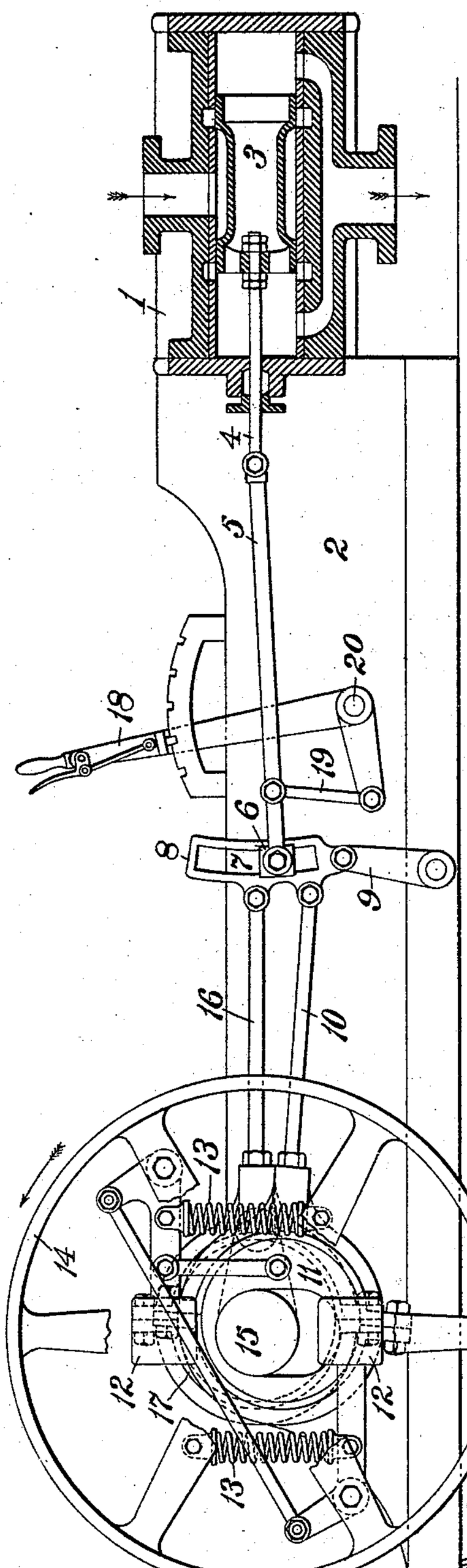
(No Model.) 5 Sheets—Sheet 1.

F. M. RITES.

VALVE GEAR.

No. 572,721. Patented Dec. 8, 1896.

FIG. I.



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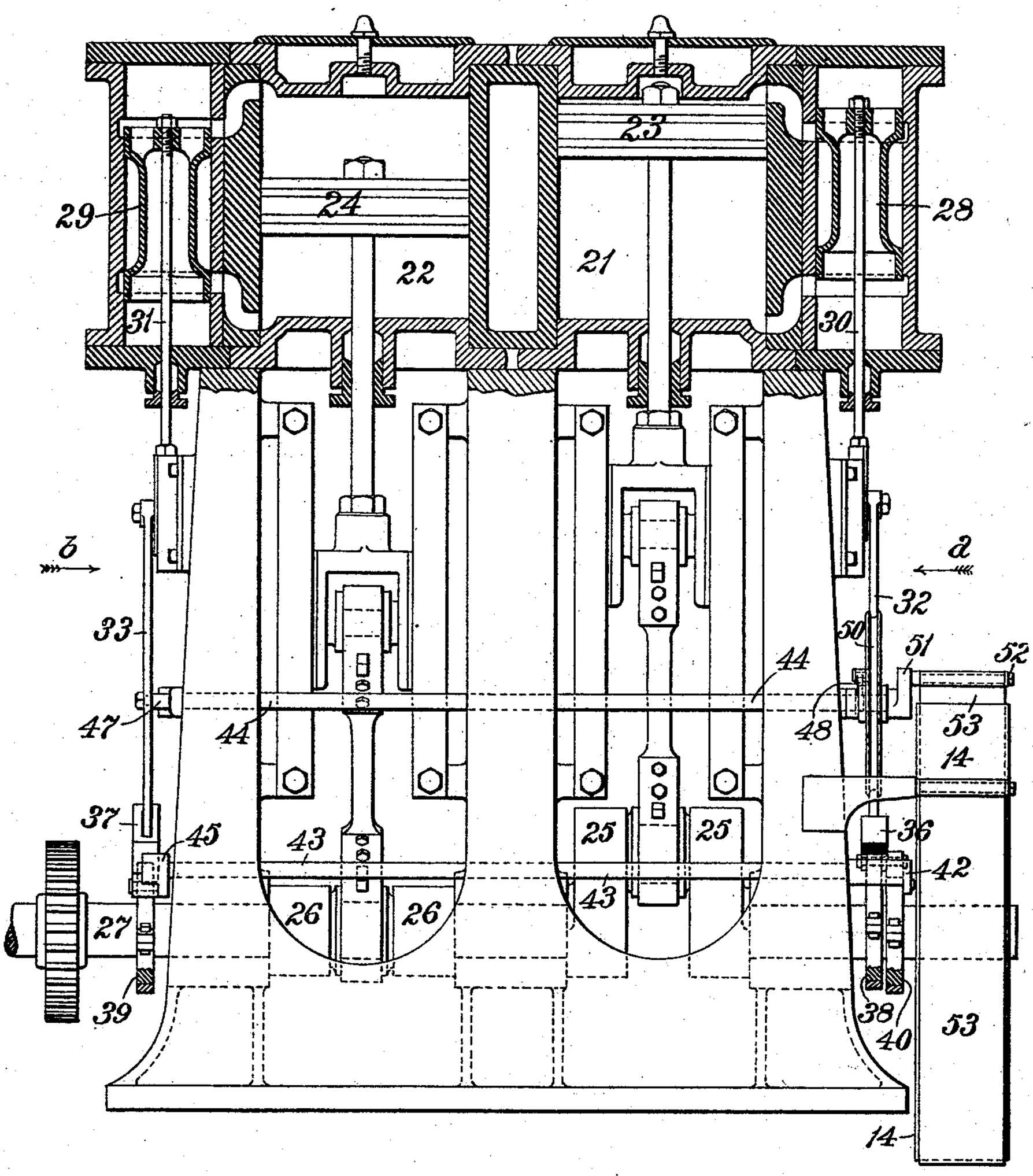
(No Model.) 5 Sheets—Sheet 2.

F. M. RITES.

VALVE GEAR.

No. 572,721. Patented Dec. 8, 1896.

FIG. 2.



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(No Model.) 5 Sheets—Sheet 3.

F. M. RITES.

VALVE GEAR.

No. 572,721. Patented Dec. 8, 1896.

FIG. 3.

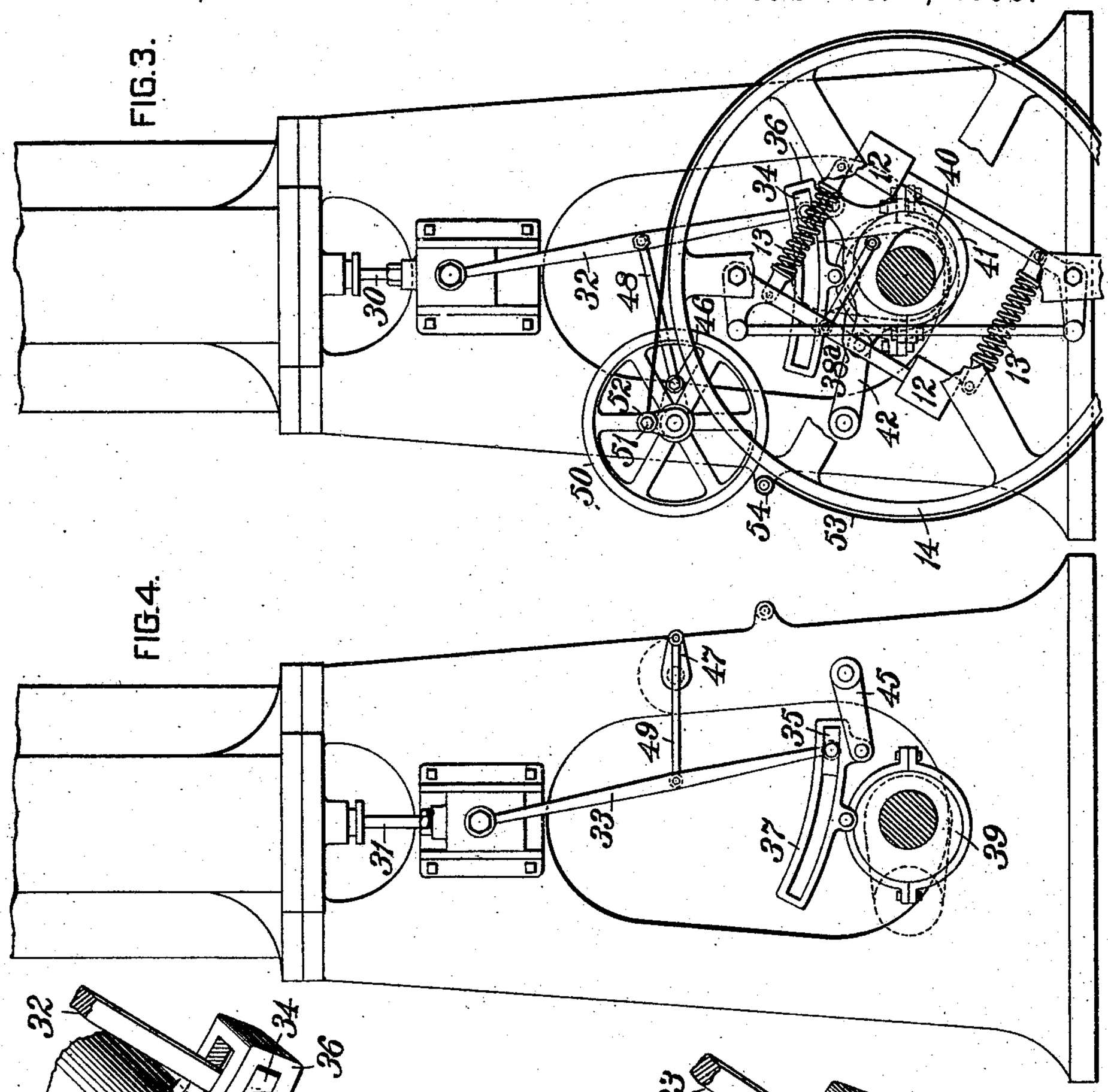
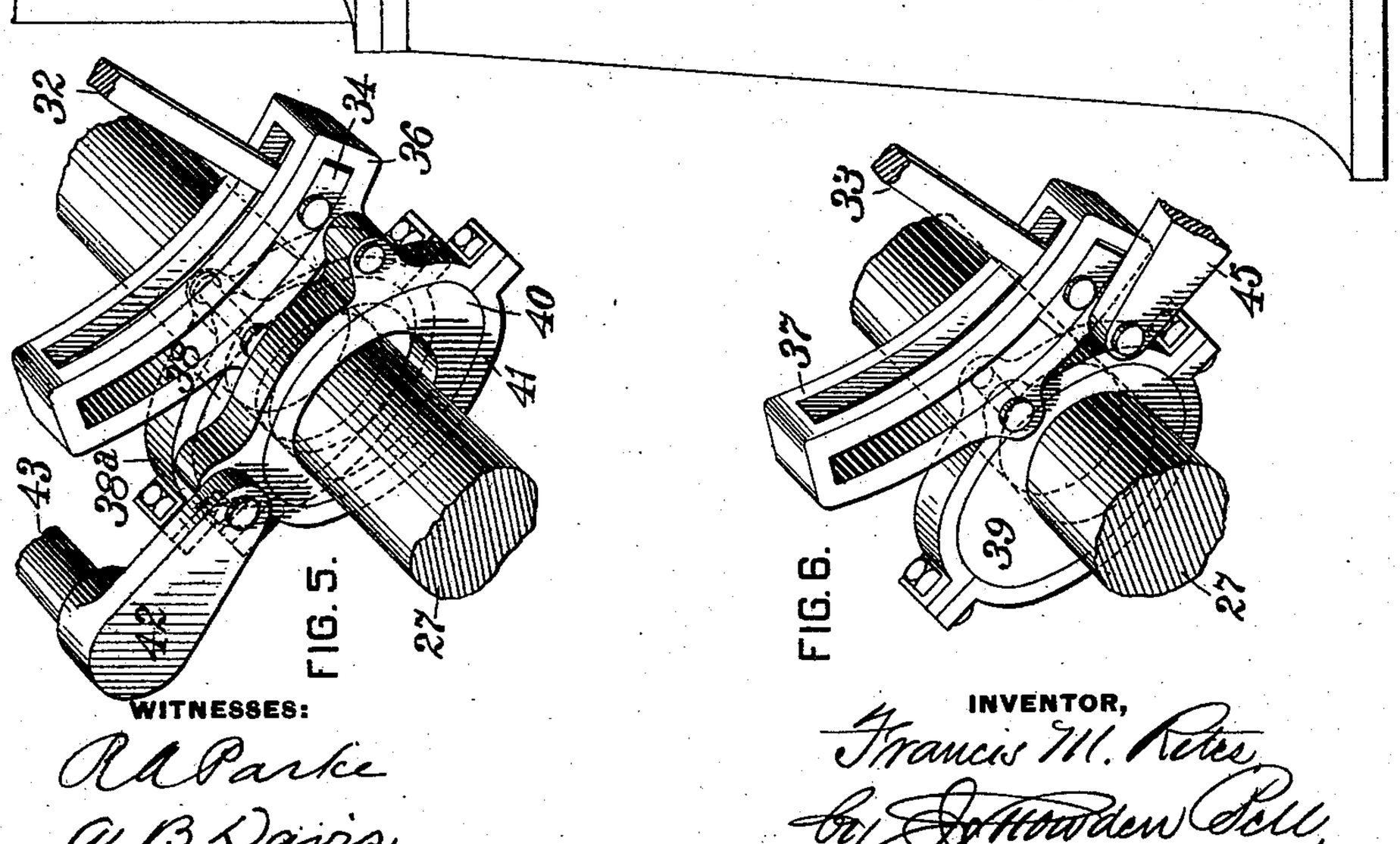


FIG. 4.



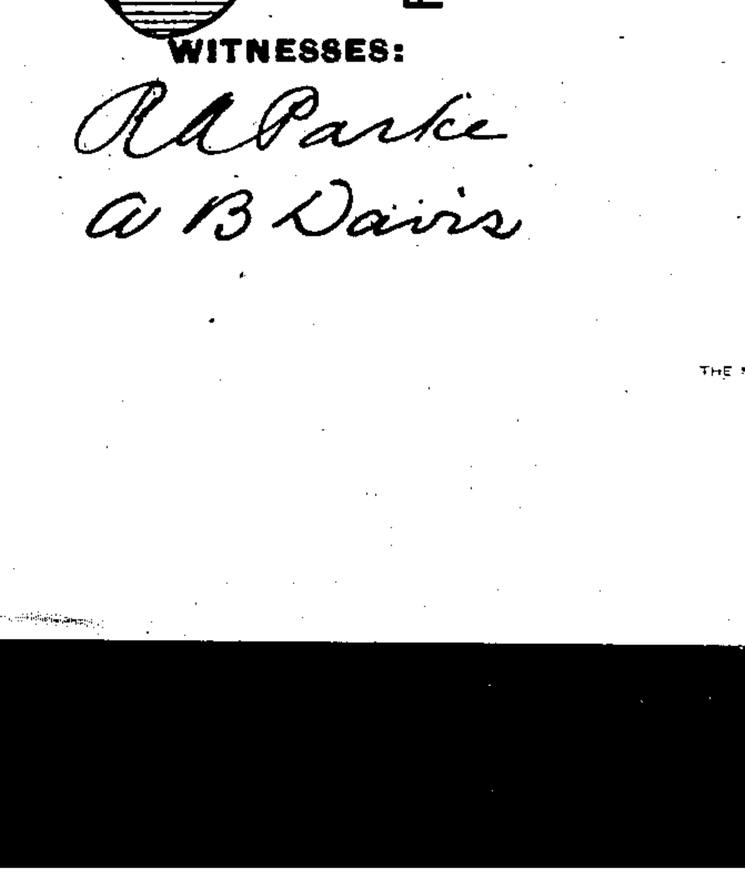


FIG. 5.

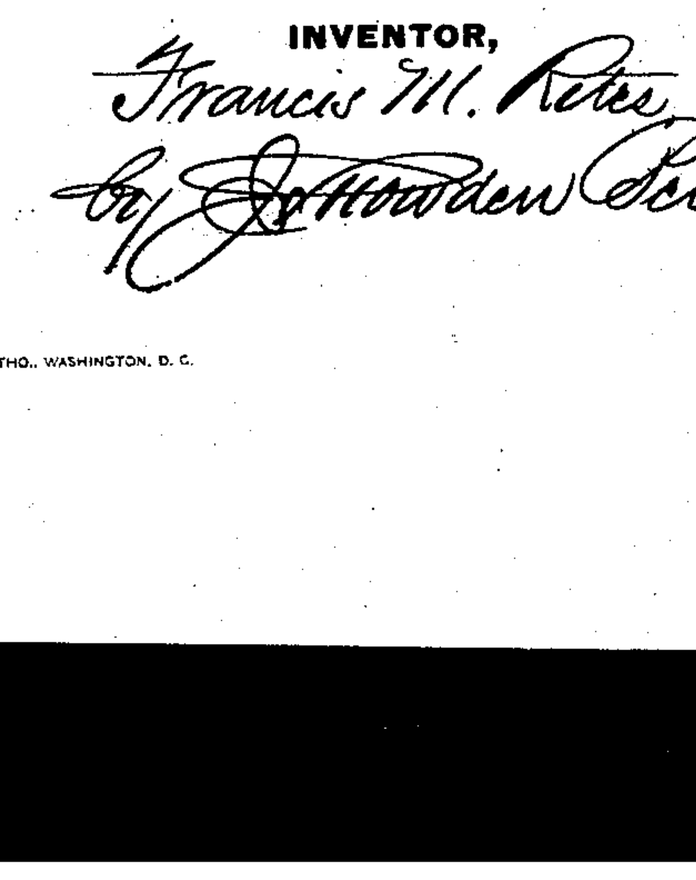


FIG. 6.

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(No Model.) 5 Sheets—Sheet 4.

F. M. RITES.

VALVE GEAR.

No. 572,721. Patented Dec. 8, 1896.

FIG. 7.

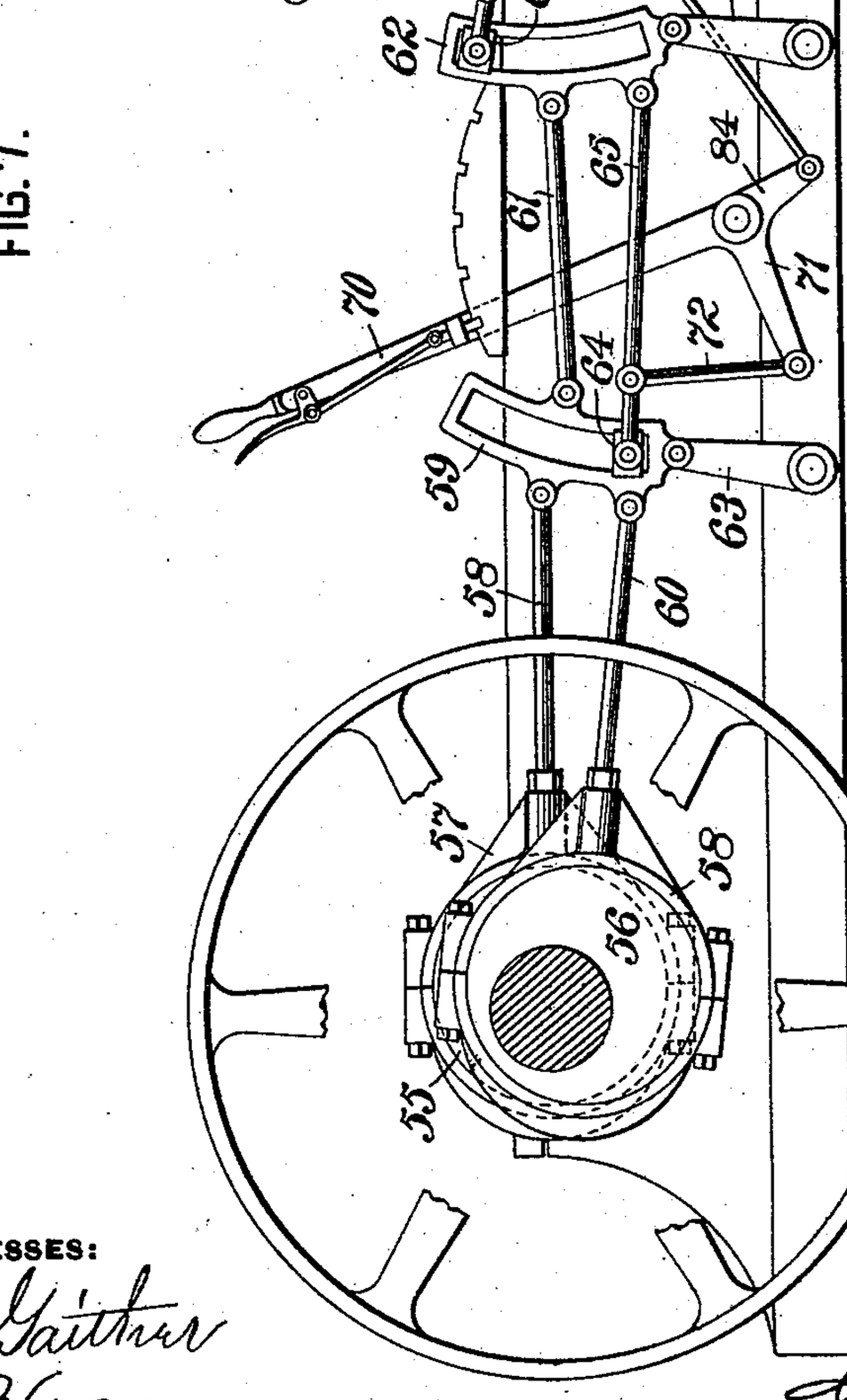
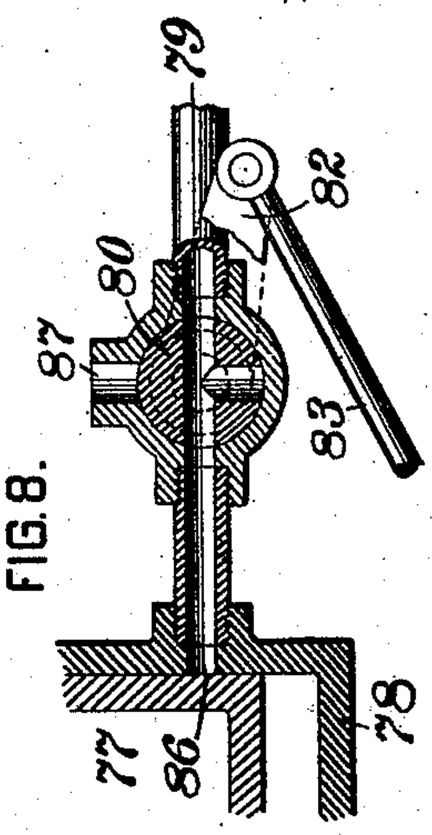


FIG. 8.



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(No Model.)

5 Sheets—Sheet 5.

F. M. RITES.

VALVE GEAR.

No. 572,721. Patented Dec. 8, 1896.

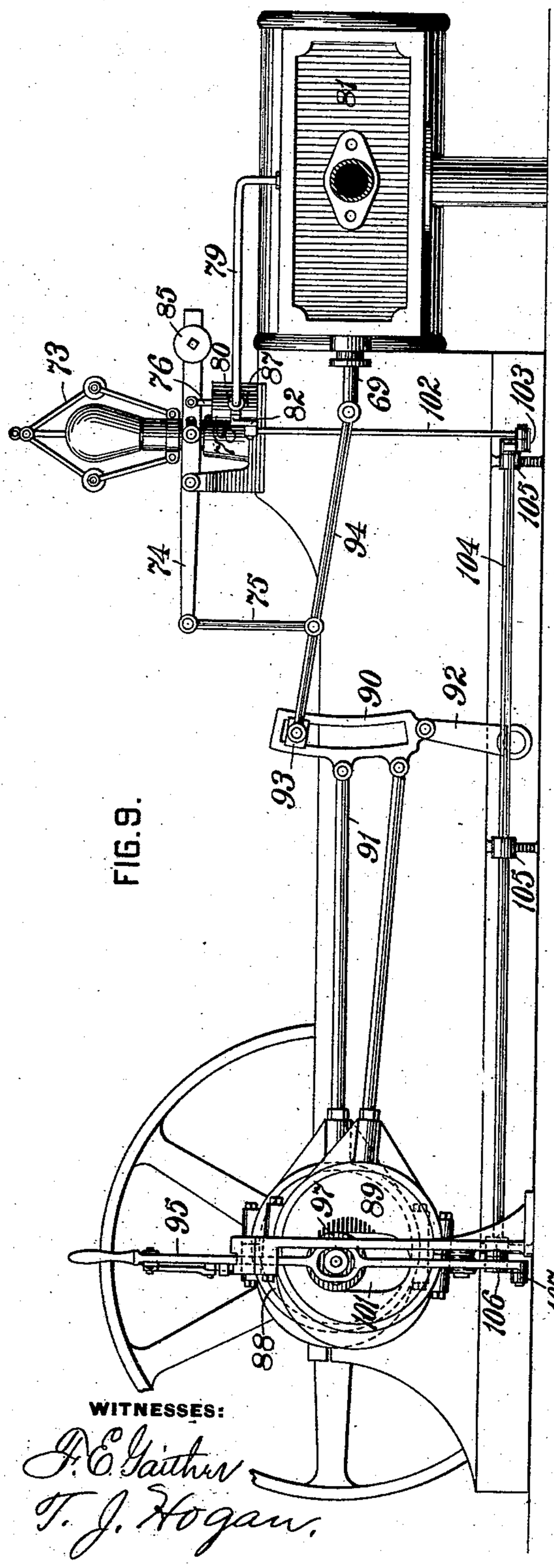

FIG. 9.

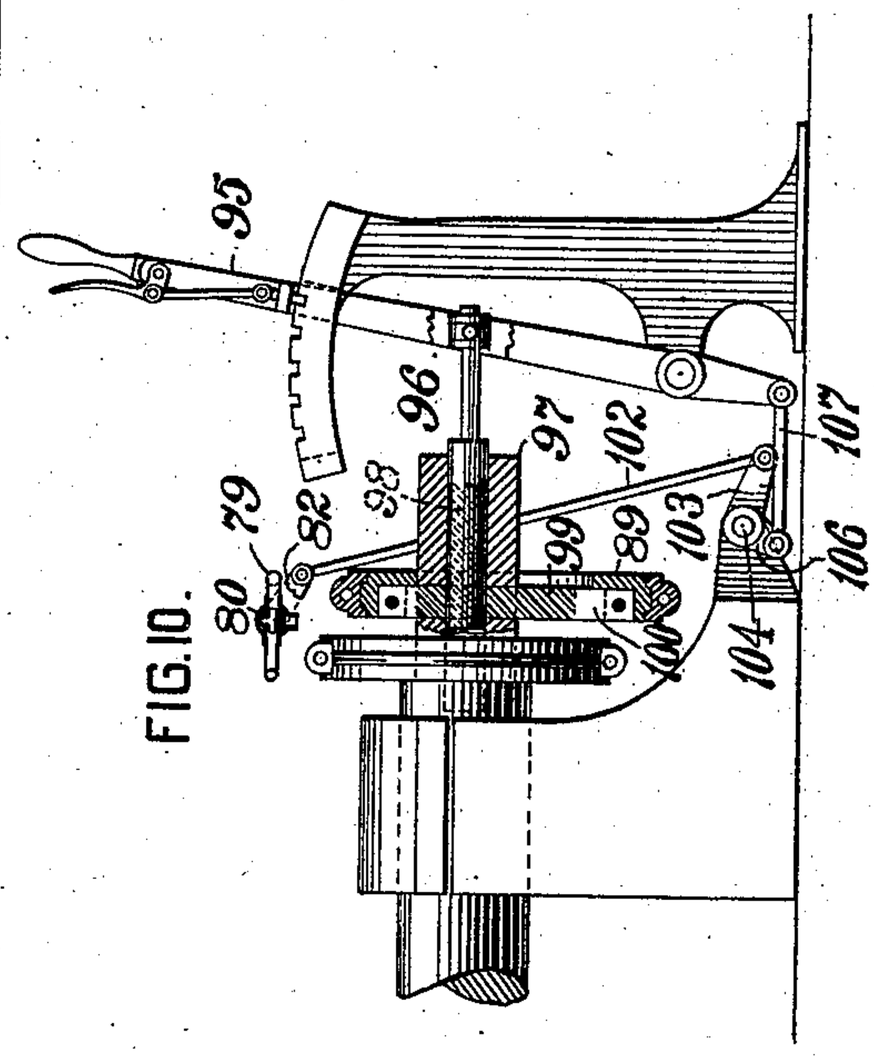

FIG. 10.

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INVENTOR,

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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF BRADDOCK, PENNSYLVANIA.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 572,721, dated December 8, 1896.

Application filed March 9, 1896. Serial No. 582,386. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, a citizen of the United States, residing in Braddock township, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Valve-Gears for Fluid-Pressure Motors, of which improvement the following is a specification.

The object of my invention is to provide an improvement in valve-gear for fluid-pressure motors; and to this end my invention consists in a new and improved valve-gear which is adapted to be adjusted by hand, or by an automatic governing device, or by the combined action of a manually-operated and an automatic governing device.

The improvement claimed is hereinafter fully set forth.

My improved valve-gear is adapted to be adjusted to effect variations in the cut-off of the motor fluid, in accordance with variations of load or pressure, or both, by either the separate or the combined actions of a manually-operated device and an automatic governing device, in whichever direction the motor may be running, and to effect the reversal of the motor or a variation in the effect of the automatic governing device by means of the manually-operated device.

In the accompanying drawings, which illustrate the application of my invention, Figure 1 is a side elevation and partial section of a horizontal engine with my improvement applied thereto; Fig. 2, an elevation and partial section of a vertical hoisting-engine with my improvement applied thereto; Fig. 3, an end elevation of the engine shown in Fig. 2, looking in the direction of the arrow marked *a* in Fig. 2; Fig. 4, an end elevation of the engine shown in Fig. 2, looking in the direction of the arrow marked *b* in Fig. 2; Fig. 5, a perspective view, on an enlarged scale, of the eccentrics and slotted link shown in Fig. 2; Fig. 6, a similar view of the eccentric and slotted link shown in Fig. 4; Fig. 7, a side elevation of an engine provided with a modification of my improvement; Fig. 8 a sectional view, on an enlarged scale, of the valve device controlling the admission and release of steam to and from the small auxiliary cylinder of the governor shown in Figs. 7 and 9; Fig. 9, a side elevation of an engine provided with another modification of my improvement, and Fig. 10 a partial section and elevation of the mechanism for shifting the eccentric shown in Fig. 9.

In valve-gears provided with an ordinary Stephenson link, in which the link is connected to and operated by two eccentrics, the motions of any intermediate point on the link between the connections to the eccentrics are substantially the same as the motions which would be obtained from an ideal eccentric whose center is located on a line joining the centers of the two actual eccentrics and at distances from the centers of the actual eccentrics proportional to the distances between the intermediate point on the link and the points of connection of the link with the actual eccentrics.

In reversing-engines the centers of the two actual eccentrics are usually located symmetrically on opposite sides of the crank, and the center of the link has a motion which is the same as the motion which would be imparted to it by an ideal eccentric whose center is located on a line joining the centers of the two actual eccentrics and at equal distances from the centers of the two eccentrics.

My invention provides for the employment of an actual eccentric whose eccentricity and the position of whose center correspond to those of such an ideal eccentric, and with such a construction I dispense with one of the usual eccentrics having connections to one end of the link, and thereby obtain important and valuable results.

In Fig. 1 of the drawings the steam-cylinder 1 is located on the end of the engine-frame 2 and provided with a distribution-valve 3, which is connected by means of a stem 4 and a link or rod 5 with a block 6, fitted to slide in the slot 7 of the link 8. The link 8 is connected at its lower end to a rocker-arm 9, which is pivoted to the engine-frame and serves as a support and guide for the link. The link 8 is connected at or near its lower end by means of a rod 10 to the strap of an adjustable eccentric 11, which is connected to and adapted to be adjusted by the action of the weights 12 and springs 13 of an automatic governing device on a wheel or rotary carrier 14, mounted on the main shaft 15.

The middle point of the link 8 is connected by means of a rod 16 to the strap of a fixed eccentric 17 on the main shaft, and the eccentricity of this eccentric 17 and the position of its center relative to the crank on the main shaft 15 are such that the movements of the center of the link are the same as the movements which would be imparted to it by two eccentrics symmetrically arranged on opposite sides of the crank and connected to the ends of the link.

If the link 8 were connected at its opposite ends, as usual, to two eccentrics located symmetrically on opposite sides of the crank, in order to obtain the full effect of an automatic shaft-governor for both forward and back motions of the engine it would be necessary to employ two adjustable eccentrics, but with my improvement the controlling effect of the governor is obtained for both the forward and back motions by the employment of a single shifting eccentric.

The adjustment of the block 6 in the slot of the link 8 is effected by means of the hand-operated lever 18, which is shown as fixed to a shaft 20, journaled on the engine-frame, and which is connected to the valve-link 5 by means of a link 19.

When the block 6 is moved to the middle of the link 8 or in line with the connection to the fixed eccentric 17 and its rod 16, the movements imparted to the block 6 and to the valve 3 are the same as they would be if the link were connected at its opposite ends to two eccentrics arranged symmetrically on opposite sides of the main crank, and the engine will not run in either direction. When the block 6 is in a position below the middle of the link, the engine will run in a forward direction or in the direction shown by the arrow in Fig. 1, and the cut-off may be shortened or lengthened by the movement of the block 6 in the link 8 or by the action of the automatic governor. When the block 6 is moved to a position above the middle of the link, the engine will run in the opposite direction, and the ratio of expansion or the point of cut-off may be controlled, as before, by the movement of the block in the link or by the action of the governor.

In whatever position the block 6 may be placed, above or below the middle of the link, the controlling effect of the governor and the shifting eccentric may be obtained regardless of the direction of rotation of the main shaft, and by making the slot in the eccentric 11 of sufficient length, as shown in the drawings, to permit the movement of the center of the eccentric 11 from one side of the shaft to the other the motion of the engine may be reversed by the action of the governor alone when the block is either above or below the middle of the link. This feature is of advantage in hoisting-engines, when the engine is running backward, in cases where the load is great enough to cause the engine to run backward at too high a speed. The increase in speed caused by the load will act, through the governor, to decrease the speed of the engine, and, with a governor designed to shift the center of the adjustable eccentric from one side to the other of the shaft, the engine may be operated by the load as a compressor or brake which resists and tends to prevent the motion of the load.

In Figs. 2, 3, 4, 5, and 6 I have shown an application of my improvement to a hoisting-engine having two cylinders 21 and 22, whose pistons 23 and 24 are connected to cranks 25 and 26, which are at right angles to one another on the main shaft 27.

The steam-distribution valves 28 and 29 are connected, as in Fig. 1, by means of stems 30 and 31 and rods 32 and 33, with sliding blocks 34 and 35, which are fitted to slide in the slotted links 36 and 37. The link 36 is connected at the middle of its length to the strap 38^a of a fixed eccentric 38 on the shaft 27 at one end of the engine-frame, and the link 37 is connected at the middle of its length to the strap of a fixed eccentric 39 on the shaft 27 at the opposite end of the engine-frame. The eccentricities and the positions of the centers of the fixed eccentrics 38 and 39 are the same as those of two ideal eccentrics corresponding to the movements of the middle points of the links when the links are each operated by two eccentrics connected to their opposite ends.

The strap 41 of an adjustable eccentric 40 on the shaft 27 is connected to one end of the link 36 and to a rocker-arm 42 on one end of a shaft 43, which is mounted in bearings on and extends the length of the engine-frame. A rocker-arm 45 on the other end of the shaft 43 is connected to one end of the link 37 and imparts to it the same motions that are imparted to the end of the link 36 by the adjustable eccentric 40.

The adjustable eccentric 40 is connected to and adapted to be shifted by the action of the weights 12 and springs 13 of an automatic governing device on a wheel or rotary carrier 14, which is mounted on the main shaft 27.

A longitudinal shaft 44, which is mounted in bearings on the engine-frame, is provided near one end with an arm 46 and at its other end with an arm 47, the arm 47 being connected by means of a rod or link 48 with the valve-rod 32 and the arm 47 being connected by means of a rod or link 49 with the valve-rod 33.

An arm 51, which is fixed on the end of the shaft 44 at right angles to the arms 46 and 47, is provided with a pin 52, and a brake-band 53, which surrounds and is adapted to bear on the rim of the wheel 14, is connected at one end to the pin 52 and at its other end to a pin 54, which is fixed to the engine-frame.

A wheel 50 is fixed on the shaft 44 in any convenient position, so that it may be turned by hand directly or by means of a belt or rope

leading to some point convenient to the operator.

The speed of the engine and the direction of rotation of the shaft 27 may be controlled by shifting the blocks 34 and 35 in the links 36 and 37, or by the action of the automatic governor and the shifting eccentric 40, or by the action of the governor and the movement of the sliding blocks in the links 36 and 37 at the same time.

When the wheel 50 is turned through an angle of ninety degrees, in the direction shown by the arrow in Fig. 3, the arms 46 and 47 will be moved through the same angle and the rods 48 and 49, connecting the arms 46 and 47 with the valve-rods 32 and 33, will move the lower ends of the valve-rods and shift the blocks 34 and 35 to the middle of the links 36 and 37. When the blocks are in this position, the engine will not run in either direction. The same movement of the wheel 50 which shifts the blocks to the middle of the links 36 and 37 will turn the arm 51 on the end of the shaft 44 through an angle of ninety degrees and the brake-band 53 will be drawn tightly around the rim of the wheel 14. If the wheel 50 be turned further in the same direction, through an angle of ninety degrees or less, the blocks will be shifted beyond the middle of the links 36 and 37 and the engine will be reversed, and at the same time the brake will be released.

In both the forward and back motions of the engine shown in Figs. 2, 3, and 4 the engine will be affected by the action of the automatic governor in the same manner, and the principle of operation as regards the action of the eccentrics and the links is substantially the same as in the construction shown in Fig. 1.

My invention is not limited to a construction in which the fixed eccentric is connected to the middle point of the link, since an equivalent motion of the link may be obtained by means of an eccentric connected to some other point on the link and having a different angular adjustment relative to the crank and a different eccentricity corresponding to the particular point on the link to which it is connected. It is essential, however, to the most advantageous operation of my improvement that the connection of the fixed eccentric to the link should be as near as possible to the middle point of the link, and any comparatively slight variations from this construction, such as might be necessary to compensate for other obvious changes of construction, I regard as being within the spirit of my invention. While I have shown a link connected to an adjustable valve-rod and curved to correspond to the movement of such rod, it will be obvious that my improvement is not limited to such details of construction, since it may, for example, be employed in connection with a shifting link or with a link in which the slot is of a different form or has a different curvature.

In Fig. 7 of the drawings I have shown a construction in which both of the eccentrics 55 and 56 are fixed on the main shaft. The strap 57 of the eccentric 55 is connected by means of a rod 58 to a slotted link 59 at or near its middle point, and the strap 58 of the eccentric 56 is connected by means of a rod 60 to one end of the link 59. The link 59 is connected by means of a rod 61 with a slotted link 62, the opposite ends of the rod 61 being secured to the links at or near their middle points. The link 59 is supported and guided by means of a rocker-arm 63, mounted on the engine-frame, and a block 64 is fitted to slide in the slot of the link 59 and is connected by means of a rod 65 with the lower end of the link 62. The link 62 is supported and guided by a rocker-arm 66, mounted on the engine-frame, and a block 67, which is fitted to slide in the slot of the link 62, is connected by means of a rod 68 with the valve-stem 69 of the valve mechanism inclosed in the steam-chest 81. The eccentrics 55 and 56 impart motion to the link 59 through the rods 58 and 60 and to the link 62 through the rods 61 and 65. The motion imparted to the link 62 will depend on the position of the block 64 in the link 59, and the movement of the valve-stem 69 will depend on the positions of the blocks 64 and 67 in their respective links. The block 64 is shifted in the link 59 by the movement of the lever 70, which is pivotally mounted on the engine-frame, and the short arm of which is connected with the rod 65 by means of a rod 72. The block 67 is adapted to be automatically adjusted in the link 62 by means of the governor 73, which is connected with the rod 68 by means of the lever 74 and rod 75. By means of this construction the cut-off may be varied by the movement of the lever 70 by hand or automatically by the governor, and the reversal of the engine may be effected either by the lever or the governor when either moves, so as to shift the block with which it is connected to the opposite side of the center of the link in which it slides.

In order to effect the automatic reversal of the engine by the governor, the lever 74 is connected by means of a link 76 with a small piston 77, which is fitted to work in an auxiliary cylinder 78, connected with steam-chest 81 of the engine by means of a pipe 79. A three-way valve 80 (shown in Figs. 7 and 8) is located in the pipe 79 and is normally in position to permit the passage of the steam from the steam-chest 81 to the cylinder 78. An arm 82 on the stem of the valve 80 is connected by means of a rod 83 with a short arm 84 on the lever 70, so that the valve 80 may be shifted by the movement of the lever 70.

The small piston 77 normally covers and closes the passage 86, through which steam is admitted from the pipe 79 to the cylinder 78, and that passage is uncovered only when the governor 73 has shifted the block 67 to a position at or near the center of the link 62. When the small piston 77 is moved far enough

to uncover the end of the pipe 79, steam from the steam-chest will enter the cylinder 78 and, acting on the piston 77, will lift the right-hand end of the lever 74 and move the block 67 downward beyond the center of the link, and thereby reverse the engine. The block 62 will be held down by the pressure of steam in the cylinder 78, and will be returned to its normal position by the weight 85 on the lever 74 when the valve 80 is moved to cut off the supply of steam and to open the exhaust-passage 87, leading to the atmosphere. If preferred, the valve 80 may be adapted to be shifted by hand or by some other means, but, as shown in the drawings, it is so connected with the lever 70 as to be shifted by the same movement that shifts the block 64 in the link 59.

As shown in Fig. 7, the parts are in position for going ahead, and the valve 80 is in position to close the exhaust-passage 87 and to open the passage for steam through the pipe 79, but the admission of steam to the cylinder 78 is prevented by the small piston 77, which covers the port or passage 86 at the end of the pipe 79. When the reversal is effected by the action of the governor 73, the lever 70 may be operated to shift the block 64 to any desired position in the link 59 for the purpose of varying the cut-off, stopping, or again reversing the engine, and when the block 64 is moved to a position at or near the upper end of the link 59 the valve 80, by means of its connections with the lever 70, will be shifted into position to permit the escape of steam from the cylinder 78 to the atmosphere. The block 62 will be moved upward by the action of the weight 85, and thereafter the operation of the engine may be controlled by the lever 70.

In the construction illustrated in Figs. 9 and 10 I have shown a fixed eccentric 88, the strap of which is connected to a link 90 at or near its middle point by a rod 91, and an eccentric 89, which is adjustable by hand and the strap of which is connected by means of a rod 90^a to the link 90 at or near one of its ends. The link 90 is supported and guided by a rocker-arm 92, mounted on the engine-frame, and a block 93, which is fitted to slide in the link 90, is connected with the valve-stem 69 of the valve mechanism in the steam-chest 81 by means of a rod 94. The rod 94 is connected by means of a link 75 to the lever 74 of an automatic governor 73, which may be substantially the same as that shown in Fig. 7 or of any other preferred form.

Any preferred construction may be employed for shifting the eccentric 89 by hand, and in the drawings, Figs. 9 and 10, I have shown a lever 95, which is connected to a sliding rack-bar 96, mounted in the shaft 97 and adapted to slide therein as the lever 95 is moved. The rack-bar 96 is provided with teeth 98, (shown in dotted lines in Fig. 10,) which are arranged at an angle to the direction of motion of the bar and which engage with the teeth 99 on a bar 100, which passes transversely through the shaft 97 and is secured at its opposite ends to the eccentric 89. As the bar 96 is moved longitudinally by the movement of the lever 95 the teeth 98 and 99 on the rack-bars 96 and 100 act to move the eccentric 89, a slot or opening 101 being formed in the eccentric 89 to permit its movement transversely across the shaft 97. By means of this construction and the constructions shown in Figs. 1, 2, 3, 5, and 6 the adjustment of the eccentric may be effected without changing the lead. It will be seen that with this construction the cut-off may be varied or the engine reversed either by shifting the eccentric 89 by hand or automatically by means of the governor 73, which is adapted to shift the block 93 in the slot of the link 90. As in the construction shown in Fig. 7, the lever 74 is connected by means of a link 76 with a small piston fitted in the auxiliary cylinder 78. The cylinder 78 is connected by means of a pipe 79 with the main steam-chest 81, and the admission and release of steam to and from the cylinder 78 is controlled, as in the construction shown in Fig. 7, by the valve 80 and by the small piston in the cylinder 78. The arm 82 on the valve 80 is connected by means of a rod 102 with an arm 103 on a rock-shaft 104, which is mounted in bearings 105 and provided at its opposite end with an arm 106, to which the lever 95 is connected by a rod or link 107.

When the lever 95 is in the position shown in Fig. 10, which shows the parts in position for going ahead, the valve 80 is in position to permit the passage of fluid through the pipe 79 to the cylinder 78, but the end of the pipe 79 will normally be closed by the piston in the cylinder 78 and will be uncovered only when the governor 73 has moved the lever 74 far enough to bring the block 93 to a position at or near the center of the link 90. Steam from the main steam-chest will then enter the cylinder 78 and, acting on the piston in the cylinder 78, will shift the block 93 to the other side of the center of the link and reverse the engine. This operation is substantially the same as that described in referring to the construction shown in Fig. 7.

If it is desired to again reverse the engine or to bring the block 93 back to its normal position, the lever 95 may be moved so as to shift the eccentric 89, and as the lever 95 approaches the opposite limit of its movement the rock-shaft 104, which is connected with the lever 95 by the link 107, will, through the connections 103, 102, and 82, operate the valve 80 so as to cut off the flow of steam from the main steam-chest and open the cylinder 78 to the atmosphere. The weight 85 on the lever 74 will then be free to shift the lever 74 and move the block 93 to its normal position near the upper end of the link 90.

Where I have referred to the reversal of the engine in describing the several constructions herein shown, I wish to be understood

as including such variations in the operation as may involve only a reversal of the valve mechanisms or their functions, regardless of the effect of such variations on the other parts of the motor.

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

1. In a fluid-pressure motor, a valve mechanism controlling the distribution of motive fluid, and two independent reversing-gears connected to the valve mechanism and adapted to independently reverse the valve functions, substantially as set forth.

2. In a fluid-pressure motor, a valve mechanism controlling the distribution of motive fluid, and two independent adjustable reversing-gears connected to the valve mechanism, one of which is adapted to be controlled or adjusted by hand, and the other by means of a governor, substantially as set forth.

3. In a fluid-pressure motor, a valve mechanism and two independently-adjustable reversing devices each controlling the cut-off of the motive fluid in both ends of the cylinder and adapted to independently reverse the valve functions, substantially as set forth.

4. In a fluid-pressure motor, the combination with a valve mechanism of two independent adjustable devices controlling the cut-off of the motive fluid, one adapted to be operated by hand and the other by a governor, substantially as set forth.

5. In a valve-gear for a reversing-engine, the combination, with valve mechanism for controlling the distribution of motive fluid, of a shifting link, or block, and an adjustable eccentric connected to the valve mechanism, substantially as set forth.

6. In a valve-gear for a reversing-engine, the combination, with a valve mechanism for controlling the distribution of motive fluid, of two or more independent reversing-gears connected to the valve mechanism and adapted to vary the cut-off of the motive fluid without substantial variation of lead, substantially as set forth.

7. In a valve-gear, the combination, with a link having adjustable connection with a valve-rod, of an eccentric connected to the link at or near one of its ends, and an eccentric connected to the link at an intermediate point, substantially as set forth.

8. In a valve-gear for fluid-pressure motors, the combination with a link having adjustable connection with a valve-rod, of means for varying the adjustment to reverse the motor and a single adjustable eccentric connected to the link and adapted to control both the forward and back motions of the motor, substantially as set forth.

9. In a valve-gear, the combination, with a link having adjustable connection with a valve-rod, of a fixed eccentric connected to the link at or near its middle point, and an adjustable eccentric connected to the link at or near one of its extremities, substantially as set forth.

10. In a valve-gear, the combination with a link having adjustable connection with a valve-rod, of an eccentric connected at or near one of the ends of the link, and an eccentric connected to an intermediate point on the link, and which is adapted to impart to the point on the link to which it is connected substantially the same motion as would be imparted by two eccentrics connected at or near the opposite ends of the link, substantially as set forth.

11. In a valve-gear, the combination, with a link, of a fixed eccentric whose center is substantially in line with the engine-crank and which is connected to the link at or near the middle point of the link, and an adjustable eccentric connected to a point at or near the extremity of the link, substantially as set forth.

12. In a valve-gear, the combination, with a link having an adjustable connection with a valve-rod, of a guide for the link, a fixed eccentric connected to the link at or near its middle point and an adjustable eccentric connected to the link at or near one of its extremities, substantially as set forth.

13. In a valve-gear, the combination, with a slotted link of a block fitted in the slot and connected to a valve-rod, a fixed eccentric connected to the link at or near its middle point, an adjustable eccentric connected to the link at or near one of its ends, a governor for shifting the adjustable eccentric and means for relatively adjusting the link and block by hand, substantially as set forth.

14. In a valve-gear, the combination, with the valves of two cylinders, of two fixed eccentrics, two links, each of which is connected to a valve-rod and, at or near its middle point, to one of the fixed eccentrics, an adjustable eccentric, and connections from the adjustable eccentric to one end of each of the links, substantially as set forth.

15. In a valve-gear, the combination, with the valves of two cylinders, of two fixed eccentrics, two links, each of which is connected to a valve-rod and, at or near its middle point, to one of the fixed eccentrics, an adjustable eccentric, direct connections from the adjustable eccentric to one end of one of the links and to an arm on a rock-shaft, and a connection from the rock-shaft to one end of the other link, substantially as set forth.

16. The combination, in a fluid-pressure motor, of a valve-gear having a relatively-adjustable link-and-block connection between the distribution-valve and its driving mechanism, a brake for stopping or checking the motion of the engine, and means, connected to the valve-gear and to the brake, for simultaneously applying the brake and shifting the block-and-link connection to stop the engine, substantially as set forth.

17. In a fluid-pressure motor, the combination, with a valve mechanism and an adjustable cut-off and reversing device, of an automatic governor connected thereto and adapted

to vary the cut-off of the motive fluid, and means controlled by the governor for operating the reversing device to effect a reversal of the engine, substantially as set forth.

18. In a fluid-pressure motor, the combination, with a valve mechanism and an adjustable cut-off and reversing gear, of an automatic governor connected thereto and adapted to vary the cut-off of the motive fluid, and a fluid-pressure-actuated device controlled by the governor and adapted to operate the reversing mechanism, substantially as set forth.

19. In a fluid-pressure motor, the combination, with a valve mechanism, of an adjustable link or block, an automatic governor connected thereto and adapted to vary the cut-off of the motive fluid, and means for effecting a reversal of the motor which is in operation during the ordinary movements of the governor, but which is operative by an excessive movement of the governor to effect a reversal of the engine, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS M. RITES.

Witnesses:

BERNARD COCHRAN,

L. E. TORRY.