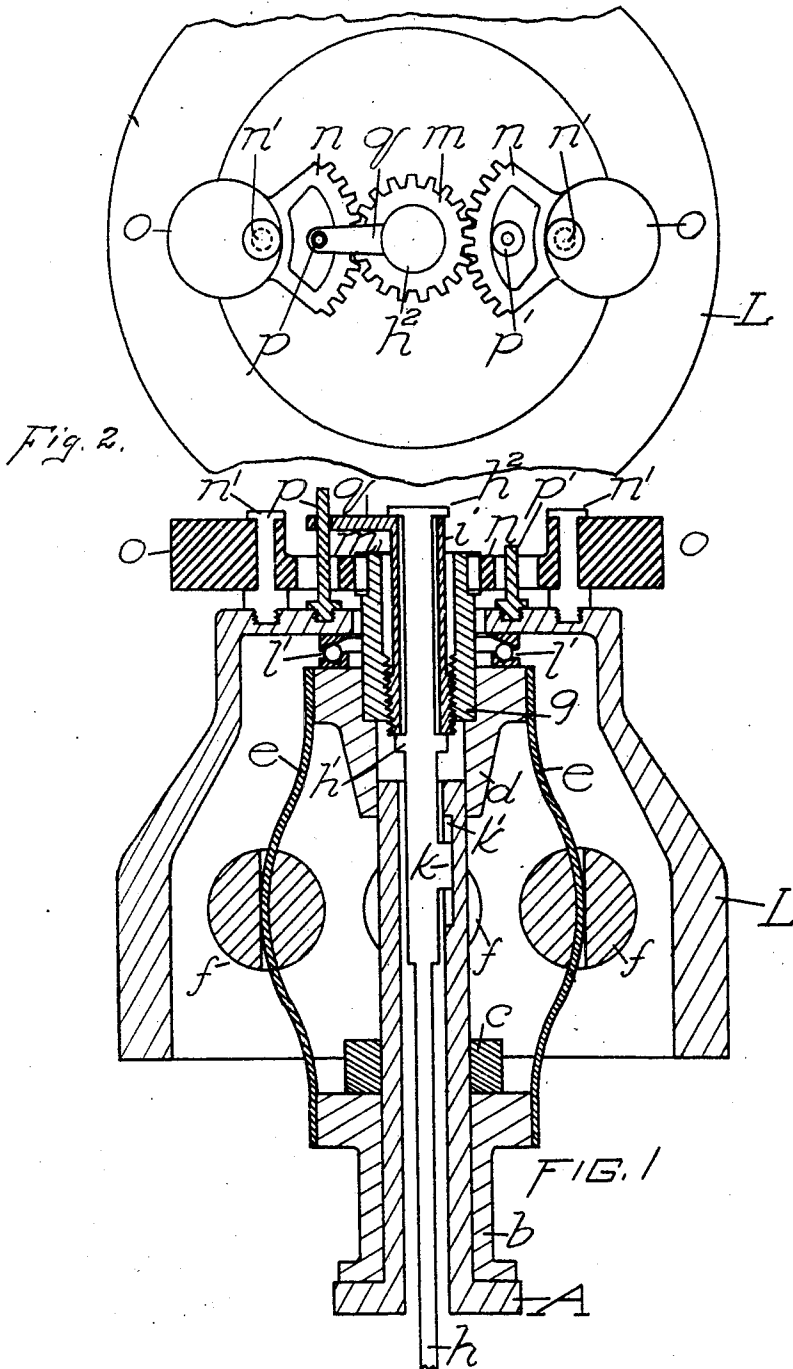


No. 805,392.

PATENTED NOV. 21, 1905.

H. E. WARREN.  
SPEED GOVERNOR.  
APPLICATION FILED MAR. 22, 1905.



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## SPEED-GOVERNOR.

No. 805,392.

Specification of Letters Patent.

Patented Nov. 21, 1905.

Application filed March 22, 1905. Serial No. 251,419.

*To all whom it may concern:*

Be it known that I, HENRY E. WARREN, a citizen of the United States of America, and a resident of Newton, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Speed-Governors, of which the following is a specification.

The invention relates to that class of governors commonly known as "inertia-governors," in which heretofore the active inertia element has consisted of a weight normally held in a definite position by a spring or by gravity, and this weight could move relatively to other revolving portions of the governor on account of changes in velocity only against the resistance of the spring or force of gravity.

The present invention consists in making the inertia element of the governor separate from the positively-driven centrifugal ball element and indirectly connected therewith, so as to permit independent movement, and in an inertia element so constructed that it will be held in normal position by centrifugal force alone when the governor is in operation, and any movement of the inertia element in relation to other revolving parts of the governor will be resisted only by such centrifugal stress. By this construction the centrifugal balls being driven positively from the motor which they control follow the speed changes instantly and do not lag with the inertia element, as has been the case heretofore where the centrifugal balls have formed a part of or have been connected so as always to revolve at the same speed as the inertia element.

A specific and convenient embodiment of the invention is illustrated in the accompanying drawings, wherein--

Figure 1 is a central vertical section of the entire governor. Fig. 2 is a plan of the inertia element of the governor, showing the means by which it is held in or constantly impelled toward its normal position. Portions of the inertia disk at opposite sides are broken away.

Referring to the drawings, A is a hollow standard, upon which the governor is supported. The centrifugal or fly ball element of the governor is of simple usual form, consisting of a lower flanged sleeve *b* which serves as a belt-pulley on the lower end of the stand-

ard A, where it is held by a collar *c*. *d* is an upper flanged sleeve which fits over the upper end of said standard and is adapted to slide vertically thereon. The two sleeves *b* *d* are connected by spring-strips *e*, midway upon each of which a ball *f* is secured. In the upper end of the sleeve *d* is secured a tubular extension *g*, interiorly screw-threaded at its lower end. *h* is the stem of the valve, (not shown,) which acts as the controller of the motor and extends up through the standard A and a tube *i*, in which it is held by collars *h'* *h''*. The tube *i* is exteriorly screw-threaded at its lower end, and this thread engages the interior thread of the tubular extension *g*. By this means the valve-stem *h* is connected with and has the vertical motion of the sleeve *d* imparted to it. The valve-stem *h* is prevented from turning by a spline *k* thereon, which projects into a groove *h'* in the interior of the standard A. It will be seen that by this construction any variation of speed imparted from the motor to the centrifugal element of the governor which causes a radial movement of the balls *f* in respect to their axis of revolution will cause the sleeve *d* to move either up or down, and with it the valve-stem *h*.

The inertia element shown in this improved governor consists in the cylindrical bell-shaped member L, mounted on ball-bearings *l'* upon the top of sleeve *d*. The bell L is caused to rotate by the engagement with a gear *m*, secured to the upper end of the tube *g*, of a pair of toothed sectors *n* *n'*, pivoted at *n'* *n'* on the top of the bell L. Diametrically opposite to the sectors *n* and secured thereto are weights *o*, which as soon as the bell L begins to revolve tend to assume the position shown in Fig. 2 by reason of their asymmetry in relation to their pivots *n'* and the action of centrifugal force upon them. In order to limit the swing of the sectors *n* upon the pivots *n'*, pins *p* *p'* are secured to the top of the bell L and extend up through slots in said sectors, and, further, the pin *p* passes through a hole in an arm *q*, which is attached to the upper end of the tube *i*, by which means that tube will be turned within the extension *g* whenever a sudden change of speed of the motor causes the centrifugal ball element of the governor to revolve at a different veloc-

ity from the inertia element, and by this turning of the tube *i* raise or lower the valve-stem *h* by the action of the screw-threaded portions of the tube *i* and extension *g*. The shape of the inertia element may be varied, as desired.

The action of the improved governor when in operation is as follows: While the speed of the motor to be controlled is constant the speed of the centrifugal ball element and the inertia element will be the same, the balls *f* will revolve in a circle of constant radius, and the weights *o* in stable equilibrium in the position shown in Fig. 2. As soon, however, as any change occurs in the speed of the motor under control there will be a sudden acceleration or retardation in the speed of the centrifugal ball element; but this change will not be transmitted immediately to the inertia element *L*, because of its tendency to revolve at a constant speed, which it will be permitted to do for a short interval by swinging the weights *o* upon the pivots *n'* out of their position of equilibrium. This rotational change of position of the bell *L* in relation to the centrifugal ball element will cause the pin *p*, through the arm *q*, to turn the screw of the tube *i* in that of the tubular extension *g* and raise or lower the stem *h*, and thus properly adjust the controller or valve and regulate the supply of motive power to counteract the change in speed of the motor. The movement of the tube *i* within the extension *g* will continue only as long as the change in speed of the motor continues, for as soon as the speed of the motor ceases to depart from normal the inertia element will be forced back to its normal position with respect to the centrifugal ball element by centrifugal action upon the weights *o*, which always tends to return them to their position of equilibrium. It will be seen, therefore, that if the motor speed should tend to remain constant at any value not the normal the centrifugal action upon the weights *o* will be effective in bringing about a return to the normal speed, which

the inertia element alone would not be able to accomplish.

The advantages of these improvements are simplicity in construction and consequent economy in manufacture and sensitiveness and reliability in operation.

I claim—

1. In a speed-governor for motors, a centrifugal element which rotates at a fixed ratio of the speed which it controls, an inertia element which tends to rotate at a constant speed and centrifugally-controlled means which interconnect the centrifugal and inertia elements and tend to cause such elements to rotate synchronously.

2. In combination with a centrifugal ball-governor, an inertia member carried by and independently rotatable thereon, a pair of weights pivoted out of their gravity centers upon the inertia member, which weights are controlled by centrifugal force, so that by their interconnection with the centrifugal ball member they tend constantly to cause synchronous rotation of the inertia member therewith.

3. In a speed-governor a centrifugal member, an inertia member, carried by and independently rotatable upon the centrifugal member, centrifugally-controlled weights pivoted out of their gravity centers upon the inertia member and having limited rotation thereon, interconnecting means between the inertia member and the governor-controlled valve, to transpose independent rotary movements of the former to vertical movements in the latter, and means connecting the centrifugal member and the pivoted weights to cause the action of the latter to tend constantly to synchronize the speed of the centrifugal and inertia members.

HENRY E. WARREN.

Witnesses:

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