

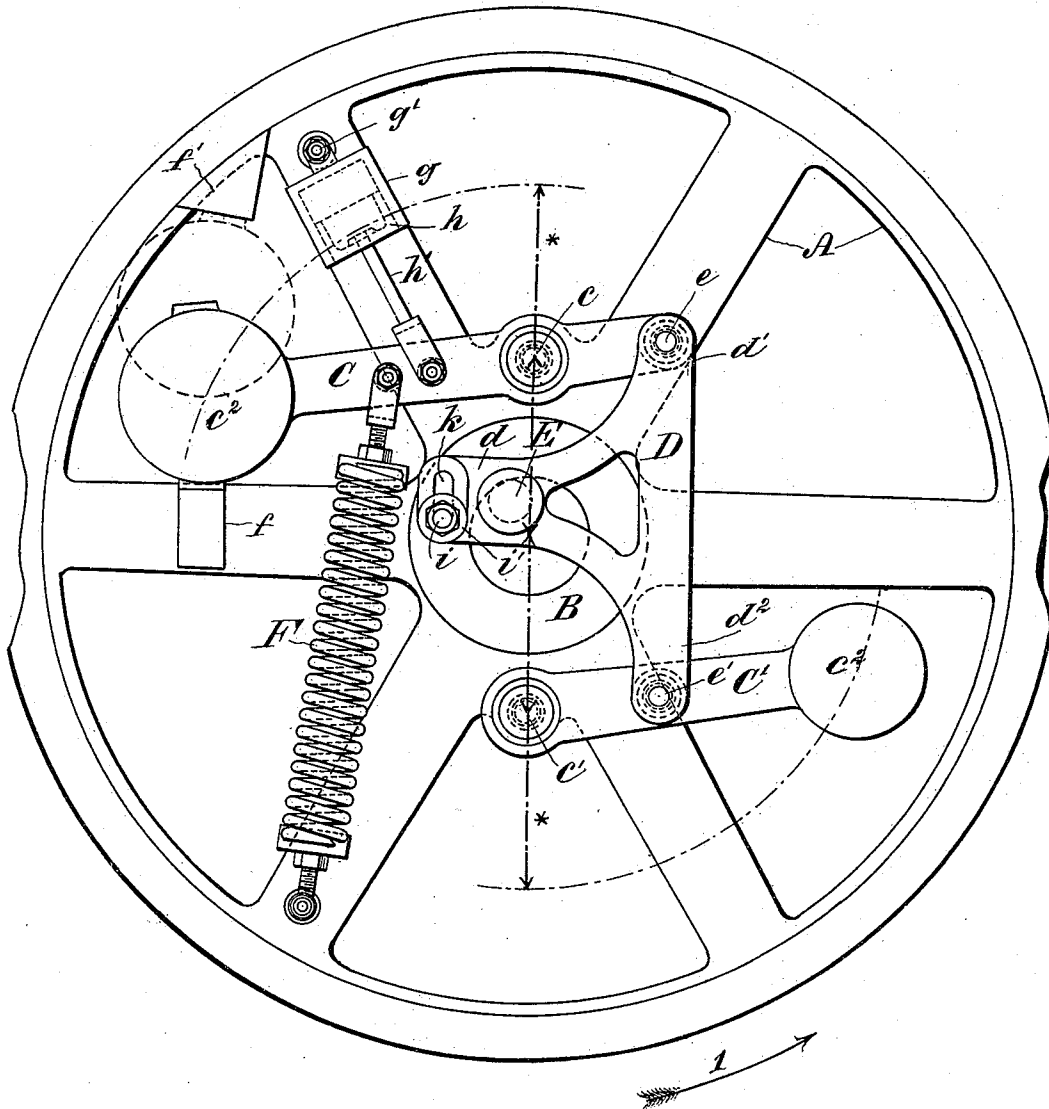
No. 618,431.

Patented Jan. 31, 1899.

H. C. NICHOLS.
GOVERNOR FOR STEAM ENGINES.

(Application filed Jan. 18, 1898.)

(No Model.)



WITNESSES:
Eugene Loewenthal
A. V. Swamy

INVENTOR
Henry C. Nichols.
BY *Wm. H. Appert*
ATTORNEY.

UNITED STATES PATENT OFFICE.

HENRY C. NICHOLS, OF HOPE VALLEY, RHODE ISLAND.

GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 618,431, dated January 31, 1899.

Application filed January 13, 1898. Serial No. 666,499. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. NICHOLS, a citizen of the United States, and a resident of Hope Valley, in the county of Washington and State of Rhode Island, have invented certain new and useful Improvements in Governors for Steam-Engines, of which the following is a specification.

My invention relates to that form of governor which is carried by the fly-wheel of the engine or other suitable carrier, and especially to that form thereof in which its governing action upon the engine is effected by changing the throw of the valve-actuating eccentric or crank, its object being to provide a governor of this class which while simple in construction and sensitive in operation shall avail not only of the centrifugal force engendered by its rotation and of spring action to regulate and equalize the variations in the speed of the engine when they gradually occur, but also of the inertia of the weights or balls and of the momentum stored up therein to effect like results when these variations in one or the other direction occur with greater suddenness.

To these ends the invention consists in the combination of the various parts comprising the governor with a fly-wheel or other suitable carrier and the eccentric for operating the distributing-valve of a steam-engine, all as will hereinafter more fully appear.

Referring to the accompanying drawing, which forms a part of this specification, the single figure illustrates a fly-wheel of ordinary construction in side elevation with my invention applied in connection therewith.

In the drawing, A indicates a fly-wheel, and B a shaft upon which it is mounted. The wheel A may be constructed in any ordinary or preferred form, and the shaft B may be either the main crank-shaft of the engine or a separate shaft geared thereto, so as to rotate in unison therewith, as preferred. As here shown, however, it is the main crank-shaft of the engine, and the fly-wheel A is secured thereto in the required position upon it.

Pivoted by the pivots c and c' to the wheel A on opposite sides of its axis, with their longer arms extending outward from their pivots in the direction of rotation of the wheel, are the levers C and C', each of which

is provided with a weight c^2 , either fixedly or adjustably secured thereto. The lever C is a lever of the first order and has its pivot c arranged intermediate its ends, while the lever C' is of the second order, with its pivot c' disposed at one of its ends, and these two levers are connected by the carrier D, which in the embodiment of the invention shown in the drawing is constructed as a tri-armed plate, with the wrist-pin or eccentric E for actuating the distributing-valve of the engine projecting from the face of its arm d and with the extremities of its other two arms d' and d^2 , respectively, pivoted to the extremity of the lever C and to the lever C' at a point intermediate its length by pivots e and e' . As thus arranged the carrier D is supported by the levers C and C', and in consequence of being pivoted to the extremity of one and at a point intermediate the ends of the other it moves with them and traverses across the shaft B to change the throw of the wrist-pin or eccentric E as such levers are swung outward or inward on their respective pivots.

For acting upon the levers C and C' to draw their free ends inward, with the weights c^2 thereon, toward the axis of the shaft B against the action of centrifugal force and tending to hold them in a withdrawn position I make use of the spiral spring F, which is connected at one of its ends with the lever C intermediate the pivot c and weight c^2 of the latter and at its other to any convenient point of the wheel B—as, for instance, with one of its spokes, as shown. The levers C and C', being thus acted upon by the spring, are maintained at all times in their withdrawn positions except when the speed of rotation of the fly-wheel A exceeds a certain limit, when they are moved outward therefrom by the action of centrifugal force acting upon their weights c^2 , the extent of which movement depends upon the speed at which the fly-wheel is rotated.

For limiting the inward and outward movements of the levers C and C', I make use of the stops f and f' , against one or the other of which the weight c^2 on the lever C contacts as it is moved to its limit in one or the other direction. In practice the stress of the spring F, which is made adjustable as to its resisting force, should be so regulated as to main-

tain a uniform speed with the levers in any position between the limits of their outer and inner movements when the engine or other motor is performing its ordinary work or carrying its usual "load," as it is called, and in order to prevent any sudden throwing out or drawing in of the weights, with their respective levers, by reason of any sudden increase or decrease in the speed of the engine or other motor I sometimes find it convenient to employ a dash-pot in connection therewith; but this is not essential, and such dash-pot may be omitted, if desired. When, however, a dash-pot is employed, any of the well-known forms may be adopted. In the form selected by me for the purpose of illustration it consists of a cylinder *g*, which is pivoted to one of the spokes of the fly-wheel *A* by a pivot *g'* and has loosely fitted to slide in its interior a piston *h*, that is connected with the lever *C* by a connecting-rod *h'*, as shown.

In some instances I find it desirable to support the end of the arm *d* of the carrier *D* from the hub of the fly-wheel *A*, and when so supported I preferably make use of a stud *i*, which, extending outward therefrom, is provided with a reduced outer portion which projects through and upon which slides a slot *k*, formed in the end of such arm, and is provided at its end with a nut *i'*, as shown; but this support is unessential, and such stud may be omitted and the carrier supported alone by the levers *C* and *C'*.

With the parts constructed and arranged as above explained when the fly-wheel *A* is rotated in the direction of the arrow 1 at the required speed the weights *c*², with their supporting levers, will be carried outward by centrifugal force from the position shown in the drawing to a position that will cause the valve to effect the cut-off of the steam from the cylinder at a point that will give the required speed, which position will be retained so long as the speed of rotation of such wheel remains uniform, but will be immediately carried outward by an increase in the centrifugal force imparted to the weights if that speed be accelerated or drawn inward by the stress of the spring *F* if it be retarded. The movements thus imparted to the levers *C* and *C'* will, through the carrier *D*, impart corresponding movements to the valve-actuating wrist-pin or eccentric *E* and the length of time that steam will be admitted to the cylinder at each stroke of the engine thereby shortened or lengthened as the speed of rotation of the fly-wheel is increased or diminished, and thus, through the movements of the levers *C* and *C'* and the wrist-pin or eccentric *E*, the regulation and equalization of the speed of the engine are accomplished when these variations are of gradual occurrence. When, on the other hand, these variations of speed are of sudden occurrence, then, in consequence of the pivots *c* and *c'* of the levers *C* and *C'* being nearer the axis of rotation of the wheel *A* than the centers of the mass of the weight

*c*², as shown by dotted lines, any increase or decrease in the speed of such wheel will in the former case, by reason of the inertia of the weights, force the pivots *c* and *c'* of the levers *C* and *C'* inward between such weights and the axis of the fly-wheel *A*, carrying the weights outward and the wrist-pin or eccentric *E* inward, and thereby shortening the time at which the steam is admitted to the cylinder of the engine, while in the latter case the momentum stored up in the weights *c*² will, when the pivots of the levers are retarded, cause such levers to swing inward thereon and, through the carrier *D*, cause the wrist-pin or eccentric *E* to move outward and correspondingly lengthen the time at which the steam enters the same. It will thus be seen that by the above-described construction not only are the centrifugal force of the weights *c*² and the stress of the spring *F* availed of to effect an equalization of the speed of the engine or other motor when the variations therein are of gradual occurrence, but also of the inertia and momentum of these weights when the variations suddenly occur. Moreover, it will also be seen that as the wrist-pin or eccentric *E* is supported and carried by the levers *C* and *C'* through the intermediary of the carrier *D* the construction of this form of governor is greatly simplified and the various parts thereof brought into substantial gravity balance in all positions of the fly-wheel.

In the drawing I have shown but a single spring *F* employed in connection with the levers *C* and *C'*; but it is obvious that a spring for each of the levers may be employed, if desired, as it is also obvious that various other changes and modifications in the parts may be made without departing from the spirit of my invention.

Having now described my invention and specified certain of the ways in which it is or may be carried into effect, I claim and desire to secure by Letters Patent of the United States—

1. The combination, with a carrier, and a wrist-pin or eccentric, of weighted levers through which the wrist-pin or eccentric is moved pivoted to such carrier with their longer arms extending in the direction of rotation of the carrier, a carrier-plate to which the wrist-pin or eccentric is secured supported by and connecting the said weighted levers, whereby, in addition to the carrying of such carrier-plate by those levers, not only is the wrist-pin or eccentric moved by the centrifugal force of the weights on such levers when the parts are in operation, but also by the inertia and momentum thereof, substantially as described.

2. The combination, with a carrier, and a wrist-pin or eccentric, of a weighted lever of the first order, and a weighted lever of the second order, pivoted to said carrier with their respective longer arms extending in the direction of rotation of such carrier, and a

carrier-plate to which the wrist-pin or eccentric is secured supported by such levers and connected to the end of the shorter arm of the first-mentioned lever and to the second
5 at a point intermediate its ends, whereby, in addition to the carrying of the said carrier-plate thereby, and the movement of the wrist-pin or eccentric in unison therewith, the outward-swinging movement of the longer arms
10 of both of such levers will cause said carrier-

plate to move in one direction, and their inward-swinging movement its travel in the opposite direction, substantially as described.

In testimony whereof I have hereunto set my hand this 12th day of January, 1898.

HENRY C. NICHOLS.

Witnesses:

WM. H. APPLETON,

W. C. FITZ SIMMONS.