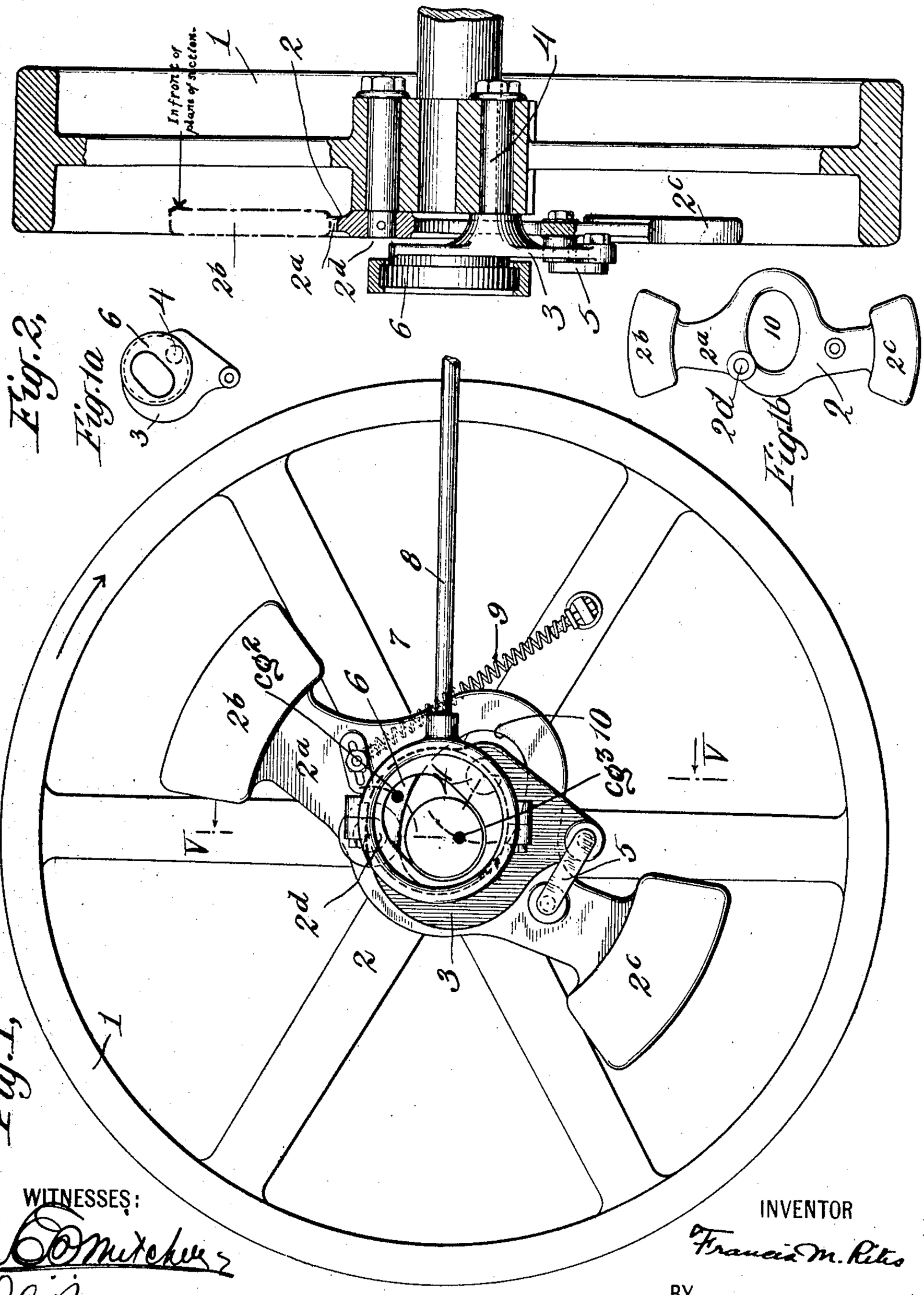
No. 895,684. PATENTED AUG. 11, 1908.

F. M. RITES.

GOVERNOR.

APPLICATION FILED JULY 6, 1907.

3 SHEETS—SHEET 1.



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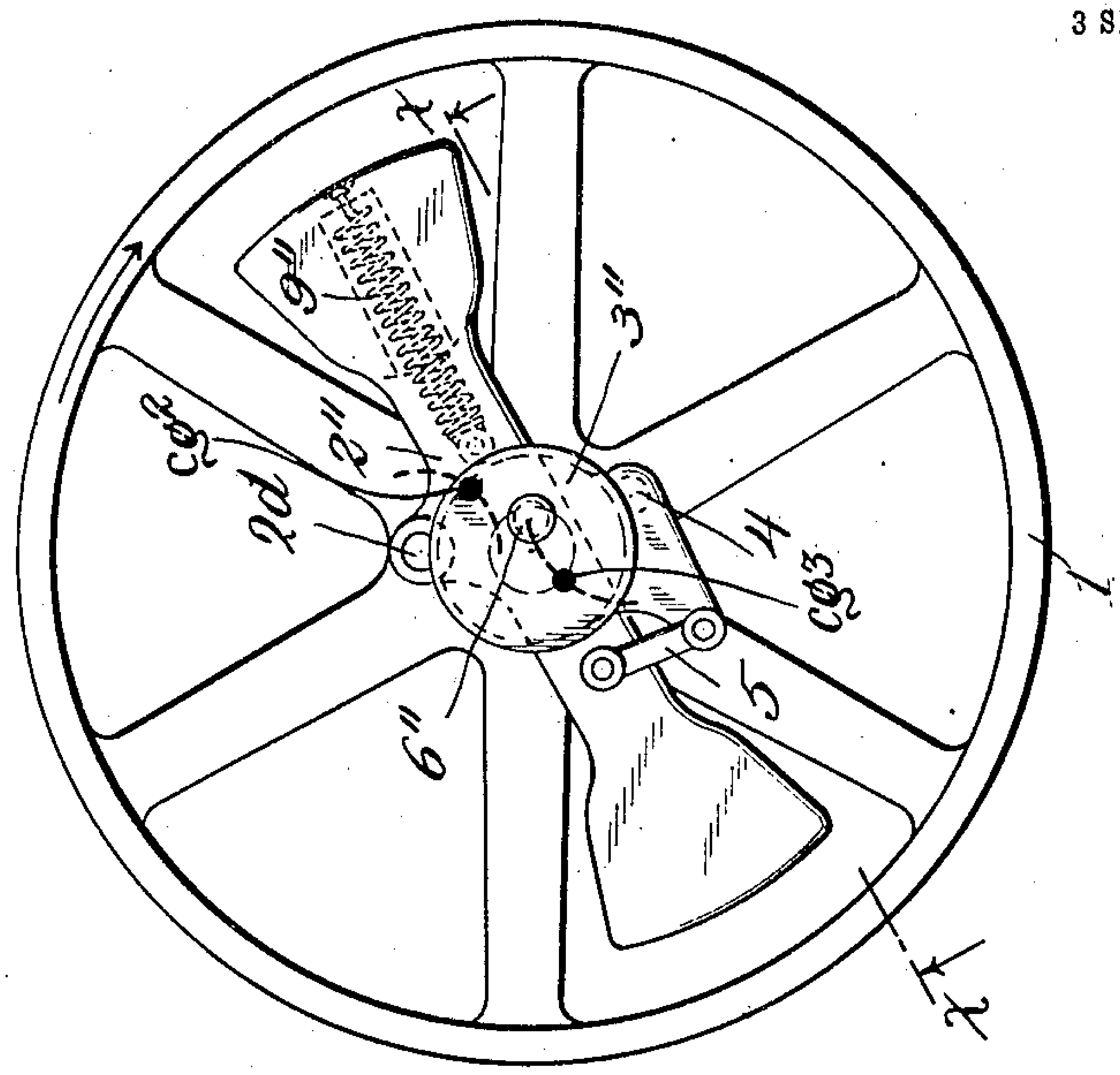

Fig. 5,

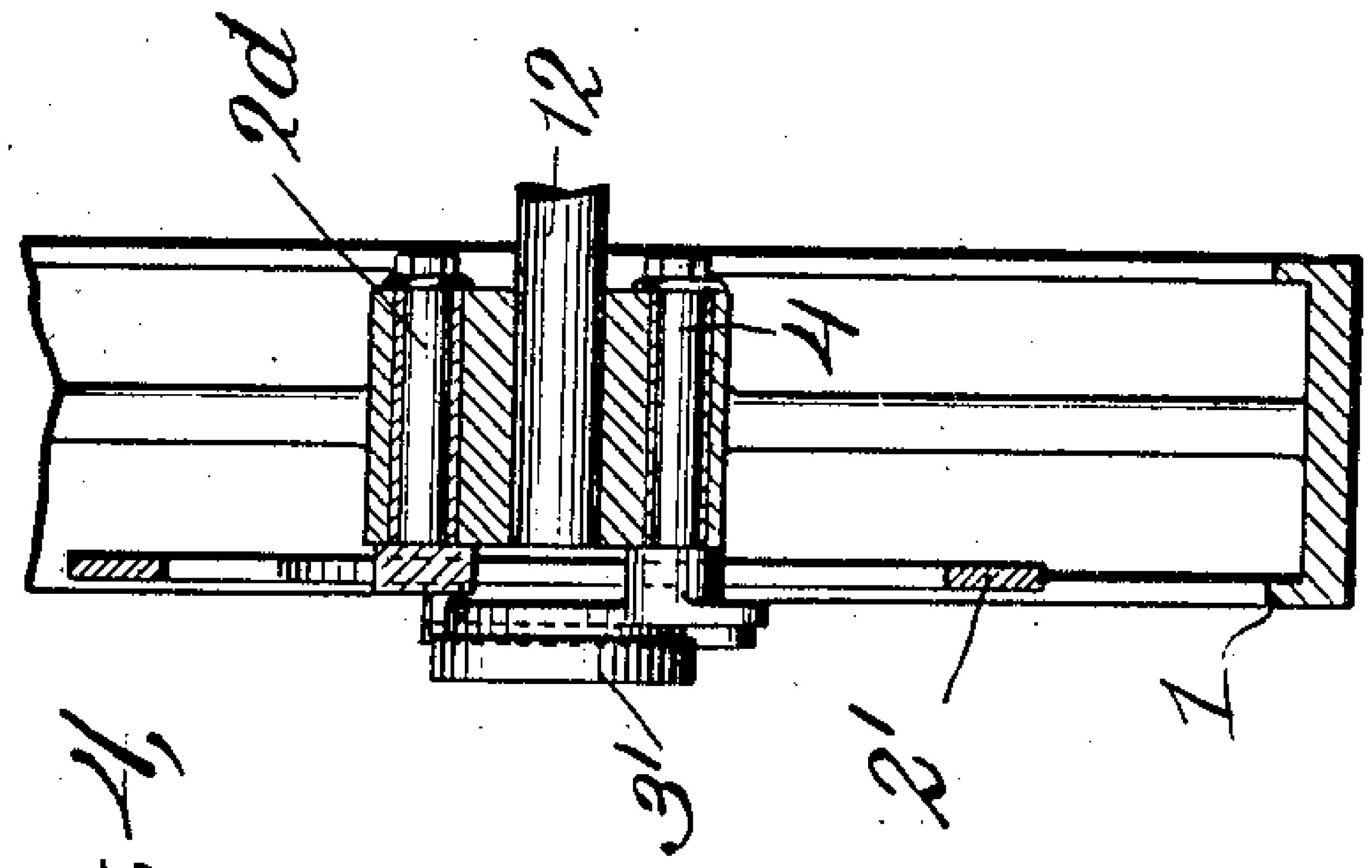

Fig. 4,

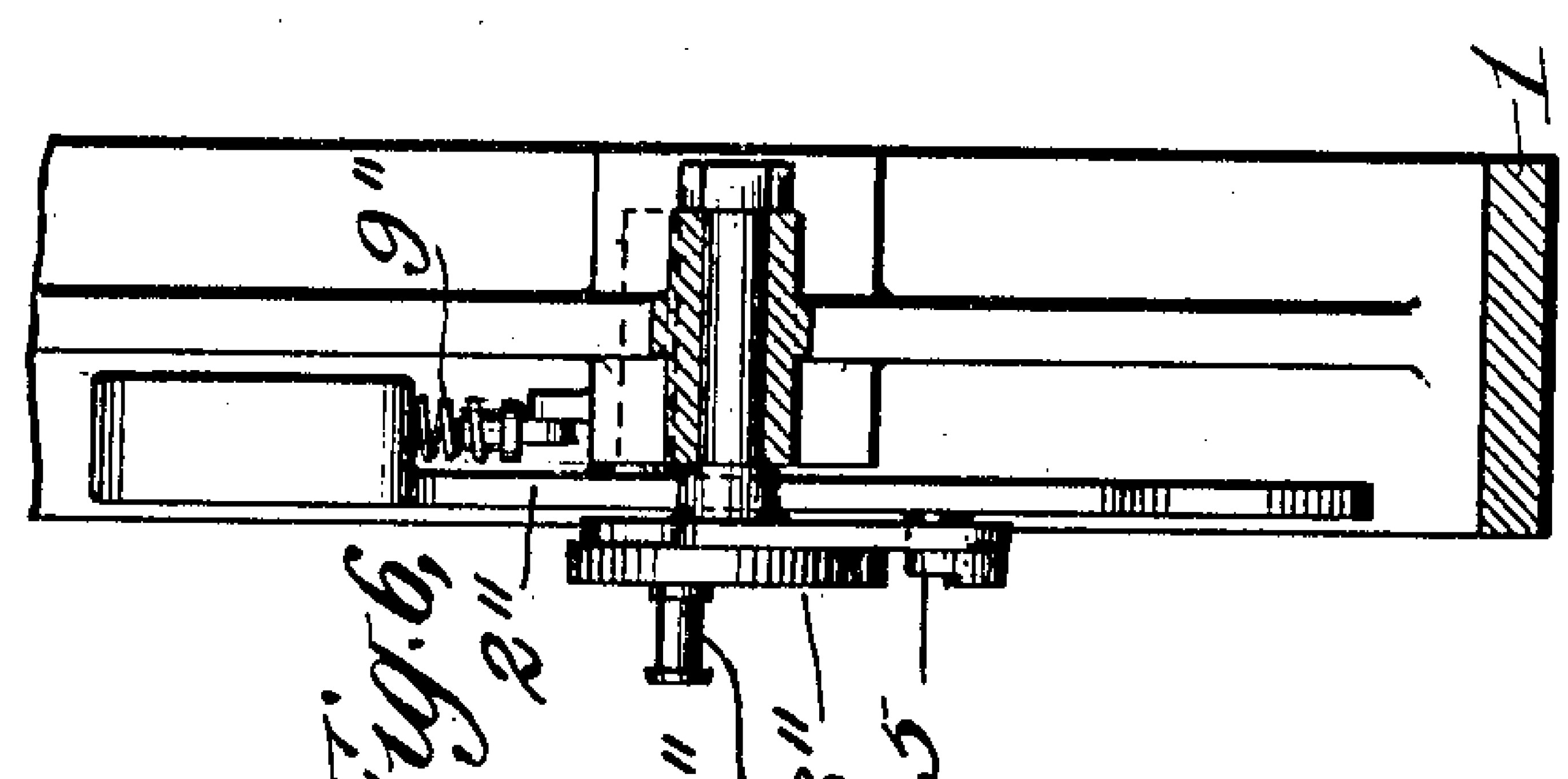

Fig. 6,

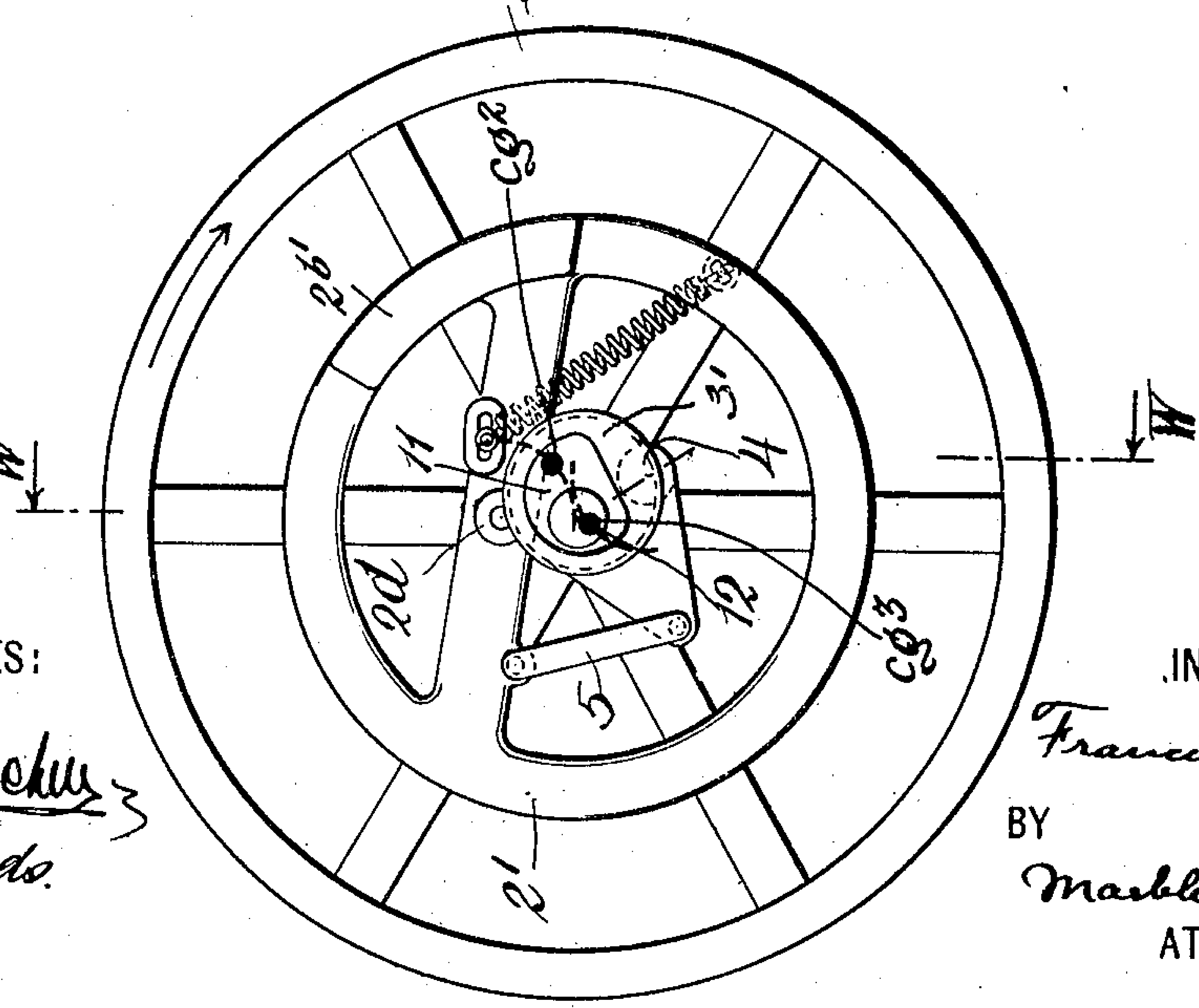

Fig. 3,

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3 SHEETS—SHEET 3.

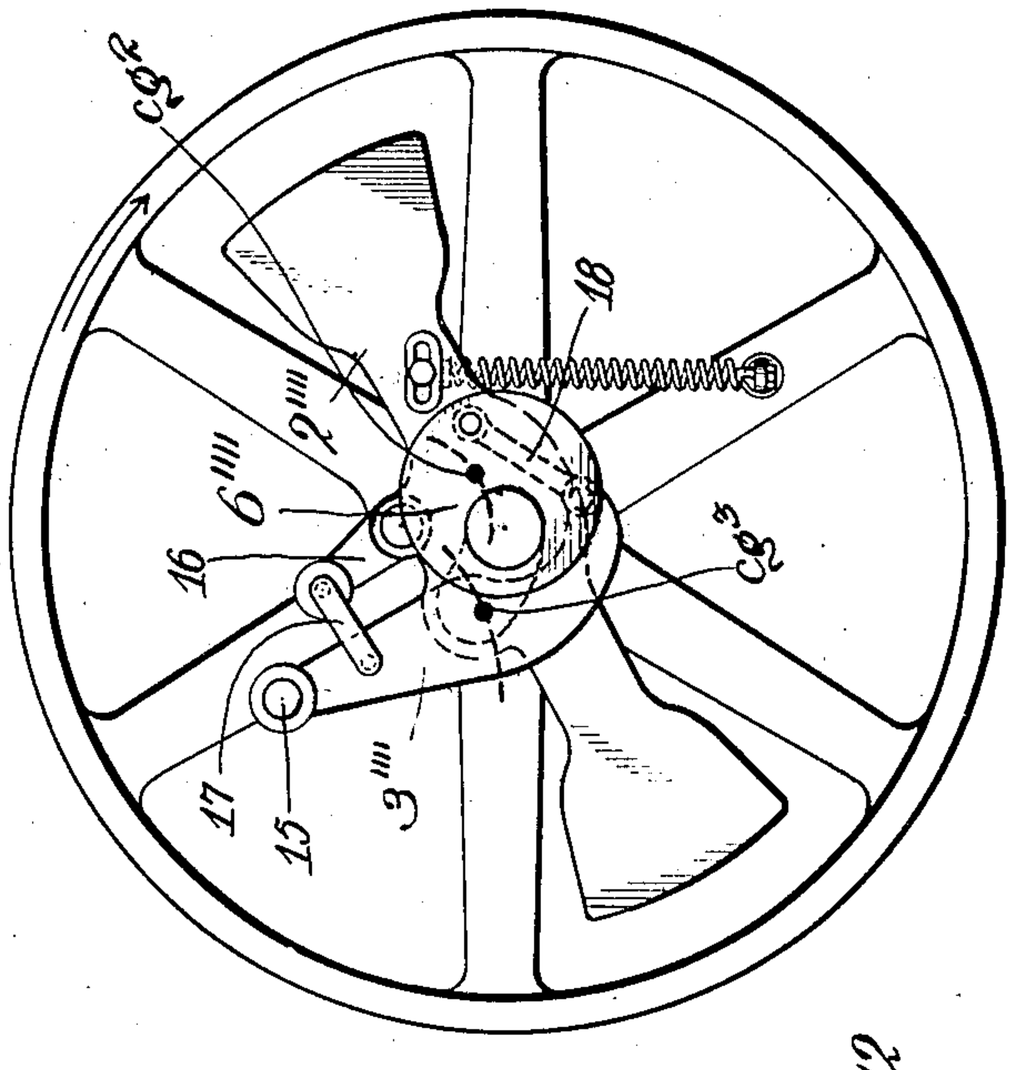

Fig. 9.

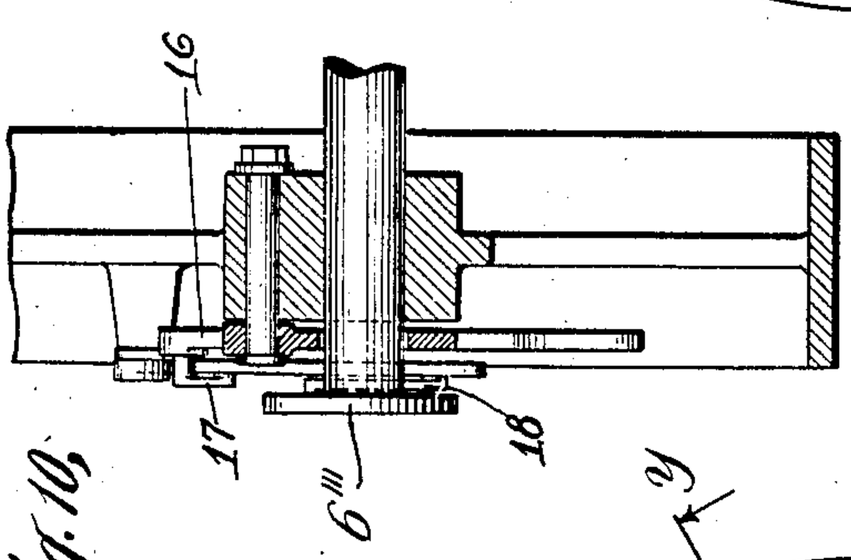

Fig. 10.

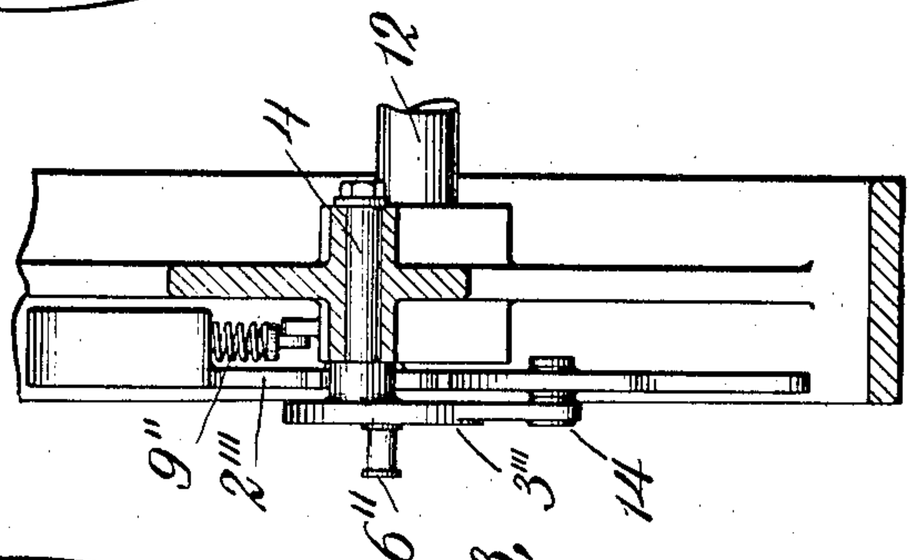

Fig. 8.

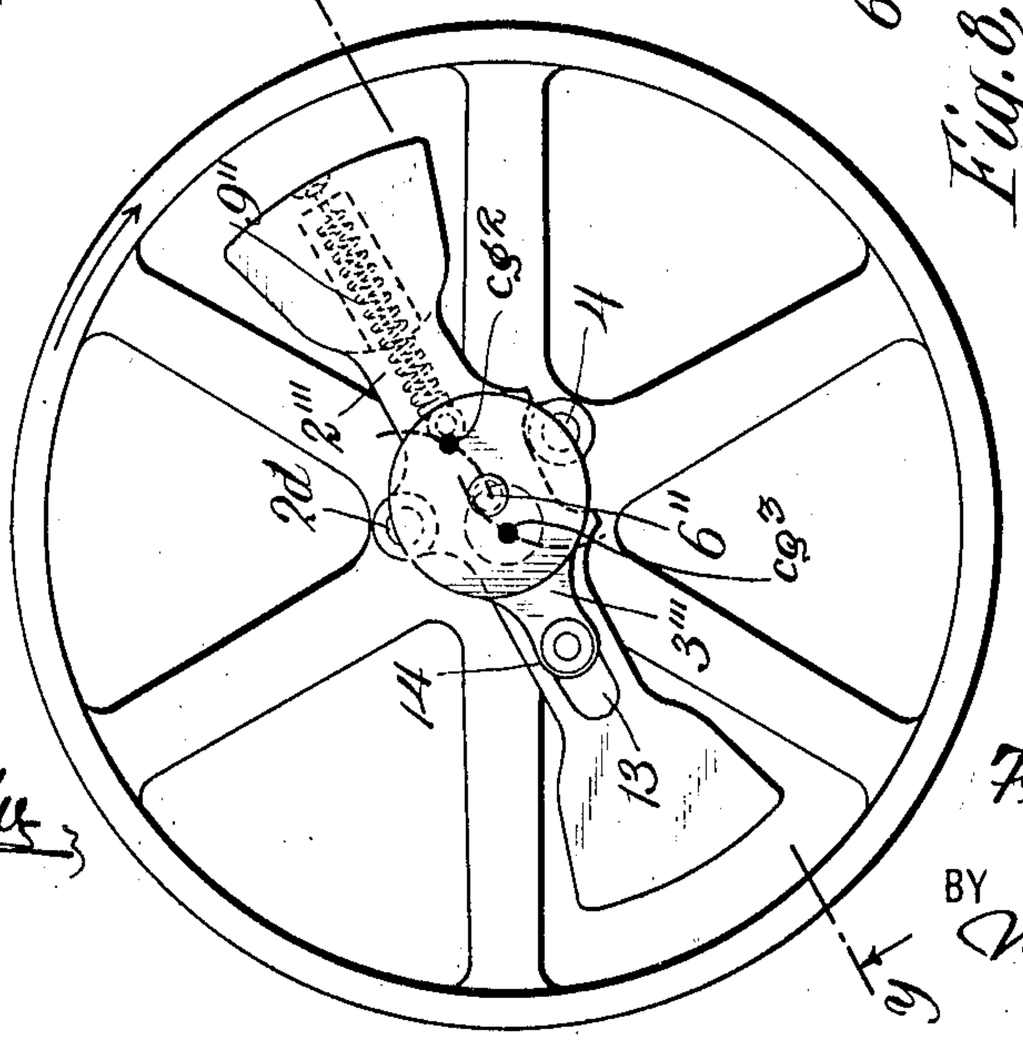

Fig. 7.

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No. 895,684. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed July 6, 1907. Serial No. 382,445.

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 same, 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 that type thereof commonly termed fly-wheel or shifting eccentric governors; though the governor herein described is not restricted to use for directly operating engine slide valves and the like, but is equally adapted for the regulation of throttle valves or the tripping gear of Corliss engines, or for the adjustment of other devices for which governors are employed.

My invention consists in the novel combination and arrangement of movable weights, by which a governor structure utilizing in its operation both centrifugal force and inertia, and balanced as to gravity with respect to its support, is produced.

The objects of my invention are to avoid the effects of unbalanced gravity of weight masses in governors, particularly governors of relatively slow-moving engines, and to make the governor simple, easy to construct, and relatively inexpensive.

I will now proceed to describe my invention with reference to the accompanying drawings, illustrating certain forms of governor embodying my said invention, and will then point out the novel features in claims.

In the said drawings; Figure 1 shows a side view of an engine fly-wheel with one form of governor mounted thereon; Fig. 1[a] shows a detail side view of the balancing weight; and Fig. 1[b] a similar view of the main weight; Fig. 2 shows a section of such governor and fly-wheel on the irregular section line V V of Fig. 1. Fig. 3 shows a side view of an alternative form of said governor in place on a fly-wheel; and Fig. 4 shows a section of such governor and fly-wheel on the line W W of Fig. 3. Fig. 5 shows a side view of a further alternative form of said governor; and Fig. 6 shows a section thereof on the line x—x of Fig. 5. Fig. 7 shows a side view of a governor similar to that of Fig. 5, except that the balancing weight is differently guided; and Fig. 8 shows a section of such governor on the line y—y of Fig. 7. Fig. 9 shows a side view of a further alternative form of my governor; and Fig. 10 shows a section thereof.

The governors illustrated in the said drawings comprise two governor weights mounted upon a common rotary carrier, (usually a fly-wheel), and connected together, one of said weights being a combined inertia and centrifugal weight, having its mass disposed on both sides of the axis of rotation, and of the pivotal point of said weight, the greater part of the mass of said weight concentrated at points relatively distant from and on opposite sides of the pivotal point, so as to secure strong inertia action of the weight; the other weight being a balancing weight mounted on said carrier and connected to the first weight in such manner as to substantially balance the otherwise unbalanced gravity of said first weight, said balancing weight arranged to move across said first weight and having its mass disposed mainly near the center of rotation and where it is most effective in balancing said first weight.

The governor further comprises an actuating device for actuating or controlling a valve or other device which the governor is to operate, regulate or adjust; said actuating device being customarily an eccentric. It may be mounted upon the said combined inertia and centrifugal weight; but more usually, and preferably, it is the balancing weight itself. By reason of the close balancing of the main governor weight, which is possible with this construction, the governor may be run at quite slow speed without the disturbances customarily experienced with ordinary fly-wheel governors running at low speeds; and owing to the mass of the balancing weight being concentrated close to where it can exert its most effective balancing action, and to the center of rotation, the mass of said balancing weight is relatively small, and it adds relatively little to the cost of the governor, and does not require an excessive counterbalance weight on the fly-wheel, to bring the governor as a whole into rotative balance.

Referring first to Figs. 1 and 2, 1 designates the said fly-wheel or carrier, and 2 the combined centrifugal and inertia weight of the governor, which is the main or primary weight thereof. This weight consists of an arm 2[a], having weight masses 2[b] and 2[c] at its

ends. It is pivoted at 2^d. 3 designates the said balancing weight. It is pivoted to the fly-wheel at 4 and is connected to weight 2 by a link 5. Said weight 3 further carries an actuating device 6 (an eccentric in the instance shown) and I have shown on said eccentric a strap 7 for operating an eccentric rod 8. Since the said eccentric constitutes the principal portion of the weight 3, said weight may, and will commonly, be termed, in the art, the eccentric.

The weight 3 has relatively little centrifugal or inertia action, the bulk of the centrifugal and inertia action being supplied by weight 2; but said weights 2 and 3 are so pivoted and connected that their centers of gravity move in nearly parallel lines but in opposite directions, so that weight 3 is able to balance substantially completely the unbalanced gravity of weight 2, without interfering with either the centrifugal or the inertia action of said weight 2. At the same time, motion of weight 2, due to its centrifugal or inertia action, or both, is transmitted through link 5 to weight 3, so adjusting the eccentric 6 to accord with the changed position of the weight 2. A spring 9 resists the centrifugal action of weight 2. Weight 2 has an enlarged central portion provided with a slot 10 within which lies the pivot 4 of weight 3; said slot permitting free swinging of the weight 2 through its necessary range of movement without conflict with said pivot.

Theory and practice both show that the reactive effect on the governor of friction of the valve gear driven thereby and the momentum or inertia of the reciprocating parts of such valve gear produces a tendency to move the eccentric toward a longer cutoff position, thus requiring more speed and more centrifugal force to overcome this tendency. Such tendency may be overcome, however, by a second weight constructed, arranged and connected as is the weight 3 shown in Figs. 1, 2 and 1^a; the center of gravity of such second weight being on one side of the engine shaft and the geometric center of the eccentric proper, 6, being on the opposite side of such center, the centrifugal effect of the weight therefore tending to resist the valve gear reactions above referred to. Such reactions, if not resisted in the eccentric-carrying member itself, produce friction and pressure and consequent wear at the joints and pivotal points of the governor; but by resisting such reactions in the weight 3 itself I avoid such pressure, friction and wear at the joints and pivotal points.

In the alternative form of governor shown in Fig. 3, the combined inertia and centrifugal weight, here designated by reference numeral 2′, is in the form of a wheel pivoted eccentrically and having a weight mass $2^{b\prime}$ at one side, whereby the center of gravity of said weight as a whole is brought into proper relation with respect to the pivotal point and the axis of rotation. The center of the wheel being open, there is no conflict with the pivot of the balancing weight 3′. I have shown the eccentric as provided with a slot 11 for the passage of shaft 12 on which the governor is mounted, this governor being thereby adapted to be placed upon the inner side of a flywheel.

In Figs. 5 and 6 I have shown a governor which is intended to be over-hung; but the form of the primary weight, here numbered 2″, is such that it does not conflict with the pivot of the balancing weight, here numbered 3″. The eccentric 6″ is in this case a pin eccentric; and the governor spring 9″ is a tension spring, mounted within the weight 2″, as shown.

The form of governor shown in Figs. 7 and 8 is substantially the same as that shown in Figs. 5 and 6, except that in lieu of a link 5 connecting the main and balancing weights, I provide said balancing weight, here numbered 3‴, with a guide pin 14 working in a slot 13 of the main weight, here designated by numeral 2‴.

The eccentric or other actuating device is not necessarily adjusted by, or a part of, either weight. This is illustrated in Figs. 9 and 10, in which the said eccentric, here designated by numeral 6‴, is a twisting eccentric mounted on the engine shaft, the main governor weight, here numbered 2‴, being mounted as in Figs. 5 and 7, and the balancing weight, here numbered 3‴, being pivoted at 15. Weight 2‴ has a backward extension, 16, connected by a link 17 with balancing weight 3‴; and said balancing weight is connected by a link 18 to the eccentric 6‴.

In Figs. 1, 3, 5, 7 and 9 I have indicated by letters $c\ g^2$ the approximate location of the center of gravity of the main weight 2, 2′, etc; and I have further indicated by reference letters $c\ g^3$ the approximate location of the center of gravity of the balancing weight, 3, 3′, etc; and I have further indicated by dotted lines the arcs through which these centers of gravity swing. It will be observed that tangents to these arcs at corresponding points are approximately parallel; which means that said weights move in approximately parallel directions. In the governors of Figs. 1, 3, 5 and 7 the two weights move always in opposite directions. In Fig. 9 the two weights have a species of "scissors" motion. It will further be noted that the line connecting the centers of gravity of the two weights passes near the axis of rotation of the fly-wheel; from which fact, and from the fact that the weights move in opposite directions in Figs. 1, 3, 5 and 7, it follows that within the small range of movement which such weights have, they are

always in approximate gravity balance, thus permitting the governor to be used on relatively low-speed engines without disturbances due to action of gravity on the governor itself.

In Patent No. 687,504, granted to me on Nov. 26, 1901, I have illustrated a governor comprising a main centrifugal and inertia weight, or primary weight, pivoted to the carrier, and a balancing weight carrying the eccentric; but in said governor the balancing weight is pivoted, not to the carrier, but to an arm of the primary weight, and is further guided and limited in its movement by a link pivoted to the carrier, the mass of the governor structure being, as a whole, quite to one side of the center of rotation. In the present governor, the mass of the weight structure, as a whole, is much more nearly over the center of rotation, and the gravity-balancing of the one weight by the other is more perfect.

I am aware that it is old, in Patent No. 252,276, to John E. Sweet, to counterbalance a pivoted centrifugal weight by a pivoted weighted eccentric; but in that patent, the centrifugal weight is relatively light, and because of its location with respect to its pivotal point, relatively small mass, etc., has practically no inertia action. In order to obtain desirable inertia action, the weight must be quite heavy, and must have the greater part of its mass concentrated at points relatively distant from the pivotal point and also from the axis of rotation, though the center of gravity of the weight may be and commonly is quite near the axis of rotation, as appears from the accompanying drawings. To counterbalance as to gravity so massive a weight mass, by an eccentric or balancing weight which, in comparison, is relatively light, and at the same time to keep the center of gravity of the weight structure as a whole near the center of rotation, so as to avoid excessive rim weights on the flywheel, is a problem for which the Sweet patent offers no solution.

What I claim is:—

1. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, the latter weight movable across the former, and means connecting said weights, said weights so connected and pivoted that their centers of gravity move in opposite but approximately parallel directions.

2. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight, and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, the balancing weight movable across the first weight and having its mass concentrated relatively closely to the axis of rotation as compared with said first-mentioned weight, and means connecting said weights so connected and pivoted that their centers of gravity move in opposite and approximately parallel directions.

3. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight, and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, the balancing weight movable across the first weight, the greater part of the mass of said first-mentioned weight concentrated at points relatively distant from the corresponding pivotal point and the greater part of the mass of said balancing weight concentrated relatively close to the center of rotation, and means connecting said weights.

4. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, and means connecting said weights and approximately gravity-balancing each said weight by the other, the mass of said balancing weight concentrated relatively close to the center of rotation and the greater part of the mass of said inertia and centrifugal weight concentrated at points located relatively distant from the corresponding pivotal point, said balancing weight movable across said first weight.

5. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight, and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, the mass of said balancing weight concentrated relatively closely to the axis of rotation as compared with said first-mentioned weight, means connecting said weights, and actuating means adjusted by one of said weights; said weights so connected and pivoted that their centers of gravity move in opposite and approximately parallel directions, and the balancing weight arranged to move across the first weight.

6. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight, and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, the greater part of the mass of said first-mentioned weight concentrated at points relatively distant from and on opposite sides of the corresponding pivotal point and the greater part of the mass of said balancing weight concentrated relatively close to the center of rotation, means connecting said weights, and actuating means adjusted by one of said weights; said balancing weight arranged to move across said first weight.

7. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weight, pivoted to the carrier at points eccentric to its axis of rotation, means connecting said weights and approximately gravity-balanc-

ing each said weight by the other, the mass of said balancing weight, concentrated relatively close to the corresponding pivotal point and the greater part of the mass of said inertia and centrifugal weight concentrated at points located relatively distant from and on opposite sides of the center of rotation, and actuating means adjusted by one of said weights.

8. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weighted eccentric, pivoted to the carrier at points eccentric to its axis of rotation, and means connecting said first-mentioned weight and said eccentric, placing the two in substantial gravity - balance; said eccentric movable across said first weight.

9. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weighted eccentric, pivoted to the carrier at points eccentric to its axis of rotation, the former having the greater part of its mass relatively distant from and on opposite sides of the center of rotation and the latter having its mass relatively concentrated near the center of rotation, and means connecting said first-mentioned weight and said eccentric placing the two in substantial gravity-balance; said eccentric movable across said first weight.

10. A governor comprising in combination a rotary carrier, a combined inertia and centrifugal weight and a balancing weighted eccentric, pivoted to the carrier at points eccentric to its axis of rotation, but substantially on opposite sides of the center of rotation thereof, and means connecting said weight and eccentric and placing the two in substantial gravity-balance, the centers of gravity of the two moving in opposite but approximately-parallel directions, and the balancing weight movable across the first weight.

11. A governor comprising in combination a rotary carrier and a weight structure the parts of which are supported thereby and are movable with respect thereto, said weight structure comprising a combined inertia and centrifugal weight, a balancing weight, and a link connecting the same, said latter weight suitably guided, said weights pivoted to the carrier at points eccentric to its axis of rotation and approximately balancing each other as to gravity.

12. A governor comprising in combination a rotary carrier and a weight structure the parts of which are supported thereby and are movable with respect thereto, said weight structure comprising a combined inertia and centrifugal weight, a balancing weight, and a link connecting the same, said latter weight suitably guided, said weights pivoted to the carrier at points eccentric to its axis of rotation and approximately balancing each other as to gravity, said second weight movable across said first weight.

13. A governor comprising in combination a rotary carrier comprising inertia and centrifugal balancing weights, pivoted to the carrier at points eccentric to its axis of rotation, one of said weights movable across the other, and means connecting said weights, said latter weight comprising an eccentric, the geometric center of said eccentric on one side of the axis of rotation of said carrier and the center of gravity of said balancing weight being on the opposite side of said axis of rotation through a portion of the arc of travel of said weight, whereby the centrifugal effort of said balancing weight tends to resist valve gear reactions.

14. A governor comprising in combination a rotary carrier and two centrifugal weights pivoted to the carrier at points eccentric to its axis of rotation with their centers of gravity on opposite sides of said axes and means connecting said weights, one of said weights having the greater part of its mass relatively distant from and on opposite sides of the center of rotation and the other of said weights having its mass relatively concentrated near the center of rotation, and one of said weights provided with an eccentric having its geometric center on the opposite side of the axis of rotation from the center of gravity of said weight through a portion of the arc of travel of said weight, whereby valve gear reactions are resisted in said weight itself by the centrifugal effort of such weight.

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

FRANCIS M. RITES.

Witnesses:
BLANCHE CARSON,
H. M. MARBLE.