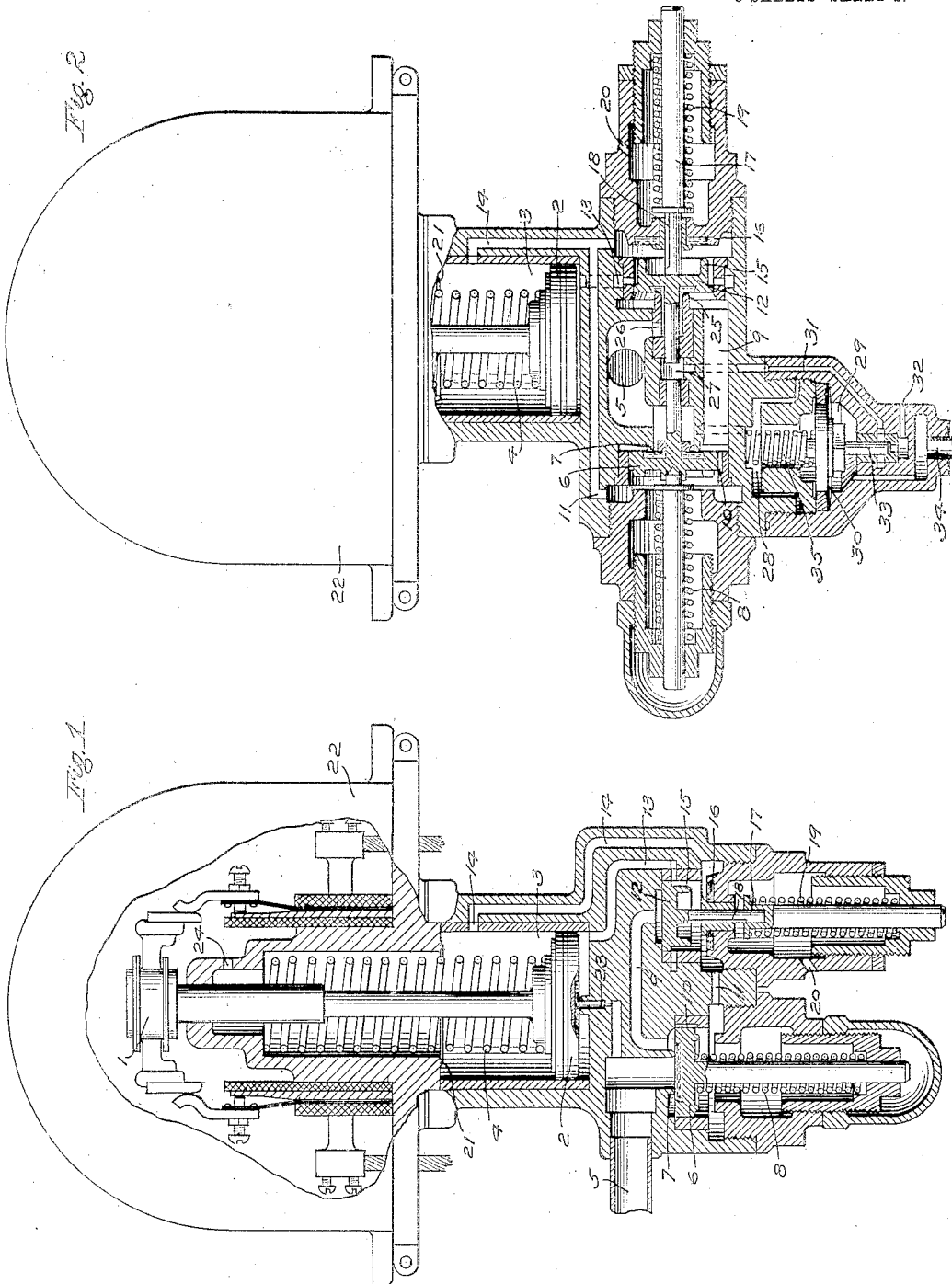


H. M. P. MURPHY.
ELECTRIC PUMP GOVERNOR.
APPLICATION FILED FEB. 25, 1907.

1,036,886.

Patented Aug. 27, 1912.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

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Fig. 2.

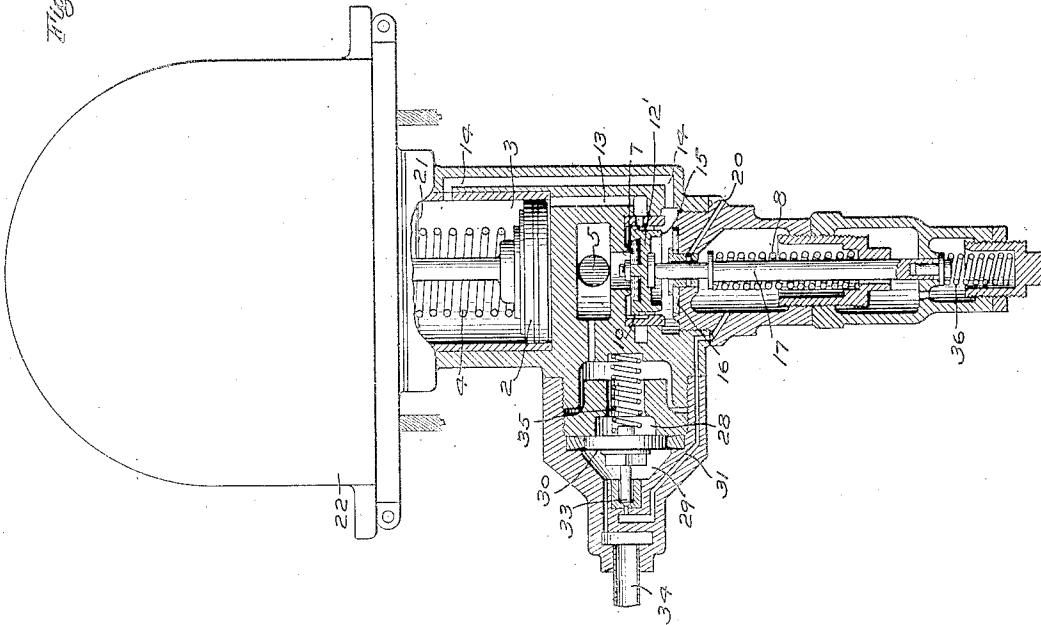
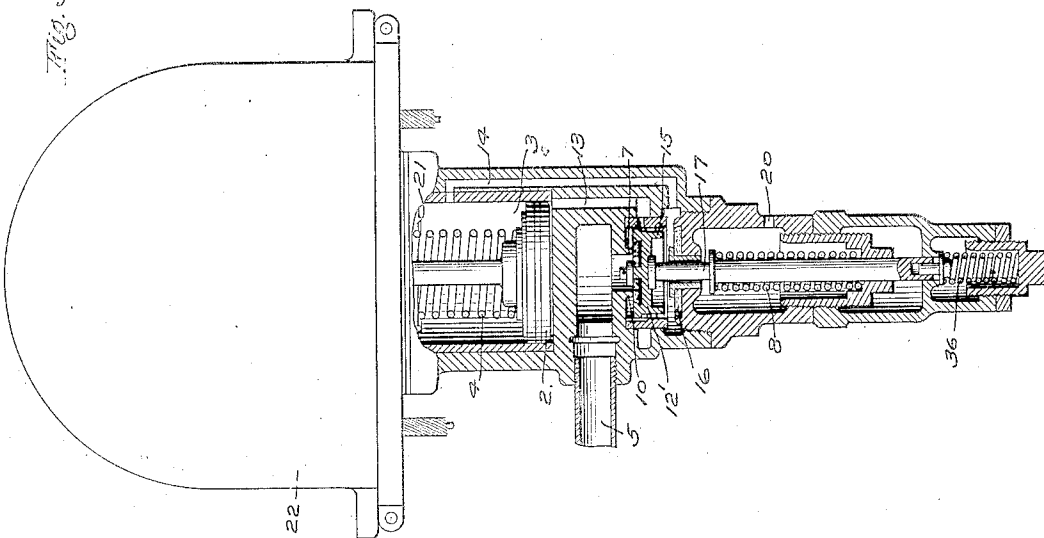


Fig. 3.



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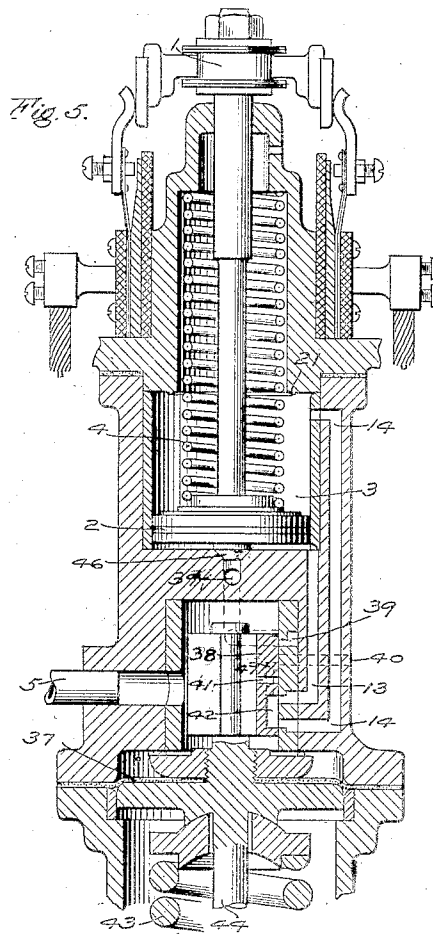
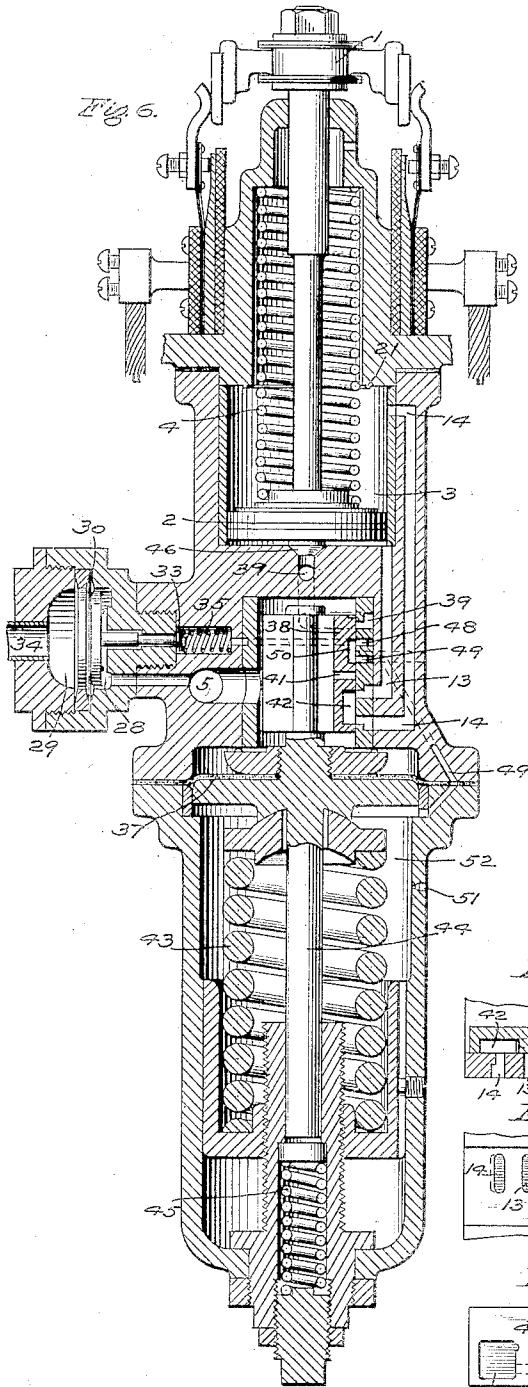


Fig. 10.

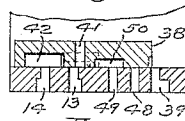


Fig. 11.

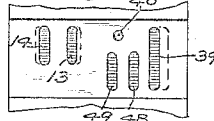


Fig. 12.

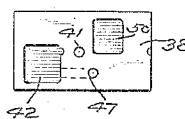


Fig. 7.

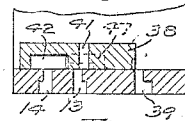


Fig. 8.

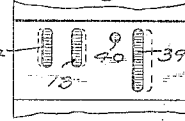
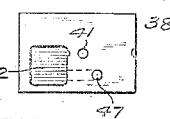


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELECTRIC PUMP-GOVERNOR.

1,036,886.

Specification of Letters Patent.

Patented Aug. 27, 1912.

Application filed February 25, 1907. Serial No. 359,241.

To all whom it may concern:

Be it known that I, HOWARD M. P. MURPHY, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Electric Pump-Governors, of which the following is a specification.

This invention relates to pump governors, and more particularly to governors for electric motor driven pumps, wherein the main controlling device, or switch, for opening and closing the circuit to the motor for driving the pump is operated according to the pressure produced by the pump.

The principal object of my present invention is to simplify the construction of pressure governors of this class, wherein a main actuating piston is employed for throwing the controlling device, or switch, to its different positions, for cutting the pump into or out of operation; and having means subject to the pump pressure for controlling the supply of fluid to and its release from the actuating piston.

Another object is to provide improved means, whereby the movement of the actuating piston from one position to the other shall be effected with a quick, positive and snap-like action, to cause a rapid and sudden shifting of the controlling device, or switch.

Another object is to provide means whereby the movement of the actuating piston from its outer position may control the release of fluid from the face of the piston and cause a rapid return movement.

Another object is to provide improved means, governed by the pump pressure, for rapidly supplying a large volume of fluid to the actuating piston.

Another object is to provide an improved adjustable spring mechanism opposing the pump pressure, whereby the governor may be readily set to any desired pressure, and the range or difference between the cutting in and the cutting out pressures may be quickly adjusted to meet any desired conditions.

Another object is to provide improved mechanism for controlling the governor by differential fluid pressures.

These objects, as well as others, are at-

tained by means of the apparatus which will now be more fully described in connection with the accompanying drawings, in which—

Figure 1 is a vertical sectional view of one form of governing device embodying my improvements; Fig. 2 a similar sectional view, showing a modification adapted to be operated by differential pressures; Fig. 3 a similar sectional view showing a modification in which the two valve pistons have been combined into one; Fig. 4 a similar view showing an attachment for operating under differential fluid pressures; Fig. 5 a sectional view showing still another modification embodying a diaphragm and valve, the lower part of the spring box being broken away; Fig. 6 a similar sectional view with additional mechanism for operating the governor under two different fluid pressures; Figs. 7, 8 and 9 views of the slide valve and seat of the construction shown in Fig. 5; and Figs. 10, 11 and 12 corresponding views of the slide valve and seat of the governor construction shown in Fig. 6.

According to the construction shown in Fig. 1, the main controlling device, or switch, 1, is connected to the actuating piston, 2, which is normally held at its inner position in the cylinder 3 by means of the spring 4.

Pressure from the pump or reservoir is admitted by pipe 5 to the valve piston 6, which is normally held to its seat 7 by the adjustable spring 8, so that only a small area of the piston 6 is then subject to the reservoir pressure. A port 9 leads from the space outside of this valve seat to the valve piston 12, which controls port 13 leading to the face of actuating piston 2 in cylinder 3. A by-pass groove 10 may be provided around piston 6, and a port 11 leads from the space below the piston to the port 14, which communicates with the cylinder 3 near its outer end.

The valve piston 12 has a rib, or seat, 15, which is adapted to engage gasket 16 in one position and cut off communication from port 14 to the one side of said piston within the seat portion, while the stem 17 is provided with a small groove 18 forming a restricted passage from this space beneath valve piston to the spring chamber and cut-

let port 20. The adjustable spring 19 determines the point at which the governor cuts in.

When the actuating piston 2 is at its outer position it engages the seat 21 for making a tight joint, and if desired, a small port 23 may be provided for maintaining the pressure upon the actuating piston, this port being closed by the piston when in its inner position. The main controlling device, or switch mechanism, may be covered by a casing, 22.

In the normal position of the parts of the governor, as shown in the drawings, the main switch is closed and the pump is operating to raise the fluid pressure in the reservoir and through pipe 5 on the small area of valve piston 6, the spring 8 being adjusted to the maximum degree of pressure at which it is desired that the pump shall cut out. When the pump pressure reaches this degree the valve piston 6 is forced slightly away from its seat 7, thereby permitting the pressure to act upon the greater area of the face of the piston and move the same quickly downward, and opening the supply of fluid through port 9 to valve piston 12. The equalizing groove 10 is closed by the first part of the downward movement of the piston 6 and the space beneath said piston, and also beneath the valve piston 12 has a free exhaust through the large passage 14 and outlet port 24, so that the pressure then acting on the upper face of piston 12 moves the same rapidly downward against its seat on gasket 16 compressing the spring 19 and opening the port 13 to supply fluid under pressure to the cylinder 3 when it acts upon the piston 2 to throw the same quickly to its outer position. This movement of the actuating piston closes the exhaust through the passage 14 and shifts the main controlling switch to its open position to cut the pump out of operation. The actuating piston is then held tightly against its seat 21 and the pressure equalizing through passages 14 and 11 upon the piston 6 allows the spring 8 to return the same to its seat 7. As the groove 18 in stem 17 maintains atmospheric pressure beneath piston 12 the parts remain in this position until the pump pressure has diminished to the point at which the spring 19 overcomes the fluid pressure acting on piston 12, at which time the seat 15 is slightly raised from the gasket 16. The fluid pressures acting on opposite sides of the valve piston 12 are then immediately balanced, by the equalization of the reservoir pressure from the cylinder 3 through passages 13 and 14, as restricted groove 18 is too small to permit the escape of any considerable volume of fluid, and the spring 19 returns the piston valve 12 rapidly to its inner position, thereby opening communication between

ports 14 and 13. As the pressure acting on the piston 2 in cylinder 3 begins to fall, due to the escape of fluid through groove 18 and outlet port 20, the spring 4 moves the piston 2 away from its seat 21 and thereby opens a large by-pass and exhaust passage from the face of the actuating piston through ports 13 and 14 and outlet port 24 to the atmosphere. The spring 4 then acts to return the piston 2 to its inner position and to throw the controlling device to its closed position with a quick, positive and snap-like action, thereby again cutting in the pump.

The ports 13 and 14 are of large capacity, in order to permit the supply or release of a large volume of fluid quickly to or from the cylinder 3 and thereby effect a sudden and positive movement of the piston and controlling switch from one position to the other.

The range of the governor, or the difference between the cutting in and cutting out pressure may be made anything desired by the adjustment of the springs 8 and 19.

During the time that the pump is cut out, and after the valve piston 6 has returned to its seat, the pressure upon the actuating piston 2 and the valve piston 12 is maintained by the feed through the small port 23.

The modified construction shown in Fig. 2 is substantially the same as that of Fig. 1 except that the valve pistons are arranged to operate horizontally instead of vertically, and the valve piston 12 is provided with an additional small seat 25 for controlling the supply of fluid from the reservoir connection 5 through ports 26 and 13 to maintain the pressure instead of the small port 23 illustrated in Fig. 1.

Fig. 2 also illustrates an additional feature of my improvement, comprising an abutment, or diaphragm, 30, subject on one side to the reservoir pressure in chamber 28 and on the other side, in chamber 29, to the pressure of another source, such as a reservoir pipe line 34, which may be employed for connecting several reservoirs where each reservoir is provided with a pump for furnishing compressed fluid thereto, and it is desirable that all of the pumps should operate together to raise the pressure in the system to its maximum cutting out point. The stems of the valve pistons 6 and 12 are extended through close fitting guides into a small chamber 27, from which leads a port 31, and the diaphragm 30 is provided with a valve 33 for controlling communication from port 31 to port 32 and the atmosphere. Spring 35 normally holds the valve 33 closed. The operation of this form of my improvement, when used with a single pump and reservoir, will now be readily understood from the foregoing description.

When employed in connection with a plurality of pumps and reservoirs connected by a reservoir pipe line, each pump and reservoir being provided with a governor, it is difficult to adjust all the governors to cut in at exactly the same degree of pressure; but with my improved differential pressure attachment, as shown in Fig. 2, the pumps may all be controlled substantially simultaneously, as will now be described.

When the pressure has diminished in one reservoir to such a point that this governor operates to cut in its pump, the other governors will be very nearly at their cutting in points also, and as the pressure in the reservoir pipe line begins to increase over that in the other reservoirs, on account of the check at each reservoir, the diaphragm 30 of each of the governors raises the valve 33 and vents the pressure in chamber 27 on the valve stem to the atmosphere, thereby assisting the cutting in spring 19 acting on the valve piston 12 sufficiently to operate the governor to cut in the pump. In the same manner each pump will be cut in by its governor immediately after any other one of the governors cuts in, and all of the pumps will assist in raising the pressure of the system, thereby distributing the labor equally among all the pumps. After the pumps have all started working, and the pressure is raised to the desired maximum degree, each governor then operates independently to cut out its pump, as before described.

It may here be stated that the specific embodiment of my invention as illustrated in Figs. 1 and 2 of the drawings has been made the subject matter of a divisional application, Serial No. 583,723, filed September 26, 1910.

According to the modification shown in Figs. 3 and 4, the structure is simplified by combining the two valve pistons, 6 and 12, into one valve piston, 12', adapted to engage the seat 7 with the small area of its upper surface subject to the reservoir pressure, and having seat 15 upon its opposite side for engaging gasket 16 when moved to the other position. In this case, the cutting out pressure is determined by the adjustable spring 8 alone, since this spring exerts its force in opposition to the fluid pressure acting upon the small area of the valve piston within the seat 7, while the cutting in pressure is determined by the combined force of the two springs 8 and 36, which is exerted in opposition to the fluid pressure acting upon the valve piston of the area within the seat 15 when the same is seated against the gasket 16. The restricted passage from the space beneath the valve piston to the outlet port 20 may be formed by making the stem 17 with a loose fit, as indicated in Figs. 3 and 4, or with grooves, as

shown in Figs. 1 and 2. The stem 17 is of such length as to be free from the supplemental spring 36 when the piston valve is in its upper position, but is adapted to engage and compress said spring upon the movement of the piston to its opposite position, and the range of the governor may be readily adjusted, as desired, by varying the tension of the spring 36. The operation of this form of my improvement will now be readily understood.

When the pump pressure acting on the small area of piston 12', within the seat 7, overcomes the pressure of spring 8, the valve is forced slightly from its seat and exposes the full area of the piston to the reservoir pressure, which instantly carries the seat 15 against the gasket 16, compressing both springs 8 and 36, and opening the large port 13 to supply fluid in a large volume to cylinder 3 to throw the actuating piston 2 and controlling switch with a quick and positive movement to the open position. The piston 2 is then held against seat 21 by the reservoir pressure, which also fills the passage 14 and space around the flange 15 of valve piston 12', but cannot escape through the restricted passage to outlet port 20. When the pressure acting on the face of the valve piston diminishes to a point less than the combined force of springs 8 and 36, the seat 15 will be moved away from the gasket and permit an immediate equalization of fluid pressure upon opposite sides of said piston, so that the spring 8 instantly returns the same to its position against the seat 7, at the same time allowing the discharge of fluid from the actuating cylinder through the restricted outlet and port 20 to the atmosphere. As the pressure diminishes on piston 2, the spring 4 starts the same away from its seat 21, and as piston passes the port 14 it opens a large passage for the release of fluid from the face of the piston around through ports 13 and 14 to the atmosphere, whereupon the spring 4 operates to return the piston and through the controlling switch to its closed position with a rapid and positive movement.

The additional differential pressure attachment shown in Fig. 4 operates substantially like that described in connection with Fig. 2, except that the diaphragm valve 33 controls the supply of fluid under pressure from the pipe line 34 through the port 31 to the spring chamber at one end of the stem of the valve piston, instead of releasing pressure from the opposite end of said stem, the result being the same in either case.

In both of these modifications, it will be noticed that the differential pressure mechanism operates to cause the governor to cut in only when the pump pressure is nearly down to the cutting in point. When the pumps are in operation, and the pressure is

increased nearly to the cutting out point, if one governor should cut out, and the other pumps continue working so as to raise the pressure in the pipe line 34, the differential pressure valve would then operate to vary the pressure upon the end of the stem of the valve piston, but this would not cause any movement of the said piston, as the reservoir pressure is then acting upon the large area to hold the piston seated on the gasket 16. The slight additional pressure applied at the end of the stem is not therefore sufficient at this time to cause the governor to cut in again, consequently each governor will operate independently to cut out its pump, as before described.

According to the modification illustrated in Figs. 5 to 12 of the drawings, the movable abutment subject to the pump pressure, is shown as comprising a diaphragm 37 having a slide valve 38 with ports for controlling the passages 13 and 14 and the supply of fluid to and its release from the cylinder 3 of the actuating piston 2. The fluid pressure acting on the diaphragm 37 is opposed by a main spring 43 in chamber 52 and the diaphragm stem 44 is adapted to engage an additional spring 45 upon a short outward movement of said stem, although the same is normally free from engagement with said additional spring when in the position shown in Figs. 5 and 6 of the drawings. The valve seat is provided with a port 39 leading to the cylinder 3, where it is normally closed by valve 46 carried by piston 2, and a port 40 leading to the atmosphere, while the valve 38 has a through port 41 and a cavity 42, with extension 47. The operation of this modified form of my improvement is as follows:—The springs being adjusted to the desired pressures, the parts normally occupy the positions shown in Figs. 5 and 6, with the controlling switch closed and the pump in operation; when the pump pressure on the diaphragm 37 increases to such a point as to compress the spring 43, the diaphragm and slide valve move downward until the stem 44 engages the additional spring 45, but this movement is not sufficient to connect the through port 41 of the valve with the port 13 in the seat, although it does open the port 39 and closes communication between the exhaust port 40 and the extension 47 of the cavity 42. It is therefore necessary for the fluid pressure to rise to such a point as to compress both springs 43 and 45, in order to bring port 41 over port 13, as indicated in Figs. 7 and 10, and supply fluid to operate the piston 2, for, although the port 39 was previously opened, the pressure of the spring 4 holding valve 46 to its seat, prevents the admission of fluid through port 39 to cylinder 3 until the piston 2 moves outward and carries valve 46 away from its seat. As

soon as the piston 2 starts outward under the pressure admitted through ports 41 and 13, the valve 46 opens the large port 39 for supplying a large volume of fluid rapidly to the cylinder 3, thereby effecting a quick and positive outward movement of the piston against the spring 4, and throwing the controlling switch to its open position. The piston 2 is then held against its seat 21 by the fluid pressure.

It should be understood that I do not claim as my invention the feature, described in connection with the modification shown in Figs. 5 to 12 inclusive, of providing a large port 39 to supply air to the actuating piston in large volume upon upward movement thereof, this feature being the invention of W. V. Turner and the subject-matter of Patent No. 950,737, issued March 1, 1910.

As the pump pressure acting on diaphragm 37 diminishes, the combined forces of the springs 43 and 45 operate to move the valve upward until the stem 44 is just free from engagement with spring 45 and the port 13 is closed. The spring 43 then acts alone against the fluid pressure upon the diaphragm, and as this pressure continues to fall the single spring moves the valve to its upper position, as indicated in Fig. 5, in which the port 39 is closed and the cavity 42 connects ports 13 and 14, while the extension 47 communicates with the exhaust port 40 and permits the discharge from the cylinder 3 through ports 13, 47 and 40 to the atmosphere.

As the pressure is reduced on the face of the piston 2, the spring 4 moves the piston away from its seat 21 and opens the port 14 to the space behind the piston and to the atmosphere, and as ports 13 and 14 are then connected through cavity 42 a large passage is provided for the rapid exhaust of fluid from the cylinder 3 upon the face of the piston 2. The actuating piston is therefore returned to its inner position with a rapid and positive movement, thereby closing the controlling switch and cutting in the pump. In this manner the movement of the actuating piston serves to control the supply and the release of fluid to and from the cylinder, whereby a more rapid and sudden action is secured in shifting the controlling switch from one position to the other.

The spring 43 is adjusted to the desired minimum degree of pump pressure, since the spring by itself determines the point at which the governor is to cut in, while the combined force of the springs 43 and 45 determines the desired maximum degree of pressure at which the governor cuts out the pump, but the range, or difference between these pressures, may be readily varied to suit any given condition by merely adjusting the tension of the additional spring 45.

The differential pressure attachment

shown in connection with this form of my improved governor in Fig. 6, operates in a similar manner to that described in connection with Fig. 4, except that the diaphragm valve 33 controls the supply of fluid under pressure from the reservoir through ports 48 and 49 to the chamber 52 beneath the main diaphragm 37 for assisting the spring 43 to move the slide valve to its cutting in position.

It will be noticed that the ports 48 and 49 are connected by the cavity 50 only when the valve is at or near its cutting in position, while this communication is cut off when the valve is in the opposite position, as indicated in Fig. 10. By this means the differential pressure mechanism can operate to cause a governor to cut in only when the pressure is low and the governor is near to its cutting in point, but will have no effect upon the governor after the pressure has increased toward the maximum sufficiently to move the valve to disconnect the ports 48 and 49. A restricted outlet port 51 permits the fluid which may be charged through port 49 into the chamber 52 to gradually leak away to the atmosphere.

It will now be seen that in all of these modified forms of devices embodying my improvements, the pressure mechanism at the time of cutting out, operates to supply a large volume of fluid under pressure to the actuating piston, so that the said piston will not move slowly outward against its spring, but will be thrown outward with a rapid movement to operate the controlling switch with a quick, snap-like action; also at the time of cutting in, that the preliminary inward movement of the actuating piston operates to control the pressure in its cylinder by opening a large exhaust passage for the escape of fluid from the face of said piston and thereby permits the spring to throw the piston and controlling switch to the other position with a quick and positive movement.

The preferred form of construction, as shown in Fig. 3, has the further advantage of being extremely simple in structure, having but a single movable abutment or valve piston with two springs, for controlling the supply of fluid to and its release from the cylinder of the actuating piston, which structure is found to be very durable and reliable in its operation in actual practice.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is:—

1. A pump governor comprising a pump controlling device, an actuating piston therefor, a valve piston for controlling the fluid pressure on said actuating piston having a seat and subject in the seated position to pump pressure in one direction and in the opposite direction to the pressure of an ad-

justable spring and a chamber having a restricted exhaust port, and means adapted upon movement of said valve piston from said seated position to admit fluid under pressure to said chamber to facilitate the movement of the valve piston.

2. A pump governor comprising a pump controlling device, an actuating piston therefor, a valve piston for supplying and releasing fluid to and from said piston to operate the same having a seated position and subject to pump pressure in one direction and in the opposite direction to spring pressure and the pressure of a chamber having a restricted exhaust port, the preliminary movement of said valve piston from its seated position being adapted to admit fluid to said chamber to accelerate the movement thereof, and means adapted in another position of the valve piston to open a large port for permitting the free exhaust of air leaking into said chamber.

3. A pump governor comprising a pump controlling device, an actuating piston therefor, a valve piston mechanism for varying the fluid pressure on said actuating piston and subject on one side to pump pressure tending to move same to one position and on the opposite side to spring pressure and the pressure of a chamber having restricted exhaust port and tending to move the same to the opposite position, the preliminary movement of said valve piston mechanism from the first position being adapted to admit fluid to said chamber to effect the positive movement thereof and the preliminary movement from the second position being adapted to expose a larger area of same to pump pressure to facilitate the quick movement thereof, and means for opening a vent port to said chamber in the last mentioned position to permit the free exhaust of fluid leaking into said chamber.

4. A pump governor comprising a pump controlling device, a piston for actuating same, a valve piston mechanism subject to spring pressure on one side and to pump pressure on the opposite side for controlling the supply and release of fluid to and from said actuating piston and having a seat in one direction exposing a small area thereof to pump pressure and the remaining area to atmospheric pressure through a restricted port and a seat in the opposite direction exposing a portion of the area thereof to atmospheric pressure through a restricted port.

5. A pump governor comprising a pump controlling device, a piston for actuating same, a valve piston mechanism subject to pump pressure for controlling the pressure on said actuating piston, a spring for opposing the pump pressure on said valve piston mechanism to determine the cutting out point and an additional spring adapted to

act with the outer spring to determine the cutting-in point.

6. A pump governor comprising a pump controlling device, a piston and cylinder for
5 actuating same, and a valve piston mechanism for admitting and releasing fluid to and from said cylinder to operate said piston and subject in one direction to pump pressure and to the pressure in the opposite
10 direction of a plurality of springs in the movement from one position, and to the pressure of a single spring in the movement from another position, for controlling the admission and release of fluid to and from
15 said cylinder.

7. A pump governor comprising a pump controlling device, a piston and cylinder for actuating same, and a valve piston mechanism for controlling the fluid pressure to
20 operate said piston subject in one direction to pump pressure and in the opposite direction to one degree of spring resistance in the movement from one position, and to another degree of spring resistance in the movement
25 from another position, for governing the operating fluid pressure in said cylinder.

8. A pump governor comprising a pump controlling device, a piston and cylinder for actuating same, and a valve piston mechanism for controlling the fluid pressure to
30 operate said piston subject in one direction to pump pressure and in the opposite direction to the resistance of two adjustable springs when in one position and to the resistance of one of said adjustable springs
35 when in another position.

9. A pressure governor for pumps comprising a pump controlling device, a piston for operating same, a movable valve piston
40 device adapted to seat in opposite directions and subject on one side to pump pressure for controlling the fluid pressure for operating said piston, an adjustable spring for opposing the pump pressure on said valve
45 piston device and a second adjustable spring adapted to act on said valve piston device upon movement from one seat.

10. A pump governor comprising a controlling device, a piston for actuating same,
50 a valve piston having a small area subject to pump pressure when seated in one position, a spring for opposing the pump pressure on said valve piston, said valve piston being adapted to expose a larger area to
55 fluid pressure upon movement away from its seat, and means for maintaining the larger area at atmospheric pressure when the valve piston is on its seat.

11. A pump governor, comprising a main
60 controlling device, a piston for actuating the same, mechanism subject to the pump pressure for supplying and releasing fluid to and from the actuating piston, and means governed by the movement of said actuat-

ing piston for further controlling the re- 65
lease of fluid therefrom.

12. A pump governor, comprising a main controlling device, a piston operated by fluid under pressure for actuating the same, and means operated by the movement of
70 said piston from one of its positions to cause a quick release of fluid from the face of said piston.

13. A pump governor, comprising a main controlling device, a piston for actuating
75 the same, a valve piston adapted to be seated in one position by the pump pressure and to control the release of fluid from the actuating piston, and means for effecting a quick return movement of said valve piston
80 as it moves away from its seat.

14. A pump governor, comprising a main controlling device, a piston operated by fluid under pressure for actuating the same, a valve mechanism subject to the opposing
85 forces of the pump pressure and an adjustable spring for controlling the release of fluid from said actuating piston, and means governed by the movement of said piston for further controlling the release of
90 fluid therefrom.

15. A pump governor comprising a main controlling device, a piston for actuating the same, a valve piston subject to the opposing pressures of the pump and a spring
95 for controlling the supply and release of fluid to and from said actuating piston, said valve piston having opposite seated positions and being adapted to expose different restricted areas to the pump pressure in
100 said opposite positions.

16. A pump governor, comprising a main controlling device, a cylinder and piston for actuating the same, means for supplying fluid to and releasing it from said cylinder,
105 and a release passage communicating with said cylinder near its outer end and adapted to be opened by the preliminary movement of said piston from its outer position.

17. A pump governor, comprising a main
110 controlling device, a cylinder and piston for actuating the same, a release passage leading from the inner end of said cylinder to a point near its outer end and adapted to be opened by the preliminary movement of the
115 piston from its outer position, and a valve mechanism operating in response to variations in the pump pressure for also controlling said release passage.

18. A pump governor, comprising a main
120 controlling device, a cylinder and piston for actuating the same, a valve piston subject to the pump pressure for controlling the pressure in said cylinder and having a seat in one position, and means for balancing
125 the fluid pressures upon said piston when it moves away from this position.

19. A pump governor, comprising a main

controlling device, a cylinder and piston for actuating the same, a valve piston subject to the pump pressure for controlling the pressure in said cylinder and having a seat in one position, a restricted discharge outlet from the seat side of said piston, and means for opening communication from the actuating cylinder to said seat side of the valve piston when said valve piston moves to its opposite position.

20. A pump governor, comprising a main controlling device, a cylinder and piston for actuating the same, a movable abutment subject to the pump pressure for controlling the pressure in said cylinder, a spring constantly acting on said abutment in opposition to the pump pressure, and an additional spring adapted to act upon said abutment in one position only.

21. A pump governor, comprising a main controlling device, a cylinder and piston for actuating the same, a valve piston for controlling the pressure in said cylinder and having differential areas subject to the pump pressure in its different positions, a spring acting in opposition to the pump pressure to determine the cutting out point, and an additional spring acting in conjunction with the other spring to determine the cutting in point.

22. A pump governor, comprising a main controlling device, a piston for actuating the same, a valve piston mechanism operated by the pump pressure on one side for supplying fluid to said actuating piston, a free exhaust passage leading from the other side of said valve piston, and means for controlling said exhaust passage by the movement of the actuating piston.

23. A pump governor, comprising a main controlling device, a cylinder and piston for actuating the same, a valve mechanism subject to the opposing forces of the pump pressure and a spring for controlling the release of fluid from said cylinder to cut in the pump, and a differential pressure mechanism subject to two opposing fluid pressures for assisting the spring to cut the governor in only when the pump pressure is nearly at the cutting in point.

24. A pump governor, comprising a main controlling device, a cylinder and piston for actuating the same, a valve mechanism subject to the opposing forces of the pump

pressure and a spring for controlling the release of fluid from said cylinder to cut in the pump, and a differential pressure mechanism having a diaphragm subject to two opposing fluid pressures and a valve operated thereby for controlling a fluid pressure, to cause the governor to cut in only when the pump pressure is nearly at the cutting in point.

25. In a pump governor, the combination, with a main controlling device and a cylinder and piston for actuating the same, of a valve piston subject to the opposing forces of the pump pressure and a spring for controlling the pressure in said cylinder, and a differential pressure mechanism having an abutment and valve operated by opposing fluid pressures to supply fluid to act upon the stem of the valve piston and assist the spring to move said valve to its cutting in position.

26. A pressure governor comprising a controlling device, an actuating piston therefor, valve means governed by the pump pressure for supplying fluid to operate said piston, and means operated by the movement of the piston for varying the pressure on one side thereof, to cause the quick movement of same.

27. A pressure governor comprising a controlling device, an actuating piston therefor, valve means governed by the pump pressure for supplying fluid to operate said piston, and means operated by the movement of the piston to cause the pump to cut in, for varying the pressure on one side of the piston to cause the sudden movement thereof.

28. A pressure governor comprising a controlling device, an actuating piston therefor, valve means governed by the pump pressure for supplying fluid to operate said piston, and means operating upon the initial movement of the piston in the direction to cause the pump to cut in, for venting fluid from one side of the piston to thereby effect the sudden movement thereof.

In testimony whereof I have hereunto set my hand.

HOWARD M. P. MURPHY.

Witnesses:

R. F. EMERY,

J. B. MACDONALD.