

(No Model.)

R. HOFFMANN.
STEAM ENGINE GOVERNOR.

No. 410,897.

Patented Sept. 10, 1889.

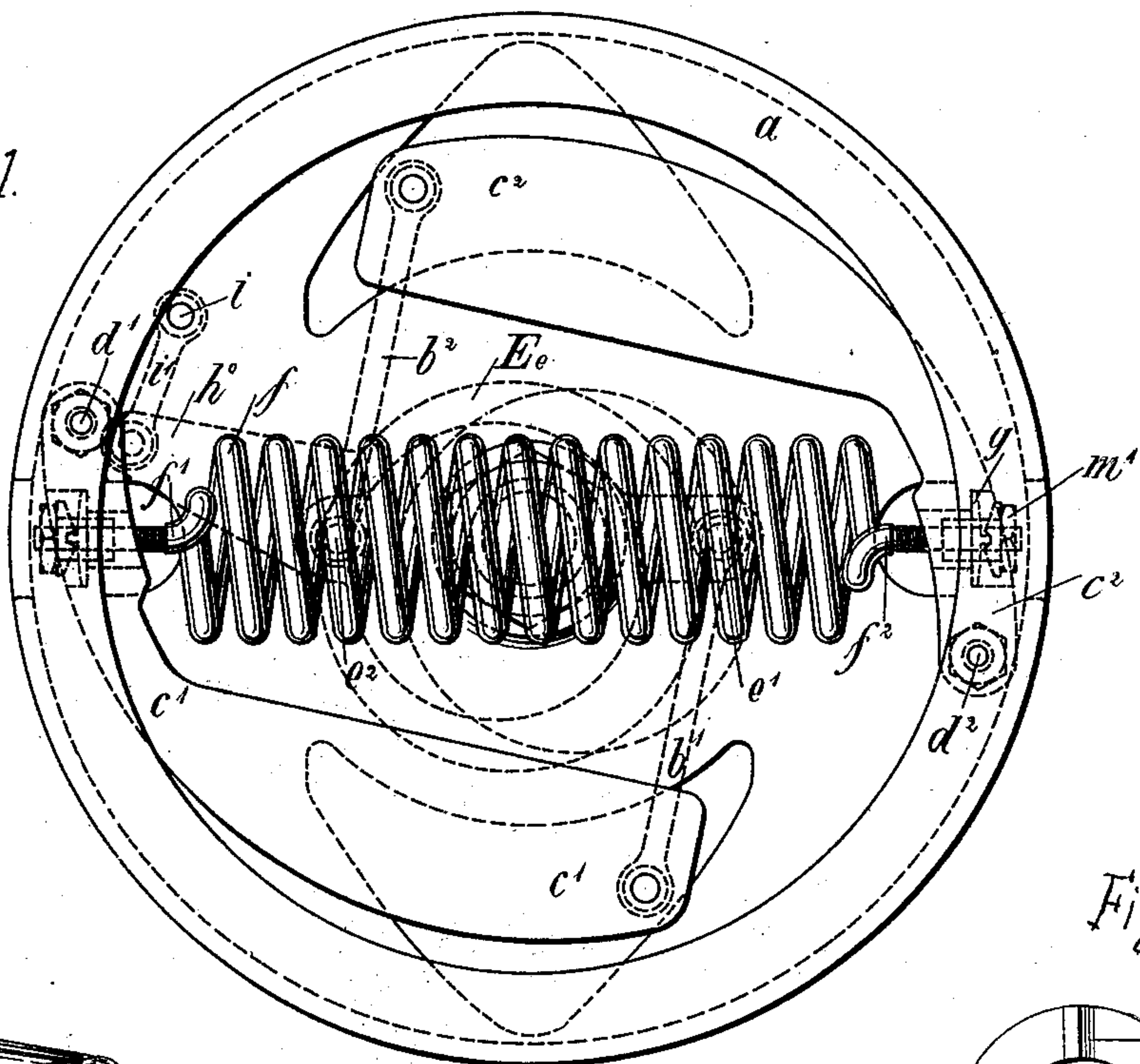


Fig. 4

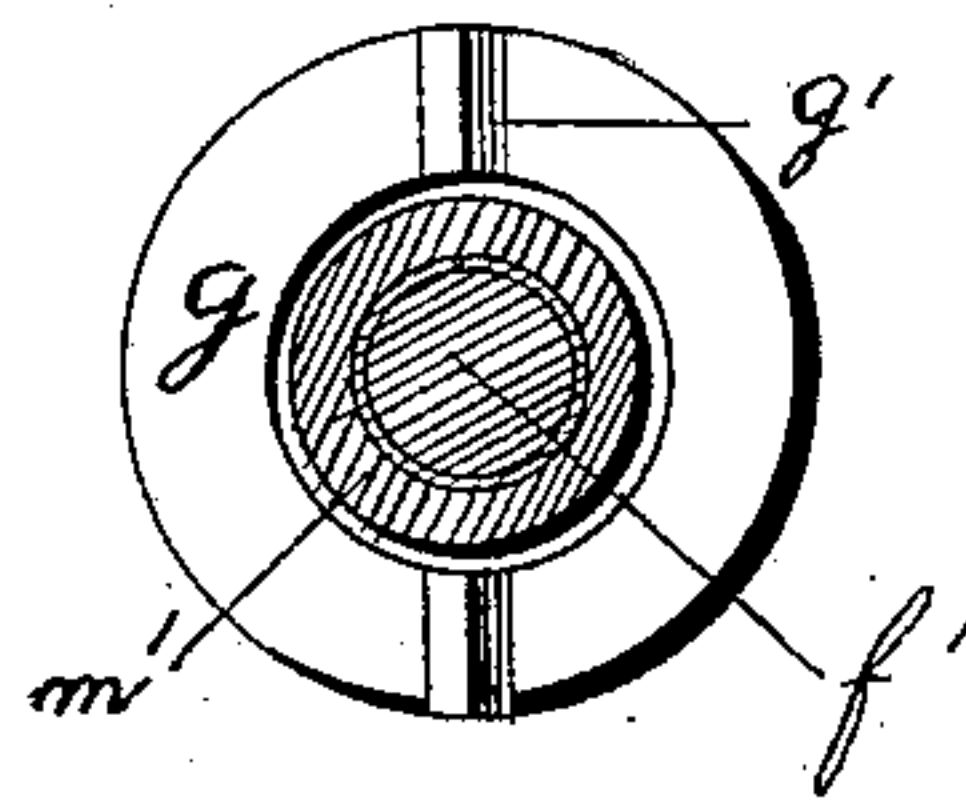


Fig. 3.

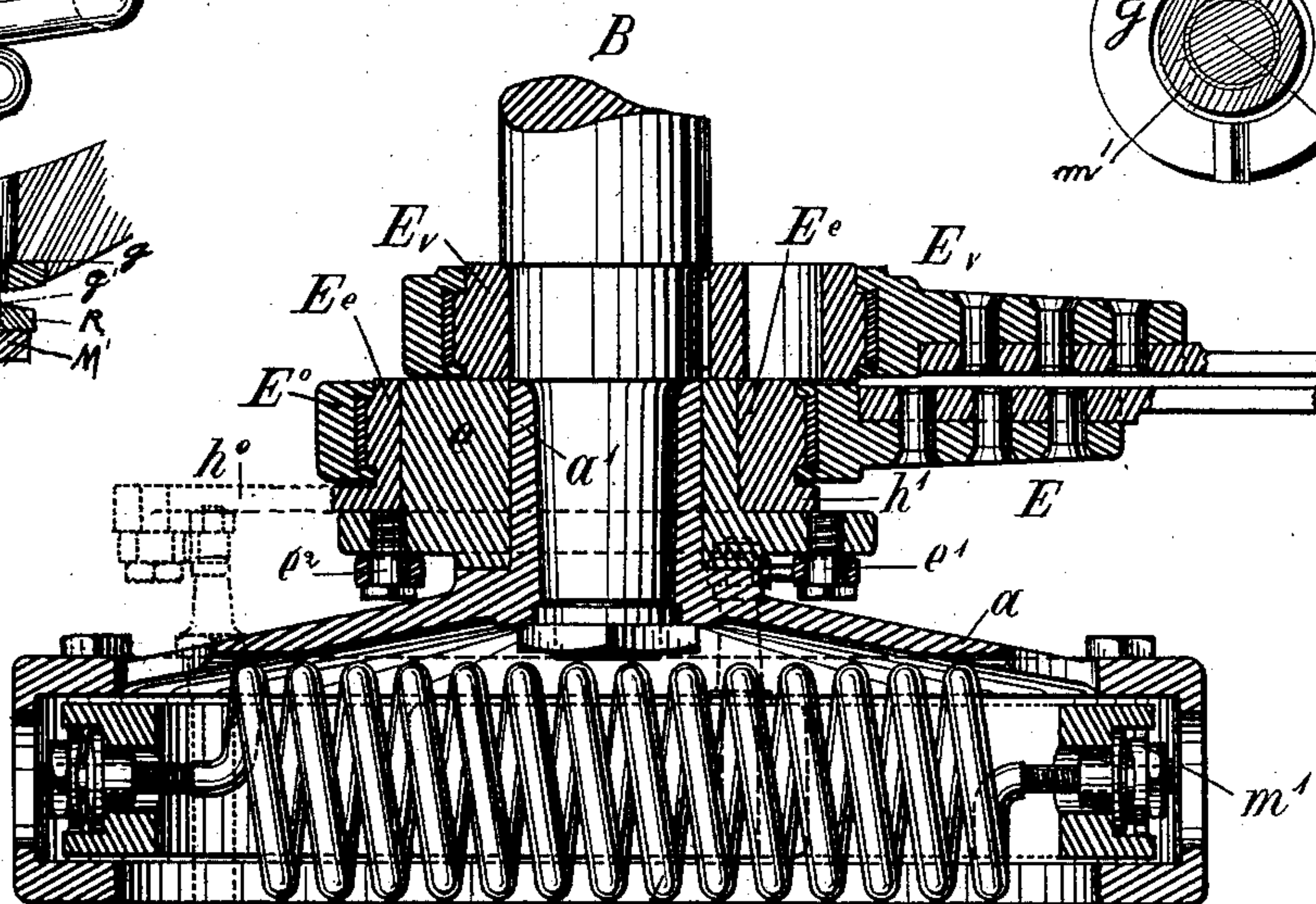
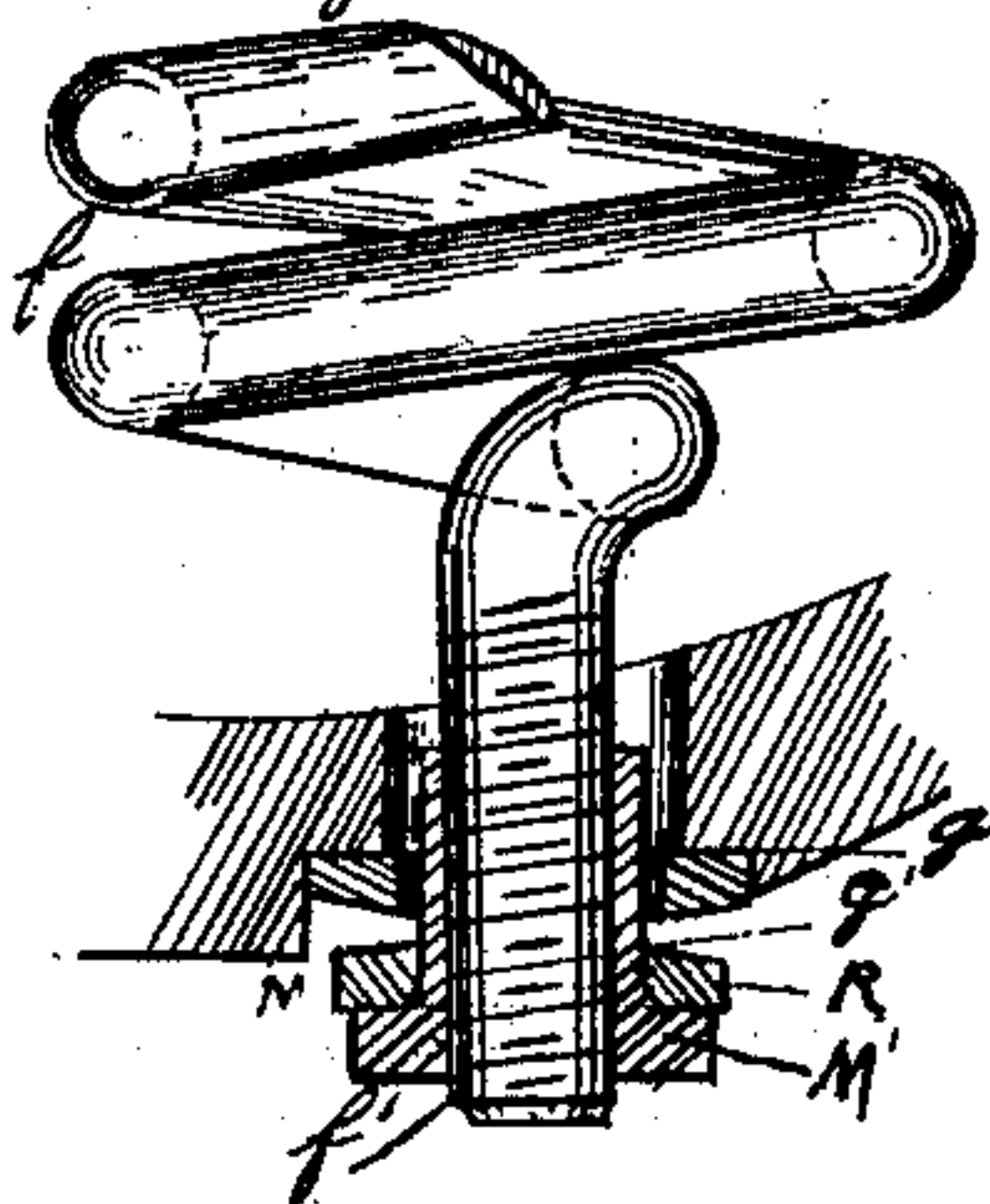


Fig. 2:

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UNITED STATES PATENT OFFICE.

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STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 410,897, dated September 10, 1889.

Application filed September 28, 1888. Serial No. 286,695. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF HOFFMANN, a citizen of the Republic of Switzerland, residing at Zurich, in the Republic of Switzerland, have invented certain new and useful Improvements in Steam-Engines, (which have not been patented to myself or to others with my knowledge or consent in any country,) of which the following is a specification.

My invention relates to improvements in steam-engine governors, the object being the production of a governor or regulator which will be superior to other governors in general efficiency.

To attain the desired object, the invention consists of a governor of the construction illustrated, described, and claimed herein.

Figure 1 is a diagrammatic side view of a valve governor or regulating device embodying my invention. Fig. 2 is a sectional view thereof. Figs. 3 and 4 are detail views of parts of the governor.

This governor R shows outwardly some resemblance to other regulating devices, the main feature of which is an eccentric fixed on the main shaft—as, for instance, to the governors of Armington and Sims. My invention, however, has notable points of difference from these, which render it possible largely to increase the sensitiveness of the governor and the efficiency of the speed-regulating device.

The cylindrical box *a*, Figs. 5 and 6, is fixed on a concentric shaft *a'*, which is a prolongation of the main drive-shaft B. On this same shaft *a'* rests independently the eccentric *E^e*, which governs the expansion-valve *S^e*. We shall now see how the governor regulates this eccentric.

The points *d'* and *d²* are the fulcrums of two symmetrically-located entirely equal centrifugal levers *c'* and *c²*. These two levers are pulled together by one or by a series of parallel spiral springs *f*, (the drawings show only one spring,) connected with said levers, as shown in detail (for the lever *c'* in Figs. 15 and 16. At the extremity *f'* the spring terminates in a screw-thread, on which is screwed a nut *m'*. Against this screw-nut rests a ring *r*, having grooves in the line of a

diameter vertical to the plane of the section shown in the drawings. On the lever rests a similar ring *g*, with fulcrums *g'* in the same line as the grooves above named, and which fit into the same. Through these fulcrums, therefore, the tension of the spring is transmitted to the levers. The swinging ends of the centrifugal levers *c'* and *c²* are connected through the connecting-rods *b'* and *b²* with two equidistant and diametrically-opposite points *e'* and *e²* on arms which are extensions of the disk *e* of the above-said eccentric *E^e*.

By the action of the spring the levers are drawn inward. When the system is in motion, the only force acting on the levers in the opposite direction to the traction of the spring is the centrifugal force. If the speed of the rotation increases, the centrifugal force will throw the levers outward, thus increasing the tension of the spring, and at the same time, through the connecting-rods *b'* and *b²*, turning the disk *e* of the eccentric *E^e* forward in the direction from left to right. If, on the contrary, the speed, and hence the centrifugal force, diminishes, the spring will pull the two centrifugal levers together, and they will by means of the connecting-rods turn the disk *e* backward in the direction from right to left. On this inner disk *e* of the eccentric rests another movable outer disk-ring *E^e*, which with the former constitutes the complete expansion eccentric pulley. This ring is provided with an arm *h⁰*, which is connected by means of the bar *i'* with the point *i* of the solid part of the box *a*. The change of position of the disk *e* moves the ring *E^e*, which, led by the arm *h⁰*, assumes a new position, by which the stroke of the expansion-valve *S^e* is also modified. Thus it will be readily seen that to every position of the centrifugal levers there is a corresponding distinct position of the compound eccentric *E^e* relative to the main drive-shaft.

The peculiarities of my governor and its improvements over other ones are therefore the following:

Differing from all other systems, the centrifugal force of the one lever *c'* acts directly to counterbalance the centrifugal force of the other *c²* through the common tension in the

connecting-spring, which acts equally on both, and may be said to be common to both levers. This spring acting in consequence of the symmetrical disposition of the governor with exactly the same force on both levers, no unequal strain on the one nor one-sided pressure on a joint g' is possible. The centrifugal force has also no tendency to bend aside the spring f , as the axis of this spiral spring goes exactly through the center of rotation. This is an important improvement over the other "single-spring" systems, for in these systems the spring is without exception placed laterally of the axis of rotation, and therefore liable to be bent aside.

The tensions in the spring or springs f being transmitted to the levers c' and c^2 through the fulcrums g' and g^2 , the friction in these joints is reduced to a minimum, and the sensitiveness of the governing device is therefore greatly increased. In my system a friction eventually occurring between the eccentric ring E^0 and the eccentric pulley or a pressure or traction in the direction of the axis of the eccentric-rod can have no retroacting influence upon the relative positions of the levers c' and c^2 . This is an important improvement over other systems in which the arm h^0 is directly connected by means of a connecting-rod with one of the two centrifugal levers, in consequence of which the friction of the outer ring E^0 on the disk of the eccentric exerts a direct influence on the centrifugal levers. In such cases different degrees of friction between eccentric ring and pulley produce different actions on the centrifugal levers, and therefore a certain given speed of the engine can be met by different positions of these levers, according to different degrees of friction in the eccentric. Reciprocally in such systems certain given equilibrium positions of the centrifugal levers can be met by different speeds of the engine, according to different degrees of friction in the eccentric.

It will be seen from the foregoing that the peculiar disposition of spiral springs for the

purpose of balancing the centrifugal force, and the use, disposition, and mode of regulation of the outer disk of the eccentric E^0 , produce a largely-increased sensitiveness of the governor (which does away with the just-exposed defect of other governing devices) and a ready adaptability of the steam-regulating device to any desired degree of intensity of the steam-supply. The sensitiveness of the governor is still further increased by the diminished friction from the valve.

The governor can of course also be fitted for the use of a single eccentric E^0 , corresponding with a single expansion-valve S^0 . It then operates similarly to an ordinary single valve. The different positions of the eccentric E^0 in relation to the main drive-shaft are met by different degrees of intensity of the steam-supply.

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

1. The governor herein described, consisting of a casing, the spiral spring arranged diametrically in said casing, the levers pivoted at one of their ends in said casing and connected near said ends with the ends of the said spring, the rods having their outer ends connected to said levers, and the disks connected to the inner end of said levers, substantially as and for the purpose described.

2. The governor herein described, consisting of a casing, a spring arranged diametrically therein, levers pivoted at one end to the casing and near said ends connected to the ends of the springs, and concentric disks connected to the free ends of said levers, substantially as and for the purpose described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

RUDOLF HOFFMANN.

Witnesses:

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WILLIAM SCHNEIDER.