No. 646,314. Patented Mar. 27, 1900.

F. M. RITES.

GOVERNOR.

(Application filed Feb. 6, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 2.

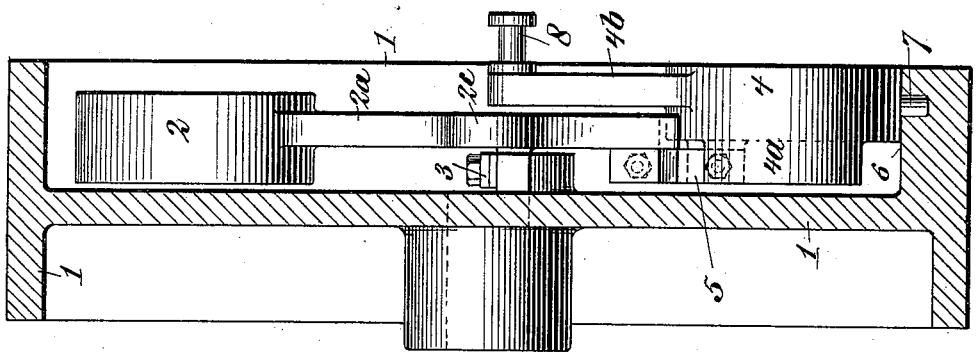
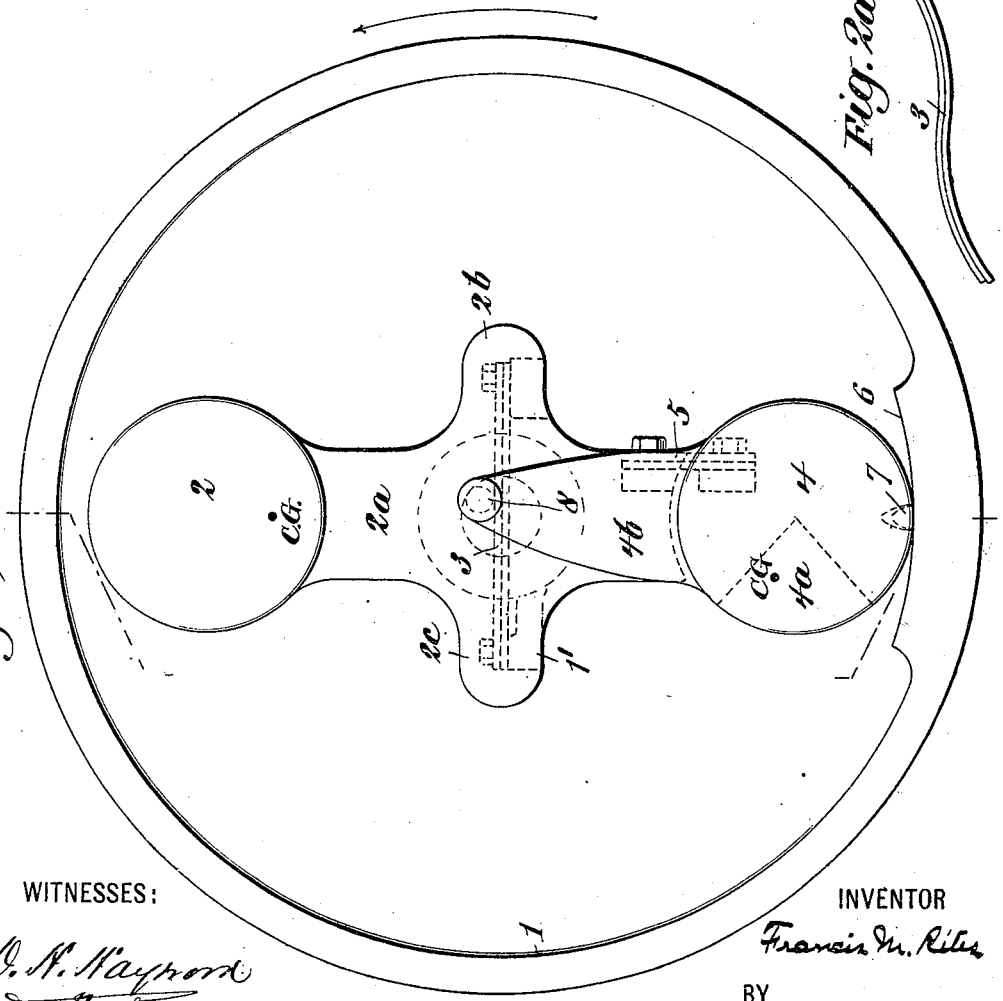


Fig. 2a.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

Fig. 4.

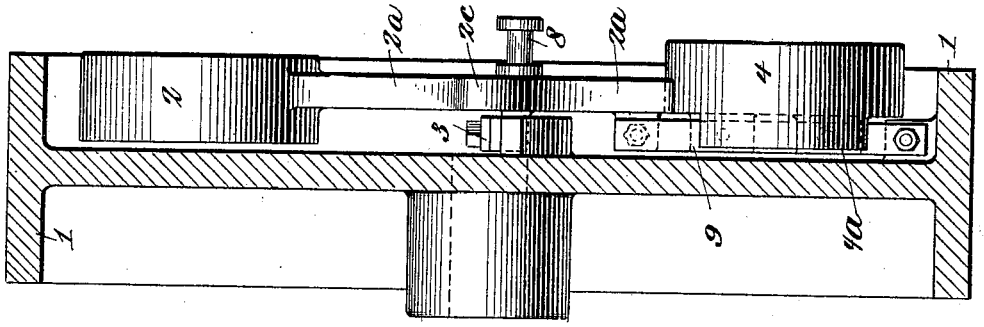
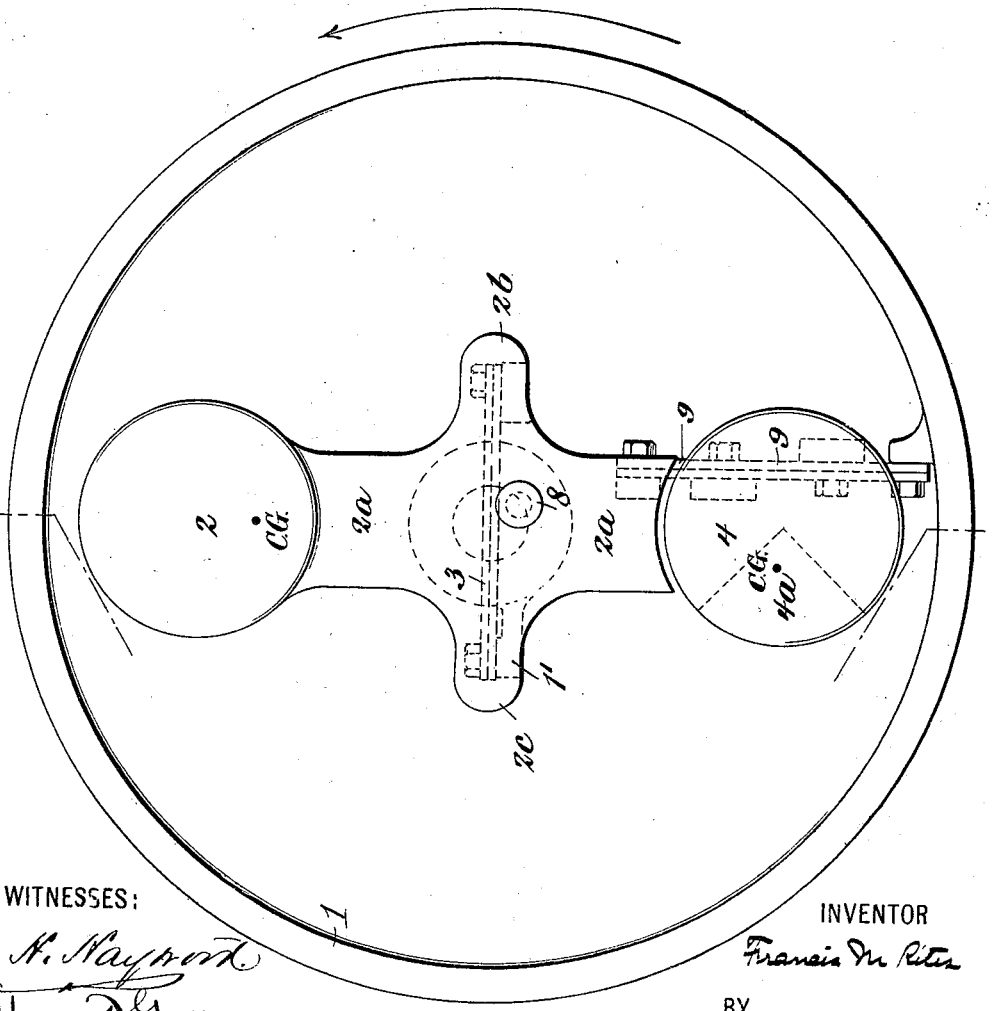


Fig. 3.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 6,

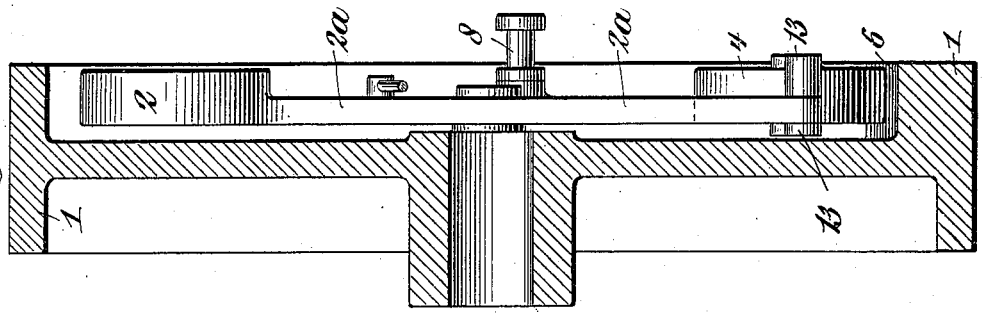
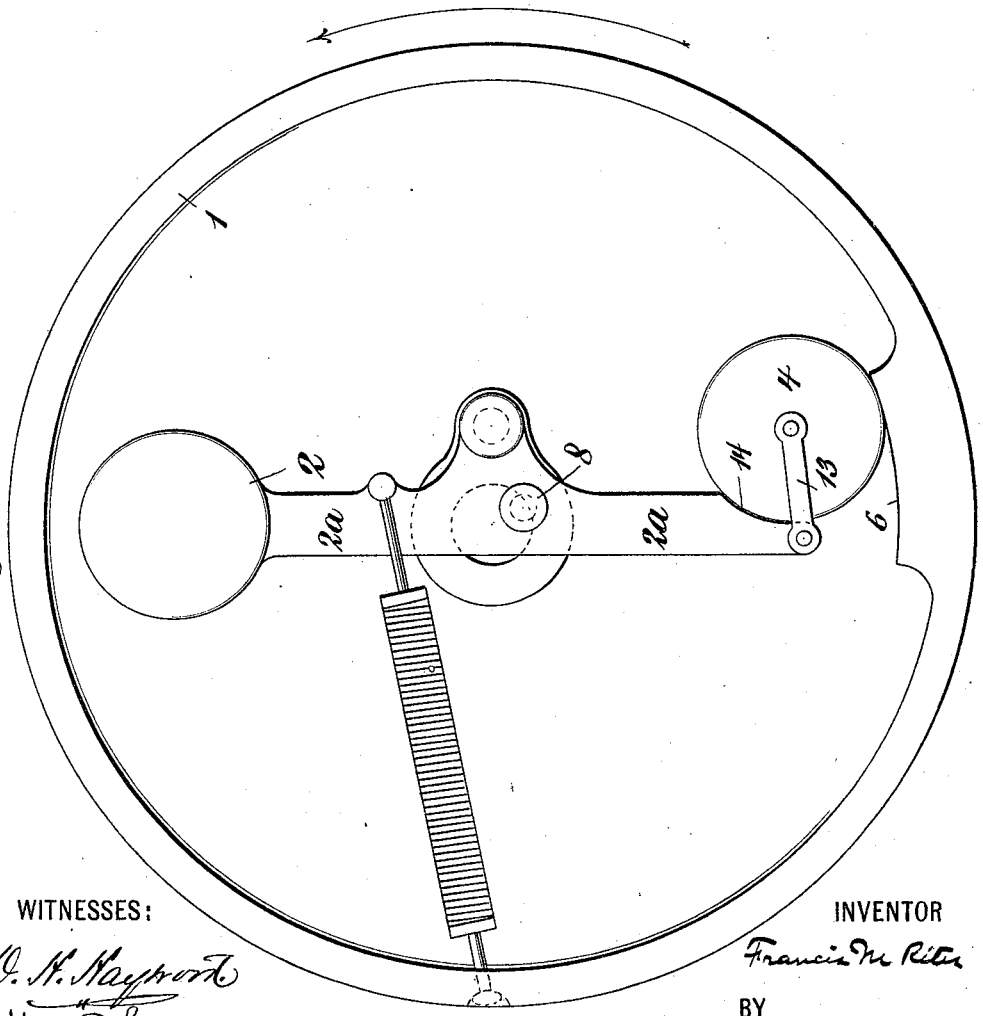


Fig. 5,



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GOVERNOR.

(Application filed Feb. 6, 1899.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 7.

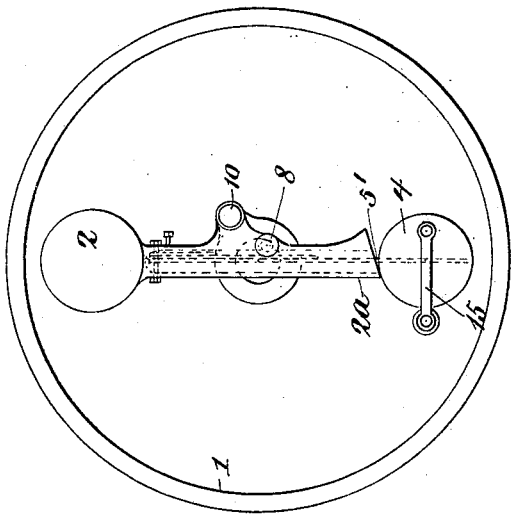
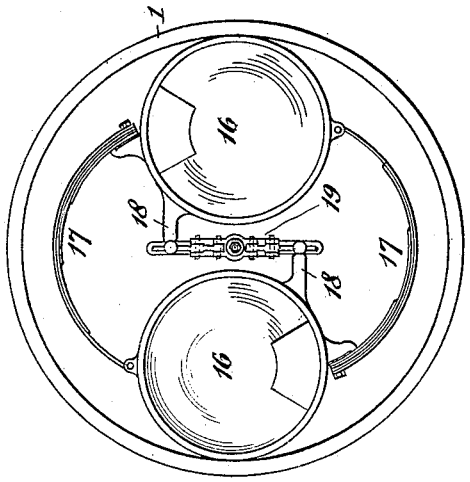


Fig. 8.



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FRANCIS MARION RITES, OF ITHACA, NEW YORK.

GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 646,314, dated March 27, 1900.

Application filed February 6, 1899. Serial No. 704,670. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS MARION 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 generally to improvements in governors or speed-regulators, and particularly to improvements in governors of the type known as "fly-wheel" or "automatic-cut-off" governors, though the governor herein described may be adapted for the regulation of throttle-valves 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 combination and relative arrangement of movable weights and supporting devices therefor by which a governor-weight structure utilizing in its operation both centrifugal force and inertia and balanced as to gravity with respect to its supports is produced, in the combination of swinging and rolling weights in a governor, and in the novel combination, construction, and arrangement of the parts.

The objects of my invention are to improve and simplify governors, to provide a weight structure composed of few parts, but balanced as to gravity with respect to its supports, and utilizing in its operation both the centrifugal force or effect of its members and the inertia of its members at times when the speed of rotation changes, to reduce friction in the governor, and to make it quick-acting, sensitive, reliable, not liable to derangement, and comparatively inexpensive. These objects are attained in the invention 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, with a portion of the fly-wheel or carrier broken away, of one form of governor containing two spring-connected weights, one arranged to swing about a support and the other to roll upon a guide carried by the carrier; and Fig. 2 is a transverse section of the governor. Fig. 2^a is a detail view of the supporting-spring employed in the governor of Figs. 1 and 2. Fig. 3 is a view similar to Fig. 1 of a form of governor differing from that of Fig. 1 in that the spring which connects the weights is also connected to the carrier and the weight which corresponds to the rolling weight of Fig. 1 has a swinging movement, the effect of which is substantially the same as the rolling movement of the corresponding weight of Fig. 1; and Fig. 4 is a transverse section of the governor shown in Fig. 3. Fig. 5 is an elevation of a governor containing a swinging and a rolling weight connected by a link, and Fig. 6 is a transverse section thereof. Fig. 7 is an elevation of a governor the weight structure of which consists of two spring-connected weights supported by a single pivot-pin, which weights by their relative motions produce flexure of their connecting-spring tending to return them to normal position; and Fig. 8 is an elevation of a governor both of the weights of which are rolling weights.

Referring now to the drawings, and first of all to Figs. 1, 2, and 2^a, 1 is a revoluble fly-wheel or carrier of suitable construction, and 2 is a weight, which for convenience may be termed a "primary" weight, secured to the fly-wheel by a leaf-spring 3. The weight 2 has an arm 2^a extending across the center of the fly-wheel and provided with two cross-arms 2^b and 2^c, to one of which, 2^b, the spring 3 is secured. The other end of the spring is secured to a boss 1′ of the fly-wheel. Opposite the main portion of the weight 2 is another weight 4, which may be termed, for convenience, a "secondary" weight and which is connected to the arm 2^a by a leaf-spring 5, so that said weight is supported from the weight 2. The weight 4 has a rolling contact with a guide 6 on the fly-wheel, and to prevent it from slipping on said guide instead of rolling thereon the guide is provided with a projecting stud 7, similar to a tooth of a gear-wheel, lying within a corresponding recess in the weight.

That side of the weight 4 which is to the left in Fig. 1 is the heavier, being provided with a segmental boss 4^a. The center of gravity of the weight therefore does not lie in the line connecting the point of contact of

the weight with the guide 6 and the center of rotation, so that the weight tends to roll upon the guide under the influence of centrifugal force.

The approximate positions of the centers of gravity of the weights 2 and 4 are indicated in each case by the letters "C G." The weight 4 is also provided with an inwardly-projecting arm 4^b, carrying an eccentric-pin 8.

The spring 3 when not under tension has the form shown in Fig. 2^a. In Fig. 1 the parts are shown in the positions occupied when the fly-wheel is revolving and the engine cutting off steam early in the stroke. The spring serves both as a means for supporting the weight structure in such manner as to leave the parts thereof free to move under the influence of centrifugal force and inertia and as a means for resisting the effect of centrifugal force.

The operation of the governor is as follows: When the fly-wheel is revolving, the weight 2 tends to swing outward, which tendency is opposed by the spring 3. The motion of the weight 2 from the position of rest to the position required to maintain constant the speed of the engine is transmitted through the leaf-spring 5 to the weight 4, causing said weight 4 to roll along the guide 6, thus flexing the spring 5 to some extent, and the centrifugal force of the weight 4 itself causes said weight to roll upon the guide 6 still farther in the same direction, still further flexing the spring 5. The motion of the center of gravity of the weight 4 is in a direction substantially opposite to the direction of motion of the center of gravity of weight 2, so that at all speeds the weights are in substantial gravity-balance. The result of the motion of the weight 4 due to these combined influences is to move the eccentric 8 inward, so producing a shorter cut-off in the engine-cylinder. If the speed of the fly-wheel rises, the inertia of the two weights causes them to lag somewhat, weight 2 swinging outward and weight 4 rolling along the guide 6, thus moving the eccentric inward and supplementing the effect of the increased centrifugal force. If the speed of the fly-wheel falls suddenly, the inertia of the weights assists the centripetal action of the springs in moving the eccentric outward. Placing the eccentric 8 upon the weight 4 has the advantage of multiplying, as to the eccentric, the angular movement of the weight 2; but the eccentric may be placed on the arm 2^a instead, as is the case in the similar governor shown in Figs. 3 and 4. The weights 2 and 4 being opposite each other and weight 4 being supported from weight 2, they balance each other as to gravity partly or completely, as may be desired, the mass of the weight 4 being proportioned accordingly. In general it is not desirable to have weight 2 balanced completely.

In the form of governor shown in Figs. 3 and 4 the weight 4, instead of having a rolling contact with the fly-wheel, is carried by a leaf-spring 9, secured at one end to the arm 2^a of the weight 2 and secured at the other end to the fly-wheel. Weight 2 is substantially the same in construction as the corresponding weight shown in Figs. 1 and 2, except that its arm 2^a carries the eccentric 8. In the operation of the governor the weight 4 swings outward by flexing the spring 9, the path of the center of gravity being very nearly the same as that of the center of gravity of weight 4 in the governor of Figs. 1 and 2. The operation of this governor is substantially the same as that of the former governor.

In the governor shown in Figs. 5 and 6 the primary weight 2 is pivoted to the fly-wheel, and the secondary weight 4, which is arranged to roll upon a guide 6 on the fly-wheel, is connected to the arm 2^a of weight 2 by a link 13. The arm 2^a has in its end a recess 14, into which the weight 4 fits and which serves to hold said weight in place when the action of gravity tends to pull it away from the guide 6. In this governor the weight 4 counterbalances the weight 2 as to gravity.

The springs 5 of the forms of governors shown in Figs. 1 to 4, inclusive, have a positive action tending to restore the governor-weights to their normal position independent of the springs 3. In Fig. 7 I have shown a governor in which such a spring as 5 is relied upon entirely to restore the parts to their normal position and to resist the effects of centrifugal force. It consists of two weights—viz., a primary weight 2 and a secondary weight 4—connected by a leaf-spring 5′. Weight 2 is pivoted to the fly-wheel 1 at 10, and weight 4, which rests against the beveled end of the arm 2^a of weight 2, is connected by a link 15 to the fly-wheel, so that weight 4 is limited to motion in a substantially-radial direction. In this governor motion of the weights relatively to each other due to centrifugal force produces flexure of the spring 5′, so that the spring tends to bring the weights back to normal position. This governor is claimed specifically in my application for Letters Patent filed April 1, 1898, Serial No. 676,058.

Swinging weights may be dispensed with entirely and rolling weights employed instead. Such a governor is shown in Fig. 8, in which 16 16 are two weights having a rolling contact with the rim of the fly-wheel and connected by leaf-springs 17. Each is weighted more heavily on one side than on the other, so that centrifugal force tends to cause them to roll upon the rim of the fly-wheel. The weights are connected by arms 18 to a system of levers 19, adapted to give movement to an axial stem. This governor and others employing rolling weights are illustrated, described, and claimed in an application for Letters Patent filed on March 8, 1898, Serial No. 673,069.

The spring-supports for the weight structures of the governors shown in Figs. 1 to 4, inclusive, are the mere equivalents of pivotal supports with separate springs for opposing

the effects of centrifugal force, and I do not limit myself to the use of either spring-supports or pivotal supports in any of the governors herein described.

The governors are capable of many modifications without departing from the essential principles herein set forth, and I do not limit myself to the particular construction and arrangement of the parts described and illustrated.

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 spring-connected weights mounted upon said carrier and movable with respect thereto and to each other, and having in common means for supporting them from the carrier and for opposing movement of said weights due to revolution of the carrier, and an actuating device adjusted by the movement of said weights, substantially as described.

2. In a governor, the combination, with a revoluble carrier, of spring-connected and spring-supported weights mounted upon said carrier in substantial gravity-balance with one another, and movable with respect thereto and to each other, and an actuating device adjusted by the movement of said weights, substantially as described.

3. In a governor, the combination, with a revoluble carrier, of two spring-connected weights, one supported from the other and movable with respect thereto, means for supporting said weights and for opposing movement thereof, due to revolution of the carrier, and an actuating device adjusted by the movement of said weights, substantially as described.

4. In a governor, the combination, with a revoluble carrier, of swinging and rolling weights, the latter adapted to roll upon a suitable guide, means for securing them to the carrier and for opposing movement thereof due to revolution of the carrier, and an actuating device adjusted by the movement of the weights, substantially as described.

5. In a governor, the combination, with a revoluble carrier, of two weights, one arranged to swing about a suitable support and the other to roll upon a suitable guide, means for securing said weights to the carrier and for opposing movement thereof due to revolution of the carrier, and an actuating device adjusted by the movement of the weights, substantially as described.

6. In a governor, the combination, with a revoluble carrier, of two weights, one arranged to swing about a suitable support and the other to roll upon the rim of the carrier, means for securing said weights to the carrier and for opposing movement thereof due to revolution of the carrier, and an actuating device adjusted by the movement of the weights, substantially as described.

7. In a governor, the combination, with a revoluble carrier, of a weight structure containing spring-connected weights, having a common support, which move with respect to each other and the carrier when the speed of the carrier changes, inducing spring action tending to return the weight structure and the parts thereof to their normal positions, and an actuating device adjusted by the movement of said weights, substantially as described.

8. In a governor, the combination, with a revoluble carrier, of a weight structure containing connected weights which are not pivotally connected to the carrier, but have a common spring-support, said weights being arranged to move with respect to each other and the carrier when the speed of the carrier changes, inducing spring action tending to return the weight structure and the parts thereof to their normal positions, and an actuating device adjusted by the movement of said weights, substantially as described.

9. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to revolution of the carrier, a secondary weight connected by a spring to the primary weight and movable with respect thereto and the carrier, and an actuating device adjusted by the movement of said weights, substantially as described.

10. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to the revolution of the carrier, a rolling secondary weight connected to the primary weight, and adapted to roll upon a suitable guide, and an actuating device adjusted by the movement of said weights, substantially as described.

11. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to the revolution of the carrier, a rolling secondary weight having a rolling contact with the carrier and connected by a spring to the primary weight, and an actuating device adjusted by the movement of said weights, substantially as described.

12. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to the revolution of the carrier, and a secondary weight having a rolling contact with the carrier and connected by a spring to the primary weight, and having an inwardly-extending arm carrying an actuating device which is adjusted by the movement of said weights, substantially as described.

13. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to revolution of the carrier, and a secondary weight supported from the primary weight and movable with

respect thereto and to the carrier, but having also a connection with the carrier, and having an inwardly-extending arm carrying an actuating device which is adjusted by the movement of said weights, the point of connection of said weights to each other being between the said actuating device and the point of connection of the secondary weight to the carrier, substantially as described.

14. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to revolution of the carrier, a secondary weight in gravity-balance with the primary weight, and supported therefrom but movable with respect thereto, said secondary weight being loaded upon one side to make it effective as a centrifugal weight, and an actuating device adjusted by the movement of said weights, substantially as described.

15. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to revolution of the carrier, a secondary weight in gravity-balance with the primary weight, and connected thereto by a spring, said secondary weight being loaded upon one side to make it effective as a centrifugal weight, and an actuating device adjusted by the movement of said weights, substantially as described.

16. In a governor, the combination, with a revoluble carrier, of a primary weight and means for supporting the same and resisting movement thereof due to revolution of the carrier, a secondary weight in gravity-balance with the primary weight, and movably connected thereto, and having a rolling contact with the carrier, and an actuating device adjusted by the movement of said weights, substantially as described.

17. In a governor, the combination, with a revoluble carrier, of a swinging and a rolling weight, the latter adapted to roll upon a suitable guide, means for securing the weights to the carrier and for opposing movement thereof due to the revolution of the carrier, means for preventing the rolling weight from slipping, and an actuating device adjusted by the movement of said weights, substantially as described.

18. In a governor, the combination, with a revoluble carrier, of a primary weight which is spring-supported but not pivotally connected to the carrier, a secondary weight connected to said primary weight, and an actuating device adjusted by the movement of said weights, substantially as described.

19. In a governor, the combination, with a revoluble carrier, of a primary weight which is spring-supported but not pivotally connected to the carrier, a secondary weight in gravity-balance with the primary weight and connected thereto by a spring, and an actuating device adjusted by the movement of said weights, substantially as described.

20. In a governor, the combination, with a revoluble carrier, of a primary weight which is spring-supported but not pivotally connected to the carrier, a secondary weight in gravity-balance with the primary weight and connected thereto by a spring, and an actuating device carried by the secondary weight and adjusted by the movement thereof, substantially as described.

21. In a governor, the combination, with a revoluble carrier, of a spring-supported primary weight, a secondary weight in gravity-balance therewith, connected thereto by a spring, and having a rolling contact with the carrier, and an actuating device adjusted by the movement of said weights, substantially as described.

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

FRANCIS MARION RITES.

Witnesses:

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H. A. CASE.