No. 874,936. PATENTED DEC. 31, 1907.

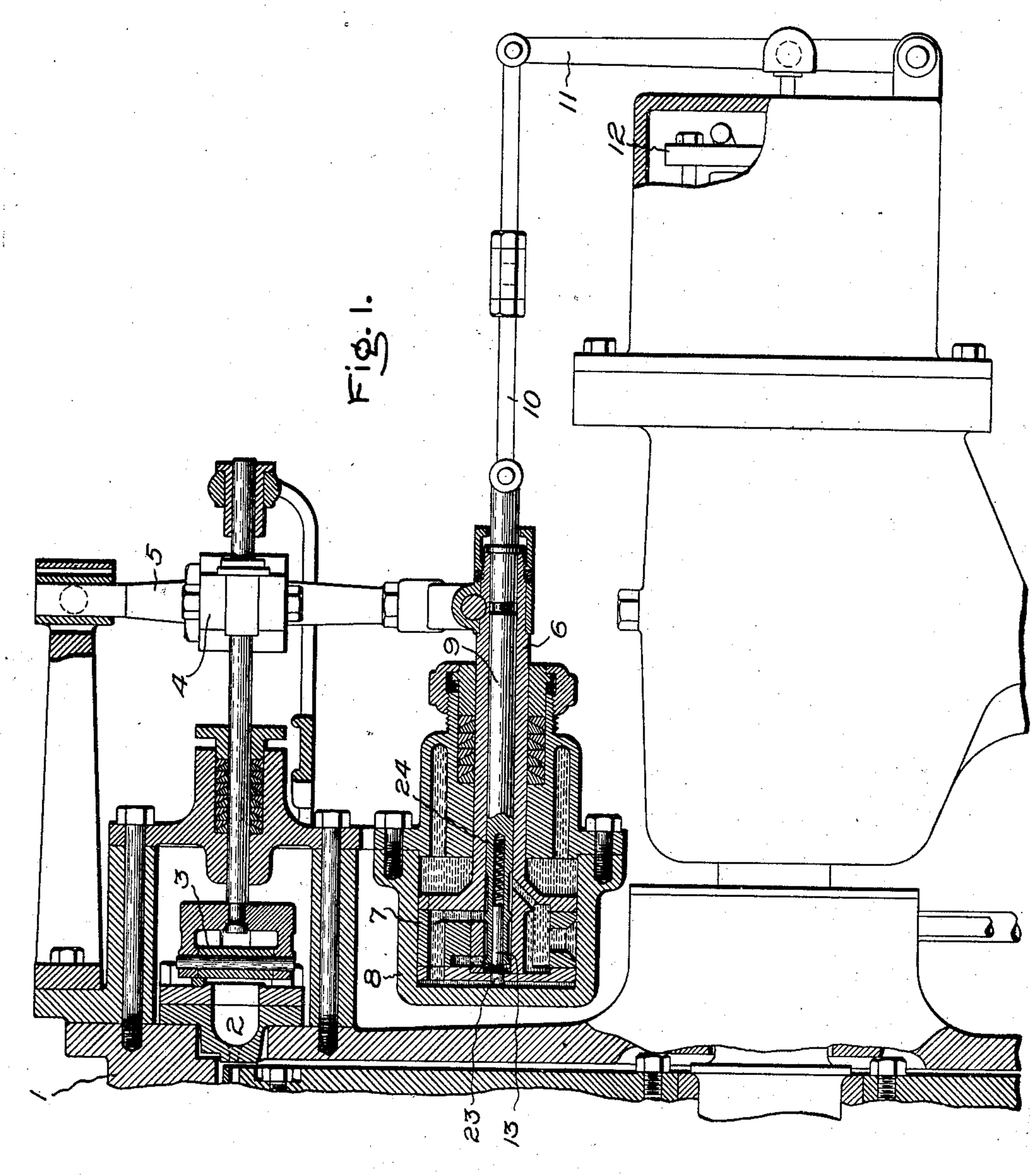
J. G. CALLAN.

GOVERNING MECHANISM FOR TURBINES.

APPLICATION FILED JUNE 16, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

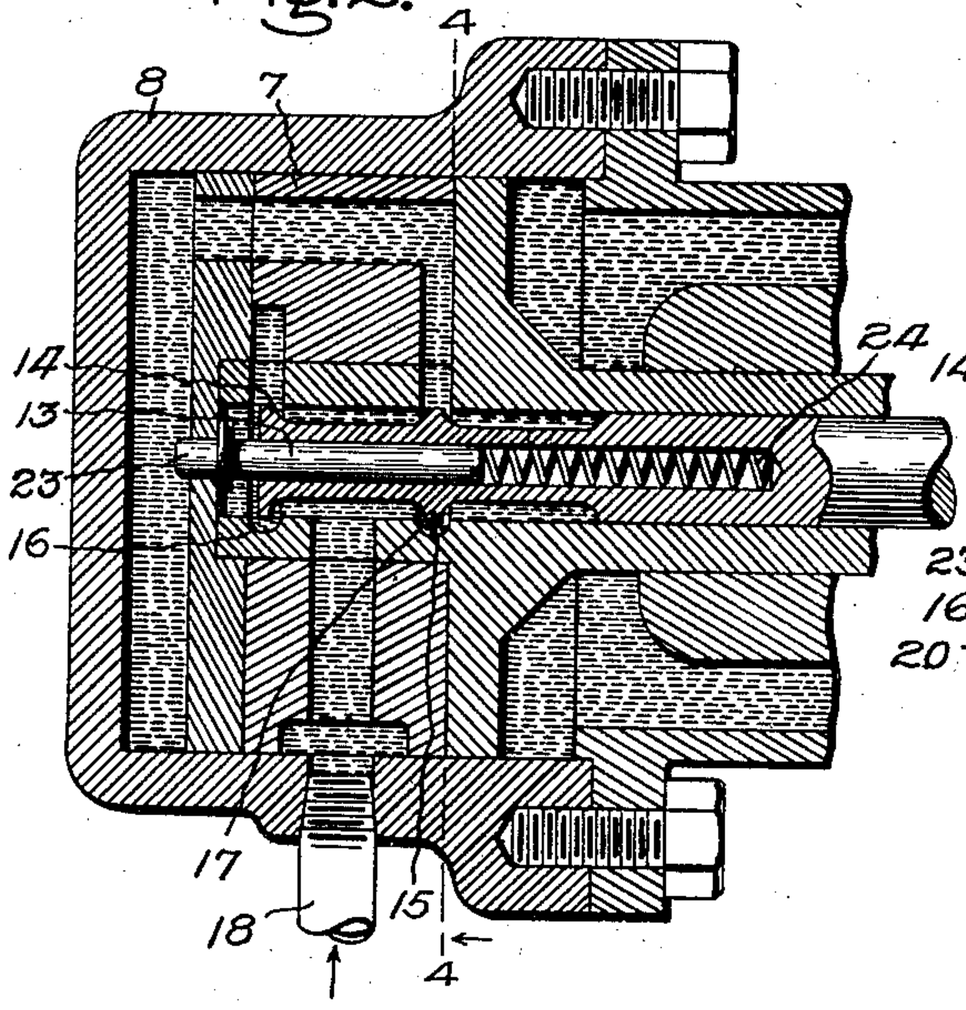


Fig. 3.

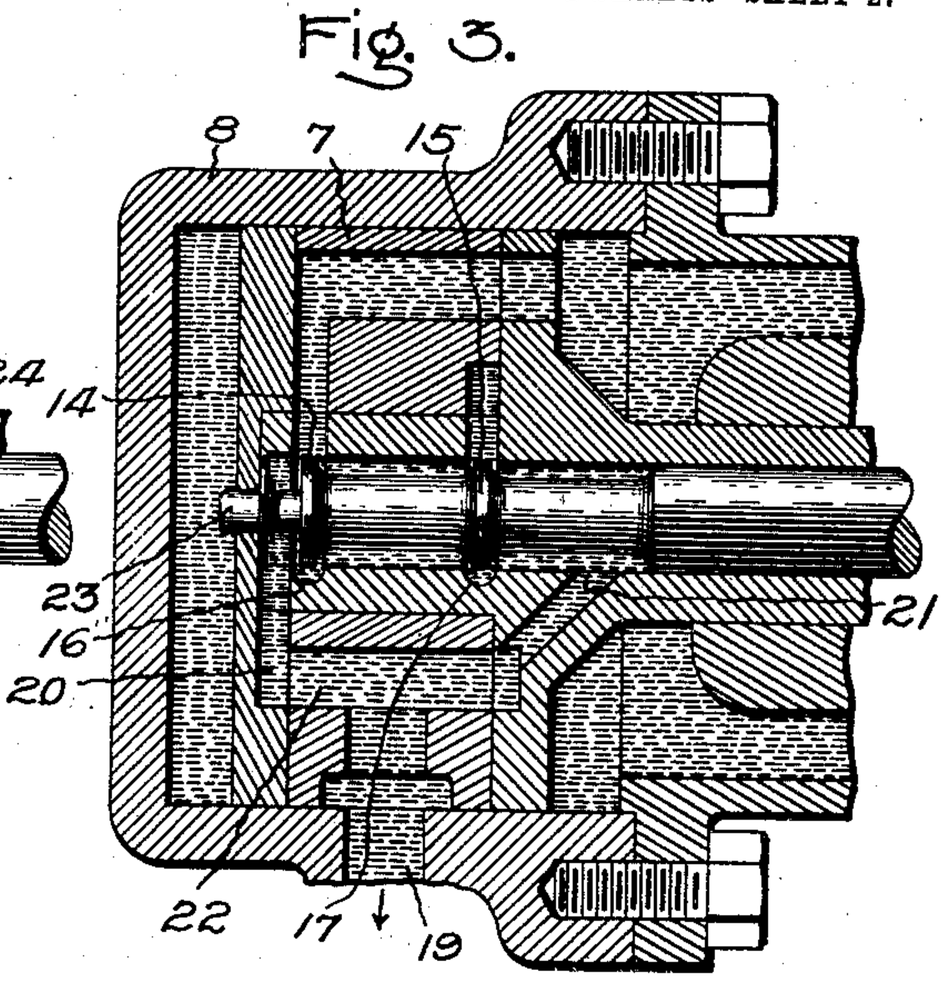


Fig. 4.

Fig. 5.

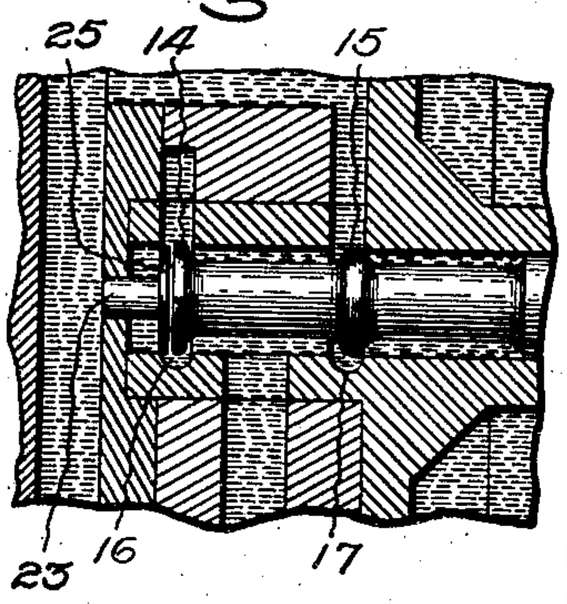


Fig. 6.

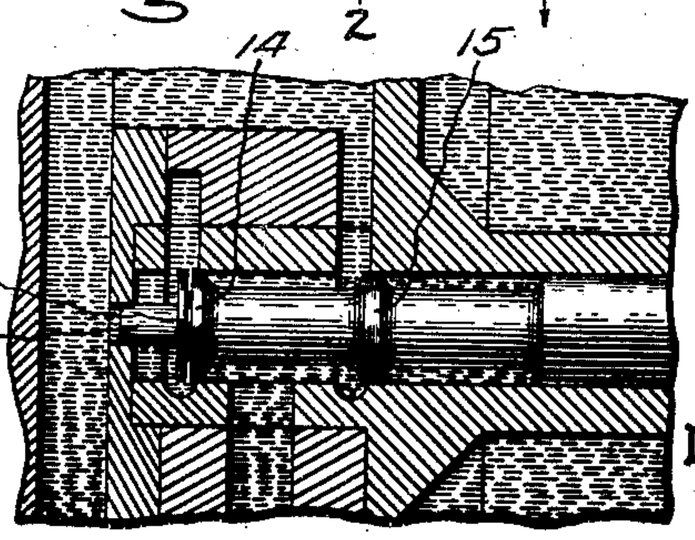
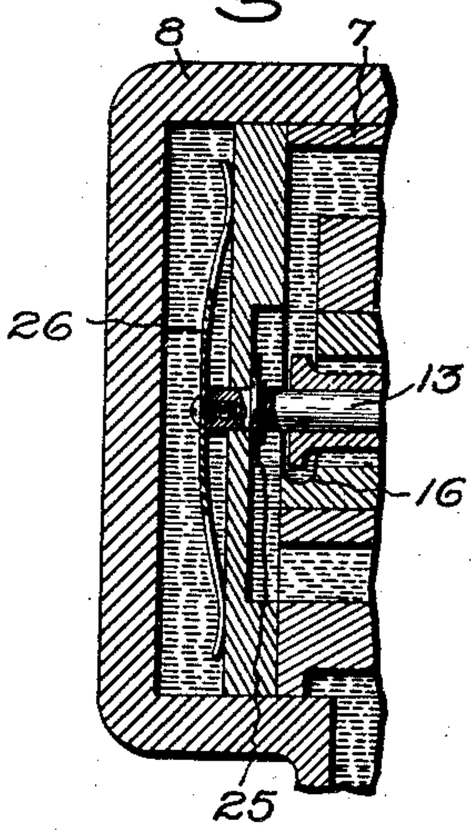


Fig. 7.



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UNITED STATES PATENT OFFICE.

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GOVERNING MECHANISM FOR TURBINES.

No. 874,936. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed June 16, 1906. Serial No. 321,993.

To all whom it may concern:

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Governing Mechanism for Turbines, of which the following is a specification.

The present invention is an improvement over the construction shown in my patent No. 845,448 dated Feb. 26, 1907.

In the valve gear referred to in said application it was found under certain circumstances that the load on the shaft governor was somewhat greater, under certain conditions, than it should be for very close regulation, as for example, where the turbine was used to drive a generator for a lighting circuit. In other words, it required a greater change in speed at times than is desirable for certain kinds of work although the action of the mechanism as a whole was satisfactory.

The present invention has for its object to improve the construction of the governing mechanism referred to, and also governing mechanisms of a similar nature, and make them more sensitive to load-changes by providing a means for supplementing the action of the shaft governor whereby the change in speed required to move the controlling valve or valves of the turbine is decreased.

In the accompanying drawings which are illustrative of one of the embodiments of the invention, Figure 1 is a view partially in section of a turbine and its controlling valves; Fig. 2 is an axial section of the hydraulic motor for moving the controlling valves and taken on line 2—2 of Fig. 4, to show the inlet port and passages; Fig. 3 is a similar section taken on line 3—3 of Fig. 4, to show the exhaust port and passages; Fig. 4 is a transverse section of the motor taken on line 4—4 of Fig. 2; Fig. 5 is an enlarged sectional view showing the pilot valve and the auxiliary actuating mechanism in one of its positions; Fig. 6 is a similar view showing the valve in a slightly different position; and Fig. 7 is a sectional view showing a slight modification.

1 represents a turbine of any suitable construction, the one shown being of the Curtis type. Steam or other elastic fluid is admitted thereto by the nozzle 2 in which there are one, two or more passages for discharging the motive fluid against the wheel buckets. The passages may be expanding or non-expanding in character and are controlled by valves or regulators 3 of which as many are provided as are necessary. The valves are arranged one behind the other, and are actuated by the cross-head 4, and the latter in turn is moved by the lever 5. The lever is pivotally supported in a trunnion bearing at one end and at the other end is attached to the tubular piston rod 6 secured to the piston 7 of the hydraulic motor, the said piston being normally substantially balanced. The cylinder 8 of the motor is suitably supported as by the head of the turbine. The piston rod 6 is packed at the point where it passes through the head of the motor. Mounted within the rod and the piston, is a pilot valve 9, the latter being connected by a rod 10 with the lever 11 of the shaft governor 12, which responds to speed variations.

The inner end of the pilot valve is bored out to receive the auxiliary or supplemental device 13 which coöperates with the shaft governor to move the pilot valve. This device functions as a piston, or plunger, for moving the pilot valve, and also as a valve to partially regulate the passage of fluid within the cylinder under certain conditions to be referred to later. The construction and arrangement of the motor is such that the motive fluid, oil in the present instance, flows continuously therethrough. Movement of the piston in either direction is obtained by restricting the flow of fluid at one point or the other in its passage. When restricted or stopped at one point, the piston moves to the right, and when restricted or stopped at another point the piston moves to the left, it being understood that when one side is under high pressure the other side is open to a reduced pressure or the exhaust.

Referring now to Figs. 2 to 6, inclusive, the pilot valve has heads 14 and 15 between which there is always fluid under high pressure, the cylinder spaces on opposite sides of the piston being connected to the exhaust. In Fig. 2 the heads are shown in their central position opposite the ports 16 and 17, and fluid can freely flow right and left from the inlet 18 and connecting passage past the pilot valve heads 14 and 15 into the passages 20 and 21, Fig. 3, thence into the axially extending passage 22, thence into the outlet 19. So long as the load remains the same the

piston and pilot valve will continue inactive, and oil will flow freely into the inlet and out of the outlet.

Assuming now an increase in load accompanied by a slight fall in speed of the turbine shaft, the governor will move the pilot valve stem to the right, the head 15 of the pilot valve seating just before the head 14, Fig. 5. As the pilot valve moves to the right from its central position it first tends to restrict the flow of oil around its head on the right-hand side, and this restriction increases the velocity because the flow of oil through the motor is constant or substantially so. This increase in velocity of the fluid reacts on the valve and prevents it from closing readily, hence the load on the governor would be temporarily increased were it not for the auxiliary device 13 coöperating therewith. This movement of the pilot valve results in an increase in pressure in the cylinder space on the left of the piston, which pressure acting on the stem 23 of the auxiliary device 13, moves it to the right and compresses the spring 24 situated at its opposite end and thus assists the governor. This relation of parts is illustrated in Fig. 5, and it is to be noted that the heads seat one after the other which reduces the effort required to move the valve. The disk 25 carried by the stem 23 also serves as a valve to restrict the flow of oil around the head 14 of the pilot valve, and this in turn causes a still greater pressure in the left-hand cylinder space until the pilot valve finally closes and the piston starts into motion toward the right, and in so doing opens one or more admission valves through the medium of the lever 5, cross-head 4, etc.

As soon as the piston starts into motion, and this irrespective of the direction of motion of the pilot valve, it will ultimately overtake the latter, and when a mid- or substantially mid-position is reached the parts will come to rest, as in Fig. 2, until there is a change in load. In event of the admission valves 3, acting without substantial opposition, as would be the case where they were not held to their seats by the steam pressure in the inclosing chest, the auxiliary pilot valve will move back and forth in response to the governor, the auxiliary device doing little or nothing to assist in the operation under these conditions. Just as soon, however, as the load on the motor increases beyond a certain point, then the auxiliary device comes into service. The auxiliary device for assisting the governor works in one direction only, in the present embodiment of the invention, because it is only necessary to assist the governor when the motor has to raise a controlling valve or valves 3, against the steam pressure. If conditions require it, however, I may arrange a device to assist the governor upon conditions of decreasing load.

Assuming that the effect of the spring 24 is not quite sufficient to return the device 13 to its normal position when the pressure in the left-hand end of the cylinder falls to normal, it will be aided by the action of the fluid in the system acting on the disk 25.

I have illustrated my improvement in connection with one type of valve mechanism because it has been found to possess material advantages when used therewith, but the invention is applicable to governing mechanisms of different constructions.

In the figures described, the effect of the compression spring 24 is transmitted to the speed governor 12, it being understood that normally the piston is held in a fixed and balanced position by a body of liquid on each side thereof. In order to avoid this, a flat spring 26, Fig. 7, is provided and arranged to engage the left-hand end of the piston, the central portion of the spring being secured to the auxiliary device 13. The action of the mechanism is the same as described above only there is no tendency for the spring to continually urge the governor in one direction.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In a governing mechanism, the combination of a regulator, a governor controlling it, and a device which coöperates with and assists in moving the governor in its action on the regulator.

2. In a governing mechanism, the combination of a regulator, a motor for moving it, a governor for controlling the movements of the motor, and a device coöperating with the governor to reduce the load thereon as it controls the motor.

3. In a governing mechanism, the combination of a regulator, a motor for moving it, a means for controlling the motor, a governor for varying the position of said means as the load requirements change, and a device coöperating with and reducing the load on the governor as it acts on said means.

4. In a governing mechanism, the combination of a regulator, a hydraulic motor for moving it, a pilot valve controlling the motor, a governor regulating the movements of the pilot valve, and a device coöperating with the governor to move the pilot valve.

5. In a governing mechanism, the combination of a regulator, a motor for moving it, a speed governor controlling the motor, and a device responding to unbalanced pressures for assisting the governor.

6. In a governing mechanism, the combi-

nation of a regulator, a hydraulic motor for moving it, comprising a piston, cylinder and pilot valve, a governor acting on the pilot valve, and a device responding to unbalanced pressure for assisting the governor in its action on the pilot valve.

7. In a governing mechanism, the combination of a regulator, a hydraulic motor for moving it, a speed governor, a pilot valve located in the motor piston so that the latter will follow up the movements of the valve, and a device set into operation by unbalanced pressures created by a movement of the pilot valve, which acts on the pilot valve in conjunction with the governor.

8. In a governing mechanism, the combination of a regulator, a motor for moving it, comprising a moving and a stationary element, a speed governor for controlling the motor, a device for assisting the governor in its action on the motor, and a spring opposing the said device that is carried by the movable element of the motor.

9. In a governing mechanism, the combination of a regulator, a piston and cylinder for moving it, a pilot valve for governing the motor, a governor for controlling the action of the pilot valve, a device responding to fluid pressure changes for assisting the governor in its action on the pilot valve, and a spring for opposing the movements of said device which engages the piston.

10. In a governing mechanism, the combination of a regulator, a fluid-actuated motor for moving it through which the fluid continuously flows, a valve for creating an unbalanced condition as to pressure on the movable element of the motor when it is desired to move the regulator, a means for moving the pilot valve, and a fluid-actuated device which coöperates with the said means.

11. In a governing mechanism, the combination of a regulator, a hydraulic motor for actuating it, a pilot valve for controlling the motor, which is provided with heads, ports coöperating with the valve heads, the relation of parts being such that one head closes its port before another to reduce the load on the actuator, and an actuator for moving the pilot valve.

12. In a governing mechanism, the combination of a regulator, a means for moving it, a speed governor for controlling said means, and a device actuated by fluid under pressure which assists in moving the governor when the speed of the apparatus being controlled changes.

In witness whereof, I have hereunto set my hand this 13th day of June, 1906.

JOHN G. CALLAN.

Witnesses:
JOHN A. McMANUS, Jr.,
HENRY O. WESTENDARP.