No. 723,185. PATENTED MAR. 17, 1903.

P. RICHEMOND.

GOVERNOR FOR STEAM ENGINES.

APPLICATION FILED MAR. 19, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

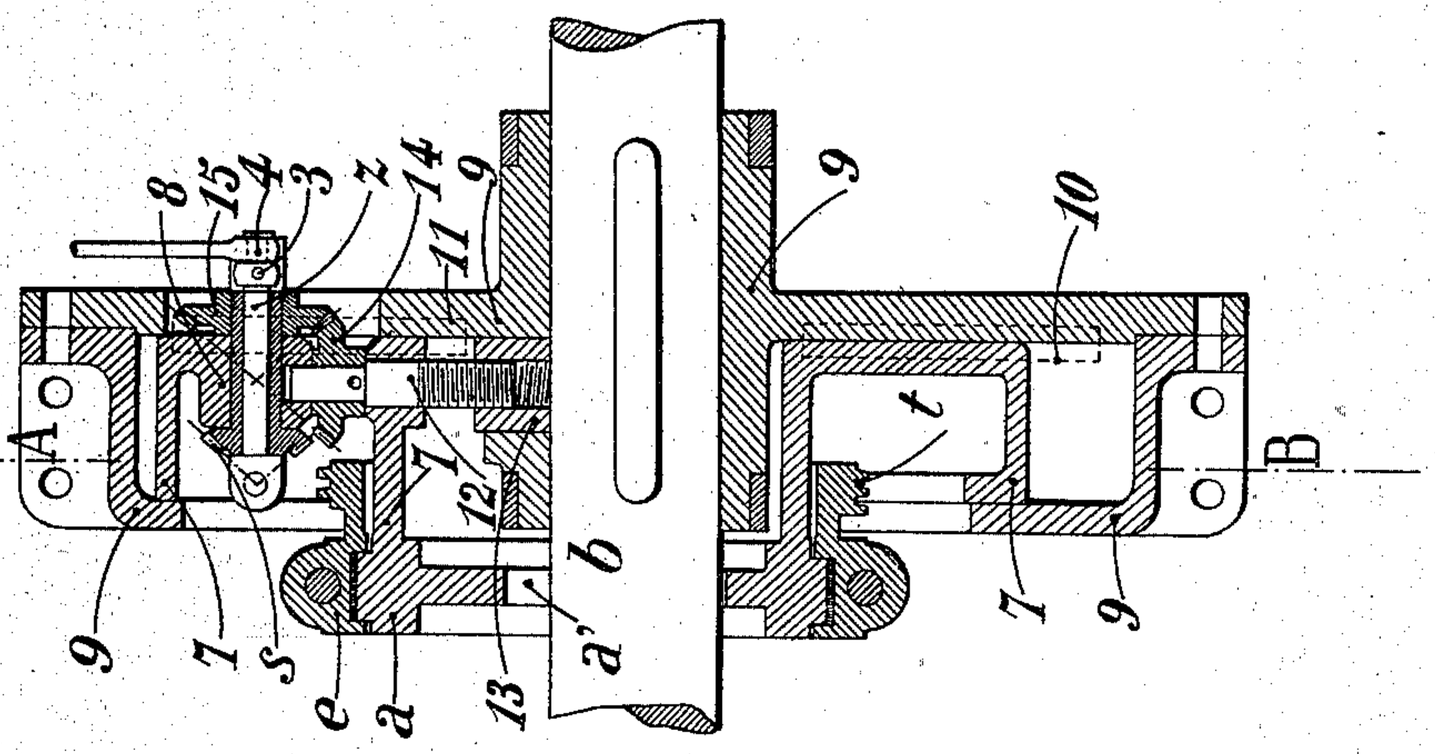
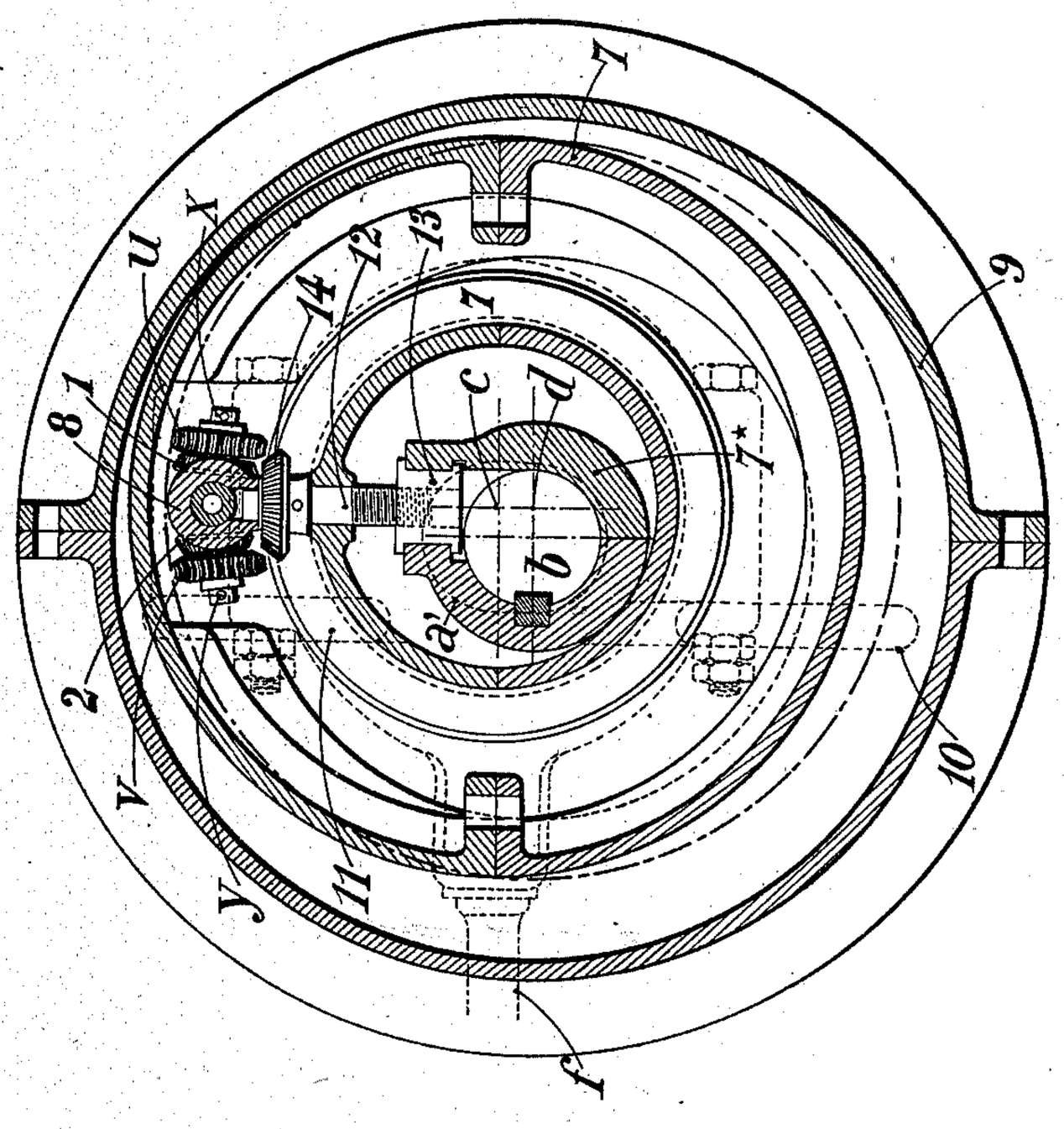


Fig. 2.



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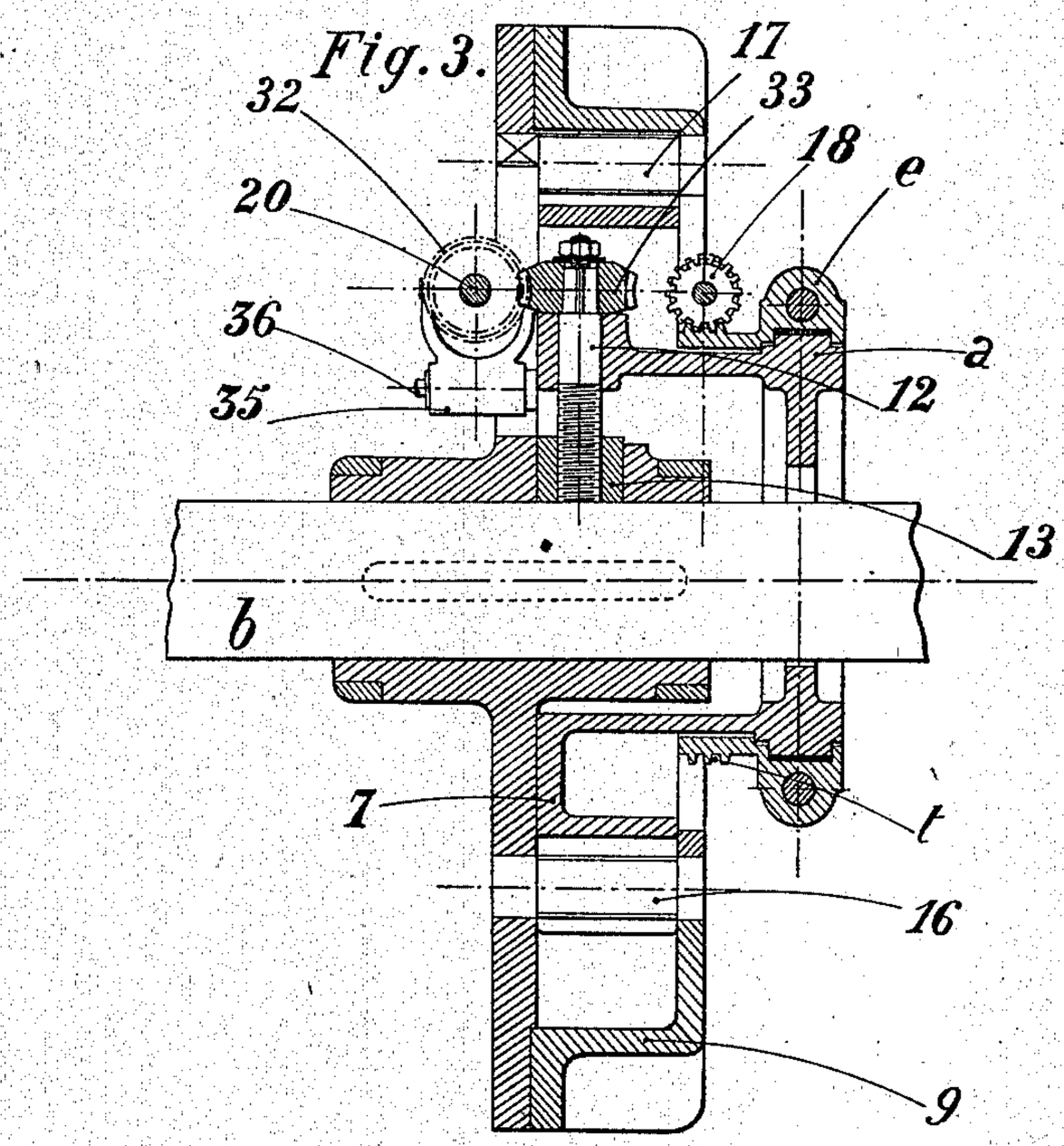
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.



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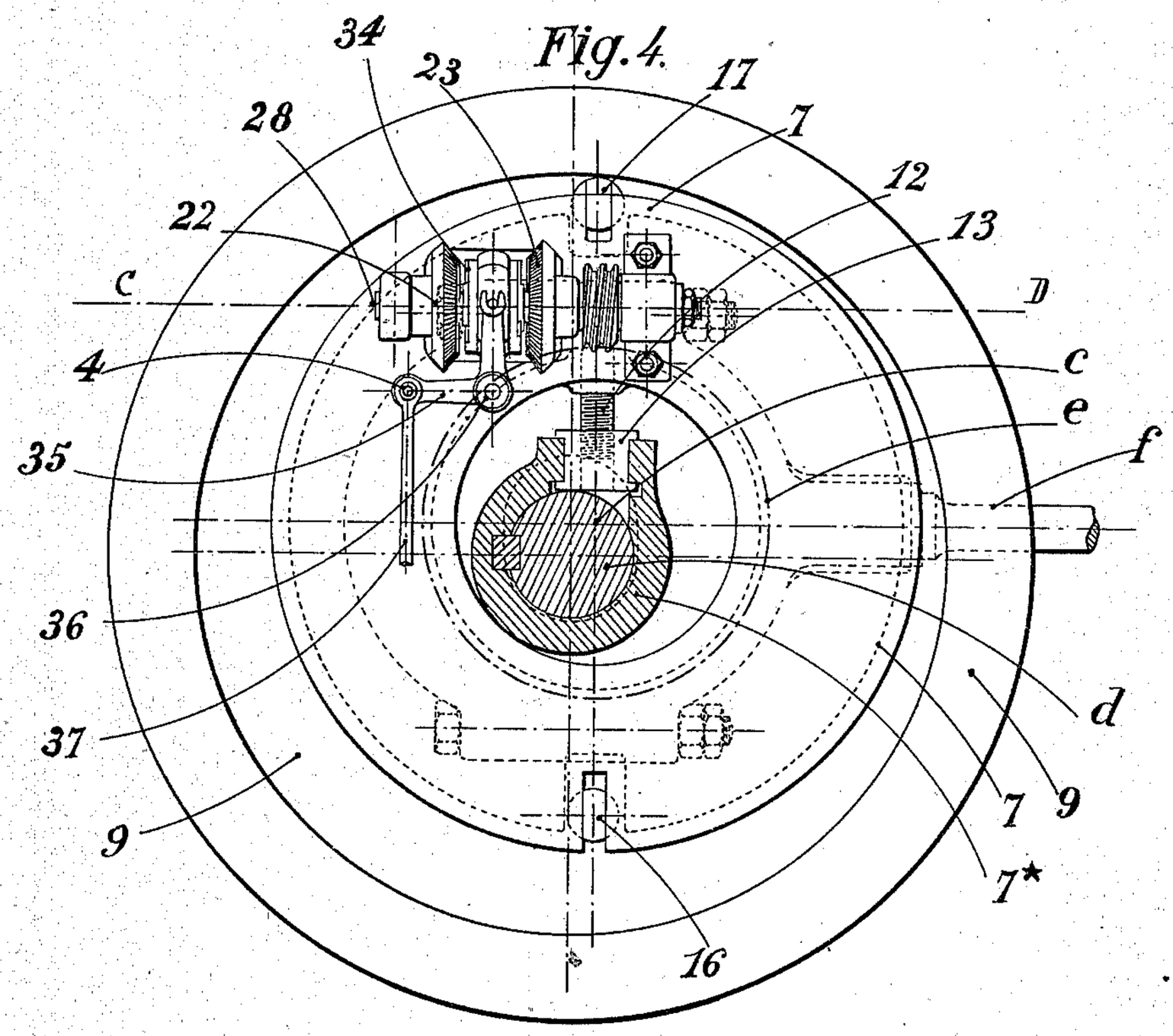
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 4.



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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

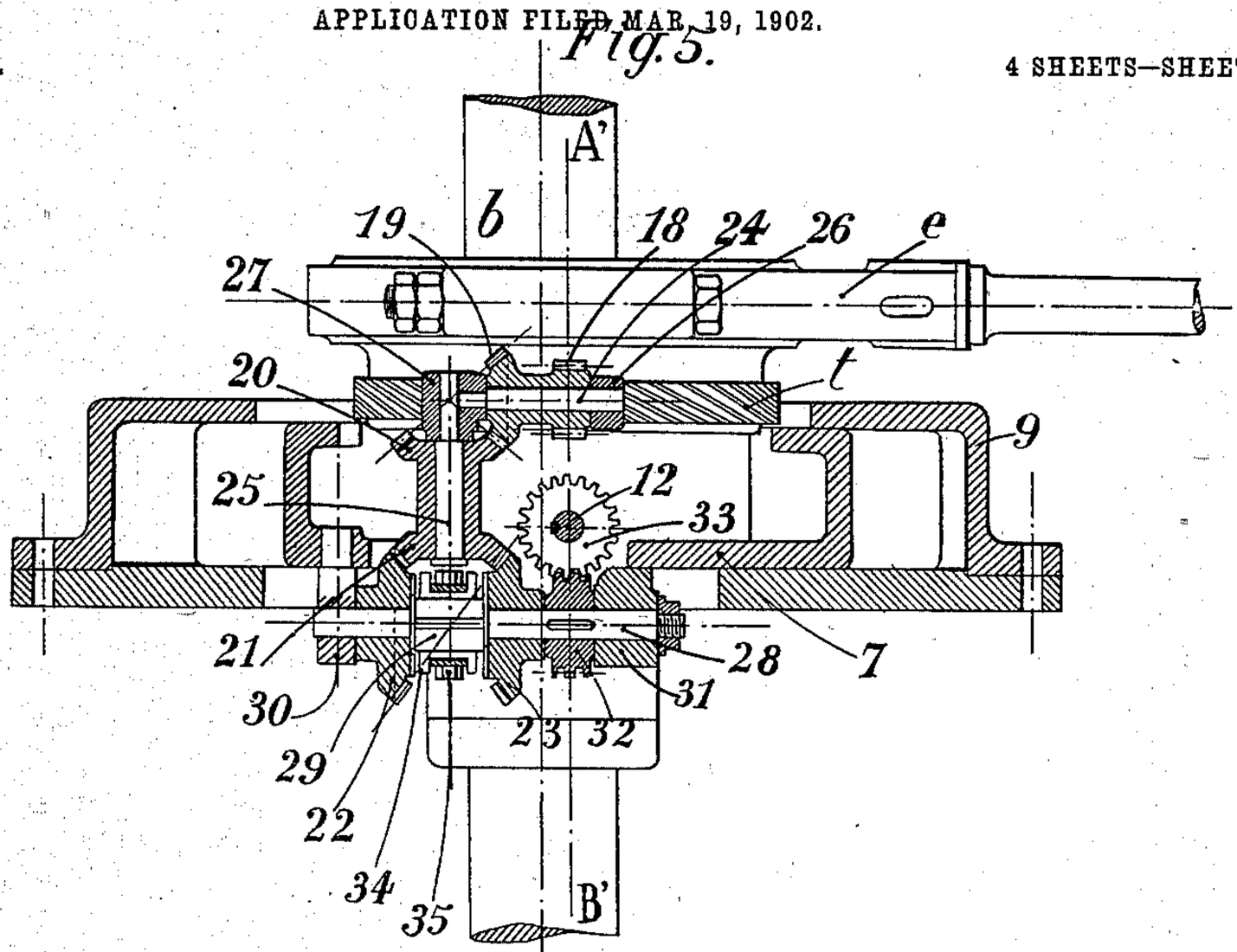
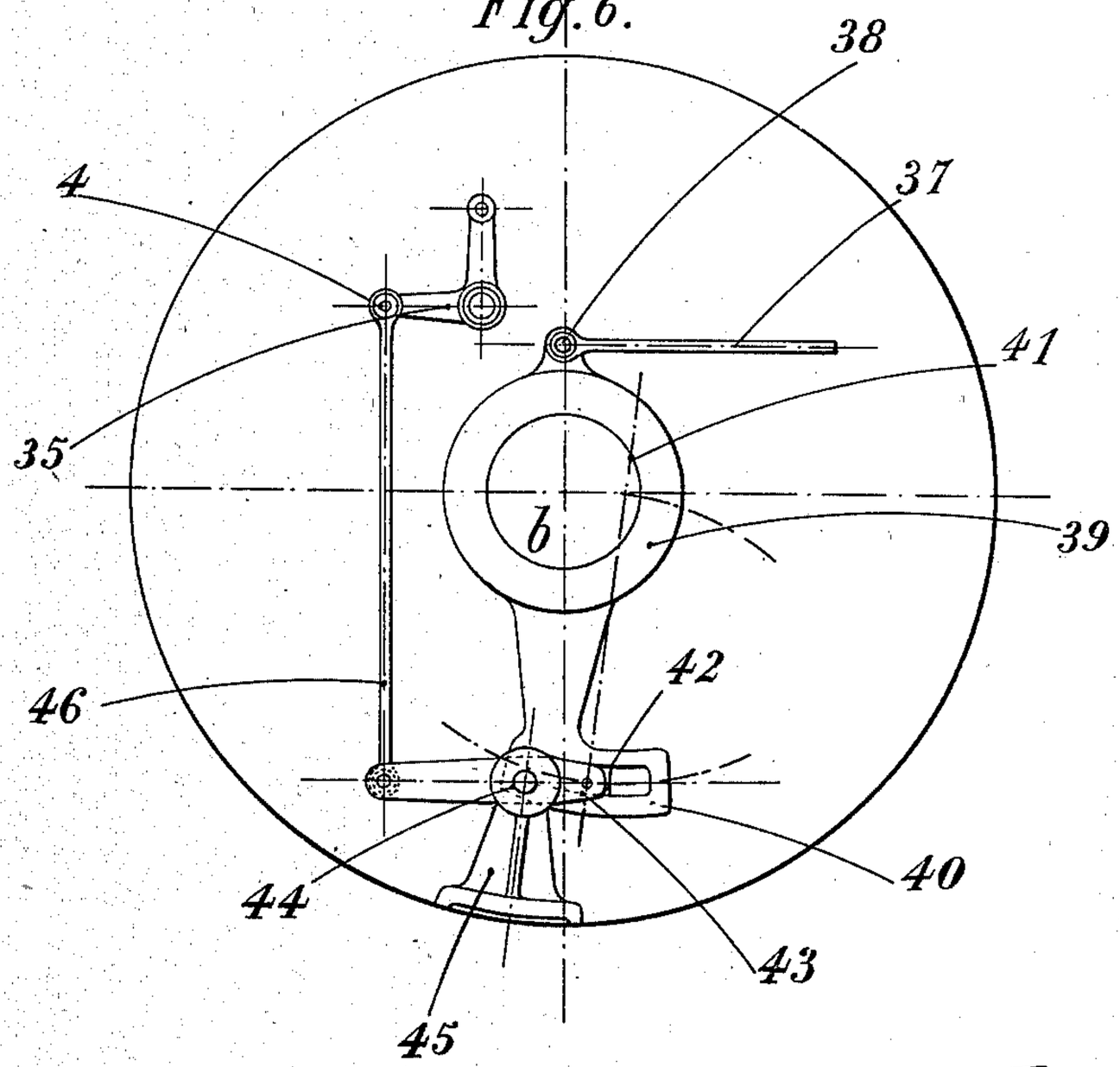


Fig. 6.



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UNITED STATES PATENT OFFICE.

PIERRE RICHEMOND, OF PANTIN, FRANCE, ASSIGNOR TO SOCIÉTÉ ANONYME DES ETABLISSEMENTS WEYHER ET RICHEMOND, OF PANTIN, FRANCE.

GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 723,185, dated March 17, 1903.

Application filed March 19, 1902. Serial No. 99,013. (No model.)

To all whom it may concern:

Be it known that I, PIERRE RICHEMOND, engineer, a citizen of the French Republic, residing at Pantin, Seine, France, (post-office address 50 Route d'Aubervilliers, in said city,) have invented certain new and useful Improvements Relating to Governors for Steam-Engines, of which the following is a specification.

This invention relates to valve-gear for steam-engines in which the distribution of steam is effected by a D-valve, a piston-valve, or the like having lap and lead, and has for its object to provide an arrangement whereby the rate of cut-off can be varied by causing the governor to act on an eccentric to alter its throw without having to overcome too great a resistance.

The essential feature of this invention consists in utilizing for the purpose the rotary motion of the eccentric relatively to its straps, and in order that the invention may be clearly understood I will now proceed to describe it with reference to the accompanying drawings, in which—

Figures 1 and 2 are vertical sections of an arrangement of mechanism according to this invention, the section in Fig. 2 being taken through a line A B of Fig. 1. Fig. 3 is a longitudinal section through line A′ B′ (not shown) of Fig. 5. Fig. 4 is a side elevation of Fig. 3, partly in section. Fig. 5 is a horizontal section on line C D of Fig. 4, and Fig. 6 shows the improved mechanism connecting the controlling device with the governor.

Like letters and numerals are employed to indicate similar parts in all the figures.

In the figures, *a* represents an eccentric-sheave through which passes the shaft *b*, the said eccentric being capable of occupying various positions relatively to the axis of the shaft. For example, as shown in the drawings, the center of the eccentric is capable of moving to any point between the extreme positions *c* and *d*.

e is the eccentric-strap, which is connected to the slide-valve by the rod *f*.

The eccentric-sheave *a* has an elongated opening *a′* therein, through which the shaft *b* passes and which permits of the eccentric being shifted in position to the extent indicated by *c d*. The eccentric-sheave *a* is integral with a disk 7, inclosed in a drum 9, keyed on the shaft *b*, and is in contact with the interior of the said drum, within which it can slide, it being guided in its movement by two feathers 10 and 11 to insure it moving in the proper direction and at the same time serving to impart to the said disk 7 and eccentric-sheave *a* rotary motion with the drum 9, which is rotated by the shaft *b*. Through a part 7*, which connects the eccentric-sheave *a* to the disk 7, passes a spindle 12, which carries on one end a bevel-wheel 14, Figs. 1 and 2, (or a worm-wheel 33, Figs. 3 and 5,) its other end being screw-threaded and screwing into a nut 13, Figs. 1, 2, 3, and 4, fitted in the boss 7* of the drum 9, so that if the screw-threaded spindle 12 is rotated the disk 7 and the eccentric-sheave *a* will be moved along the feathers 10 and 11, the elongated opening *a′*, embracing the shaft *b*, admitting of this movement.

As shown in Figs. 1 and 2, the eccentric-strap *e* is provided with a worm *t*, with which can be caused to gear two worm-wheels *u* and *v*, mounted loosely on the spindles or axles *x* and *y*, carried on a spindle *z*, capable of being partially rotated in a boss 8, integral with the disk 7.

As bevel-wheel 1 is formed integral with the worm-wheel *u* and another bevel-wheel 2 is also formed integral with the worm-wheel *v*, the wheels *u* and 1 are loose on the axle *x* and the wheels *v* and 2 are loose on the axle *y*. The wheels 1 and 2 gear with a wheel *s*, forming part of a sleeve revolving freely on the spindle *z* within the boss 8 and with a bevel-wheel 15, situated outside the boss 8, this latter bevel-wheel 15 gearing with the bevel-wheel 14 on the aforesaid screwed spindle 12. On the spindle *z* is a crank 3, on the crank-pin 4 of which is mounted a rod connected to the governor by suitable means. The operation of this arrangement is as follows: When the spindle *z* is turned in the sleeve by the crank 3 to operate the governor, the crank-pin 4 of the crank 3 will be caused to recede from or approach toward the axis of the shaft *b*, the partial rotation of the spindle *z* causing one or the other of the wheels *u* and *v* to gear with the worm *t*,

and since there is a considerable relative motion between the eccentric-strap *e*, which does not revolve, and the rest of the mechanism, which revolves with the shaft, it will be understood that as soon as the worm *t* comes in contact with one or the other of the worm-wheels *u* and *v* a rotation of the wheel *s* will take place and impart rotation to the screw 12 through the medium of the wheels 14 and 15 in one direction or the other, according to which of the wheels *u* or *v* be in gear with the worm *t*. The rotation of the screw 12 results in a movement of the same in the nut 13, and as the screw 12 forms part of the disk 7, with which it revolves, longitudinal motion of the screw causes a longitudinal movement of the disk 7 on the feathers 10 and 11 and the center of the sheave comes nearer the point *c* or the point *d*, according to the direction of rotation imparted to screw 12. The direction of the threads of this screw is such that if the crank-pin 4 on receding from the shaft *b* causes the worm-wheel *u* to gear with the worm *t* the operation of the system as it has just been described causes the center of disk 7 to move toward the point *c*, and thus to throw the worm-wheel *u* out of gear with the worm *t*. If, on the contrary, the crank-pin 4 is moved toward the shaft *b*, the worm-wheel *v* is caused to gear with the worm *t*. The operation of the system has for effect to shift the center of the disk 7 toward the point *d* and to cause the wheel *v* to be thrown out of gear.

In the modified arrangement shown in Figs. 3, 4, and 5 the eccentric-sheave *a* is integral with the disk 7, mounted within the drum 9, inside which it is capable of sliding. This sliding motion is obtained, as hereinbefore described, by means of the screw-threaded spindle 12, and the direction of the sliding motion of the sheave is insured by two feathers 16 and 17 engaging with grooves provided in the disk 7. These feathers not only guide the disk 7 in its longitudinal motion, but also cause it to participate in the rotation of the drum 9, to which the said feathers 16 and 17 are attached. The disk 7 carries the whole of the parts which determine its sliding motion within 9 and are arranged as follows: A worm-wheel 18, actuated by the worm *t* on the eccentric-sheave, is integral with a bevel-wheel 19, gearing with a bevel-wheel 20, which is integral with a bevel-wheel 21. The bevel-wheel 21 gears with two other bevel-wheels 22 23, which rotate in opposite directions. The worm-wheel 18 and the bevel-wheel 19 rotate loosely on an axle 24, one end of which rests in a support 26 and the other end in a support 27, which also carries the axle 25, on which the wheels 20 and 21 revolve. The bevel-wheels 22 and 23 rotate on the axle 28, carried by the supports 30 and 31, attached to the disk 7. The axle 28 carries between the wheel 23 and the support 31 a worm 32, gearing with a worm-wheel 33, keyed on the upper end of the screwed spindle 12. The part 29 of the axle 28 carries a sleeve 34, participating in the rotary motion of the axle 28 and capable of sliding on this axle under the action of a forked bell-crank 35, pivoted on the pin 36, fixed to the disk 7.

The sleeve 34 is provided on both ends with claws or clutch-teeth capable of engaging with corresponding teeth formed on the internal faces of the bevel-wheels 22 and 23, so as to cause either of these bevel-wheels to rotate with the axle 28, according to the position of the bell-crank 35. When the two wheels 22 and 23, as shown in Figs. 3, 4, and 5, are out of gear with the sleeve 34, they rotate loosely on the axle 28.

The whole of the parts 18 to 35 are carried by the disk 7 and participate in its motion when the eccentric *a* moves along the path *c d*. The operation of this arrangement is as follows: The motion of the eccentric within the strap *e* causes the rotation of the worm-wheel 18 around the worm *t*, forming part of the said strap *e*. The wheel 18, gearing with the worm *t*, is thus caused to rotate on the axle 24 and through the wheels 19, 20, and 21 cause the rotation of the wheels 22 and 23, which rotate loosely on the axle 28 so long as the sleeve 34 is not in gear with the wheels 22 and 23. When the crank-pin 4 of the bell-crank 35 is moved away from the axis of the shaft *b* by the rod 37, the bell-crank 35 turns on the pin 36, and the sleeve 34 is caused to engage with the bevel-wheel 23 and impart rotatory motion to this wheel and through the sleeve 34 rotates the spindle 28, which in turn rotates the screwed spindle 12 through the medium of the worm 32 and worm-wheel 33. The direction of the threads of the worm 32 and screwed spindle 12 is such that the rotation of this screw by the bevel-wheel 23 moves the center of the disk 7 and eccentric *a* and the whole of the parts carried thereby away from the axis of the shaft *b*. This movement of the center causes the sleeve 34 to be thrown out of gear with the wheel 23. The movement of the center of disk 7 on the path *c d* is therefore proportional to the movement of the crank-pin 4, caused by the rod 37. If the crank-pin 4 be moved in the opposite direction—that is to say, toward the axis of the shaft *b*—the sleeve 34 is caused to gear with the wheel 22. This wheel 22, which rotates in a direction opposite to that of wheel 23, causes the screwed spindle 12 to rotate through the medium of axle 28, worm 32, and worm-wheel 33 in such manner that the center of the disk 7 is moved toward the axis of the shaft *c*, causing the sleeve 34 to be disengaged from the bevel-wheel 22 when the crank-pin 4 ceases to be acted upon by the rod 37.

It will be seen from the foregoing that the center of the disk 7 and eccentric *a* is constrained by the feathers 16 and 17 to move along *c d* by an amount equal to and in the same direction as the travel of the crank-pin

4, controlled by rod 37, and that the effort exerted by this rod is very small, as it has only to throw the sleeve 34 in gear with either of the bevel-wheels 22 or 23. The effort required for the movement of the disk 7 is supplied by the worm *t* and transmitted thereto by the wheels 18, 19, 20, 21, 23, 32, and 33. When the crank-pin 4 has been moved so as to cause the sleeve to engage with either of the wheels 22 or 23, it has a tendency to follow the movement of the disk 7, and to prevent this it is necessary to exert on it an effort corresponding to the friction of the clutch. Fig. 6 shows an arrangement to prevent this effort from being borne by a governor-rod controlled directly by a governor which it is wished to protect against reactions that might impair its sensitiveness. For this purpose the governor-rod 37 is not directly connected to the crank-pin 4, but is jointed at 38 to a collar 39, embracing the shaft *b* and carrying a curved slotted link 40, the slot of which is eccentric to the axis of the shaft *b*, point 41 being the center from which the curved slot is struck. A block 42 is fitted to slide in the curved slot and is connected to one end of a rocking lever 43, pivoted in 44 on a support 45 in the drum 9. When the rod 37 causes the collar 39 to turn on the shaft *b*, the slotted link 40, turning around shaft *b*, brings the block 42 nearer to or farther from the axis of the shaft *b* and rocks the lever 43 on its center. These movements of the lever 43 are transmitted by the rod 46 to the crank-pin 4 and cause the sleeve 34 to be thrown in gear with one or other of the bevel-wheels 22 or 23, as hereinbefore explained. When the sleeve 34 tends to disengage the said wheels in consequence of the motion of the disk 7 and the immobility of the crank-pin 4, the reaction due to the friction of the sleeve 34 is transmitted by the rod 46 and lever 43 to the block 42 and through it to the slotted link 40; but the slot in this link is so arranged that the movements of the link are transmitted to the block 42, and as this block is pressed by the lever 43 on the sides of the slot it cannot cause the slotted link to turn on the shaft *b* on account of the friction. This arrangement constitutes a non-reversible transmission member, which transmits the efforts exerted on the rod 37, Fig. 6, to the crank-pin 4; but the efforts exerted on the crank-pin 4 are not transmitted to the rod 37.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a valve-gear for engines, the combination with an eccentric-sheave and its strap, a worm attached to the strap, a drum, a disk connected with the sheave and operating within the drum, a screw connection between the sheave and the drum, and a shaft for supporting said sheave and drum, of a means for rotating the said screw in opposite directions, said means consisting of gear-wheels carried by said disk, an oscillating shaft controlled by the engine-governor, gear-wheels mounted on said oscillating shaft and adapted to be moved into gear with the said worm, and a pair of gear-wheels carried by said oscillating shaft and adapted to be moved into gear with one of the wheels carried by the disk.

2. In a valve-gear for engines, the combination of a shaft, a drum mounted thereon, an eccentric-sheave mounted on the shaft and adapted to slide within said drum, a screw connection between the drum and the eccentric-sheave, a strap for the said sheave, a worm connected to the strap, a disk integral with the said sheave, an axle carried by said disk, a continuously-moving gearing interposed between the eccentric-strap and the axle, a worm-wheel gearing interposed between the eccentric-sheave and the drum, and a clutch mounted on the said axle and adapted to be operated by the governor of the engine, substantially as shown and for the purpose specified.

3. In a valve-gear for engines, the combination of a shaft, a drum mounted thereon, an eccentric-sheave mounted on the shaft and adapted to slide within said drum, a screw connection between the drum and the eccentric-sheave, a strap for the said sheave, a worm connected to the strap, a disk integral with the said sheave, an axle carried by the said disk, a continuously-moving gearing interposed between the eccentric-strap and the axle, a worm-wheel gearing interposed between the eccentric-sheave and the drum, a clutch mounted on the said axle, a collar loosely mounted on the said shaft, a slotted link integral with the collar, a block sliding in the slot of the link, a lever connected to said block, and a rod attached to the lever and suitably connected with said clutch, substantially as shown and for the purpose specified.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

PIERRE RICHEMOND.

Witnesses:
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EDWARD P. MACLEAN.