM.

(Application filed Feb. 19, 1901.)

(No Model.)

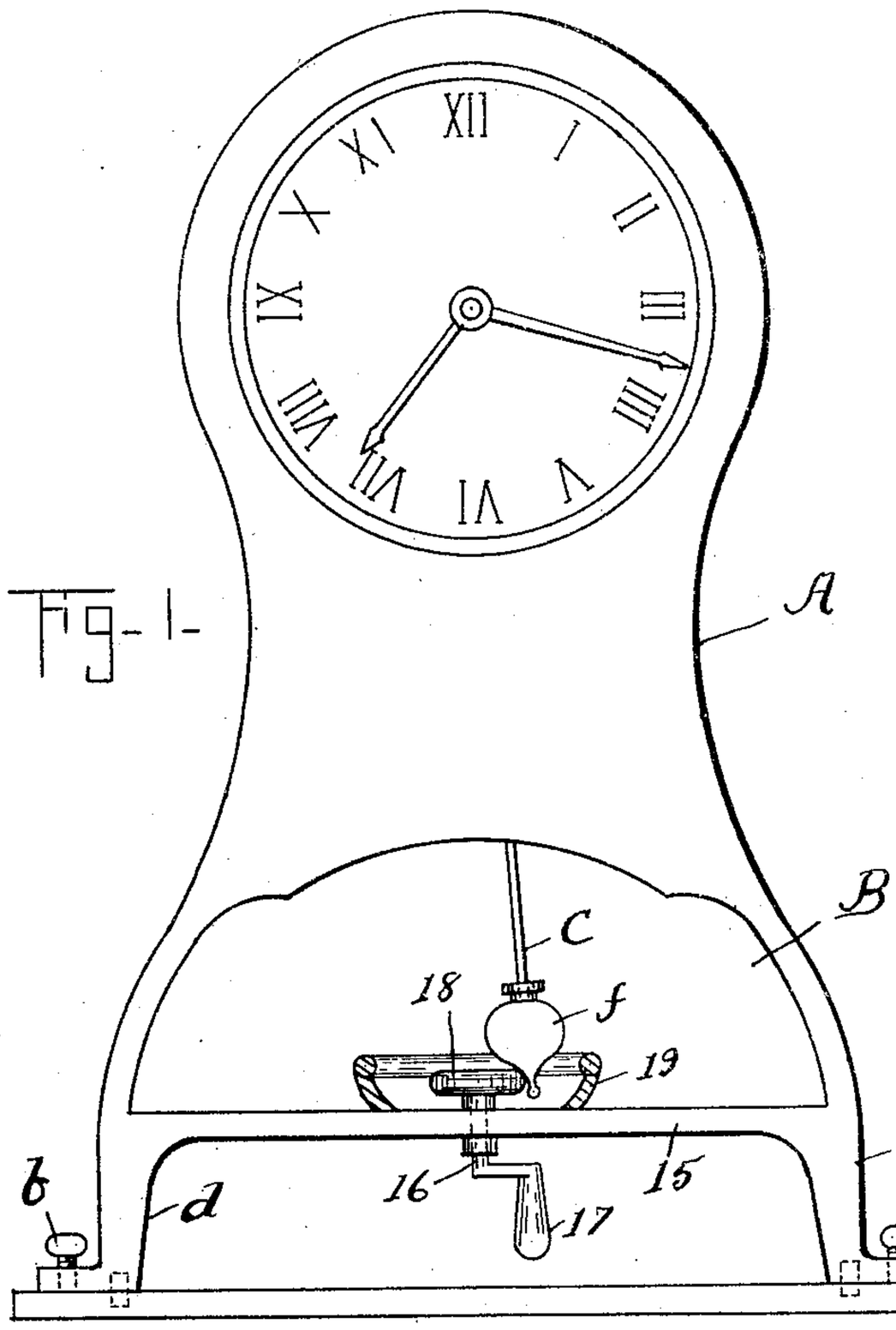


Fig-1-

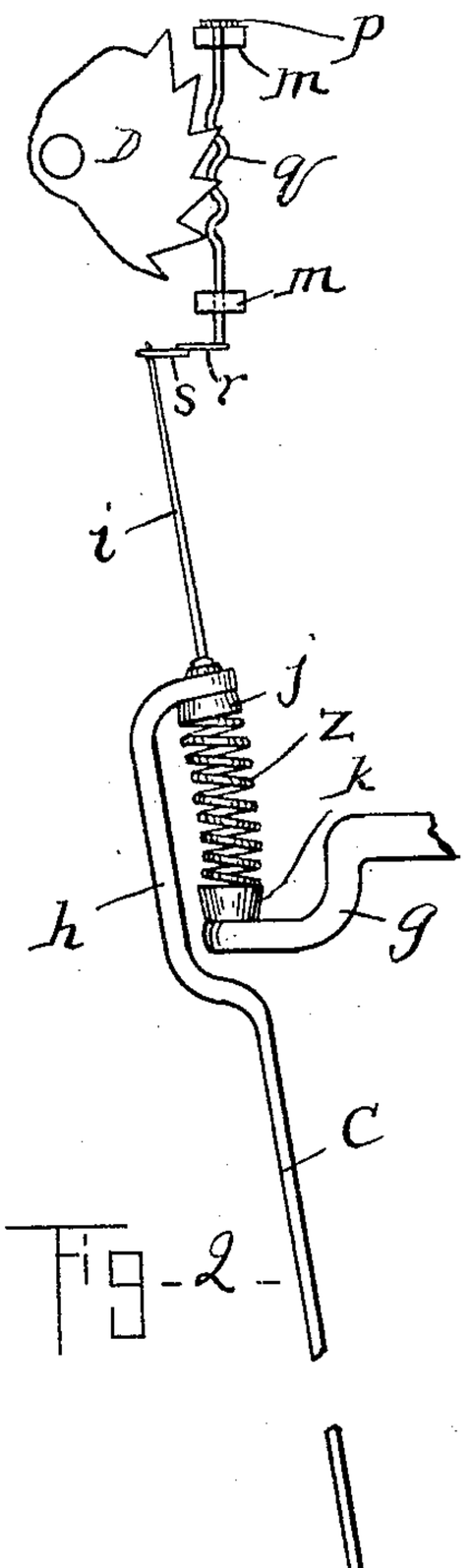


Fig-2-

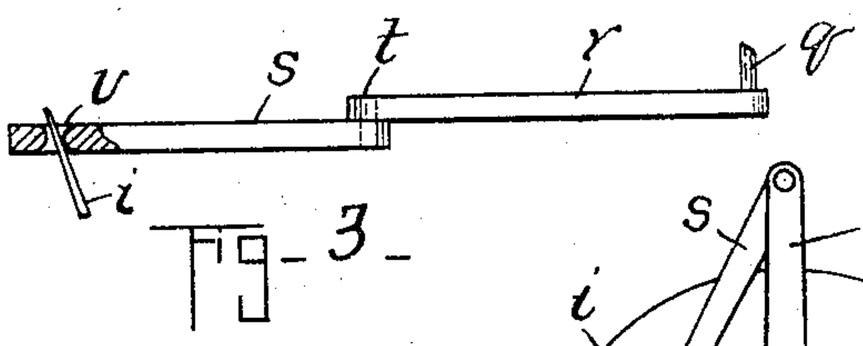


Fig-3-

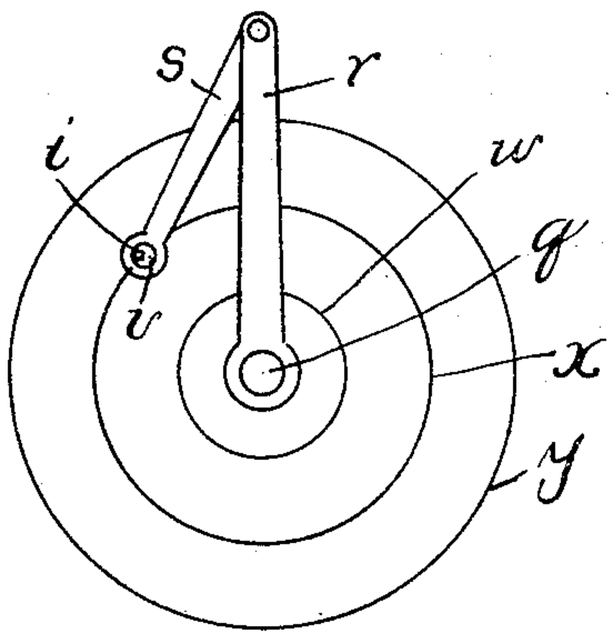
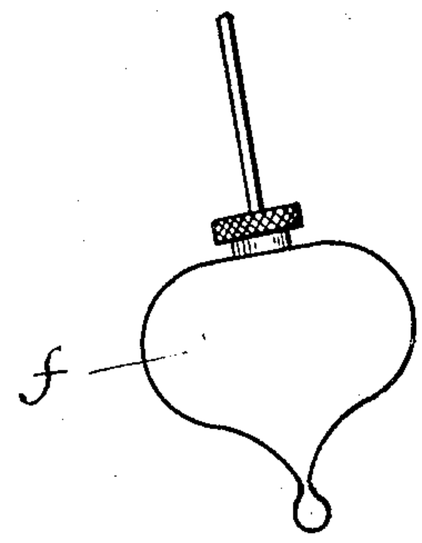


Fig-4-



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UNITED STATES PATENT OFFICE.

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CONICAL PENDULUM.

SPECIFICATION forming part of Letters Patent No. 705,647, dated July 29, 1902.

Application filed February 19, 1901. Serial No. 47,971. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. CLARK, of Tilton, county of Belknap, State of New Hampshire, have made certain new and useful Improvements in Conical-Pendulum Clocks, of which the following is a description sufficiently full, clear, and exact to enable any person skilled in the art or science to which said invention appertains to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a front elevation of a clock provided with my improvement, the lower portion of the case being glazed to show the pendulum; Fig. 2, an elevation showing the method of mounting and driving the pendulum; Fig. 3, a side elevation showing the crank and connecting rod, and Fig. 4 a diagram illustrating the movements of the same.

Like letters and figures of reference indicate corresponding parts in the different figures of the drawings.

My invention relates especially to that class of clocks known as "noiseless," wherein there is a rotary escapement and in which the pendulum has a continuous conical movement, the object being particularly to provide a simple, cheap, and effective device whereby the pendulum may be driven from its upper end, so directed that its weight will be maintained in an even circular course and that its mount shall compensate for variations in length caused by temperature.

The nature and operation of the device will be readily understood by all conversant with such matters from the following explanation.

In the drawings, A represents a clock-case of ordinary construction and provided in its lower face with a glazed opening B, through which the pendulum C is exposed. The legs *d* are provided with leveling-screws *b*. The main works of the clock are of the usual construction and arrangement and provided with a rotary escapement-wheel D. Hence it is not deemed essential to herein particularly show or describe the same.

In bearings *m m* within the case and arranged vertically there is mounted a spiral worm *q*, meshed with the teeth of the escape-wheel D and driven thereby. The upper end of this worm is stopped at *p*, as the thrust is upward. In alinement with this worm and below it there is a spirally-wound spring *z*, mounted on a bracket *g*, secured to the clock-frame. The lower end of the spring is fast in a cup *k*, secured to the outer end of said bracket. The upper end of said spring is free and a cup *j* is fast thereon. The pendulum-rod C is pendent from this upper cup *j*, being offset at *h* to pass around said spring and under the bracket, so that when at rest the body of said rod will be in alinement with the worm *q*. On the lower end a pear-shaped weight *f* is fast. From the upper end of the rod C and in alinement therewith a needle *i* projects vertically. On the lower end of the worm *q* a horizontal crank-arm *r* is fast. To the outer end of this arm one end of a connecting-rod *s* is pivoted by a crank-pin *t*. In the outer end of this connecting-rod there is a flaring opening *v*, Fig. 3, in which the upper end of the needle *i* plays and is directed by the movements of said crank. As this connection projects laterally from the worm, it will readily be seen that by slipping the needle end in this opening the pendulum C is thrown out of alinement with the worm and is held at an angle, as shown in Fig. 2.

Centrally in the bottom 15 of the clock-case there is a starting device. This consists of a vertical shaft 16, journaled in said bottom and provided with a crank-handle 17. Within the case a disk 18 is fast on said shaft and the pendulum-weight *f* normally rests against the periphery of this disk when the clock is run down. Surrounding this disk is a circular cup-shaped guard, which determines the outward movement of the pendulum-weight.

In the diagram shown in Fig. 4 the circle *w* represents the periphery of the starting-disk, the circle *y* the circle of the guard-cup, and the circle *x* the normal circle of travel of the pendulum-weight. To maintain this weight in such course *x* and keep it at all times traveling in a substantially perfect circle, the crank movement is designed. The connecting-rod S is therefore so arranged that when the end of the needle *i* is disposed in its free end and the weight *f* is resting against the disk 18 said connecting-rod is nearly on the line of a tangent to the circle *w*, as shown,

and leads out to tangent of circle *x* in motion.

In operation to start the clock the handle 17 is rotated. The friction of the disk 18 against the weight *f* carries it in circular motion, which gradually widens in diameter until the course of travel of said weight is in the circle *x*. The escapement-wheel D being driven by the mainspring in the usual manner, the worm *q* is rotated, thereby driving the crank in a perfect circle and carrying the upper end of the needle *i* also in a circle concentric with the weight course with which the crank is tangent. As the natural tendency of the weight *f* is to fall into an elliptical course in its conical rotation, this precise movement of the connecting-rod exerts pull or pressure on the upper end of the needle at the proper times and maintains the movement of the weight in a circle in a manner which will be obvious to those conversant with such matters without a more explicit description. It will be noted that the fulcrum or pivoted center of the pendulum is the center of the spring *z*. By supporting or cushioning the pendulum on said spring and driving it from the upper end I not only simplify the needed mechanism, but I also in a very appreciable measure regulate the clock, for the variations of the pendulum-rod through temperature are very closely compensated for by the variations in opposite direction (on account of position) of the spring *z* for like causes. I find, moreover, in practice that a clock constructed as described runs nearly twice as long with the same tension of mainspring as it will when the ordinary reciprocating pendulum is employed. One cause of this is the radical reduction of friction in the escapement, the movement of which is continuous with the worm. There is also no noise, as results from the contacting of the detent ordinarily used, and where a clock would ordinarily stop when the mainspring is little more than one-half expanded in this device the expansion, and hence the driving power, is extended until the spring is practically "dead."

Having thus described my invention, what I claim is—

1. In a clock a conical spring arranged with its base-coil horizontally nearer the clock-base than is its apex; a conically-moving pendulum supported from the apex of said spring; and devices for driving said pendulum from its upper end substantially as described.

2. In a clock a conical spring arranged with its base-coil horizontally nearer the clock-base than is its apex; a conically-moving pendulum supported from the apex of said spring; a worm driven by the scape-wheel of said clock and a crank connection between the upper end of said pendulum and said worm whereby the pendulum may be guided positively above its point of suspension substantially as specified.

3. In a clock the pendulum, C, in combination with the spiral, *z*, supporting said pendulum; the escape-wheel, D, and mechanism actuated by said wheel for guiding the end of said pendulum above its fulcrum-point in a circle.

4. In a clock provided with a conically-moving pendulum the case in combination with the crank-actuated disk disposed in position to contact the pendulum-weight when at rest.

5. In a clock of the class described the case; the crank-actuated disk; 18; and the encircling guard, 19, arranged as specified.

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