No. 747,626. PATENTED DEC. 22, 1903.

C. R. MINOR.

REVERSIBLE SHAFT GOVERNOR.

APPLICATION FILED APR. 4, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

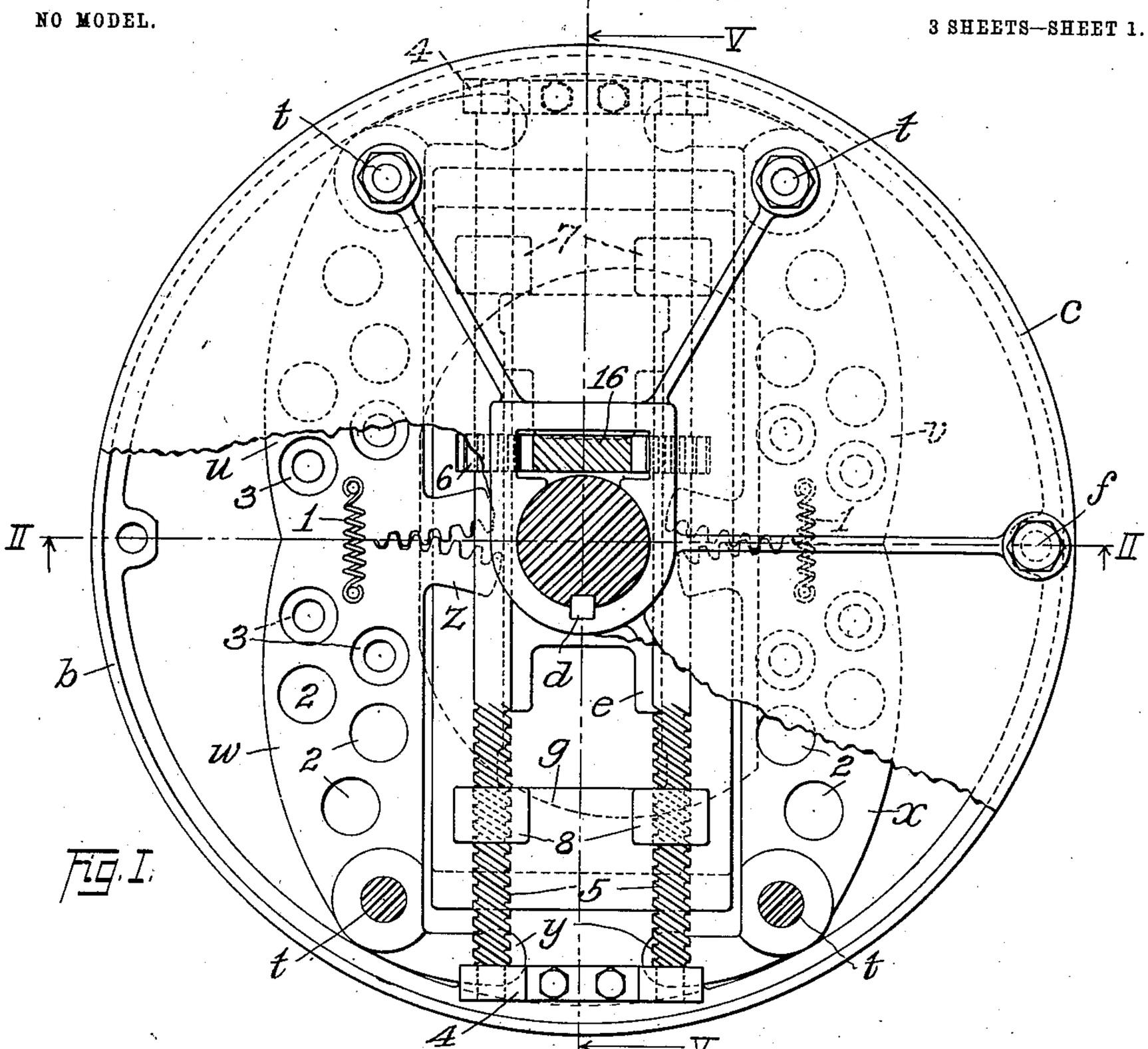

Fig. I.

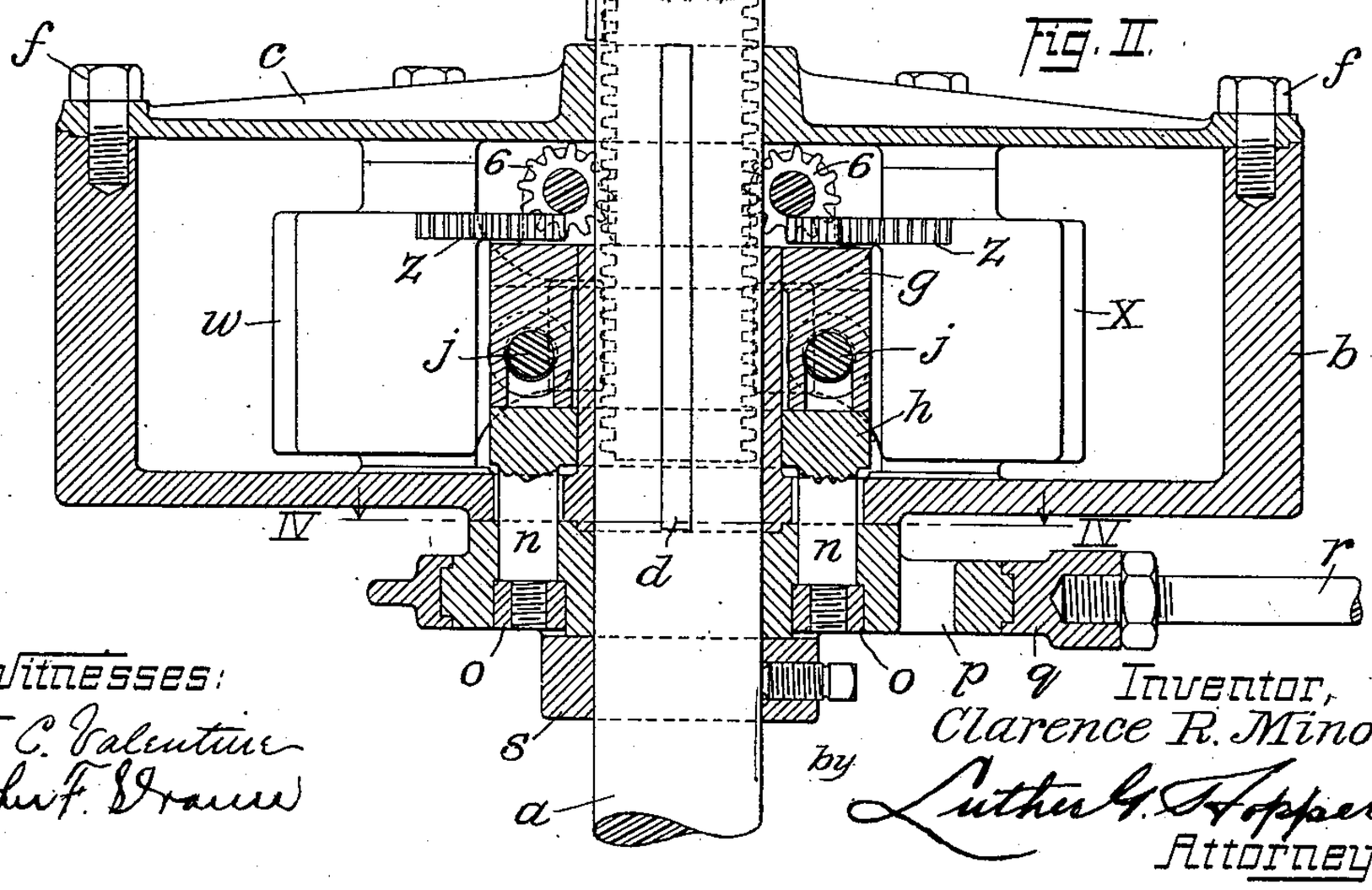

Fig. II.

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NO MODEL. 3 SHEETS—SHEET 2.

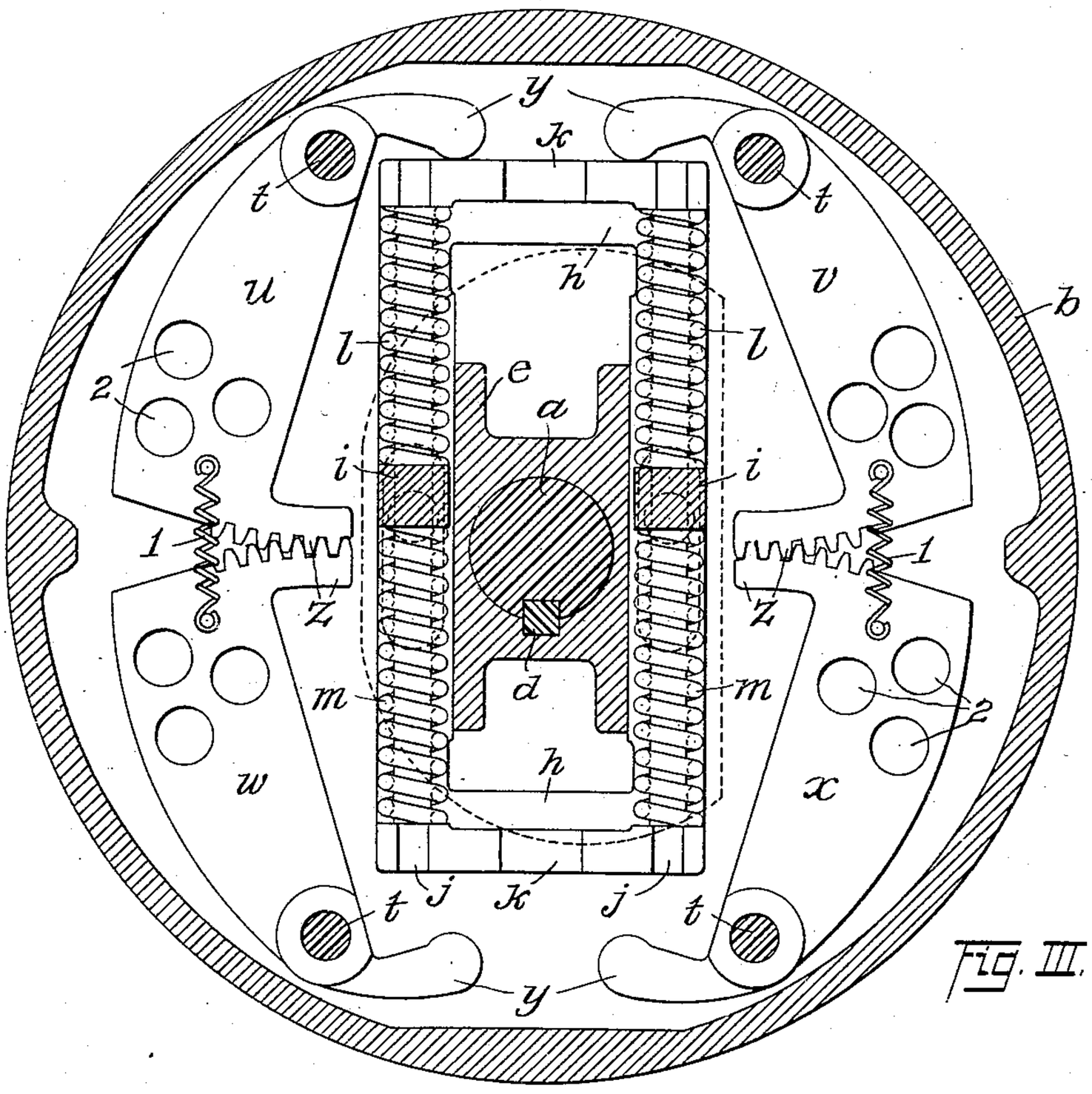

Fig. III.

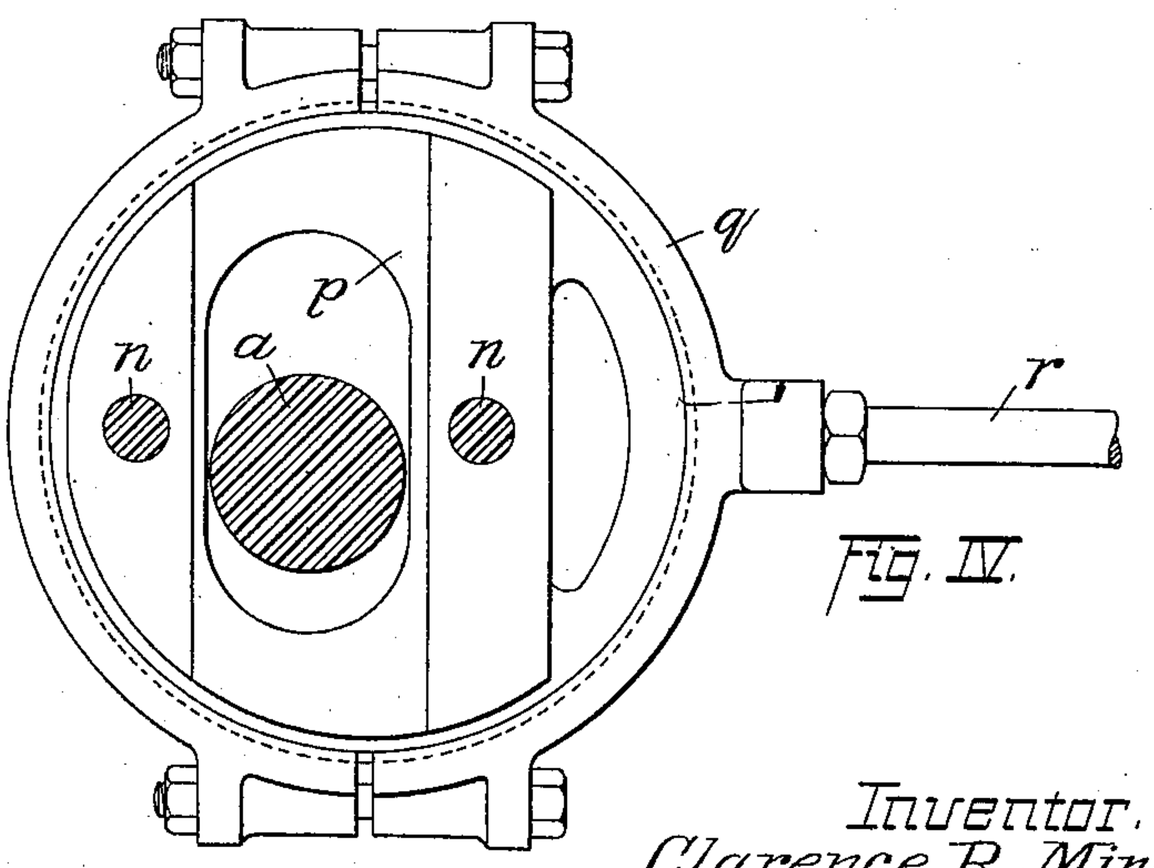

Fig. IV.

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NO MODEL. 3 SHEETS—SHEET 3.

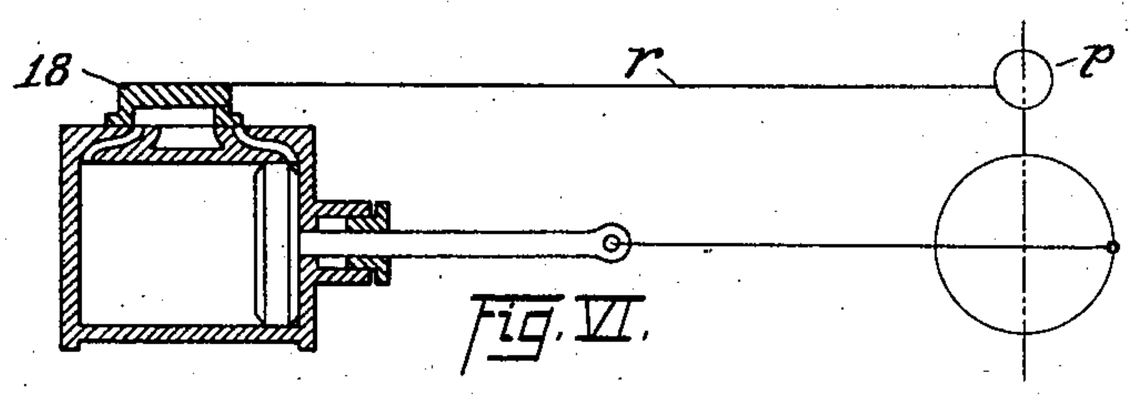
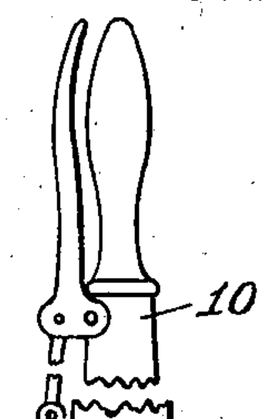


Fig. VI.



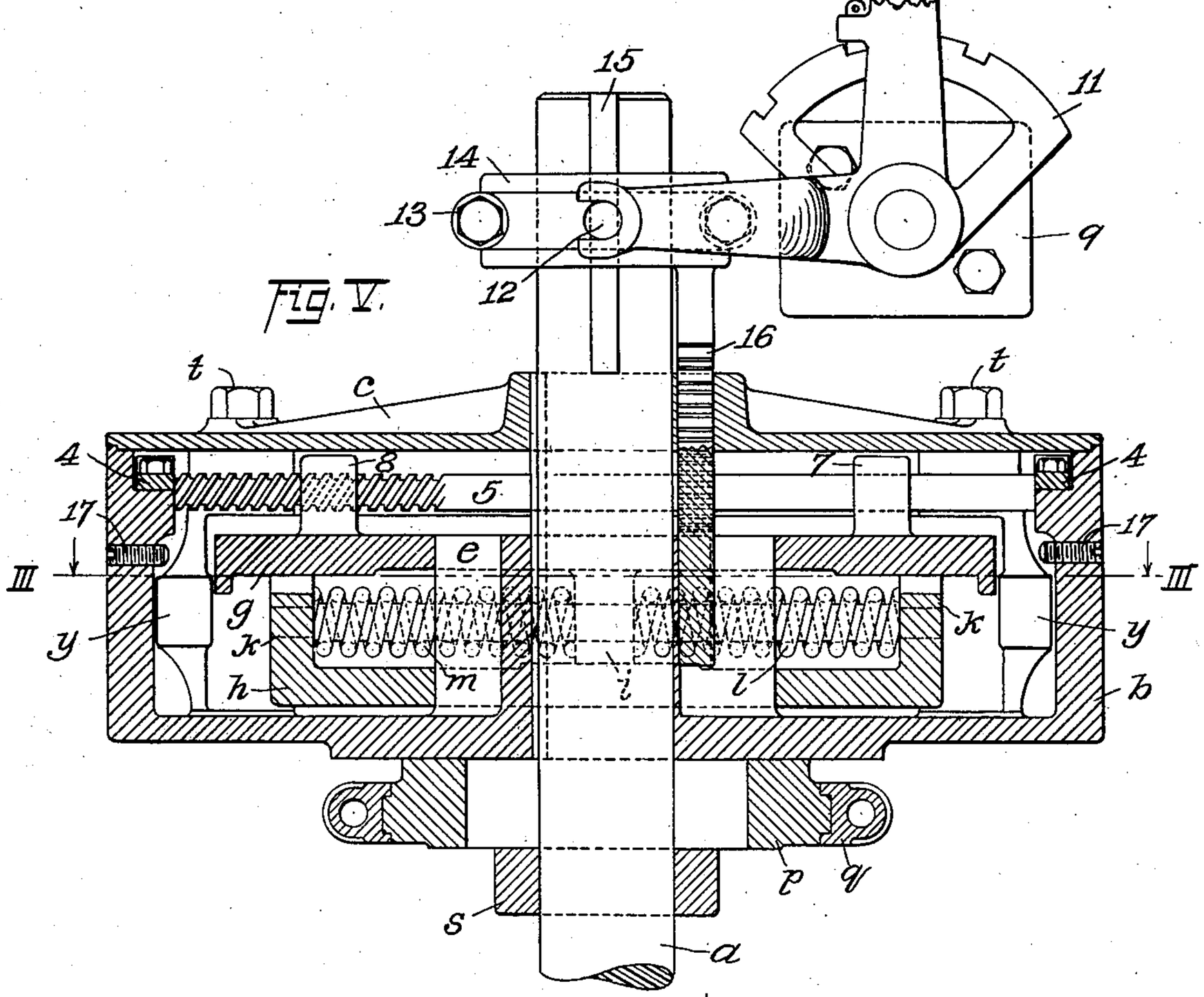


Fig. V.

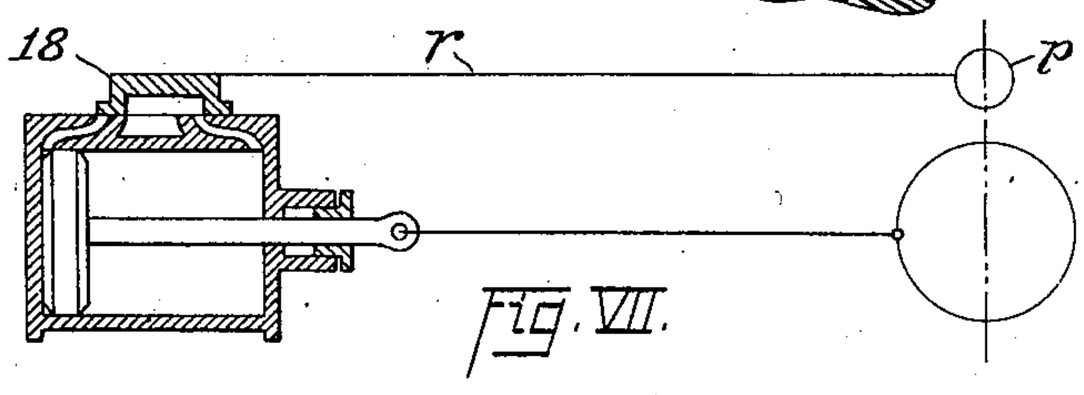


Fig. VII.

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No. 747,626. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

CLARENCE RAY MINOR, OF SANDUSKY, OHIO.

REVERSIBLE SHAFT-GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 747,626, dated December 22, 1903.

Application filed April 4, 1903. Serial No. 151,032. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE RAY MINOR, a citizen of the United States, residing at Sandusky, in the county of Erie and State of Ohio, have invented certain new and useful Improvements in Reversible Shaft-Governors, of which the following is a specification.

This invention relates to shaft-governors for controlling the speed of engines.

The prime object of the present invention is to provide a governing construction arranged upon the engine-shaft and connected with the admission-valve capable of operating promptly to regulate and control the intake of steam to preserve the normal speed of the engine under varying loads and steam-pressures and which will operate to this effect when the engine is running either forward or backward.

Another object is to provide suitable means for reversing the motion of the engine, together with the action of the governor to correspond therewith.

Further advantages are gained by the novel arrangement and construction of the parts, thereby providing for the proper adjustment, ease of operation, and durability of the mechanism.

To these ends my invention consists in the features, arrangements, and combinations hereinafter described and claimed, an embodiment thereof being illustrated in the accompanying drawings, in which—

Figure I is an elevation of the outer face of the governor with one side of the cover-plate broken away to show the internal construction. Fig. II is a section on line II II of Fig. I. Fig. III is a section on line III III of Fig. V. Fig. IV is a section on line IV IV of Fig. II. Fig. V is a section on line V V of Fig. I. Fig. VI is a diagram showing the initial position of the engine-valve when the governor mechanism is set for running the engine in one direction; and Fig. VII is a view similar to Fig. VI, showing the initial position of said valve when the governor is set to run the engine in the opposite direction.

The reference-letter *a* represents the main shaft of the engine. A cylindrical casing *b*, provided with a tight-fitting cover-plate *c*, is mounted upon said shaft and securely fixed thereto by a key *d* or other suitable means. The casing *b* has a hub *e* projecting inwardly, and the cover-plate is removably secured to said casing by screws *f*. The cover-plate is designed to fit the casing snugly, so that oil may be contained therein to lubricate the working parts of the governor.

The casing-hub *e* is elongated or flanged and provided with parallel side faces, as shown, to serve as guides for both the reversing-plate *g* and the eccentric-plate *h*. The reversing-plate *g* is designed to be normally held stationary in relation to the casing, but is arranged to be shifted across the shaft for the purpose of reversing the motion of the engine, as will presently be described. Midway of its length said reversing-plate is provided with a pair of lugs *i*, one upon each side, projecting inwardly and having grooves therein through which the spring-rods *j* may reciprocate. The eccentric-plate *h*, working against the inner face of the casing *b*, is provided at its ends with outwardly-projecting flanges *k*, having grooves therein fitted to receive the ends of the said spring-rods *j*. Said spring-rods are turned to a smaller diameter at their ends, so as to form shoulders abutting, respectively, against the flanges *k* for the purpose of retaining them in place. Surrounding the rods *j* and abutting against the respective flanges *k* and the lugs *i* are two pairs of spiral springs *l* and *m* of substantially equal size and strength and preferably somewhat in compression when the eccentric-plate is in its middle position.

Projecting inwardly through elongated slots in the casing *b*, midway of the length of the eccentric-plate *h* and preferably integral therewith, is a pair of pins *n*. Secured upon said pins by suitable means, such as the nuts *o*, and bearing against the casing is an eccentric *p*, through an elongated slot in which the main shaft *a* extends. Said eccentric is provided with the usual encircling strap *q*, to which is attached a valve-rod *r*, connecting with the intake-valve of the engine, and a shaft-collar *s* is provided when necessary. It will thus be observed that the eccentric *p* and the eccentric-plate *h* are rigidly connected together and arranged to move across the shaft as one piece.

Fulcrumed upon studs *t*, set into the casing *b* near its periphery, are four centrifugal

weights u, v, w, and x, each provided with arms y, projecting beyond their fulcrums and adapted to engage the respective ends of the eccentric-plate h. The studs t are extended through the cover-plate c, being provided with shoulders inside and nuts outside of said plate. The said weights are arranged to move in pairs, the weights u and w forming one pair and weights v and x another. This is accomplished, preferably, by means of toothed segments z upon the free ends of the respective weights, the segments of each pair meshing together. The weights of each pair are also connected by spiral springs 1, the tension of which serves to hold the weights at their inner position, as shown in Fig. I, except when they are thrown outward by the centrifugal force of revolution. For convenience in adjusting the governor to operate at differing rates of speed I form circular apertures 2 in the weights, some or all of which may be filled, as required, with plugs or hollow bushings 3, Fig. I.

Referring now to the reversing mechanism, it will be observed that means must be provided for shifting the reversing-plate g across the shaft and holding it firmly in position. Shouldered against and rotatably mounted in bearings 4 in the casing b is a pair of transverse shafts 5, disposed one upon each side of the main shaft a, screw-threaded with multiple threads at one end, provided with toothed pinions 6, and made similar to each other in all respects. The reversing-plate g is mounted upon the shafts 5 by means of a pair of outwardly-projecting lugs 7, bored to a sliding fit upon said shafts, and a pair of similar lugs 8, threaded internally to fit the screw-threaded portions of said shafts, the respective pairs of lugs being located near opposite ends of the plate, as shown.

Fulcrumed upon a suitable extraneous support, as 9, Fig. V, is a hand-lever 10, which should be provided with means for locking it in its central and outermost positions—such, for example, as the well-known notched quadrant 11 and latch engaging therewith. The lever 10 is provided with a bifurcated end, each branch of which is forked or slotted to engage the oppositely-projecting pins 12 of a two-part collar 13. The collar 13 is loosely fitted between the flanges of a sliding collar 14, mounted upon the main shaft, and a feather-key 15, so that said sliding collar revolves with the shaft. Carried by the collar 14 and preferably integral therewith is a rack 16, projecting through an aperture in the cover-plate c into the casing between the pinions 6 and provided with gear-teeth upon each of its side faces adapted to engage, respectively, with said pinions. Adjustable screws 17 may be provided in the peripheral shell of the casing to serve as stops to prevent excessive travel of the reversing-plate g.

In the operation of the mechanism let us first consider the lever 10 as being thrown over to one of its extreme positions. This will operate to rotate the shafts 5 and carry the reversing-plate g, and with it the eccentric-plate h and eccentric p, into their extreme outer positions upon one side of the main shaft, and since said eccentric is operatively connected with the slide-valve 18 of the engine, as shown in Figs. VI and VII, the position of said valve will be such in relation to the crank-shaft, as shown in one of said figures, that steam will enter the cylinder to drive the engine in one direction, and by throwing the lever 10 to its other extreme position the said parts, including the eccentric, will be shifted to the opposite side of the main shaft, effecting a change in the initial position of the slide-valve 18, as shown in the other diagrammatic figure, whereby steam will enter the cylinder at such times that the engine will be driven in the opposite direction. It will also be observed that when the hand-lever 10 is thrown over to one of its outer positions one end of the eccentric-plate h will bear against the arms y of two of the weights. In Fig. III said plate h is shown bearing against the arms of the weights u and v, being opposed thereto by the force of the springs 1, which are in compression. When the engine is at rest, the weights assume the inner position, as shown in Fig. I, with their ends abutting, respectively, against the ends of the opposite weights. When the engine is running and tends to exceed its normal rate of speed, the weights are swung outward by the centrifugal force of revolution, as in Fig. III, overcoming the resistance of the pair of springs l or m, according as the engine is running in one direction or the other, and shifting the plate h and eccentric p toward their central position, thereby decreasing the travel of the slide-valve 18 and cutting off the flow of pressure fluid to the engine-cylinder earlier in the stroke of the piston, and, conversely, as the speed tends to decrease the weights swing inward and the springs force the eccentric toward its outer position, where it makes the valve travel further, thus admitting more pressure fluid to the cylinder. By these means the slightest fluctuations of speed are at once controlled and the engine kept running steadily at its normal rate of speed under varying conditions of load and steam-pressure, and this close regulation of speed will be accomplished whether the engine is running forward or backward, the change in direction of the movement of the engine being brought about by manipulating the reversing-lever, as above described.

I have described what I now consider the best form and mode of operation of my invention; but modifications may be made in the details of the mechanism herein disclosed without departing from the spirit thereof, provided the principles of construction set forth, respectively, in the following claims are employed.

I therefore particularly point out and distinctly claim as my invention—

1. In a governor for engines, the combination with a rotatable shaft, of an eccentric operatively connected with the pressure-fluid-admission valve of the engine, a sliding plate suitably mounted upon the shaft and rigidly attached to said eccentric, both said plate and said eccentric being adapted to be moved across the shaft, a reversing-plate operatively connected with said sliding plate and provided with means for holding it in position, centrifugal weights and opposing springs arranged to revolve with the shaft and adapted to engage directly with said sliding plate and shift its position according as the speed of revolution increases or decreases, substantially as set forth.

2. In a governor for engines, the combination with a rotatable shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft eccentrically thereto, a sliding plate mounted in said casing and rigidly attached to said eccentric, and centrifugal weights and opposing springs arranged to vary the position of said sliding plate and eccentric according as the speed of revolution varies, substantially as set forth.

3. In a governor for engines, the combination with a rotatable shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, a sliding plate mounted in said casing and rigidly attached to said eccentric, a reversing-plate operatively connected to said sliding plate and provided with means for holding it in position, and centrifugal weights and opposing springs arranged to engage directly with said sliding plate to vary the position of said sliding plate and eccentric according as the speed of revolution varies, substantially as set forth.

4. In a governor for engines, the combination with a rotatable shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, a sliding plate mounted in said casing and rigidly attached to said eccentric, a reversing-plate provided with means for holding it in position, centrifugal weights fulcrumed in said casing and adapted to bear against said sliding plate, and springs inserted between said sliding plate and reversing-plate arranged to oppose the action of said weights, substantially as set forth.

5. In a governor for engines, the combination with a rotatable shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, a sliding plate provided with flanges upon its ends mounted in said casing and rigidly attached to said eccentric, a reversing-plate carrying lugs upon its middle portion and provided with means for holding it in position, springs inserted between said lugs and the flanges of said sliding plate, and centrifugal weights fulcrumed in said casing and adapted to bear against said sliding plate and compress said springs, substantially as set forth.

6. In a governor for engines, the combination with a rotatable shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, a sliding plate provided with flanges upon its ends mounted in said casing and rigidly attached to said eccentric, a reversing-plate carrying lugs upon its middle portion and provided with means for holding it in position, springs inserted in compression between said lugs and the flanges of said sliding plate, and centrifugal weights fulcrumed in said casing, geared together in pairs and provided with arms adapted to bear against said sliding plate and shift its position as the weights swing outward, substantially as set forth.

7. In a governor for engines, the combination with a rotatable shaft, of an eccentric operatively connected with the pressure-fluid-admission valve of the engine, a sliding plate suitably mounted upon the shaft and rigidly attached to said eccentric, both said plate and said eccentric being adapted to be moved across the shaft, a reversing-plate operatively connected with said sliding plate, centrifugal weights and opposing springs arranged to revolve with the shaft and adapted to engage said sliding plate and shift its position according as the speed of revolution varies, and suitable means for shifting said reversing-plate across the shaft and locking it in its central or outermost positions, substantially as set forth.

8. In a governor for engines, the combination with a rotatable engine-shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, a sliding plate mounted in said casing and rigidly attached to said eccentric, centrifugal weights and opposing springs arranged to vary the position of said sliding plate according as the speed of revolution varies, a reversing-plate parallel with and operatively connected to said sliding plate, rotatable and parallel shafts mounted in said casing, supporting said reversing-plate and screw-threaded therein, and means for rotating said parallel shafts and locking them in place as required, substantially as set forth.

9. In a governor for engines, the combination with a rotatable engine-shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing rigidly attached to a sliding plate inside thereof, operatively

connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, centrifugal weights and opposing springs arranged to vary the position of said sliding plate according as the speed of revolution varies, a reversing-plate parallel with and operatively connected to said sliding plate, rotatable and parallel shafts mounted in said casing, screw-threaded in and supporting said reversing-plate and provided with toothed pinions, a collar slidingly mounted upon said engine-shaft having a rack projecting between said pinions and adapted to engage therewith to revolve said parallel shafts, and suitable means for sliding said collar along the shaft and locking it in requisite positions, substantially as set forth.

10. In a governor for engines, the combination with a rotatable engine-shaft, of a governor-casing rigidly mounted thereon, an eccentric outside of said casing rigidly attached to a sliding plate inside thereof, operatively connected with the pressure-fluid-inlet valve of the engine and adapted to move across said shaft, centrifugal weights and opposing springs arranged to vary the position of said sliding plate according as the speed of revolution varies, a reversing-plate parallel with and operatively connected to said sliding plate, rotatable and parallel shafts mounted in said casing, screw-threaded in and supporting said reversing-plate and provided with toothed pinions, a collar slidingly mounted upon said engine-shaft having a rack projecting between said pinions and adapted to engage therewith to revolve said parallel shafts, a reversing-lever mounted upon an extraneous support provided with means for sliding said collar along the shaft, and means for locking the reversing mechanism, substantially as set forth.

In testimony whereof I affix my signature, in the presence of two subscribing witnesses, at Sandusky, Ohio, this 28th day of March, 1903.

CLARENCE RAY MINOR.

Witnesses:
JOHN RAY,
J. C. CLARK.