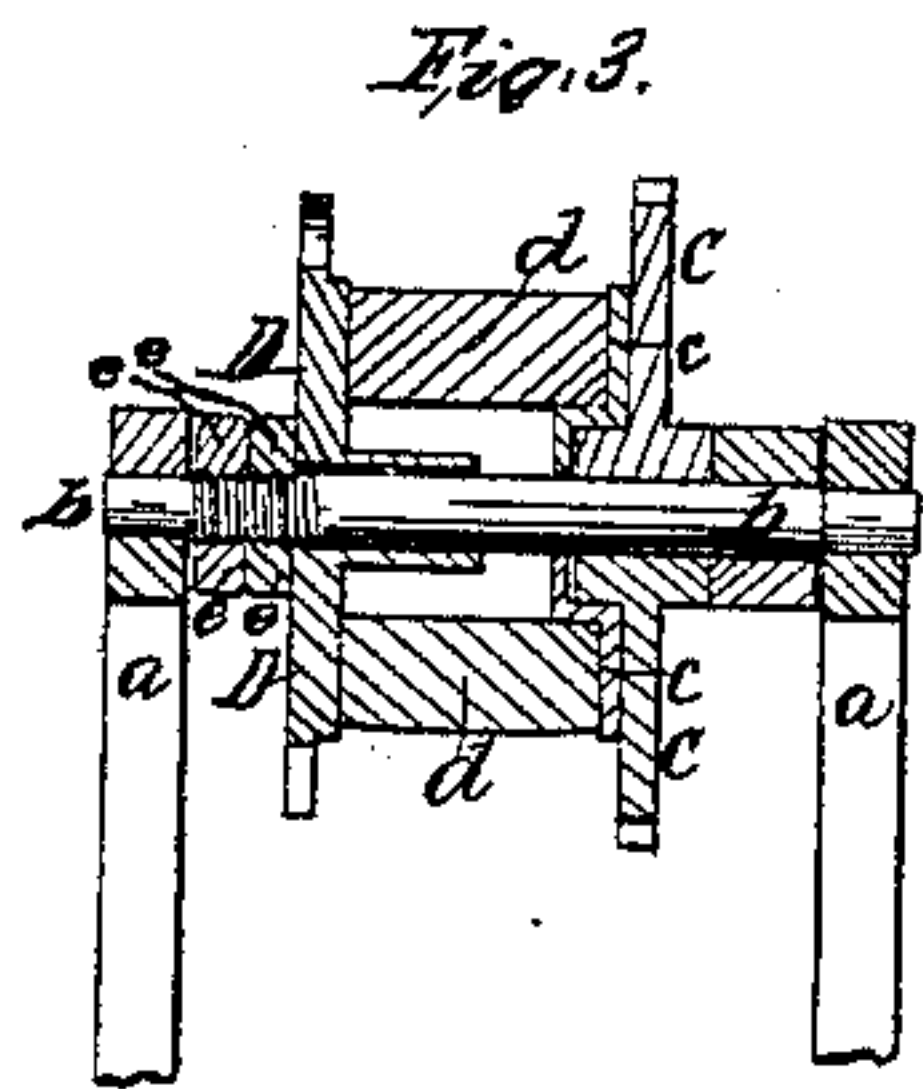
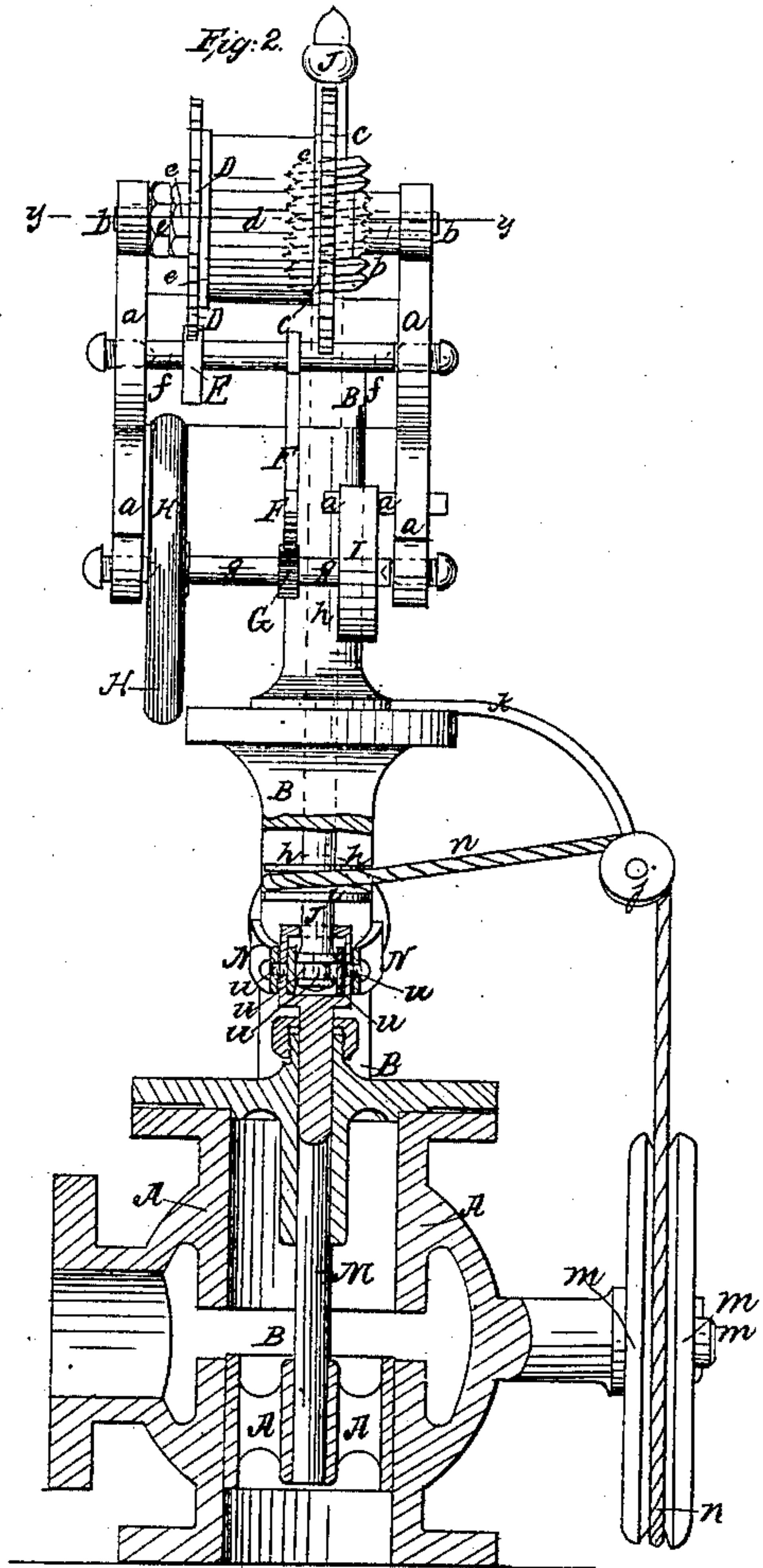
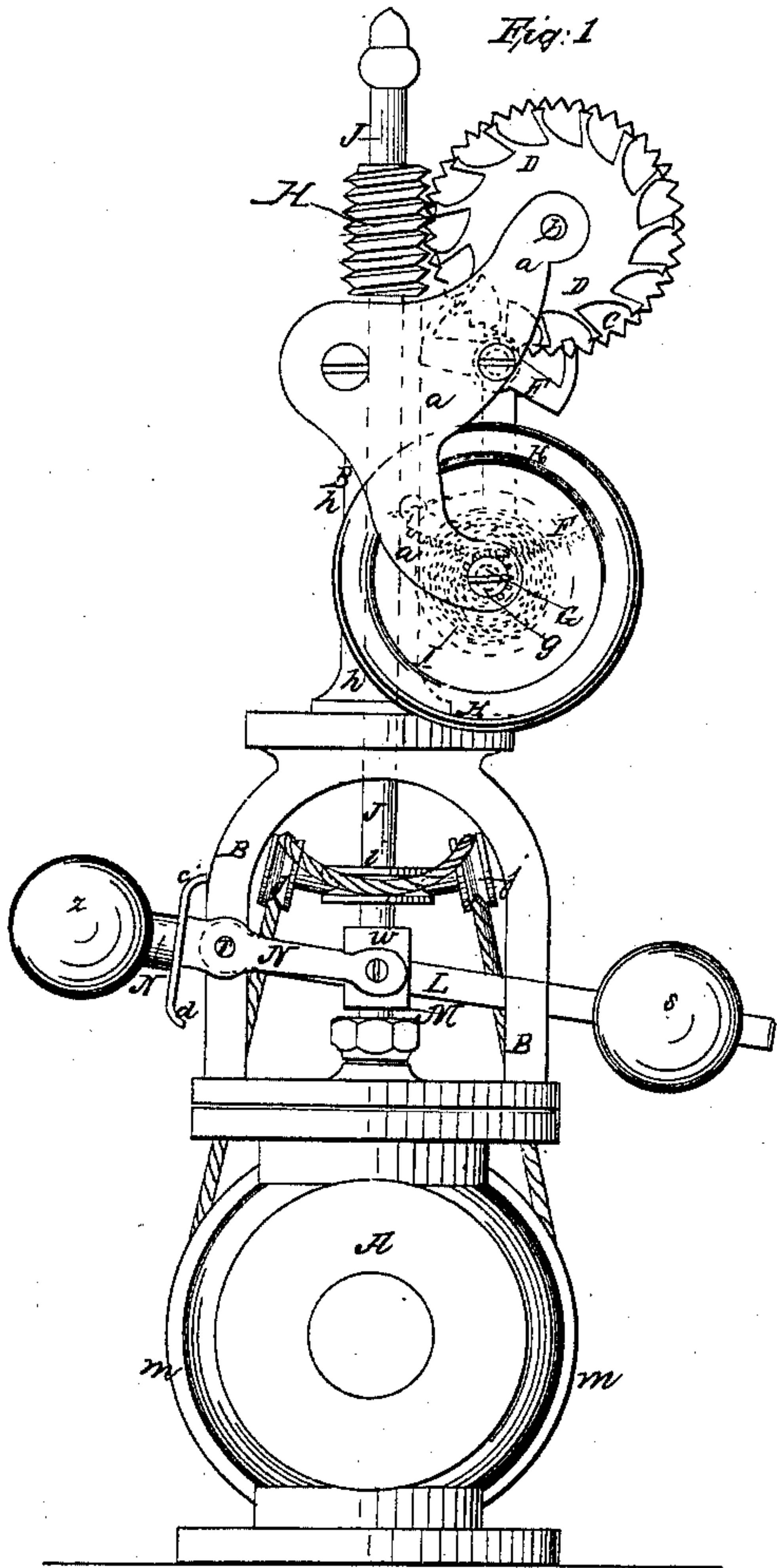


*R. Fickemeyer,*  
Governor.

*No 57,490.*

*Patented Apr. 28, 1866.*



*Witnesses:*  
*J. H. Coombs*  
*G. W. Reed.*

*Inventor:*  
*R. Fickemeyer*



# UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

## IMPROVEMENT IN STEAM-ENGINE GOVERNORS.

Specification forming part of Letters Patent No. 57,490, dated August 28, 1866.

*To all whom it may concern:*

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Governors for Steam-Engines and other motors controlled by valves; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a side elevation of a governor constructed according to my invention. Fig. 2 is a partial vertical transverse section, taken in the line *x x* of Fig. 1. Fig. 3 is a horizontal transverse section of a portion of the invention, taken in the line *y y* of Fig. 2.

Similar letters of reference indicate corresponding parts in all the figures.

The governors heretofore constructed for regulating the speed of steam-engines and other motors, and operating either by centrifugal force or by the resistance of the air to the motion of revolving vanes, have been defective, inasmuch as an appreciable length of time has been required for their operation, so that they have only approximated to the production of an invariable or perfectly uniform speed of the motors to which they have been applied. This invention is designed to secure a much more uniform and regular movement of the motor than has been obtained by such governors; and it consists in a novel construction of a governor, whereby the desired result is effectually accomplished, the principal feature of this governor being an escapement and a balance or other contrivance making isochronal vibrations, driven by the motor whose speed is to be governed, and so connected with the valve or valves, or their equivalent, by which the speed of the motor is controlled as to regulate the supply of motive power by the irregular motion of the motor.

To enable others to understand the construction and operation of my invention, I will proceed to describe it with reference to the drawings.

A is a valve-casing containing the regulating-valve A', which the governor is designed to operate, and which forms a base for the support of the governor, for which purpose it has

fixed upon it an upright frame or standard, B, which supports the working parts of the apparatus. The upper end of this frame B is made broad, as shown more clearly in Fig. 2, and fixed upon each side thereof is an upright bracket, *a*; and working in suitable bearings formed in the upper ends of the two brackets is a transverse shaft, *b*, on which, near one end, is rigidly secured a worm-wheel, C, and near the opposite end is placed an escapement-wheel, D, which is loose upon the said shaft. Placed upon said shaft, at the inner side of the worm-wheel C, is a flat annular friction-plate, *c*, and interposed between the said plate *c* and the escapement-wheel D is a strong annular spring, *d*, of india-rubber or other equivalent material.

*ee* represent two nuts, screwed upon the end of the shaft *b*, outside of the escapement-wheel, in such manner as to press the said escapement-wheel inward against the spring *d*, so that under ordinary circumstances the escapement-wheel will be prevented from turning upon its shaft by the friction upon its sides of the spring *d* and the innermost nut, *e*.

E is a verge or anchor, the pallets of which act upon the teeth of the escapement-wheel D, and which is secured upon a transverse rock-shaft, *f*, which works in bearings in or on the brackets *a*, and projecting downward from which is a toothed sector, F, which gears into a pinion, G, secured upon the staff *g* of a balance-wheel, H, the bearings of the said staff being in the lower parts of the aforesaid brackets *a*. This staff has a balance-spring, I, applied to it in the manner common to escapements, the outer end of the said spring being secured to one of the brackets *a*, as shown at *a'* in Fig. 2.

J represents a vertical shaft or spindle, which is situated within the tubular portion, *h*, of the frame or standard B, and has a longitudinal movement therein. The lower end of this spindle J is connected with the valve A', as will be hereinafter fully set forth. The upper end of the said shaft has formed upon it a worm or tangent-screw, K, which gears into the worm-wheel C. Firmly secured upon the lower end of the spindle J is a small pulley, *i*.

*j* represents two small guide-pulleys supported on the outer end of an arm, *k*, which



projects laterally from the frame B, and *m* is a driving-pulley arranged below the pulleys *j* on a fixed stud, *m'*, and receiving a continuous rotary motion from any suitable part of the engine or motor to be governed. A belt, *n*, passes from the pulley *m* over the friction-pulley *i*, so that the revolutions of the pulley *m* communicate a rotary motion to the shaft or spindle J.

L is a lever of the third class, one end of which is pivoted on a horizontal pivot, *r*, at one side of the frame B, while upon the opposite end thereof is placed an adjustable weight, *s*. A vertical slot is formed in this lever L, into which projects the lower extremity of the spindle J. An annular groove, *u*, is formed around the said lower end of the spindle J; and projecting inward from the opposite sides of the forks of the said lever L, with their inner ends fitted into the groove *u*, are two pins or screws, *u'*, which thus attach the spindle J to the said lever.

*w* is a rectangular strap or frame, which has a hole in its upper side, through which the lower end of the stem J passes, the said strap receiving within it that part of the lever L to which the spindle J is attached, as just explained. This strap *w* is fixed firmly upon the upper end of the valve-stem M, which projects upward from the valve A', and is of such vertical length that the lever L and spindle J may have a slight vertical movement without affecting the valve-stem M, as will be presently further set forth.

N is a forked lever of the first class, which is pivoted on the same fulcrum-pin *r* as the lever L, and has its inner ends attached to the strap *w* by pins or screws *v* passing through slots in the said ends, while at its outer or opposite extremity is a weight, *z*, which acts as a counterweight to the valve-strap and stem. Formed upon this lever N are two arms or prongs, *c'* and *d'*, which, by striking against the frame B, act as stops to limit the upward and downward motion of the lever N, and consequently of the valve, as will be presently further explained.

A rotary motion being communicated to the pulley *m* from any suitable part of the engine, the stem J is caused to revolve through the agency of the belt *n* and pulley *i*, thus causing the tangent-screw or worm K on the said stem to turn the worm-wheel C, and consequently operate the escapement formed by the wheel D, anchor E, sector F, pinion G, and spring I with a regular and uniform movement. As long as this motion of the worm-wheel C is no more than sufficient to neutralize the tendency of the tangent-screw to move upward upon the teeth thereof, the lever L will be lifted but slightly within the strap *w*; but when the velocity of the worm K exceeds that of the worm-wheel C the teeth of the said wheel C act in the same manner as the threads of a stationary nut, in such manner that the stem J is carried upward by the action of the screw upon the said teeth, so that

the lever L being lifted strikes the top of the frame *w*, and consequently lifts the valve-stem M and raises the valve A', thus closing the steam-passage B' to an extent proportioned to the excess of the velocity of the said screw over and above that neutralized by the rotation of the worm-wheel C.

When the speed of the engine is suddenly increased, as from the breaking of a belt, or from other causes, the valve will be raised by about one-fourth of a revolution of the engine, so as to entirely shut off the steam, the further ascent of the valve being prevented by the striking of the stop *d'* against the side of the frame B, as hereinbefore mentioned; but inasmuch as the increased momentum of the fly-wheel will prevent the engine from being immediately brought back to its usual speed by such shutting off of the steam, the spindle J, and consequently the worm-wheel C, will still rotate at a higher velocity, while the escapement-wheel D, being controlled by the action of the anchor E, moves at its ordinary speed, which it is enabled to do by the slipping of the shaft *b* within it, the increased speed of the said shaft overcoming the friction of the rubber spring *d* and nut *e* upon the sides of the escapement-wheel.

When the increased momentum of the fly-wheel is spent and the speed of the engine is reduced to such a degree that the movement of the tangent-screw or worm K corresponds to that of the escapement-wheel D, as hereinbefore fully explained, the spindle J instantly descends, and, lowering the valve, again admits the steam, the proper descent of the said valve being insured by the weight S on the lever L. This rapid opening of the valve could not be effected by the ball or other ordinary governor, which, after moving the valve beyond its closing position, has of itself to move the valve all the way back again, and therefore cannot open the valve again till its normal speed is nearly restored, and therefore causes constant oscillation of the valve and unsteadiness of the motor.

Besides operating to produce and regulate the friction upon the sides of the escapement-wheel, as hereinbefore fully set forth, the spring *d* performs the additional function of acting as a spring to ease the striking of the teeth of the escapement-wheel D upon the anchor E, its operation being in this respect somewhat similar to the take-up spring of a clock, inasmuch as it enables the worm-wheel to make a more steady rotary movement, and at the same time reduces the friction of the several parts of the escapement upon each other.

When desired, a pendulum may be attached to the shaft *g*, and act, in the place of the toothed sector F, pinion G, and spring I, to produce the uniform motion of the escapement.

When it is desired to use the governor as a cut-off, the strap *w* is fitted closely upon the lever L, and the spindle J is connected with any suitable moving part of the engine by means of appropriate gearing, or by a chain,



in such manner that the steam will be cut off at each motion of the wheel or balance H, while the position of the tangent-screw K, as it operates the worm-wheel C, will regulate the time, the number of beats of the escapement being in this case just twice the number of the revolutions of the engine.

Inasmuch as the action of the governor, and consequently the velocity of the engine, are regulated by the speed at which the escapement operates, the engine may be run at any desired speed by adjusting that of the escapement, either by changing the proportions of the driving-pulleys *m* and *i* or by lengthening or shortening such pendulum.

The position of the spindle J, as well as the shape of the valve, may be changed to correspond to any desired position of the governor, and, instead of employing the weighted lever L, the weight may be placed on the upper end of the spindle J; or when the said spindle is placed horizontally the said lever may be of bell-crank form. Furthermore, in place of the valve shown in the drawings, a butterfly or other suitable balanced valve may be used; and instead of the tangent-screw and worm-wheel a suitable combination of gears may be used to operate the escapement, to produce the same result.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A governor consisting of an escapement and a balance, making isochronal vibrations,

connected with the valve, by which the speed of the motor is controlled, so as to regulate the motive power, substantially as herein described.

2. The combination of the escapement D, balance H I, and friction-spring *d*, or their equivalents, with the valve, in such manner that the latter may cease moving after the supply of motive power has been entirely shut off and before the normal speed of the motor is restored, substantially as herein set forth.

3. The arrangement of the lever L with graduating-weight *s*, connected with the escapement and balance by means of a loose strap, *w*, substantially as and for the purpose herein specified.

4. The spring *d*, applied to produce friction between the escapement-wheel and its shaft, and to insure the falling of the pallets of the verge or anchor on the teeth of the said wheel, substantially as herein specified.

5. The counterbalance-lever N, in combination with the valve and escapement, substantially as and for the purpose herein specified.

6. The governor consisting of the escapement and balance, the friction-spring *d*, weight *s*, counter-balance *z*, stops *c'* *d'*, and their connections, the whole constructed, combined, and applied substantially as herein specified.

R. EICKEMEYER.

Witnesses:

A. LE CLERC,  
J. W. COOMBS.