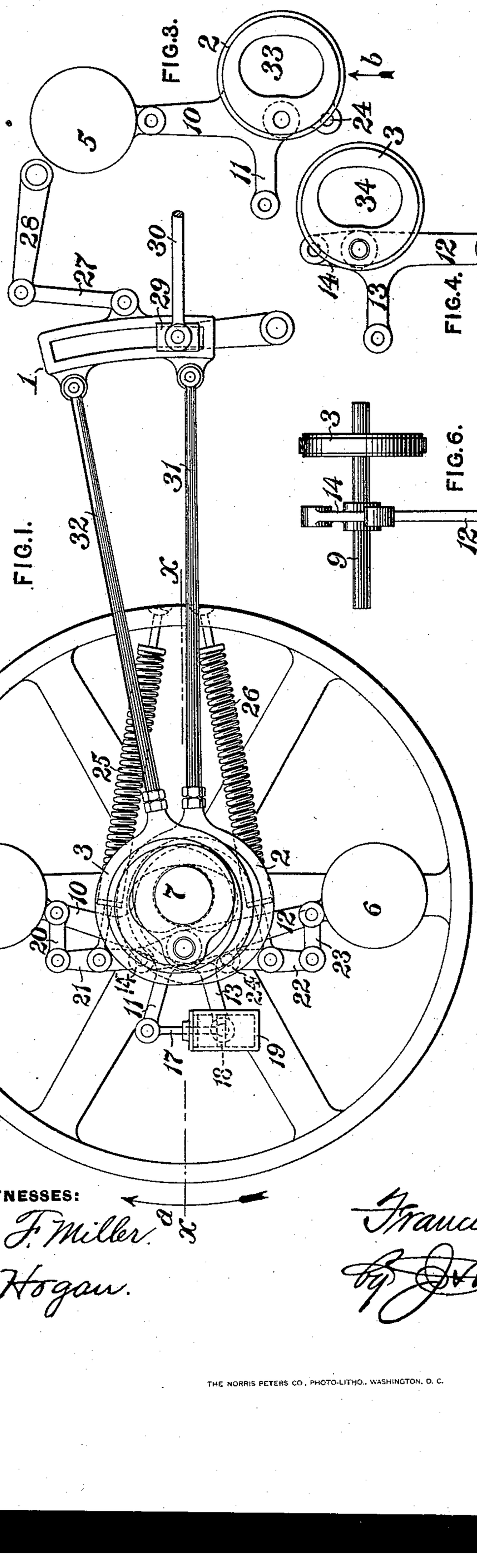
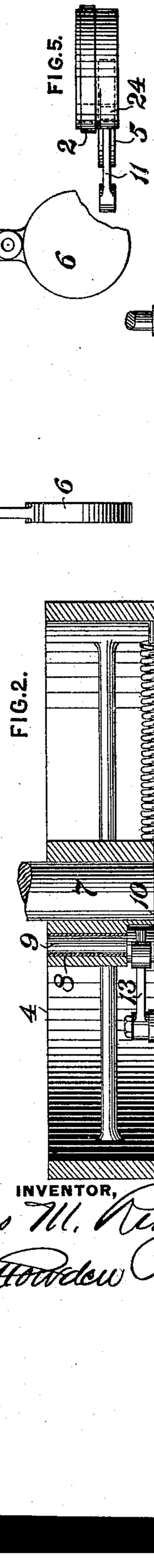
(No Model.)

F. M. RITES.

VALVE GEAR.

No. 572,722. Patented Dec. 8, 1896.





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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF ITHACA, NEW YORK.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 572,722, dated December 8, 1896.

Application filed July 31, 1896. Serial No. 601,186. (No model.)

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 or discovered certain new and useful Improvements in Valve-Gear, of which improvement the following is a specification.

The object of my invention is to provide a governing mechanism for automatically controlling the cut-off of motive fluid in a motor in either direction of motion and to utilize the forces of inertia in effecting adjustment in both directions of motion; and to this end my invention consists in the combination, with a reversing link-motion, of two automatic eccentric cut-off mechanisms, each of which is connected with the link-motion and adapted to effect reversal of the valve-motion and variations in the cut-off of the motive fluid in either direction of motion of the motor; and my invention further consists in certain combinations and features of construction, all as hereinafter fully set forth.

In the accompanying drawings, which illustrate my invention, Figure 1 is a side elevation of a valve-gear, showing an application of my invention; Fig. 2, a partial section on the line *x x* of Fig. 1, the eccentrics, link, and rods being shown in plan view; Figs. 3 and 4, side elevations of the shifting eccentrics and their weights, shown detached from the rotary carrier or wheel; Fig. 5, an end view looking in the direction of the arrow marked *b* of the eccentric, weight, and lever-arm shown in Fig. 3; Fig. 6, a view of the other eccentric and its weight and lever at right angles to the view shown in Fig. 4.

In most cases where reversing-gears are used it is in combination with motors subjected to rapidly-varying loads, such as are employed in saw-mills, rolling-mills, and in the propulsion of steam vessels, and in all of these applications, so far as I am aware, no simple mechanism has been devised for properly controlling the motor by an automatic cut-off of the motive fluid in both directions of motion. My present invention provides simple and efficient means for effecting this purpose and means whereby the force of inertia is rendered effective and utilized in both the forward and back motions.

In the operation of rolling-mill engines and the engines of marine vessels reversal of the direction of motion is frequently necessary when the speed is high and the engine is running with little or no load, and at times the full load of the engine is suddenly thrown on or off. In such cases it is desirable that the regular speed of the engine should not change materially and that the running portions of the machinery should not be subjected to sudden and great strains due to improper regulation on a sudden application or release of the load.

The improvement herein set forth is adapted to effect all of these desirable results with a greater efficiency and simplicity of construction than has heretofore existed.

In the embodiment of my invention, as shown in the drawings, I employ a shifting link 1, which may be adjusted to vary the point of cut-off or to reverse the motion, and connected to the link at or near its opposite ends two adjustable eccentrics 2 and 3, which are mounted on the rotary carrier or wheel 4, each of the eccentrics being connected to or formed integral with a weight 5 or 6, which forms part of a governing mechanism for effecting automatic adjustment of the eccentrics.

The rotary carrier or wheel 4 is mounted on the engine-shaft 7, and a hole provided with a bushing 8 is formed in the wheel on or near its hub to receive the small shaft or pin 9. The eccentric 2 is preferably formed integral with the arms 10 and 11 and with the weight 5, and is loosely mounted on the pin 9, so that it may be partially rotated thereon. The eccentric 3 is rigidly fixed to the pin 9 outside of the eccentric 2, and is adapted to be rotatively moved with the pin which is loosely fitted in the bushing 8, that is, so fitted that it may turn therein. The weight 6 is formed integral with the arms 12, 13, and 14, and is rigidly fixed to the pin 9, so that the eccentric 3, weight 6, arms 12, 13, and 14, and pin 9 may be rotated together as though they were formed in one piece. The outer end of the pin 9 is fitted and turns in a bushing 15, fitted in a hole formed in a collar 16, which is mounted on the shaft 7 outside of the eccentrics.

The arm 11, which is substantially at right

angles with the arm 10 of the weight 5, is connected at its outer end to the rod 17 of a piston 18, fitted in a dash-pot cylinder 19. The piston 18 is shown in dotted lines in Fig. 1. An arm 13, which is substantially at right angles to the arm 12 of the weight 6, is connected to the cylinder 19, so that the arm 13 and the cylinder 19 move together.

A lever 21 is pivoted at one end to the arm 14, which forms an extension of the arm 12, and is integrally connected with the weight 6, and the other end of the lever 21 is connected with the arm 10 of the weight 5 by means of a link 20. Similarly on the other side of the main shaft a lever 22 is pivoted at one end to an extension of the arm 10 by a pin passing through a hole 24, formed in the integral casting of the eccentric 2 and weight 5, as shown in full lines in Fig. 3 and in dotted lines in Fig. 1. The other end of the lever 22 is connected by means of a link 23 with the arm 12 of the weight 6. While the arm 14 is described as an extension of the arm 12, this is not an essential of my construction, and it is not essential that the arm 14 should be in line with the arm 12, as it may be placed at an angle thereto, and similarly the angular position of the equivalent arm, which is formed integral with the eccentric 2, may be varied.

Two springs 25 and 26 are connected at their outer ends to the rotary carrier 4, and their inner ends are connected, respectively, to the levers 21 and 22.

The openings or slots 33 and 34 in the eccentrics 2 and 3 are of sufficient size to permit the movement of the centers of the eccentrics from one side of the center of the main shaft to the other into positions corresponding to reverse motions of the shaft or of the valve-motion.

In the construction shown in the drawings the shifting link 1 is connected by means of a link or rod 27 with an arm 28, by the movement of which the position of the link 1 may be adjusted. If preferred, however, the block 29, to which the valve-rod 30 is connected, may be adjustable relative to the link 1, and the link movable only by the eccentrics, or the relative adjustment of the link and block may be effected by moving both of these parts.

As shown in Fig. 1, the inner shifting eccentric 2 is connected by its rod 31 to that end of the link 1 in which the block 29 is located, and movement of the valve-rod 30 is controlled by the eccentric 2, the other eccentric, 3, which is connected to the opposite end of the link 1 by the rod 32, having little or no effect on the valve-rod while the link is in the position shown. With the adjustment as shown in the drawings the rotation of the main shaft 7 and the carrier 4 is in the direction indicated by the arrow marked *a*.

The resistance of the dash-pot device, which comprises the piston 18 and the cylinder 19, may be made sufficient to act as a counterbalance to the action of gravity on the two weights without offering any undue resistance to the action of centrifugal force, and in sudden adjustments of the weights, due to their inertia, the weights and the dash-pot device may move together, so that the dash-pot offers no resistance to the forces of inertia acting on the weights.

When the parts are in the positions shown in Fig. 1, the weights 5 and 6 are in the most unfavorable position for gravity-balancing by the dash-pot device, since the action of gravity on the weights tends to turn them in the same direction and to cause movement of the cylinder and piston of the dash-pot device both in the same direction. When running with shorter cut-off, this effect will be less on account of the smaller leverage of the weights, and in any other position of the rotary carrier or wheel the action of gravity will tend to move the weights in opposite directions of rotation and also to give opposite directions of motion to the piston and cylinder, respectively, of the dash-pot device, which tendency will be resisted by the fluid in the dash-pot with the effect of balancing the action of gravity. This will be made clear by supposing the wheel to be rotated through such an angle that a vertical line through the center of support shall pass to the right of the center of the weight 6, or by turning the drawing through an angle of ninety degrees or less and considering the action of gravity on the weights when in that position.

My improvement effects adjustment of the eccentrics and corresponding regulation of the cut-off of the motive fluid by the action of centrifugal force in accordance with the speed and gradual changes of speed and by the combined action of centrifugal force and inertia on sudden changes, such as are due to great and rapid variations of load.

When the engine is running regularly, the weights will assume a certain position in accordance with the centrifugal force acting on them, and this position once established will be maintained without resistance from the dash-pot device so long as there is no variation in the speed. In speeding up the engine to this or any other regular speed, or in gradual variations from the regular speed, the dash-pot device may offer a slight resistance to the centrifugal action, because the weights being then acted on by centrifugal force only, the inertia effect being too small to be considered, the weights will both be moved outward, or oppositely rotated on their bearings, the cylinder and piston of the dash-pot device will be moved in relatively opposite directions, and the resistance of the fluid in the dash-pot device will oppose the movement of the weights. Under the circumstances now under consideration, however, the variation of speed being slight and gradual and the change of position of the weights being slight and gradual, the resistance offered by the dash-pot device will be small, and the duration of the force tending to change the

position of the weights will finally overcome this slight resistance.

In case of a sufficiently sudden and great change in the speed of rotation of the carrier or wheel 4 the inertia of the weights will instantly be effective to cause a new adjustment of the eccentrics, and this inertia effect will not be obstructed or resisted by the action of the dash-pot device, because both weights will by their inertia tend to fall behind or move more slowly than the carrier, and since the motion of the weights will then be in the same direction the arms 11 and 13, the piston 18, and the cylinder 19 will also move in the same direction, or relatively opposite to the direction of rotation of the carrier, and the whole governing device will move as one structure. It will be seen that in such a movement since the piston and cylinder of the dash-pot device move in the same direction under the same forces they can offer no resistance to the motion.

If we suppose the adjustment and the direction of rotation of the carrier to be as described and shown in Fig. 1, it will be readily seen that the relative backward movement, or movement to the left, of the weight 5 will instantly adjust the operative eccentric 2 to a position of shorter cut-off and that both the inertia and the centrifugal forces acting on the weight 5 tend to effect this result. The similar movement of the weight 6 shifts the eccentric 3 to a position of longer cut-off, but since the eccentric 3 is then inoperative on the valve-rod no effect on the cut-off is produced thereby with the link and block in the positions shown.

In order at all times to effect a proper operation of the governor, the weights should occupy similar positions of adjustment at the same time, so that the inertia force may be free to act, for if either one of the weights happens to be in contact with or very near to its stop the dash-pot device may be immovable and prevent an adjustment for a sudden change of load. In order to prevent this and to insure a proper operation of the governor, I have provided the springs 25 and 26, one for each weight, so connected, through the compensating levers 21 and 22 and the links 20 and 23, that a movement of one of the weights 5 or 6 brings into action an assisting force tending to produce a corresponding movement of the other weight. With this construction if on account of a decreased load the weight 5 moves outward the tension of the spring 25 is increased accordingly by the movement of the lever 21 and the link 20, and if for any reason the spring 26 is already under such tension that the weight 6 does not tend to move out to the same extent as the weight 5 the tension of the spring 25 acts through the lever 21 on the extended arm 14 of the weight 6 and tends to move the weight 6 to a position corresponding to that of the weight 5. At the same time the movement of the weight 6 acts in a similar manner on the other weight and its connected parts, and the combined effect is to produce similar movements in the two opposite similar portions of the governing device, whereby they will tend to occupy positions such as to admit of adjustment by the action of inertia. After such adjustment the differential action of the springs will tend to return the parts to their normal symmetrical positions.

It will be seen that with my improvement the cut-off may be varied and the engine reversed by means of the shifting link 1 alone or in combination with the shaft-governor, or the cut-off may be varied by the automatic action of the shaft-governor either alone or simultaneously with a variation due to movement of the link, or the reversal of the valve functions may be effected by means of the automatic governor alone in a manner similar to that described in my pending application, Serial No. 582,386, filed March 9, 1891.

The description of the operation of my improvement with the link 1 in the position shown in Fig. 1 applies also to the operation with the link in reverse position, in which case the direction of rotation of the carrier 4 and shaft 7 will be opposite to that indicated by the arrow marked *a* in Fig. 1.

My improvement combines with a link reversing-gear two shifting eccentrics with elastic connections between them, independent governing-weights, each effecting the adjustment of a separate eccentric, and opposing springs, each connected to one of the weights, an intermediate gravity-balancing device adapted to balance the action of gravity on the weights, a compensating system of links and levers by which any movement of one of the governing-weights, its eccentric, and connected parts tends to effect a similar movement of the other governing-weight, so that any change of position of one governor in regular service tends to produce a similar change in position of the other and an elasticity in the compensating system that does not interfere with the inertia effect for sudden changes of load, but which puts the opposite parts of the compensating system under unequal strain momentarily in order to effect the rapid adjustment of the governors into the proper relative positions to be ready for another sudden adjustment.

It will be seen that in slow adjustments that involve similar changes of cut-off of the two governors the rotation of the weights is in opposite directions and the strains of the compensating gear are constantly equal, but in case of an instantaneous and considerable change of load the rotation of the weights is as if they were in one piece for the moment, while one moves to a shorter cut-off and the other to a longer cut-off, after which the balancing effects places the two systems in similar positions.

I claim as my invention and desire to secure by Letters Patent—

1. In a fluid-pressure motor, the combina-

tion, with an adjustable link device, of two shifting eccentrics each of which is connected to the link at or near one of its extremities, substantially as set forth.

2. In a fluid-pressure motor, the combination, of an adjustable link device for controlling the cut-off of motive fluid, and two independent shifting-eccentric governors connected with the link device at or near its opposite extremities, substantially as set forth.

3. In a fluid-pressure motor, the combination, of an adjustable link device connected to the distributing-valve, and two shifting eccentrics adapted to be reversely adjusted by a sudden change of load, substantially as set forth.

4. In a reversing-gear, the combination of two shifting eccentrics connected to an adjustable link or frame at or near its opposite extremities, a manually-operated adjusting mechanism connected to the link or frame, and mechanism connected to the eccentrics and adapted to be operated by an automatic governor, substantially as set forth.

5. In a valve-operating mechanism for fluid-pressure motors, the combination, of two shifting eccentrics, governing mechanism connected to each of the eccentrics, and compensating connections adapted to effect corresponding movements of the two systems and to permit unequal or opposite movements under the force of inertia, substantially as set forth.

6. In a valve-operating mechanism for fluid-pressure motors, the combination, of two governing devices, each comprising a shifting eccentric and an unbalanced governing-weight, and a dash-pot device through which the governing devices are connected, substantially as set forth.

7. In a valve-operating mechanism for fluid-pressure motors, the combination, of two governing devices, each comprising a shifting eccentric and a rigidly-connected centrifugal weight, and means connecting the governing devices whereby they are balanced as to gravity, substantially as set forth.

8. In a valve-operating mechanism for fluid-pressure motors, the combination, of two independent governing devices each adapted to control the distribution of motive fluid and connected together through the medium of a dash-pot device and thereby balanced as to gravity, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS M. RITES.

Witnesses:
S. E. BANKS,
CHAS. D. BOSTWICK.