

(No Model.)

2 Sheets—Sheet 1.

H. C. NICHOLS.
STEAM ENGINE GOVERNOR.

No. 527,503.

Patented Oct. 16, 1894.

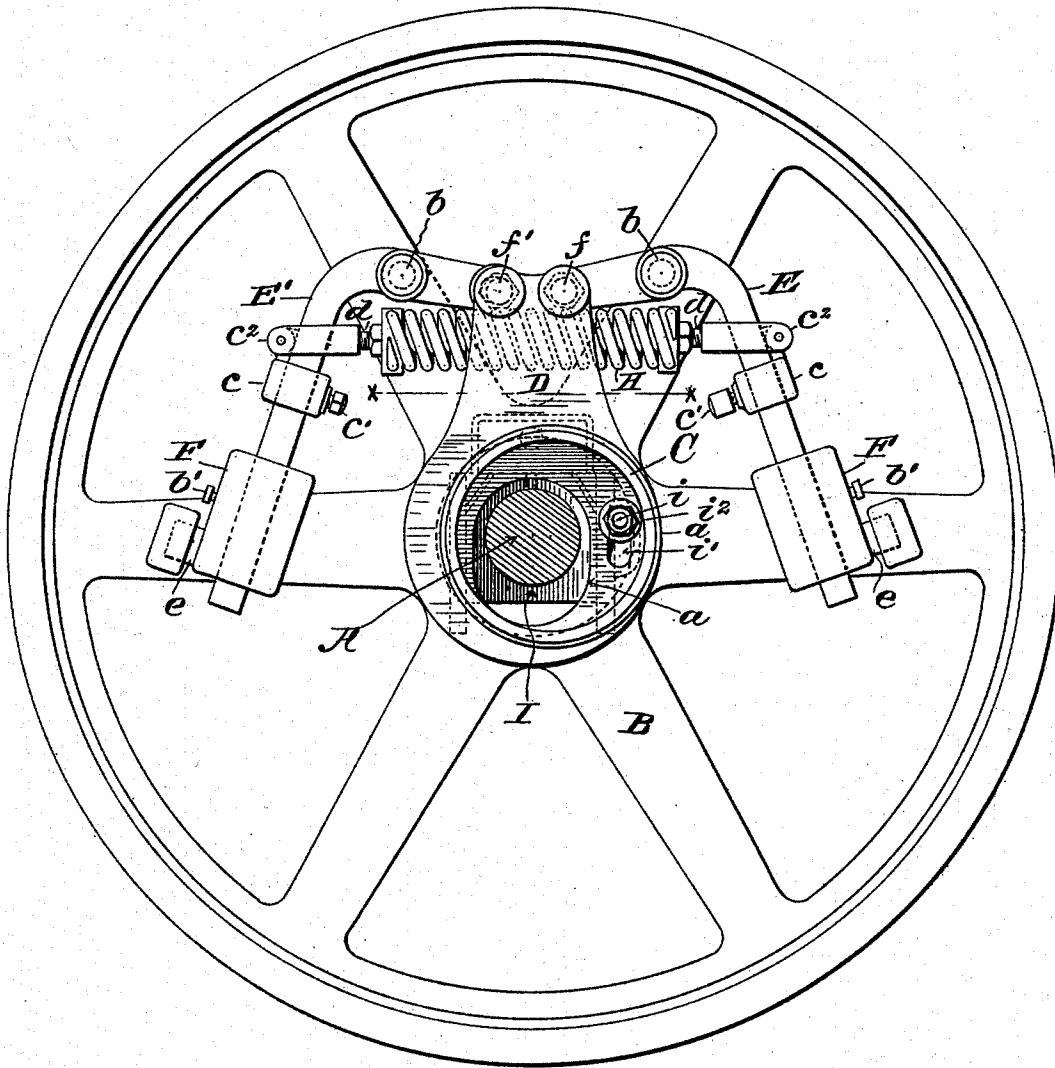


Fig. 1.

Attest
C. W. Benjamin
Wm. E. Trever.

Inventor,
Henry C. Nichols
by Wm. E. Trever.
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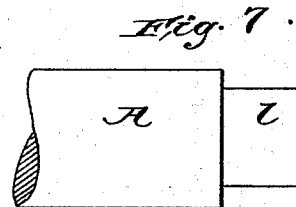
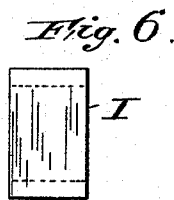
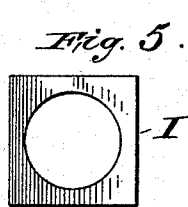
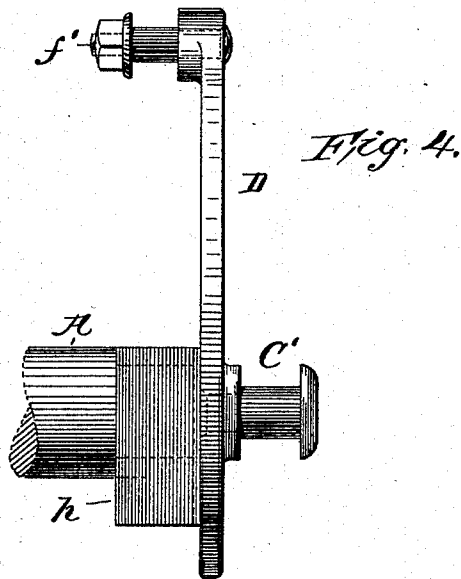
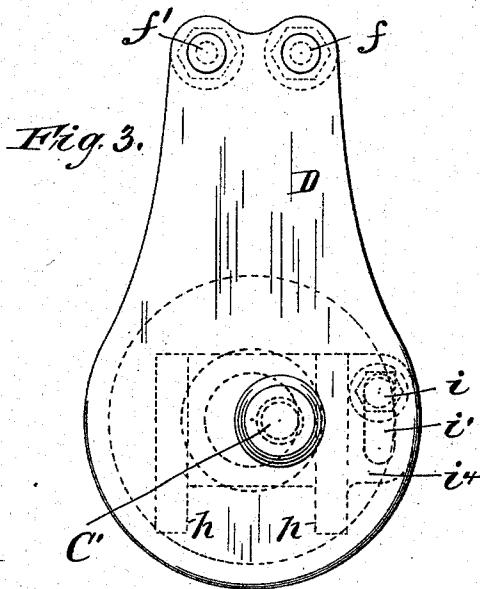
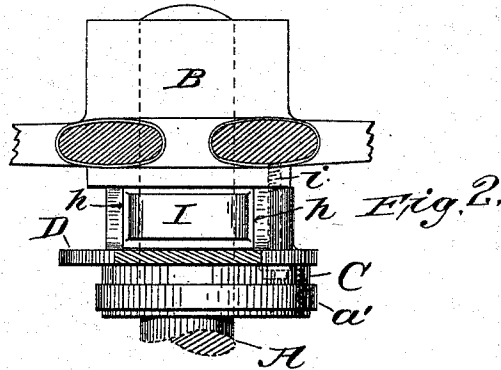
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2 Sheets—Sheet 2.

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Attest:
C. W. Benjamin
Wm. E. Greer.

Inventor:
Henry C. Nichols.
by Wm. E. Greer
att'y

UNITED STATES PATENT OFFICE.

HENRY C. NICHOLS, OF HOPKINTON, RHODE ISLAND.

STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 527,503, dated October 16, 1894.

Application filed February 9, 1894. Serial No. 499,628. (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 Hopkinton, county of Washington, and State of Rhode Island, have invented certain new and useful Improvements in Steam-Engine Governors, of which the following is a specification.

My invention has reference more particularly to that class of steam engine governors which involve in their construction a radially movable eccentric, and effect the equalization of the speed of the engine by changing the amount of throw of such eccentric and thereby the point in the stroke of the piston at which the flow of steam to the cylinder shall be cut off; its object being to provide a governor of this class which, while simple in construction and efficient in operation, shall, at the same time, be extremely sensitive to variations in the speed of the engine.

To the ends thus specified, the invention consists, first, in the means made use of for mounting the movable eccentric whereby, in its movements to vary the throw of the cut off valve, such eccentric is guided in a direct line across the shaft carrying the governor, while yet left free to move around the same as the requirements of the governor mechanism may demand; second, in the means whereby the movable eccentric is guided in its movements across the shaft carrying the governor, while yet left free to move around the same as the exigencies of the governor mechanism may require, and is rotated, and third, in various other constructions and combinations of parts, all as will hereinafter more fully appear.

Referring to the accompanying drawings, which form a part of this specification, Figure 1, is a side elevation and transverse section respectively of a pulley and shaft, with a governor constructed in accordance with my invention applied in connection therewith; Fig. 2, a horizontal section of such parts, taken in the plane xx in Fig. 1 and looking downward; Fig. 3, a side elevation of a slightly modified construction of movable eccentric and carrier, showing also in dotted lines the guide block upon which the eccentric and carrier are guided and the end of the shaft upon which they are mounted; Fig. 4,

an edge view of the parts shown in Fig. 3, looking from the left in that figure; Figs. 5 and 6, a side and edge elevation, respectively, of the guide block upon which the movable eccentric is guided, detached, and Fig. 7, a side elevation of the end of the shaft upon which the form of plate and eccentric shown in Figs. 4 and 5 are mounted.

In the several figures of the drawings, like letters of reference are employed to designate corresponding parts.

A indicates a shaft which is or may be the main crank shaft of a steam engine, and B a pulley secured thereon. Mounted on the shaft A, in close relationship to the pulley B, is the radially movable eccentric C, which is preferably though not necessarily formed upon the side of a plate like carrier, D, near the lower end thereof, and is provided with an elongated aperture, a , where it encircles the shaft, the dimensions of which aperture are such as to prevent the walls thereof from coming into contact with the said shaft as they are moved back and forth over the same in the adjustment of the eccentric to the requirements of the engine. In the construction of this eccentric, I sometimes find it convenient to provide it with a circumferential flange, a' , around its periphery for engagement with a correspondingly shaped groove formed in the interior of the eccentric strap, whereby to hold such strap upon the eccentric when the engine is in operation, but this is not essential, and such flange and groove may be reversed and the flange appear upon the interior of the strap and the groove in the periphery of the pulley, or both may be omitted and other arrangements adopted for accomplishing that result without in any way affecting the scope of my invention.

Jointed directly to the outer end of the eccentric carrier D are the shorter arms of the bell crank lever E E' through which the radially shifting movement of the eccentric is effected. These bell crank levers are pivoted to the pulley B on opposite sides of the eccentric carrier D, by pivots b , and carry on their longer arms weights F F', which are or may be held in adjusted position thereon by screws b' or other equivalent means, the object and purpose of such weights being to move the eccentric in one direction as they

are thrown outward under the influences of centrifugal force when the pulley B is in rotation.

In the construction of the bell crank levers 5 and weights, they are preferably though not necessarily so proportioned as to make them approximately balance the eccentric C and carrier D, when such levers and weights are thrown outward into the positions shown in 10 Fig. 1; and as they are arranged on opposite sides of the carrier, it is obvious that this balancing of the parts is maintained in all the positions to which they may be carried by the rotation of the pulley B.

15 To overcome the centrifugal force engendered in the bell crank levers and weights by the rotation of such parts with the pulley B, when their speed of rotation is reduced below a certain limit, and thereby move the eccentric and its carrier in a direction opposite 20 to that imparted to them by that force, the spring H is employed, which extends across from one bell crank lever to the other and has its ends connected thereto by suitable clips. These clips may be constructed in various forms. In the preferred form of construction however, they are made with a sleeve-like member, *c*, which is adapted to be 25 adjusted along the lever and secured thereto at the desired point by a binding screw, *c'*, and also with a second member, *c''*, which, pivoted to the outer edge of the first, is provided with a suitable opening through it for the passage and movement of the lever, 30 and receives in a suitable threaded orifice formed in its inner face, a screw rod *d*, to which is fixedly secured one end of said spring. By these means provision is made 35 for adjusting not only the points where the spring connects with the levers, but the tension of the spring as well. As the parts are thus constructed and arranged, the movement of the eccentric in one or the other of the directions required to equalize the speed 40 of the engine, when in operation, is effected by the conjoint action of the bell crank levers, the weights, and the spring H. When the speed of the engine is at the required height, the bell crank levers with their weights 45 F F', will be thrown outward by centrifugal force to near their outermost limit and the eccentric with its carrier, moved into substantially the positions illustrated in Fig. 1. In these positions, such parts will remain so 50 long as the engine is operating at the required speed, but the moment that the speed increases or diminishes the bell crank levers with their weights will be either thrown outward under the influences of the increased 55 centrifugal force, or drawn inward under the stress of the spring H, moving the eccentric and its carrier in one or the other direction across the shaft A, and thereby hastening or deferring the cut off of the steam to the cylinder 60 to an earlier or later period in the stroke of the piston, as the requirements of the engine demand a diminution or increase in the

speed thereof. When the engine is at rest the bell crank levers, with the weights F F' carried thereon, will be drawn inward until 70 they are in contact with, or nearly in contact with, the hub of the pulley B, but when it is operating at its full speed they will be carried outward until the levers nearly contact with the stops *e* secured to the arms of the pulley 75 B, in which position they will remain so long as the engine is operated at that speed.

The inner ends of the short arms of the bell crank levers being both jointed to the outer end of the eccentric carrier D, it is obvious 80 that, as those ends describe arcs of circles in their movements that curve outwardly from each other, they could not co-operate with such carrier to move it back and forth over the shaft, if provisions were not made for allowing of a slight lateral translation of one 85 of these arms with respect to the carrier as the former moves around the axis of pivot *b*. In order therefore to allow of this movement, the bell crank lever E, while jointed to the 90 eccentric carrier by a pivot *f* that is fitted to work closely in a hole formed in such carrier, the pivot *f'* of the bell crank lever E' works in an elongated orifice formed therein. As a result of this construction and arrangement 95 of parts, the eccentric carrier D, and with it the eccentric C, are not only moved laterally of the shaft A, by the levers E E', but they also partake of the curvilinear movement of the inner end of the lever E, and thereby receive a slight oscillatory movement around 100 said shaft, the pivot *f'* in the joint of the lever E' sliding in the elongated orifice formed in the carrier D permitting of this movement taking place. 105

To properly hold and guide the eccentric with respect to the shaft A when the movements above explained take place, I provide the eccentric carrier D with a guide way, *h*, on its back, which receives and slides upon 110 a guide block, I, (see Figs. 5 and 6) that is loosely mounted upon the said shaft, in such a manner as to permit of its easy oscillation thereon, and the rotation of the latter therein. In the construction of this guide block it 115 may, in some cases, be made in one piece, as shown in said figures, in which case its dimensions will be such that the sides thereof will accurately fit within the guide way *h*. In other cases it may be made in a plurality 120 of parts, and the guide way in which it slides provided with a gib, the adjustment of which in the guide way to take up any wear that may have been occasioned between those 125 parts being effected by setting out one or the other of such parts. Either of these constructions of block may be adopted as may be desired or as the exigencies of the particular service of the engine may demand. I prefer 130 however to make it of a single piece as greater simplicity of parts are attained and the liability of derangement thereby obviated. By this arrangement of parts, as will be seen, not only are the eccentric and its carrier

guided in a direct line across the shaft, when a lateral or radial translation of these parts are required, but, in consequence of the capability of the block I to oscillate upon such shaft, the oscillatory movements of the eccentric and its carrier occasioned by the movements of the short arm of the bell crank lever E, permitted as well, and this too around the axis of the shaft A, which remains a permanent center of oscillation no matter in what positions the eccentric and its carrier are moved by the bell crank levers E E'.

The eccentric with its carrier and the guide block I, being loosely mounted on the shaft A, might in some cases move along such shaft if no provisions were made for preventing it and the parts thus mentioned, with the valve rod and connection, thrown out of alignment. To obviate this, I make use of a stud, i , which, secured in the hub of the pulley B, extends through a slot, i' , formed through the eccentric carrier D, and receives on its outer end a nut, i^2 . In the formation of this slot, the length and breadth thereof are made sufficiently great as to permit of it moving radially over the stud i as the eccentric and carrier are moved by the bell crank levers E E'; and the nut i^2 , instead of binding the eccentric carrier tightly against the hub of the pulley B, will be screwed firmly up against a shoulder formed on the stud, without exerting any pressure on the carrier which will be free to move thereunder.

In Figs. 3 and 4, there is shown a slightly modified form of eccentric and a slightly different mounting of the eccentric with its carrier and the guide block upon the shaft. In this construction, the eccentric carrier D provided with the guide way h , and the guide block I, are or may be the same as those illustrated in the preceding figures, but instead of the eccentric being made of a diameter sufficiently great to embrace the shaft A, it is constructed in the form of a wrist-pin, C', of smaller diameter, and, with its carrier and the guide block I, is mounted upon the end of said shaft which is preferably reduced in diameter for that purpose, as illustrated at l in Fig. 7. Although made of smaller diameter, the eccentricity of this wrist-pin C' with respect to the axis of the shaft A, is or may be the same as that of the eccentric C shown in Figs. 1 and 2, and its operation, and movement with respect to the shaft A, will be the same as that of the eccentric C in the last mentioned figures. Again, while the slot i^2 , for the reception of the stud i which holds the wrist-pin with its carrier and the guide block, back on the reduced portion of the shaft A, may be made through the carrier D as in the construction shown in Figs. 1 and 2. It is preferred however with this construction to form it through an ear i^4 , secured to the side of one of the walls of the guide way h , as clearly illustrated in dotted lines in Figs. 3 and 4.

With the constructions above set forth, a

governor for high speed and other engines is produced in which the movable eccentric is not only guided in its movements in a direct line across its supporting shaft, while yet left free to oscillate with its guide block upon said shaft as a permanent center of oscillation, but is also rotated from the pulley B, through the bell crank lever E E', without any strain or binding action upon the guide way and guiding block, and the use of connecting rods between the bell crank levers and the eccentric carrier thereby obviated. As a result of this, greater sensitiveness in the operation of the governor is attained, while, in dispensing with the connections between the bell crank levers and the eccentric carrier, the points of wear are reduced to the minimum.

Although in the foregoing the best means contemplated for carrying the invention into practice has been described, it is to be understood that the same may be modified in various ways and still be within the scope of the invention.

Having now described the invention and specified certain of the ways in which it is or may be carried into effect, what is claimed as new, and for which Letters Patent of the United States is desired, is—

1. The combination, with an eccentric adapted to receive an eccentric strap and provided with guides, a shaft, and devices for moving the eccentric laterally of such shaft, of devices for engaging with said guides whereby to guide said eccentric in a direct line across the shaft while permitting of an oscillatory movement on such shaft, substantially as described.

2. The combination, with an eccentric adapted to receive an eccentric strap and provided with guides, a shaft, and devices for moving the eccentric laterally of such shaft, of a guide block loosely mounted on said shaft for co-operation with the guide whereby to guide the eccentric in a direct line across the shaft while permitting of an oscillatory movement on such shaft, substantially as described.

3. The combination, with an eccentric provided with guides, a shaft, and levers for moving the eccentric radially of such shaft, of a guide block loosely mounted on the shaft and co-operating with the guides on the eccentric, for guiding such eccentric in a direct line across said shaft while permitting it to oscillate about the same as the exigencies of the levers may require, and weights and a spring for co-operation with the levers, substantially as described.

4. The combination, with an eccentric provided with guides on its back, a shaft upon which it is mounted, bell crank levers provided with weights, and a spring, of a guide block loosely mounted on said shaft and co-operating with the guides on the eccentric whereby to guide such eccentric in a direct line across the shaft while permitting of its oscil-

lation thereon, as the requirements of one of the bell crank levers in its movements may demand, substantially as described.

5 The combination, with an eccentric, a carrier therefor provided with guides upon its back, a shaft upon which such eccentric and carrier are mounted, bell crank levers jointed at one of their ends directly to the outer end of said carrier and provided on
10 their other ends with weights, and a spring for co-operating with the bell crank levers, of a guide block loosely mounted on the shaft and engaging with the guides on the carrier whereby the rotation of the eccentric is ef-
15 fected from the bell crank levers, and its lateral movement guided in a direct line across the shaft while free to oscillate around the same, as the requirements of one of said bell crank levers may demand, substantially as
20 described.

6. The combination, with the bell crank levers EE', and the spring H, extending between

them, of the clips composed of members c c^2 jointed together, the screw threaded rods to which the ends of the spring H are secured, 25 and the binding screws c' , substantially as described.

7. A clip composed of two members c c^2 pivoted together, a binding screw, c' , and means in the inner face of the member c^2 30 whereby to connect it with a rod or bar, substantially as described.

8. The combination, with an eccentric C, and its carrier provided with the guide way h and with the slot i' , of the pulley B, and 35 stud i provided with a nut on its outer end, substantially as described.

In testimony whereof I have hereunto set my hand this 1st day of February, 1894.

HENRY C. NICHOLS.

Witnesses:

S. L. TRIPPE,

WM. E. TREFOER.