(No Model.)

W. S. JOHNSON.

PNEUMATIC CLOCK.

No. 567,983. Patented Sept. 22, 1896.

Fig. 1.

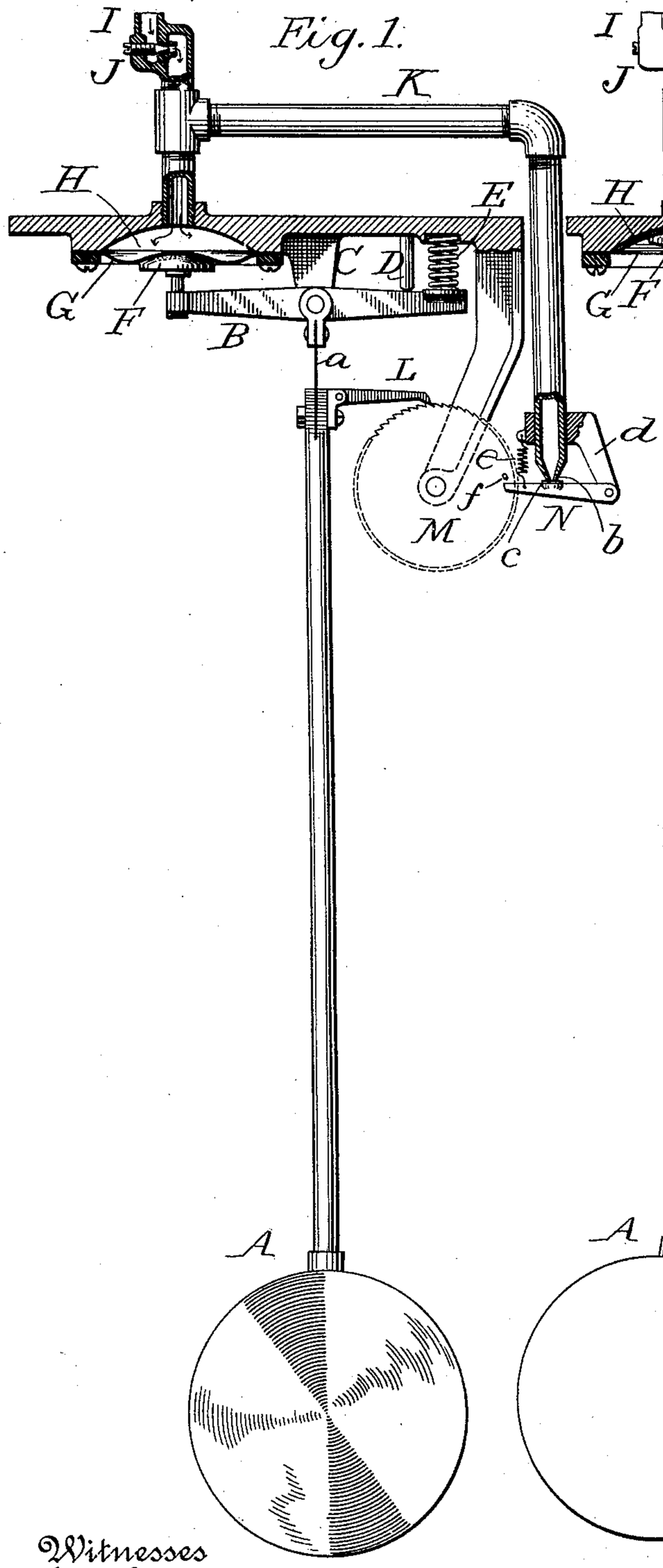
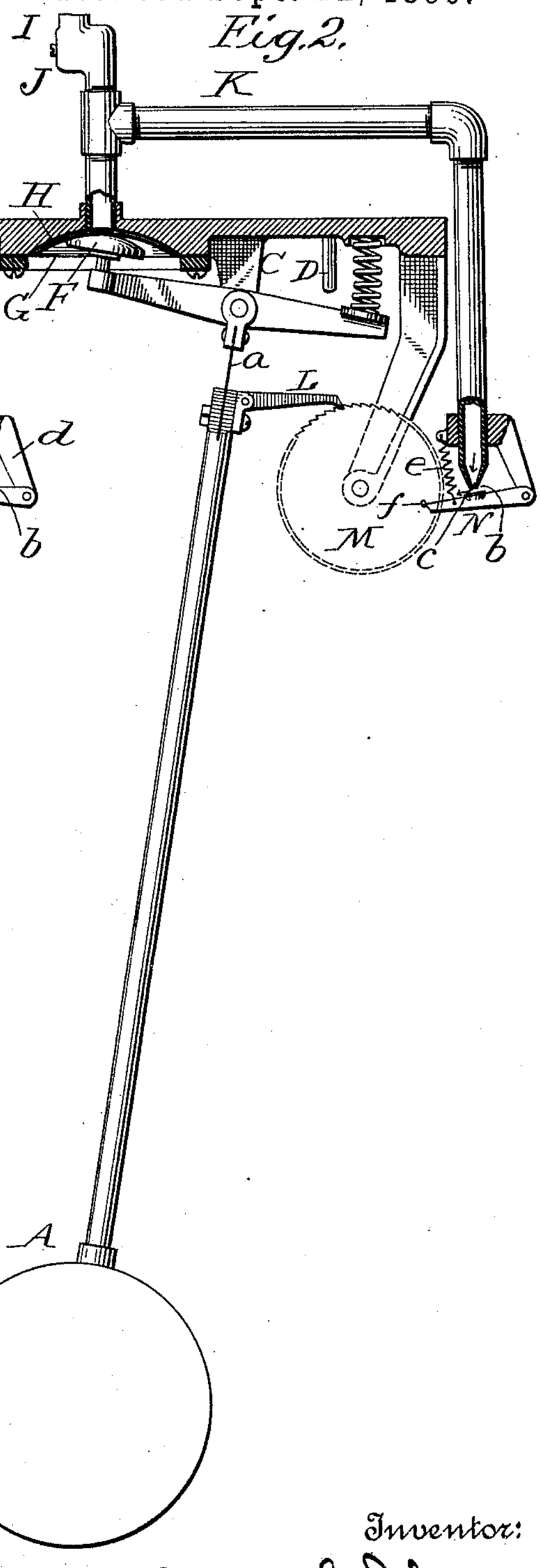


Fig. 2.



Witnesses
C. C. Burdick.
J. M. Pond.

Inventor:
Warren S. Johnson,
by Dodger Sons,
Attorneys

UNITED STATES PATENT OFFICE.

WARREN S. JOHNSON, OF MILWAUKEE, WISCONSIN.

PNEUMATIC CLOCK.

SPECIFICATION forming part of Letters Patent No. 567,983, dated September 22, 1896.

Application filed March 3, 1896. Serial No. 581,662. (No model.)

To all whom it may concern:

Be it known that I, WARREN S. JOHNSON, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Time-Measuring Devices, of which the following is a specification.

My invention relates to time-measuring devices, and particularly to such as are actuated or controlled pneumatically.

The invention consists in the method of and apparatus for imparting oscillating motion to a pendulum and maintaining such motion, as will be hereinafter explained.

In the drawings, Figure 1 is a front elevation, partly in section, of a pendulum and mechanism for imparting motion thereto, and thence to a wheel of the register-train; and Fig. 2, a similar view showing the action of the apparatus in applying or storing up power for oscillating the pendulum.

It is well understood that a pendulum put in motion will continue to vibrate for a greater or less length of time, depending, primarily, upon its freedom from friction or resistance of any kind. If, therefore, means be provided for periodically oscillating a pendulum or carrying it to a given point in its arc of movement, it may be kept constantly moving and made to serve as a means of actuating the time registering or recording device. Such an arrangement I have illustrated in the accompanying drawings, in which A indicates a pendulum suspended by means of a thin or flexible plate or hanger-spring *a* from a two-armed lever B, pivoted at a point between its ends in hangers or supports C. The lever B stands normally in a horizontal position with one arm in contact with a stop D, and also bearing against a spring E, which is normally under compression. The opposite end of the lever B carries a rounded head or disk F, which bears against a flexible diaphragm G, constituting one wall of an expansion-chamber or fluid-pressure chamber H. This chamber receives fluid under pressure through a pipe I from any convenient source or reservoir. The inflow of fluid is controlled and restricted by means of a valve J, preferably in the form of a conical-pointed screw fitting a seat of like form. From the pipe I a branch K extends outward and downward, as shown in Figs. 1 and 2, and is provided with an orifice or outlet *b*, somewhat larger than the restricted inlet. It will be seen that if the outlet *b* be open there will be no pressure in the chamber H, because the outlet is of so much larger capacity than the inlet that the fluid passes freely through said outlet. When, however, the outlet *b* is closed, the pressure of the fluid entering through pipe I will be received by the diaphragm G as the chamber H fills, and the head or disk F will be pressed downward until the farther arm of lever B is forced into contact with the stop D and the spring E is pressed to the predetermined limit.

Pendulum A carries near its upper end a pivoted pawl L, which engages with a ratchet-wheel M, which may conveniently be made with thirty teeth, though I do not restrict myself to any specific number. It will be seen that during each movement of the pendulum in one direction the dog or pawl L will ride backward over the long face of a tooth of the ratchet-wheel M and engage with the abrupt face thereof, and that upon the return movement or opposite swing the dog will press against said upright face and advance said ratchet-wheel a given distance. The teeth will be so proportioned and the pawl will be so located that the slight variation in the amplitude of the vibrations of the pendulum in the short time elapsing between the application of power to the pendulum shall not permit the pawl to pass over more than one tooth, nor to fail to engage a fresh tooth at each stroke.

N indicates a lever provided with a disk, of rubber, leather, or other suitable material, adapted to seal the outlet-orifice *b*, said lever being pivoted to an arm or bracket *d*, and normally held in position to press the disk *c* against the mouth of pipe K by a light spring *e*.

Projecting from the side face of wheel M is a pin or stud *f*, which in each revolution of the wheel engages the free end of the lever N and carries said lever away from the end of pipe K, thereby unsealing the orifice *b* and venting pipe K, and consequently chamber H. Whenever this venting occurs, the air contained in chamber H rushes therefrom and escapes through orifice *b*, permitting the col-

lapse of the diaphragm G and allowing the spring E to move the lever B about its pivot and thereby to swing the pendulum A to the limit of its oscillation in one direction. The pin *f* and the lever N are so related in location and so proportioned that the movement of the lever away from the pipe K is but momentary, and lasts only during the movement of a single tooth, but this period is of sufficient duration to permit of the effective action of spring E. Assuming that the pendulum be of a length to beat seconds and that the wheel M be provided with thirty teeth, which will be found a convenient proportion and arrangement, it will be seen that the pipe K will be vented once every minute, and that the venting will last but a second or a portion thereof. It will also be seen that once every minute the pendulum will be thrown to the predetermined limit of oscillation, and that it will thus be given sufficient amplitude to secure its continued oscillation until another impulse is given to it, and in this way an extremely simple time measuring and register actuating mechanism is produced.

It is obvious that the details of the apparatus may be varied somewhat without departing from the essential features of my invention. Thus the pawl may be made in the form of a hook and arranged to pull instead of to push, the spring may be a leaf instead of a spiral spring, the spring may be placed under tension instead of compression, in which case the lever may have but one arm, and other minor modifications within the province of the mechanic will readily suggest themselves to those skilled in the art.

The apparatus may be employed in connection with any means of producing fluid-pressure, and, as is well understood in regard to all apparatus of this general nature, it may be made to act by suction instead of pressure by merely reversing the arrangement of parts.

The wheel M or its arbor may give motion to any common registering or recording mechanism.

Having thus described my invention, what I claim is—

1. In combination with a pendulum and a support therefor capable of oscillation, a stop to limit the movement of the support in one direction, a spring tending to oscillate the support in one direction, a fluid-pressure device serving to compress the spring and to hold the support normally against its stop, and means for periodically venting the fluid-pressure chamber, and thereby permitting the spring to rock the support.

2. In combination with a pendulum, a spring for moving the pendulum in one direction, a fluid-pressure device for holding the spring normally under compression, and means for periodically venting the pressure device, and permitting the spring to oscillate the pendulum.

3. In combination with a pendulum and an oscillating support or carrier therefor, a spring tending to rock said support in one direction, a fluid-pressure device serving to rock the support in the opposite direction, to compress the spring and to hold it normally under compression, a valve or sealing device serving to seal the pressure-chamber against communication with the atmosphere, a ratchet-wheel, a pawl or dog connected with the pendulum and serving to rotate said wheel, and a lug or projection carried by the wheel and serving to actuate the valve and thereby to vent the fluid-pressure device.

4. In combination with a pendulum A and its resilient hanger *a*, an oscillating lever B carrying the hanger *a*, a stop D to limit the play of lever B, a spring E tending to move the lever in one direction, a fluid-pressure chamber H having a movable wall G bearing upon one arm of lever B, fluid-pressure pipe I provided with a restricted port or inlet communicating with chamber H, vent-pipe K provided with orifice *b*, lever *n* provided with valve or disk *c*, spring *e* serving to hold the valve normally over the orifice *b*, ratchet-wheel M provided with stud or projection *f*, and pawl L connected with the pendulum A and serving to impart rotation to wheel M.

In witness whereof I hereunto set my hand in the presence of two witnesses.

WARREN S. JOHNSON.

Witnesses:

HORACE A. DODGE,

C. C. BURDINE.