No. 863,235. PATENTED AUG. 13, 1907.

J. STURGESS.

SPEED REGULATOR.

APPLICATION FILED DEC. 10, 1906.

3 SHEETS—SHEET 1.

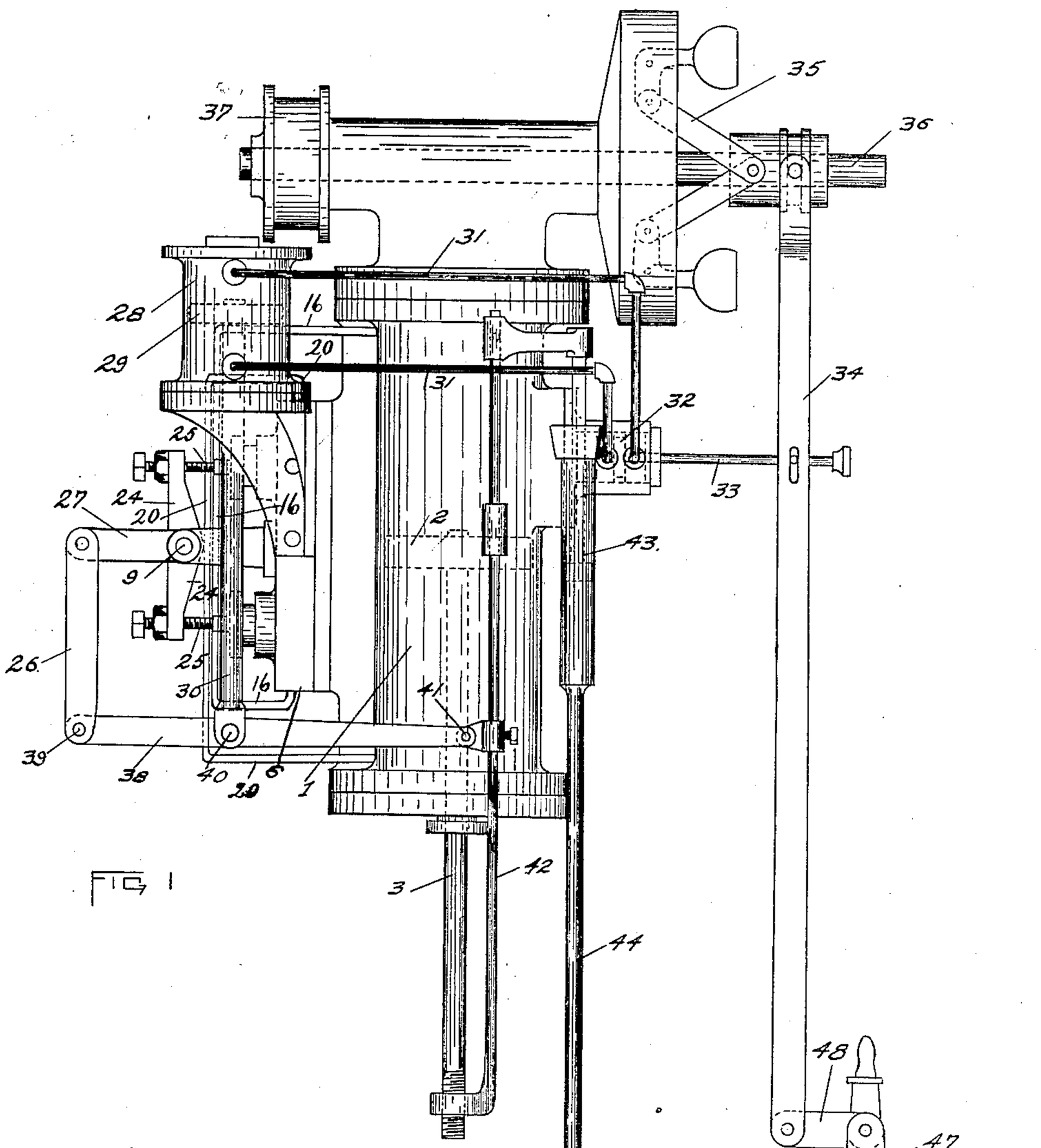

FIG 1

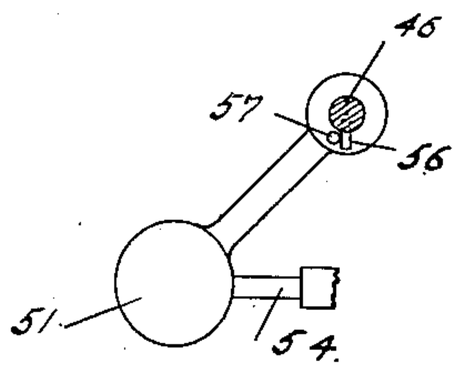

FIG 7

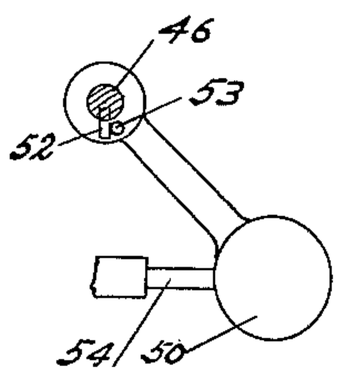

FIG 8

WITNESSES

J. L. Fuller.

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3 SHEETS—SHEET 2.

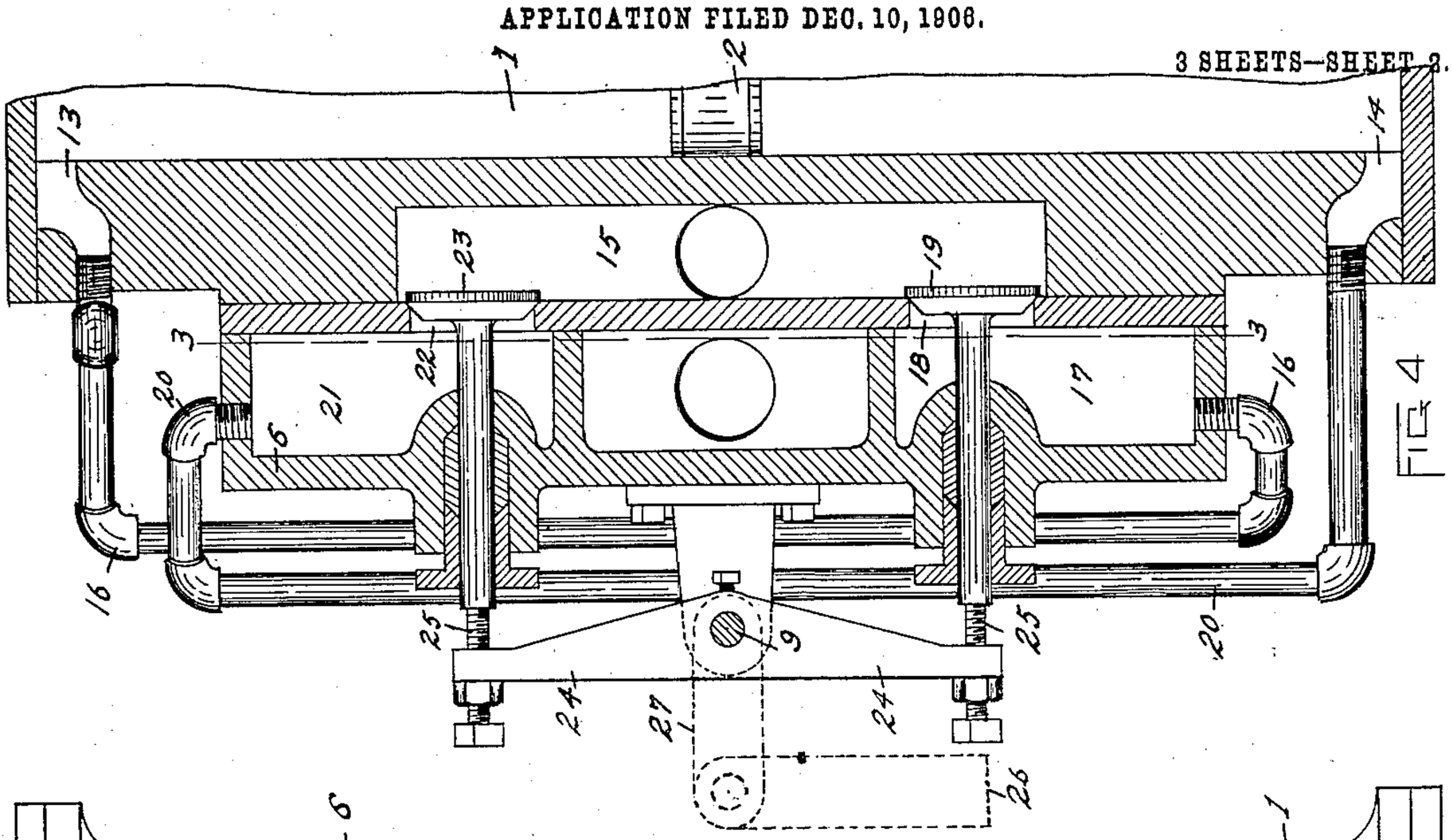

FIG 4

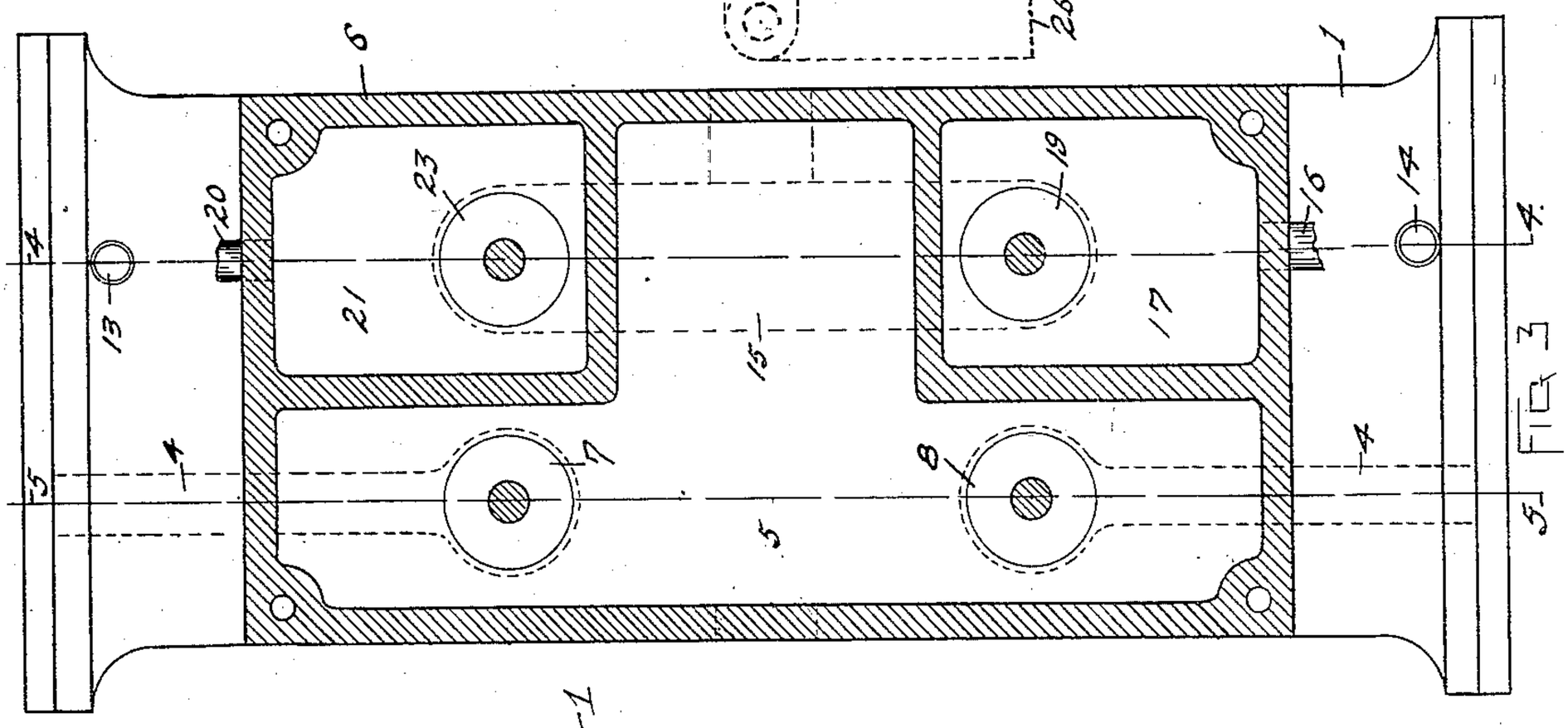

FIG 3

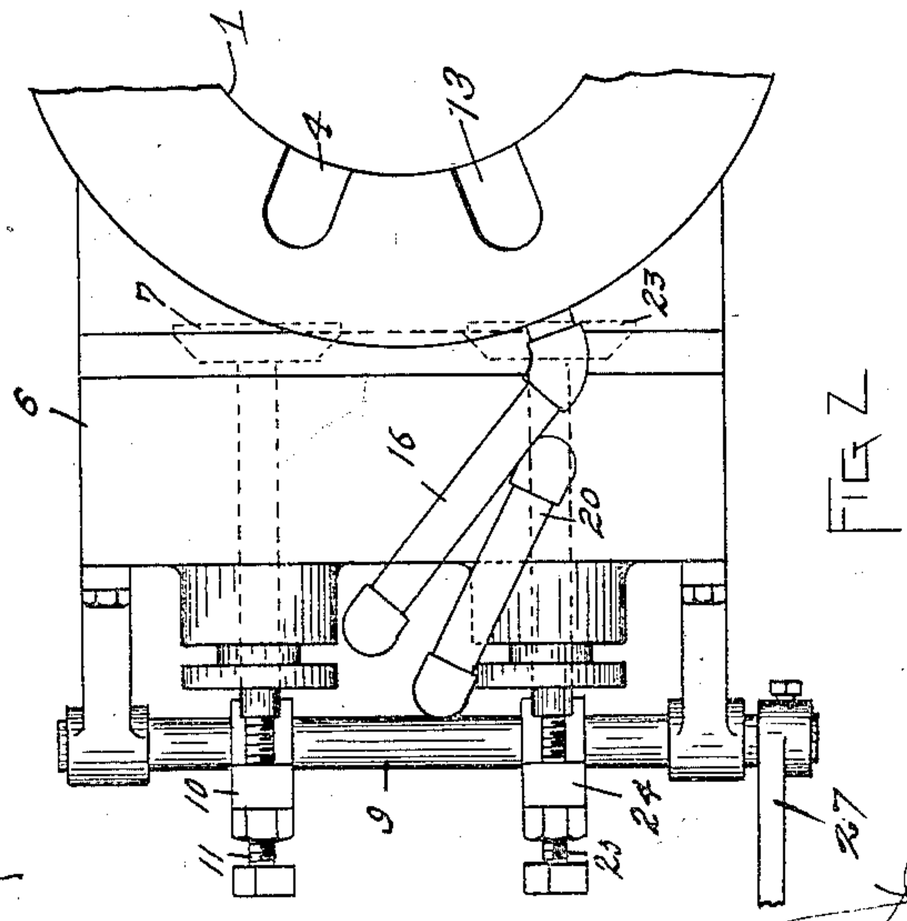

FIG 7

WITNESSES
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3 SHEETS—SHEET 3.

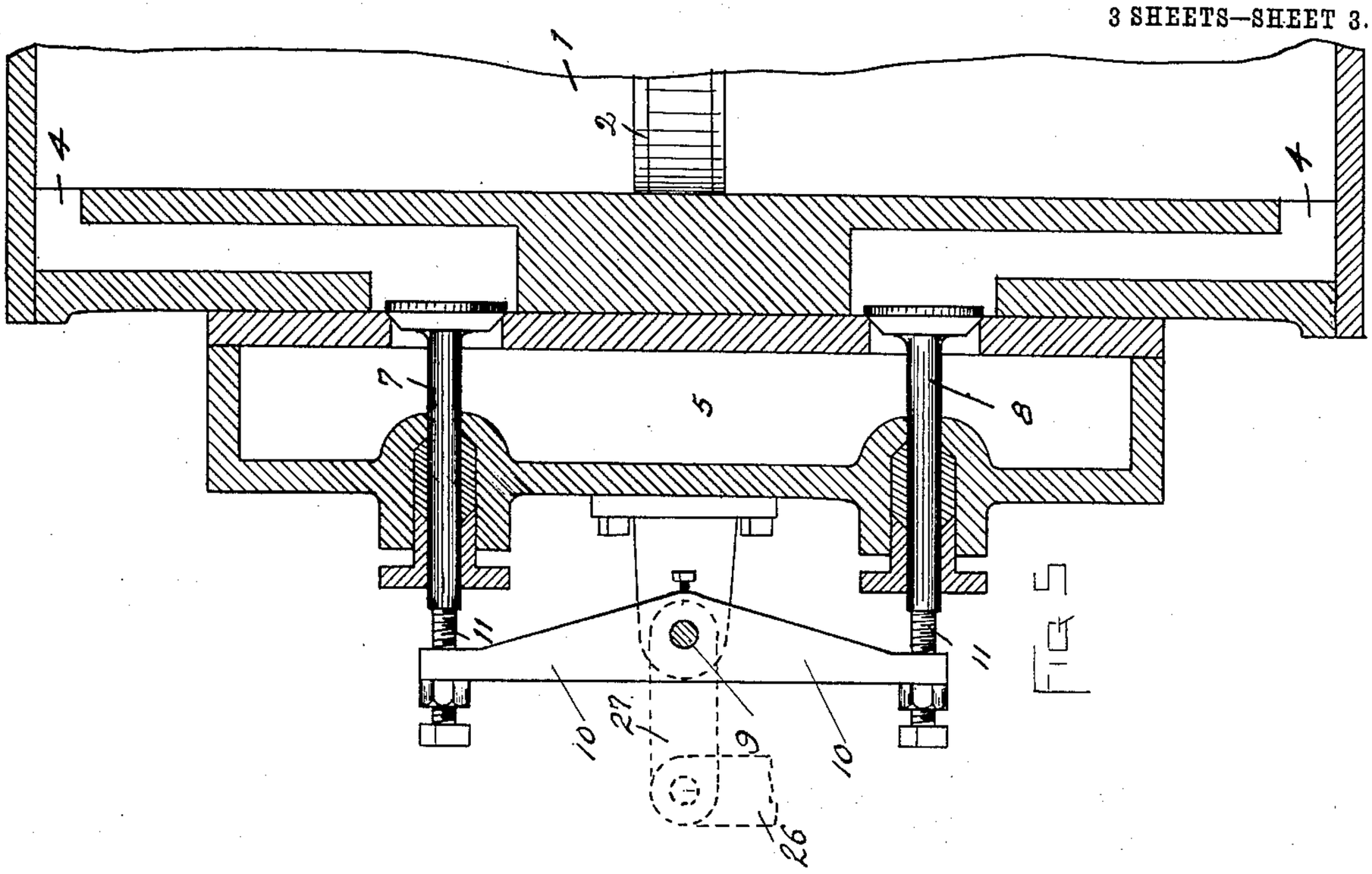

FIG 5

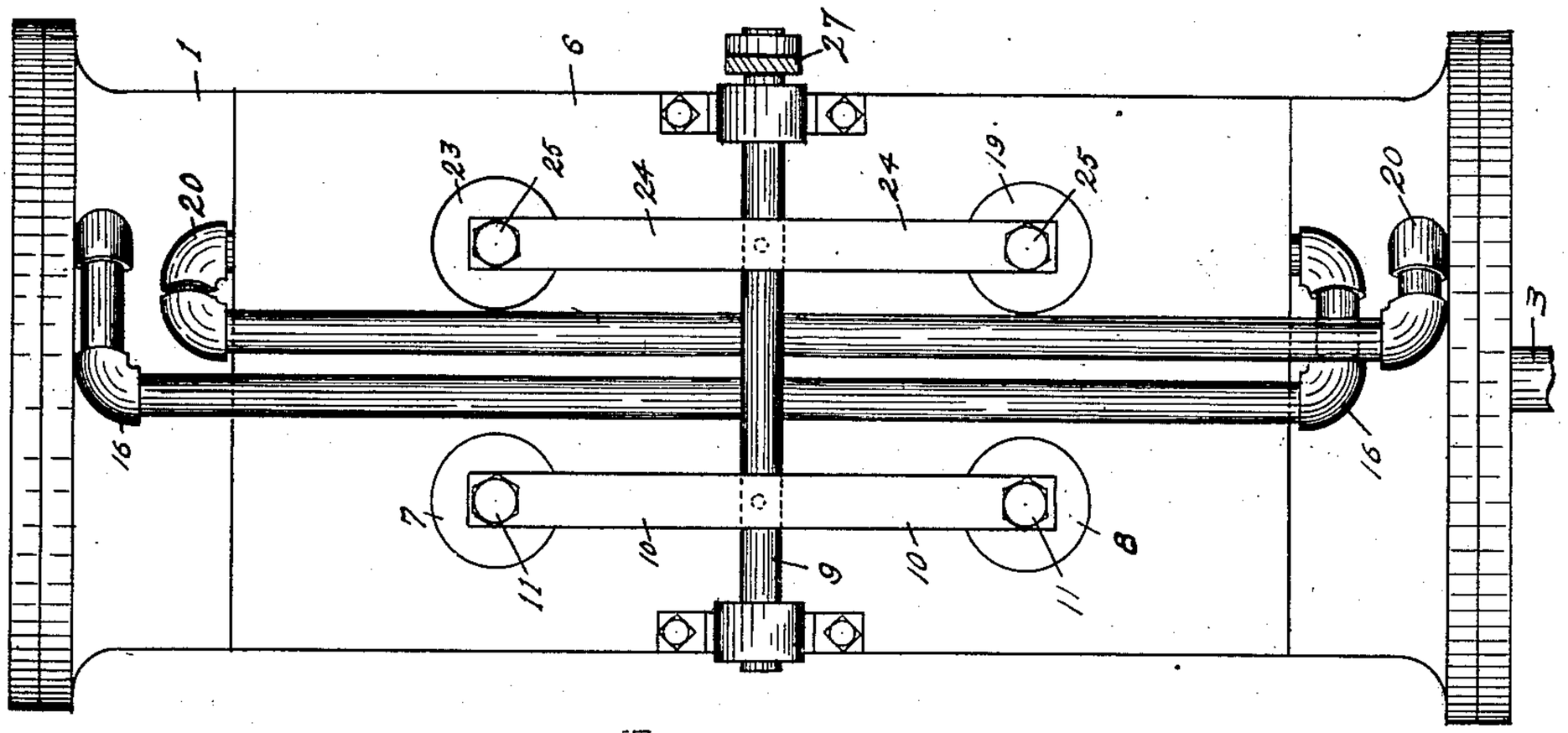

FIG 6

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN STURGESS, OF TROY, NEW YORK, ASSIGNOR TO STURGESS GOVERNOR ENGINEERING COMPANY, OF TROY, NEW YORK, A CORPORATION OF NEW YORK.

SPEED-REGULATOR.

No. 863,235. Specification of Letters Patent. Patented Aug. 13, 1907.

Application filed December 10, 1906. Serial No. 347,009.

To all whom it may concern:

Be it known that I, JOHN STURGESS, a subject of the King of Great Britain, residing at Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Speed-Regulators, of which the following is a specification.

The invention relates to such improvements and consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures therein.

Figure 1 of the drawings is a view in elevation of my improved speed-regulator. Fig. 2 is a top plan view of the primary motor and valve construction, with the cap of the primary cylinder and attachments thereto removed. Fig. 3 is a vertical cross-section taken through the valve-case of the primary motor on the broken line 3—3 in Fig. 4. Fig. 4 is a vertical, radial section of the primary motor and its controlling inlet-valves taken on the broken line 4—4 in Fig. 3. Fig. 5 is a similar radial section showing the outlet-valves. Fig. 6 is a view in elevation of the left-hand side of the primary motor and its valve-operating mechanism, as shown in Figs. 1 and 2. Figs. 7 and 8 are views showing cross-sections of the shaft through which is accomplished a compensating movement of the lever which operates the main valve of the apparatus, showing compensating weighted-arms mounted on said shaft.

This invention relates more particularly to speed-regulating mechanism adapted to automatically maintain and control the speed of a fluid-actuated prime mover at a uniform rate, and prevent variations due either to load changes or power fluctuations.

The invention is applicable more particularly to that class of prime movers operated by water-power, such as turbine, reaction and impulse-wheels, but it may be advantageously used with other prime movers, more especially when the mechanism for controlling the volume or amount of working fluid passing to the prime mover requires appreciable effort to move it.

In certain of its features the invention is applicable to various mechanisms in the operation of which it is desired to accomplish a simultaneous, proportionate movement of two members.

The principal objects of the invention, when used to control the speed of a prime mover, are to secure a more efficient and satisfactory operation of the mechanism for controlling and regulating the supply of fluid, under pressure, to the motor, whereby a gate, controlling the supply to the prime mover, is operated.

Other objects of the invention will appear in connection with the following description.

Referring to the drawings wherein the invention is shown in preferred form, 1, is a cylinder, which, with its piston, 2, and piston-rod, 3, comprises a fluid-motor which will be referred to herein as the primary motor of my improved apparatus. The piston-rod, 3, is adapted to be connected with the gate of a water-wheel or similar controller for the supply to a prime mover, not shown.

The cylinder, 1, is provided with a pair of outlet-ports, 4, leading from opposite ends of the cylinder to an exhaust-chamber, 5, in a valve-case, 6, mounted upon the cylinder, said ports being controlled by the respective puppet-valves, 7 and 8, as shown in Fig. 5, which are automatically closed by the pressure within the cylinder, and are adapted to be alternately opened by rocking movements in opposite directions of the rock-shaft, 9, which movements are transmitted to said valves through the respective rocker-arms, 10, and adjusting screws, 11, on said arms adapted to engage the respective valve-stems, all as shown in Fig. 5. The cylinder, 1, is also provided, in its opposite ends, with a pair of inlet-ports, 13 and 14, each of which is adapted to communicate, through a valve-controlled passage-way, with a supply-chamber, 15, containing fluid under pressure. The inlet, 13, is thus connected by a pipe, 16, and chamber, 17, with the pressure-chamber, 15, the opening, 18, between said chambers being controlled by the puppet-valve 19. In like manner the inlet, 14, is connected by a pipe, 20, and chamber, 21, with the pressure-chamber, 15, the opening, 22, between the chambers, 21 and 15, being controlled by a puppet-valve 23. These puppet-valves, 19 and 23, are held to their seats by the pressure within the pressure-chamber, and are adapted to be alternately opened by rocking movements, in opposite directions, of the rock-shaft, 9, which movements are transmitted to said valves through the respective rocker-arms, 24, and adjusting screws, 25, on said arms adapted to engage the respective valve-stems, all as shown in Fig. 4. The arms, 10 and 24, which project from the upper side of the rock-shaft, 9, are thus adapted, when the rock-shaft is rotatively moved or rocked to the right, to simultaneously open the outlet from the upper end of the cylinder, 1, and the inlet to the lower end thereof; and, when said rock-shaft is rocked in the opposite direction, the arms, 10 and 24, which project from the lower side of said rock-shaft, are thus adapted to simultaneously open the outlet from the lower end of the cylinder, 1, and the inlet to the upper end thereof. The rock-shaft, 9, is adapted to be operated by means of a link, 26, connected with a rocker-arm, 27, on said shaft.

Mounted parallel with the cylinder, 1, is a cylinder,

28, which, with its piston, 29, and piston-rod, 30, comprises a fluid-motor which will be referred to herein as the secondary motor of my improved apparatus. Fluid under pressure is alternately supplied to opposite ends of the cylinder, 28, through supply pipes, 31, under control of a piston-valve, 32, the stem, 33, of which is connected with a lever, 34, adapted to be operated by a centrifugal governor, 35, mounted upon a shaft, 36, provided with a pulley, 37, adapted to receive a belt, not shown, whereby it is adapted to be connected with the machinery driven by the prime mover, not shown. The centrifugal governor, 35, and the valve, 32, may be of any known forms whereby variations in the rotary speed of the centrifugal mechanism will be caused to induce the proper operation of said valve.

A floating-lever, 38, is connected at, 39, with the link, 26; at, 40, with the piston-rod, 30; and at, 41, indirectly with the piston-rod, 3, the latter connection being accomplished through a rod, 42, fixed upon said piston-rod, 3, and extending parallel therewith. The rod, 42, carries on its upper end, one member of a dash-pot, 43, the other member of which is connected by a rod, 44, with a lever, 45, fixed upon a rock-shaft, 46, which rock-shaft is connected through a rocker-arm, 47, and link, 48, with the valve-operating lever 34.

The operation of the apparatus as thus far described is as follows. Variations in speed of the machinery will be indicated by the centrifugal apparatus, and, whenever the machinery departs from normal speed, the centrifugal apparatus will thus cause the valve, 32, to be operated, the arrangement being such, that said valve is operated in a direction to induce the proper operation of the various mechanisms to cause such a variation in the supply of fluid in the prime mover as will restore the machinery to normal speed. For example, the valve, 32, having been thus moved to admit fluid under pressure through the pipe, 31, to the upper end of the cylinder, 28, the piston and piston-rod in said cylinder will be forced downward. The point, 41, of connection between the floating-lever, 38, and the piston-rod, 3, being temporarily a fixed point, the rocker-arm, 27, will, through the link, 26, be forced downward by the downward movement of the floating-lever, 38, which is caused by the downward movement of the piston-rod, 30, as a result of which, the downwardly projecting rocker-arms, 10 and 24, on the rock-shaft, 9, will be forced inwardly to open the inlet-valve, 19, controlling the supply to the upper end of the cylinder, 1, and the outlet-valve, 8, controlling the exhaust from the lower end thereof; whereupon, the piston, 2, and piston-rod, 3, will also be forced downward, such downward movement being utilized in the usual manner to operate the gate, controlling the supply of fluid to the prime mover; all of which is well understood in the art, making it unnecessary to describe the same in detail. The floating-lever, 38, acts as a proportionating element for inducing proportionate movement of the two piston-rods, 3 and 30, causing them to move simultaneously and proportionately so long as the valve, 32, remains open. A disproportionate movement of said piston-rods is instantly counteracted by the resultant operation of the puppet-valves through the floating-lever, 38, and other connections. When the piston-rod, 3, has been thus moved a sufficient distance to cause such a variation in supply to the prime-mover as will eventually restore the speed of the machinery to normal, the valve, 32, will be automatically closed by a movement of the lever, 34, through the link, 48, rocker-arm, 47, rock-shaft, 46, rocker-arm, 45, rod, 44, dash-pot, 43, and rod, 42, the quickness of the movement causing the dash-pot, 43, to act as a substantially rigid element. The closing of the valve, 32, is thus accomplished as soon as the gate has been moved to the position which will eventually restore the machinery to normal speed, but an appreciable time is required to overcome the inertia of the machinery and working fluid. It thus becomes necessary to provide compensating mechanism to prevent said valve from being again opened by the displacement of the centrifugal mechanism, due to gradual restoration of the machinery to normal speed. As a preferred form of such compensating mechanism, I employ in connection with the dash-pot, 43, a pair of weighted-arms, 50 and 51, loosely mounted upon the rock-shaft, 46, and projecting from opposite sides thereof. Upon the rock-shaft, 46, is a pin or offset, 52, adapted, when the rock-shaft is rocked to the left, to engage the weight-arm, 50, through a pin, 53, fixed thereon, and to lift said weight-arm away from the stop, 54, against which it normally rests. This displacement of the weight-arm, 50, occurs during the movement of the piston-rod, 3, which moves the gate to the required position and also closes the valve, 32, it being borne in mind, that during this movement the dash-pot, 43, acts as a substantialiy rigid element. After such movement has been completed, and the valve, 32 closed, the force of the weight-arm, 50, will gradually contract the dash-pot element until the weight, 50, again engages its stop 54. This movement of contraction of the dash-pot element is accompanied by an upward movement of the rocker-arm, 45, and by a movement to the right of the rocker-arm, 47, and of the lower end of the lever, 34, which movement causes a movement of the valve, 32, in a direction opposite to that in which the centrifugal mechanism tends to operate said valve, as the machinery is being restored to normal speed.

When the variation in speed of the machinery is to be corrected by an upward movement of the piston-rod, 3, the compensation will be accomplished in substantially the same manner through the weight, 51, which is adapted, when the rock-shaft, 46, is rocked to the right, to lift the weight-arm, 51, by engagement of a pin or offset, 56, on the rock-shaft with a pin or offset, 57, on said weight-arm, 51, in the latter case the weight-arm, 51, serving to expand the dash-pot element, 43, and to move the rocker-arm, 47, and lower end of the lever, 34, in the opposite direction.

What I claim as new and desire to secure by Letters Patent is

1. In an apparatus of the class described, and in combination, a primary fluid-motor; a secondary fluid-motor; puppet-valves controlling inlet and outlet ports of the primary motor; means for supplying fluid under pressure to said puppet-valve-controlled inlet-port; valve-controlled means for supplying fluid under pressure to the secondary motor; puppet-valve-operating mechanism controlling the movements of said puppet-valves; and proportionating connections between said valve-operating mechanism and movable elements of both of said motors, whereby disproportionate movement of said elements automatically actuates said puppet-valve-operating mechanism.

2. In an apparatus of the class described, and in com-

bination, a primary cylinder; a secondary cylinder; a piston and piston-rod for each of said cylinders; puppet-valves controlling inlet and outlet-ports of the primary cylinder; means for supplying fluid under pressure to said puppet-valve-controlled inlet-port; valve-controlled means for supplying fluid under pressure to the secondary cylinder; puppet-valve-operating mechanism controlling the movements of said puppet-valves; and proportionating connections between said puppet-valve-operating mechanism and both piston-rods, whereby disproportionate movement of said piston-rods automatically actuates said puppet-valve-operating mechanism.

3. In an apparatus of the class described, and in combination, a primary cylinder; a secondary cylinder; a piston and piston-rod for each of said cylinders; valve-controlled means for supplying fluid under pressure to the secondary cylinder; centrifugal mechanism for operating said valve; puppet-valves controlling inlet and outlet ports of the primary cylinder; means for supplying fluid under pressure to said puppet-valve-controlled inlet-port; puppet-valve-operating mechanism controlling the movements of said puppet-valves; and proportionating connections between said puppet-valve-operating mechanism and both piston-rods, whereby disproportionate movement of said piston-rods automatically actuates said puppet-valve-operating mechanism.

4. In an apparatus of the class described, and in combination, a primary cylinder; a secondary cylinder; a piston and piston-rod for each of said cylinders; puppet-valves controlling inlet and outlet-ports of the primary cylinder; means for supplying fluid under pressure to said puppet-valve-controlled inlet-port; valve-controlled means for supplying fluid under pressure to the secondary cylinder; puppet-valve-operating mechanism controlling the movements of said puppet-valves; and a floating lever connecting with the respective piston-rods, and with the puppet-valve-operating mechanism.

5. In an apparatus of the class described, and in combination, a primary cylinder; a secondary cylinder; a piston and piston-rod for each of said cylinders; four puppet-valves; two controlling inlet-ports for the opposite ends of the primary cylinder, and two controlling corresponding outlet ports therefor; means for supplying fluid under pressure to the respective puppet-valve-controlled inlet-ports; valve-controlled means for supplying fluid under pressure to the secondary cylinder; a rock-shaft; puppet-valve-operating members projecting from one side of said rock-shaft and adapted to correspondingly control the operation of the puppet-valves for the inlet-port to one end and the outlet-port from the other end, of said primary cylinder; members projecting from the opposite side of said rock-shaft and adapted to correspondingly control the operation of the gate-puppet valves for the other inlet and outlet-ports of said primary cylinder; and proportionating connections between said rock-shaft and both piston-rods whereby disproportionate movement of said piston-rods automatically actuates said rock-shaft.

6. In an apparatus of the class described, and in combination, fluid-actuated gate-operating mechanism; a valve for controlling the supply of fluid under pressure to said gate-operating mechanism; a centrifugal governor; valve-operating connections between said valve and governor; a rock-shaft; a rocker-arm fixed on said shaft; connections between said rocker-arm and gate-operating mechanism comprising in part a dash-pot; connections between said valve-operating mechanism and a rocker-arm on said rock-shaft; a pair of weighted members movably disposed on opposite sides of said rock-shaft; and an offset on said rock-shaft engageable with one only of said weighted members when the rock-shaft is moved in one direction, and with the other only of said weighted members when the rock-shaft is moved in the opposite direction.

In testimony whereof, I have hereunto set my hand this 1st day of December, 1906.

JOHN STURGESS.

Witnesses:
FRANK C. CURTIS,
E. M. O'REILLY.