

No. 646,237.

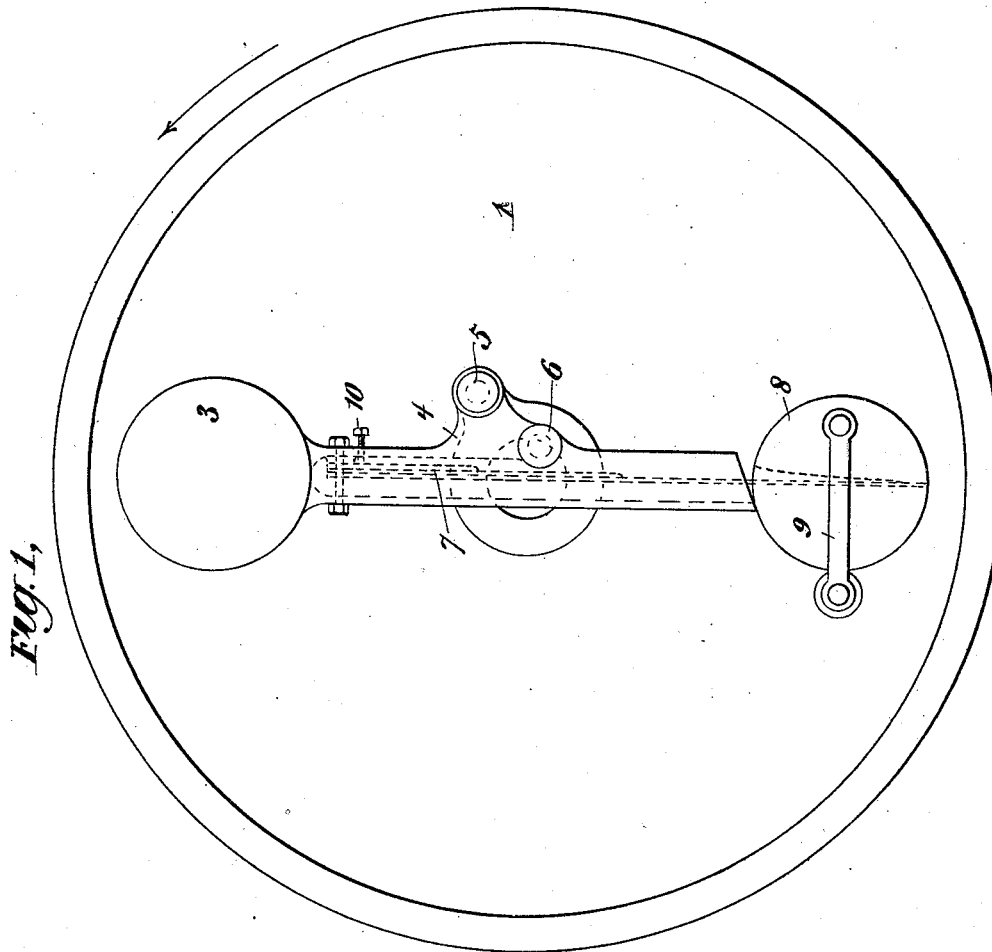
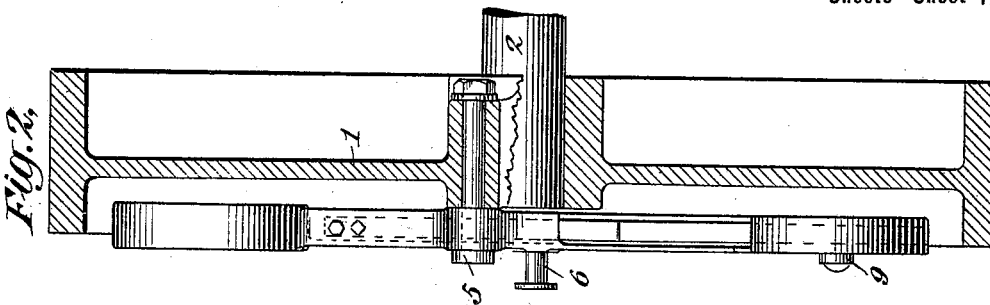
Patented Mar. 27, 1900.

F. M. RITES.
GOVERNOR.

(Application filed Apr. 1, 1898. Renewed Dec. 21, 1899.)

(No Model.)

4 Sheets—Sheet 1.



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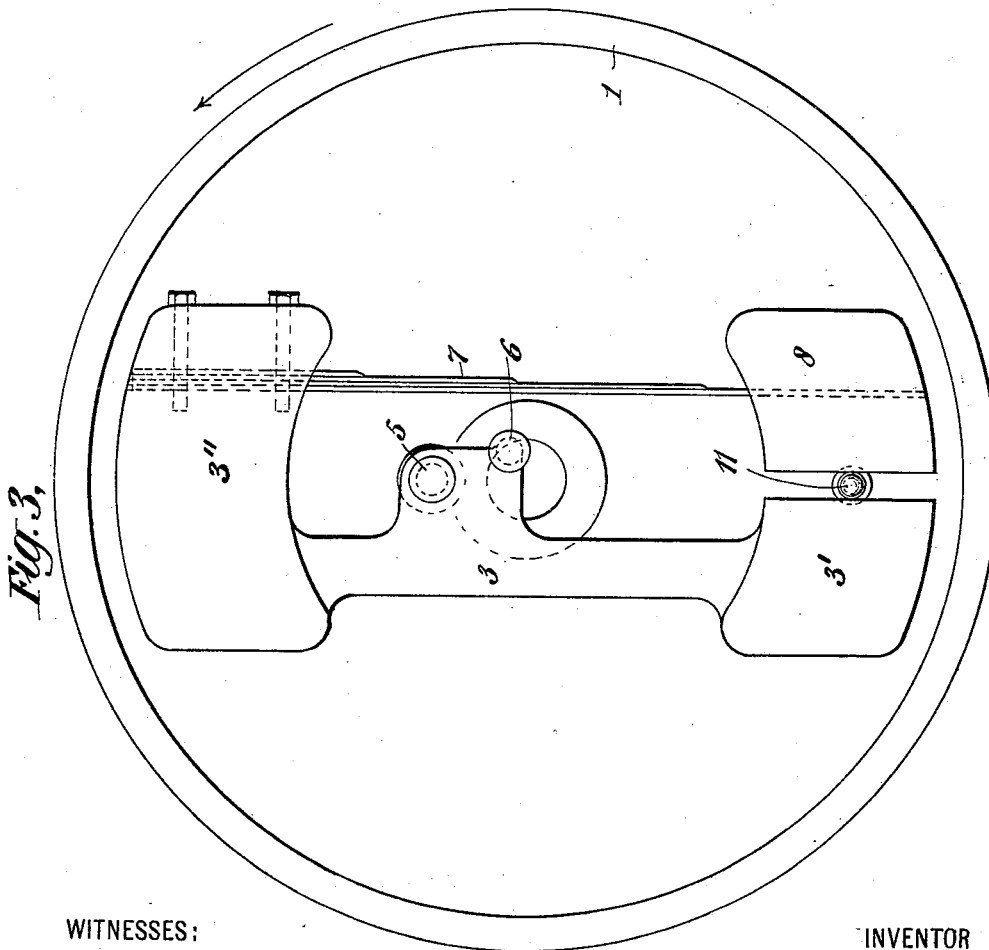
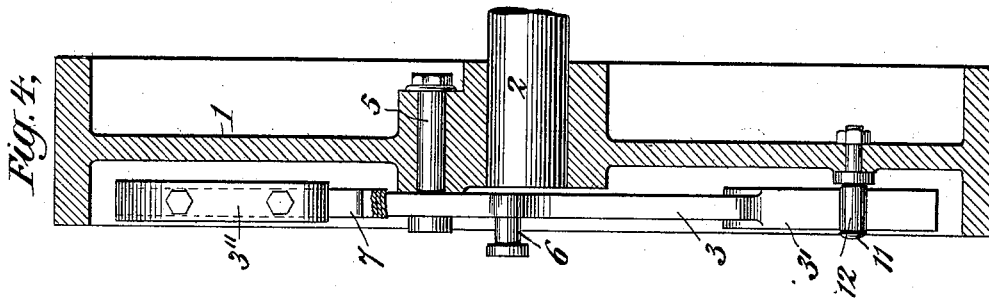
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(No Model.)

4 Sheets—Sheet 2.



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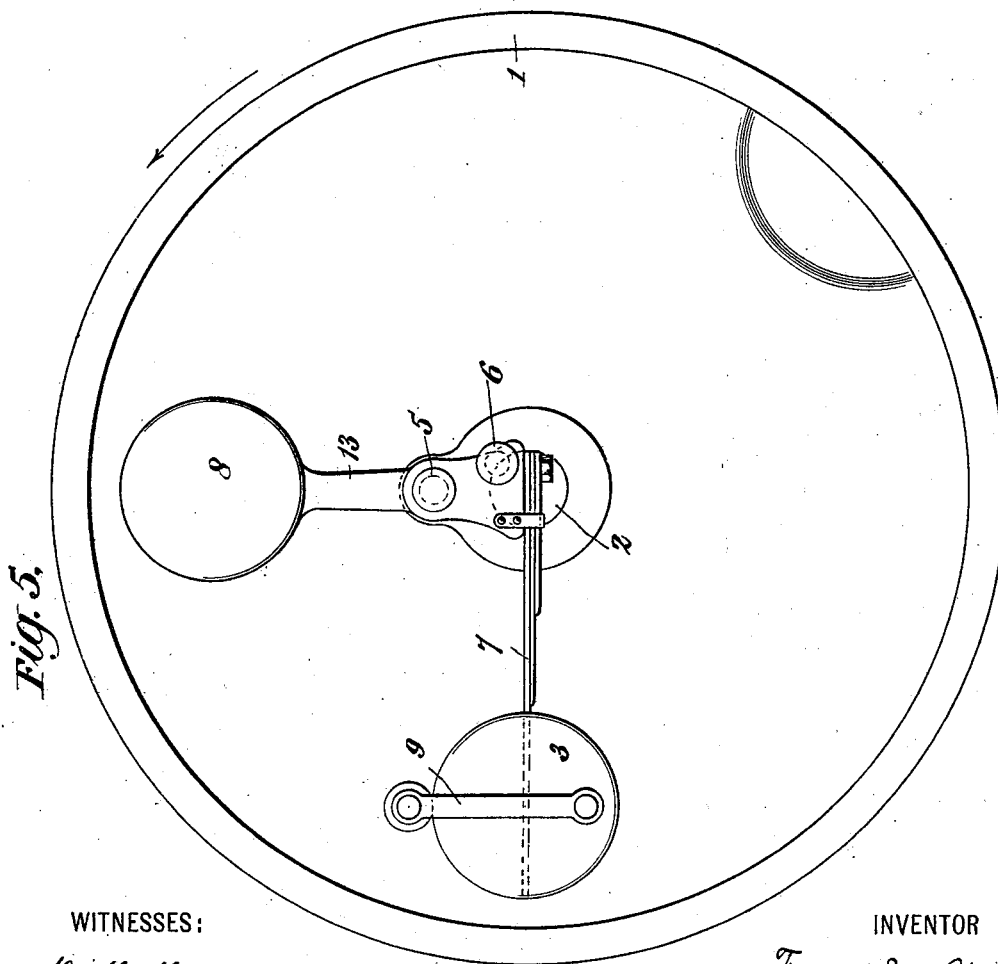
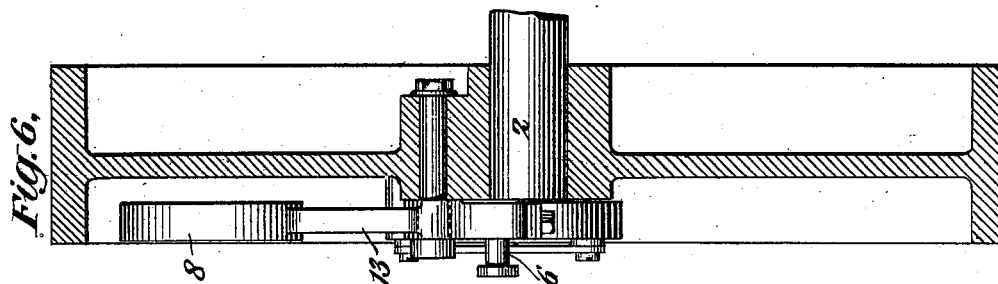
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4 Sheets—Sheet 3.



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4 Sheets—Sheet 4.

Fig. 8.

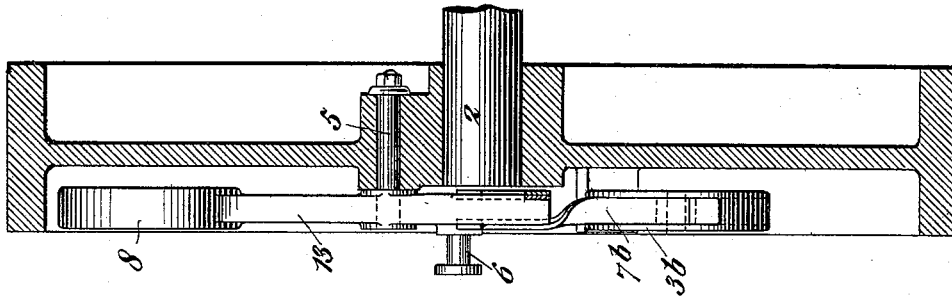
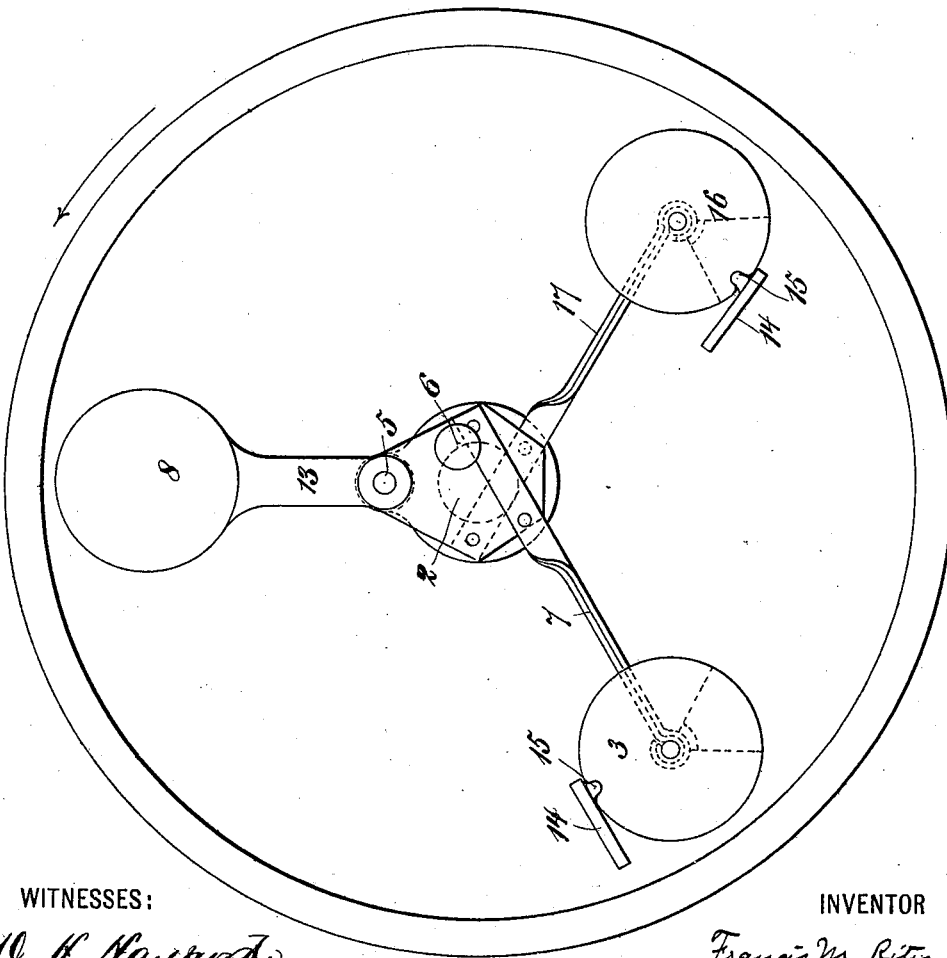


Fig. 7.



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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF ITHACA, NEW YORK.

GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 646,237, dated March 27, 1900.

Application filed April 1, 1898. Renewed December 21, 1899. Serial No. 741,188. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, a citizen of the United States, residing at Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Governors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in governors, and particularly to governors of that class known as "fly-wheel" or "automatic cut-off" governors, though the governor herein described may be adapted for the regulation of a throttle-valve or the tripping-gear of a Corliss engine or any other device for the operation of which governors are employed.

My invention consists in the novel construction of the governor by which a weight structure supported from a single pivot-pin and yet balanced as to gravity about said pivot is produced, in the novel combination of weights and a governor-spring, all supported from a single pivot and so arranged that by their movements relative to each other when the fly-wheel is revolved the weights distort the spring, so as to cause the same to return the parts to their initial positions when the revolution of the fly-wheel ceases, and in the novel combination, construction, and arrangement of the parts.

The objects of my invention are, first, to provide a governor the weight structure of which shall be supported from a single pivot or equivalent device and shall be more perfectly balanced as to gravity than former single-pivot governors; second, to provide a governor possessing the above advantages and so constructed as to embody to a high degree in its action inertia force as well as centrifugal force, so that prompt adjustment of the governor for changes in speed or load shall be assured, and, third, to so construct and arrange the parts of the governor that it shall be strong, simple, not liable to derangement, and comparatively inexpensive. These objects are attained in the governor herein described and illustrated in the drawings which accompany and form a part of this specification, in which the same reference-numerals

indicate the same or corresponding parts, and in which—

Figure 1 is an elevation, and Fig. 2 a transverse section, of one form of governor embodying my invention. Fig. 3 is an elevation, and Fig. 4 a transverse section, of a governor similar to that shown in Figs. 1 and 2, but having its parts constructed and arranged somewhat differently. Fig. 5 is an elevation, and Fig. 6 a transverse section, of another form of governor embodying my invention, in which two weights are employed, one of which is a pure inertia weight and the other a pure centrifugal weight; and Fig. 7 is an elevation, and Fig. 8 a transverse section, of still another form of governor embodying my invention.

The governors herein described all contain a primary weight, which in some of the forms of governor is purely a centrifugal weight and in other forms has both centrifugal and inertia action and which directly affects the adjustment of the eccentric or other actuating member of the governor to correspond to any changes of speed or load and, a secondary weight connected to the primary weight by a spring and which coöperates with the primary weight in the adjustment of the eccentric or other actuating member, but the principal function of which is to produce, together with the primary weight, a distortion of the connecting-spring, so as to offer resistance to movement of the weights and to cause their return to their normal or initial positions. One of the weights is supported by the spring connecting the weights. This spring is preferably what is known as a "flat" or "leaf" spring, but which may be termed more generically, with reference to its manner of action, a "flexure" spring.

Referring now to the drawings, and first of all to Figs. 1 and 2, 1 is the fly-wheel or carrier, arranged to rotate with a shaft 2. 3 is the primary weight. In this form of governor it is secured to or formed integrally with an arm or lever 4, mounted on the fly-wheel 1, by means of a pivot-pin 5, and carrying an actuating device 6 for operating the mechanism which the governor is intended to operate. The particular actuating device shown is an ordinary eccentric-pin 6 for operating an engine slide-valve. The arm 4 has an internal

channel within which at a point in close proximity to the primary weight is secured one end of the leaf-spring 7. Except at its extreme end the spring is free to move laterally under flexure stress within the channel. The outer end of the spring projects beyond the arm 4 and has secured to it a secondary weight 8. The spring 7 serves as a means for supporting the weight 8 and for connecting it to the primary weight 3. The effect of centrifugal force upon the weight 3 is to cause it to move, relatively to the fly-wheel, in the arc of the circle of which the pivot 5 is the center, moving to the right of Fig. 1 if the rotation be in the direction indicated. In order that the spring 7 may be put under stress so as to resist this motion of the weight 3 and tend to restore the parts to their normal or initial positions, it is necessary that the weight 8 shall be restrained in its movement, so that it shall not be free to move with the arm 4 about the pivot 5 as a center, but must move in some other direction. This is effected by a link 9, preferably pivotally connected to the weight at a point not coincident with its center of gravity, and also pivotally connected to the fly-wheel or carrier 1. This link prevents circumferential movement relatively to the fly-wheel and permits radial movement thereof. The length of the arm 4 is such that it just touches the weight 8, and the shape of its end is such that as the weight moves in the manner hereinafter described it rolls upon the end of the arm 4. The purpose of this is to prevent buckling of the spring when the parts are in the opposite position to that shown in the drawings with the weight 8 uppermost. A screw 10 is provided for adjusting the force exerted by the spring 7. The operation of this form of governor is as follows: When the carrier 1 is revolved in the direction of the arrow, the weight 3 moves to the right of Fig. 1, relatively to the fly-wheel, in the arc of a circle of which the pivot 5 is the center. This movement is due to centrifugal force or to the combined effect of centrifugal force and inertia, the effect of inertia being very marked if the change in speed be at all sudden. The weight 8 tends to fly outward toward the rim of the wheel under the influence of centrifugal force and the centrifugal force thereby generated is transmitted to the weight 3 through the spring 7. The weight 8 is of less mass than the weight 3, and hence does not entirely neutralize the effect of centrifugal force upon the weight 3; but the effect of the action of centrifugal force upon the weight 8 and of the movement of the weight 3 about the pivot 5 is to produce flexure of the spring 7 within the channel of the arm 4, the weight 8 rolling upon the end of the arm 4. Being flexed in this manner, the spring 7 tends to return the weights to their normal position, and hence resists the action of centrifugal force upon the governor. The effect of the movement of the arm 4 upon the eccentric 6 is to move the eccentric toward the center of the shaft, thus

decreasing the amount of valve travel. This governor is extremely sensitive to inertia action, since the secondary weight 8, not being subject to inertia action, cannot act as a drag upon the inertia action of the primary weight 3. It will be noted that in this governor the function of the secondary weight 8 is, by cooperation with the primary weight, to cause flexure of the spring 7 and also to balance the primary weight about the pivot 5. In all positions of the parts the two weights are so nearly opposite to each other that, taking into consideration the longer lever-arm of the weight 8, the governor is balanced almost perfectly for gravity, while both the weights are supported from the single pivot 5. The link 9 does not act to support the weight 8, except for an instant when the center of gravity of the weight is directly in line with the two pivots of said link, but merely to limit the movement of the weight, so that it shall be acted upon by centrifugal force only. Therefore a moderate degree of friction at the bearings at the ends of the link 9 has comparatively little effect upon the governor, and for all practical purposes the governor may be considered to be a single-pivot governor.

In the form of governor shown in Figs. 3 and 4 the primary weight 3 consists of an arm connected by a pivot 5 to the fly-wheel or carrier 1, and having at one end a centrifugal and inertia weight 3' and at the other end an inertia-weight 3'', the mass of which is so disposed that it is not influenced by centrifugal force. All of the parts of the weight may be integrally formed or rigidly connected, as they have no movement relative to one another. The secondary weight is a centrifugal weight 8, supported from and connected to the inertia-weight 3'' by a leaf-spring 7. The weight 8 is restrained from circumferential motion relatively to the fly-wheel by a guide-pin 11. When the fly-wheel 1 is rotated in the direction of the arrow, the primary weight 3 swings about the pivot 5 as a center, the weight 3 moving away from the pin 11. This motion is assisted by the centrifugal force exerted by the weight 8 and transmitted through the spring 7 to the inertia-weight 3''. It is also assisted by inertia action of the weight 3' if the change in speed be rapid. This motion of the weight 3 bends the spring 7 so that said spring resists the motion of the weight 3 away from the pin 11 and tends to return it to its original position. The spring 7 also presses the secondary weight 8 against the pin 11, so that there is no need of a link, such as the link 9 of Fig. 1, to prevent circumferential motion of the weight 8, any tendency to circumferential motion being more than overcome by the pressure of the spring 7. In this governor, as in the form of governor shown in Figs. 1 and 2, the parts are so disposed as to insure substantially-perfect balancing as to gravity in all positions of the parts. The pin 11 may be provided with a friction-roller 12.

In the form of governor shown in Figs. 5 and 6 the primary weight is a pure centrifugal weight and is supported by the governor-spring from the secondary weight, which is pivoted to the fly-wheel, in this respect the governor being the reverse of the governors shown in Figs. 1 to 4, inclusive. 3 is the primary weight, and 8 the secondary weight. The primary and secondary weights are not approximately diametrically opposite to each other, but are only about ninety degrees distant from each other. The governor-spring 7 is at right angles to the arm 13, by which the weight 8 is pivoted to the fly-wheel. The weight 3 is provided with a link 9, which prevents motion of the weight in a circumferential direction relative to the fly-wheel. In this governor the primary weight is a pure centrifugal weight and the inertia-weight is a pure inertia-weight, since in its normal position—namely, the position shown in Fig. 5—its center of gravity is directly in a radial line from the center of the shaft 2, and it can never depart sufficiently from such position to be materially affected by centrifugal force. The operation of this governor is as follows: When the fly-wheel rotates, the weight 3 tends to fly outward, in so doing moving the weight 8 somewhat to the right of the position shown in Fig. 5 relatively to the fly-wheel and also revolving somewhat about the pin which connects it to the link 9, thus flexing the spring 7. This spring 7 therefore tends to return the parts to their normal position. The weight 8 by its inertia action at times when changes of speed occur coöperates with the centrifugal weight 3 in adjusting the position of the eccentric 6. This form of governor is perfectly balanced as to gravity. In the position shown in Fig. 5 the weight 3 is supported by the link 9, its center of gravity being directly below the point at which the link 9 is connected to the fly-wheel. In any other position except the opposite position the weight 3 tends to tip to one side or to the other, but in so doing it must move the weight 8 in such manner as to directly counteract its own tendency to fall. In this governor the weights 3 and 8 may be of the same mass. The fly-wheel should be provided with a counterbalance, since the center of gravity of the weight structure is much to one side of the center of rotation.

In the form of governor shown in Figs. 7 and 8 the secondary weight 8 is pivoted to the fly-wheel and is a pure inertia-weight, being affected by centrifugal force only when it is moved from its normal position, and then but slightly affected. The primary weight 3 is supported by the spring 7, attached to the arm 13. Instead of limiting the motion of the primary weight 8 by means of a link 9 it is shaped to roll along a guide 14, which is provided with a projection 15 similar to the tooth of a gear-wheel and engaging a suitable recess in the weight 3, which prevents slipping of the weight and forces it to roll along

the guide. Motion of the weight 3 away from the center of the shaft causes the secondary weight 8 to move out of its normal position, thereby carrying the eccentric closer to the center of the shaft and flexing the spring 7. The spring therefore resists the action of centrifugal force on the weight 3. The centrifugal force of the weight 3 is also resisted by another secondary weight 16, similar to weight 3, arranged to roll along a guide 14 and connected to the arm 13 of the weight 8 by a spring 17. Weights 3 and 16 are of the same mass; but the center of gravity of weight 3 is more distant from the guide of said weight than is the center of gravity of weight 16 from its guide. Hence centrifugal force acts more effectively on weight 3 than on weight 16. The connections between weights 3 and 16 and the ends of their springs are pivotal connections.

In another application for Letters Patent for improvements in governors, filed March 8, 1898, I have illustrated, described, and claimed a governor in which the position of an eccentric or other actuating device is adjusted by means of weights rolling upon guides carried by a revoluble fly-wheel or carrier under the influence of centrifugal force and inertia. I do not claim in this application, therefore, the use of rolling weights for adjusting an eccentric or other actuating device.

In an application for Letters Patent filed February 6, 1899, Serial No. 704,670, I have claimed, broadly, the combination, with a revoluble carrier or fly-wheel, of spring-connected weights having in common means for supporting them from the carrier and for resisting movement of the weights due to revolution of the carrier and an eccentric or other actuating device adjusted by the movement of said weights. In the said application I have also illustrated, described, and claimed governors having spring-connected weights supported from a carrier by a spring, which likewise serves to resist movement of the weights due to revolution of the carrier. I do not claim such inventions broadly herein, therefore, but only the combination, with the carrier, of a weight structure comprising spring-connected weights connected to the carrier by a pivot or other equivalent device other than a spring.

It is obvious that in all of these forms of governors the eccentric instead of being carried by the weight structure may be connected to the weight structure by a link, as is the case in many governors known in the art.

Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a governor, the combination, with a revoluble carrier, of a weight structure containing spring-connected primary and secondary weights mounted upon the carrier by a single pivot, and which when the carrier is revolved, or its speed changed, move with

respect to each other and the pivot, inducing spring action tending to return the weight structure and the parts thereof to their initial positions, and an actuating member for operating a valve or other device, adjusted by the movement of the weight structure, substantially as described.

2. In a governor, the combination, with a revoluble carrier of a weight structure containing a primary weight, a secondary weight, and a spring connecting said weights, all mounted upon the carrier by a single pivot, the parts being so proportioned and arranged that when the carrier is revolved, or its speed changed, the weights move with respect to each other and to the pivot, thereby inducing spring action tending to restore the weight structure and the parts thereof to their initial positions, and an actuating member for operating a valve or other device, adjusted by the movement of the weight structure, substantially as described.

3. In a governor, the combination, with a revoluble carrier, of a weight structure containing a primary weight, a secondary weight, and a flexure-spring connecting said weights, all mounted upon the carrier by a single pivot, means for confining one of the weights to motion in a direction other than about said pivot, thereby causing flexure of the spring when the carrier is revolved, and an actuating member for operating a valve or other device, adjusted by the movement of the weight structure, substantially as described.

4. In a governor, the combination, with a revoluble carrier, of a weight structure containing a primary weight, a secondary weight, and a flexure-spring connecting said weights, all mounted upon the carrier by a single pivot, means for confining one of the weights to movement in a substantially-radial direction, thereby causing flexure of the spring when the carrier is revolved, and an actuating member for operating a valve or other device, adjusted by the movement of the weight structure, substantially as described.

5. In a governor, the combination, with a revoluble carrier, of a primary centrifugal and inertia weight, pivoted to the carrier, a flexure-spring secured to said primary weight, a secondary weight likewise secured to said spring and supported thereby from the primary weight, means for confining said secondary weight to motion in a direction other than about the pivot of the primary weight, and an actuating member for operating a valve or other device, adjusted by the movement of the weights, substantially as described.

6. In a governor, the combination, with a revoluble carrier, of a primary centrifugal and inertia weight, pivoted to the carrier, a flex-

ure-spring secured to said primary weight, a secondary weight likewise secured to said spring and supported thereby from the primary weight, means for confining the secondary weight to motion in a substantially-radial direction, and an actuating member for operating a valve or other device, adjusted by the movement of the weights, substantially as described.

7. In a governor, the combination, with a revoluble carrier, of a primary centrifugal and inertia weight pivoted to the carrier, a flexure-spring secured at one end to said primary weight and having secured to its other end a secondary weight which is substantially opposite the primary weight and balances the same as to gravity about the pivot, means for confining the secondary weight to motion in a radial direction, and an actuating member for operating a valve or other device, adjusted by the movement of the weights, substantially as described.

8. In a governor, the combination, with a revoluble carrier, of a primary centrifugal and inertia weight pivoted to the carrier and having a channeled arm or extension, a flexure-spring within said channel and projecting from the end thereof, secured to the arm at the inner end of said channel and having secured to its outer end a secondary weight, substantially opposite the primary weight and which balances the same as to gravity about the pivot and rests upon the end of the arm of the primary weight, said arm being shaped to permit the secondary weight to roll thereon, a link pivoted to the secondary weight and to the carrier, and restricting the secondary weight to motion in a substantially-radial direction, and an actuating member for operating a valve or other device, adjusted by the movement of the weights, substantially as described.

9. In a governor, the combination, with a revoluble carrier, of a weight structure containing spring-connected primary and secondary weights mounted upon the carrier by a single pivot or equivalent device, and which when the carrier is revolved, or its speed changed, move with respect to the carrier and the pivot, inducing spring action tending to return the weight structure and the parts thereof to their initial positions, and a shifting eccentric adjusted by the movement of the weight structure, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS M. RITES.

Witnesses:

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