No. 879,699. PATENTED FEB. 18, 1908.

W. V. TURNER.

ELECTRIC PUMP GOVERNOR.

APPLICATION FILED SEPT. 21, 1905. RENEWED JUNE 28, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

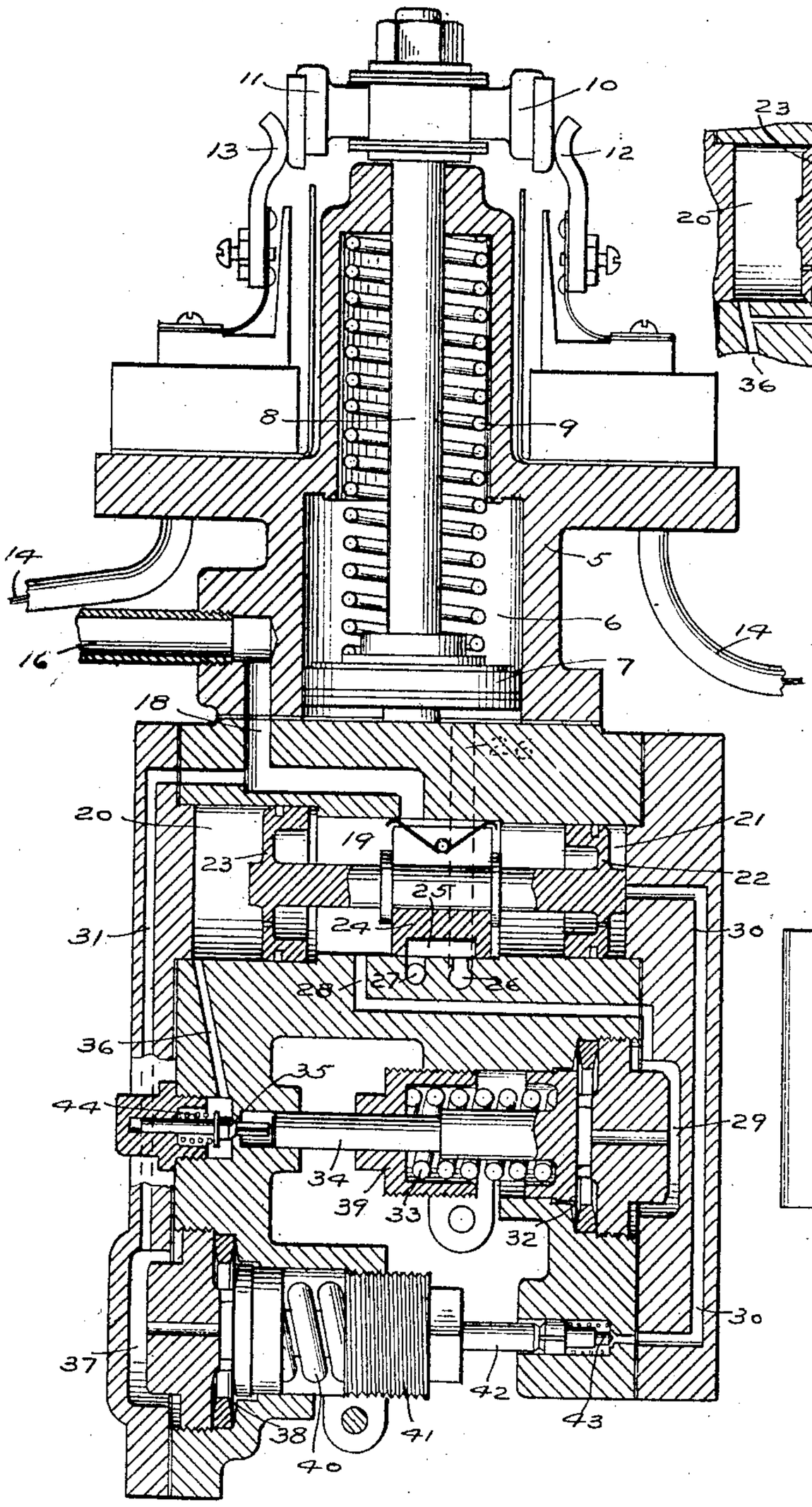


Fig. 2.

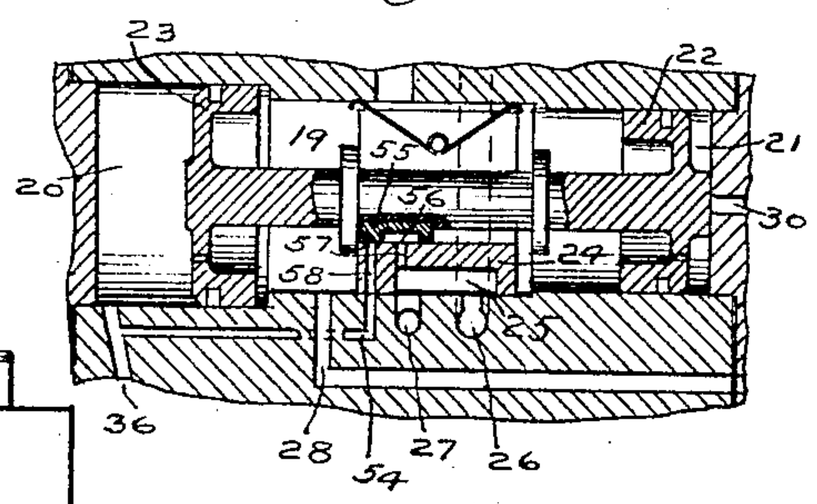
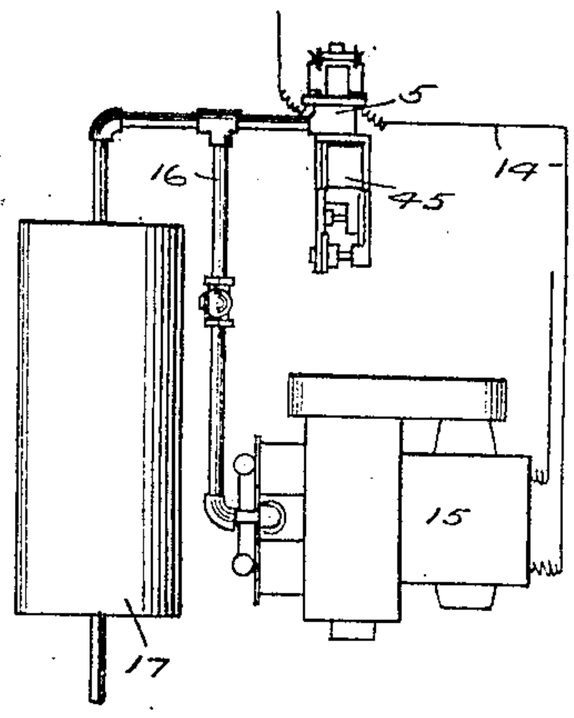


Fig. 3.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 4.

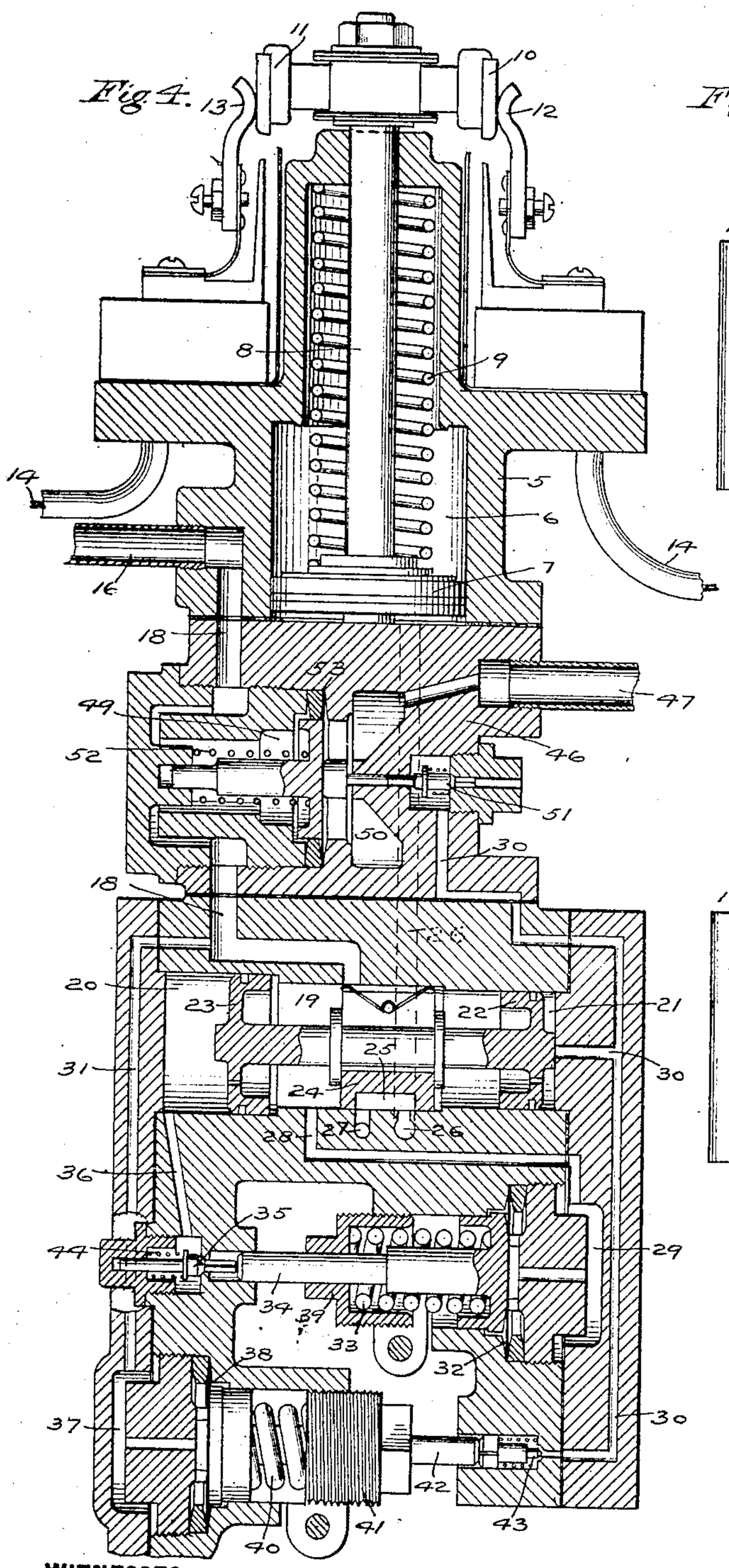
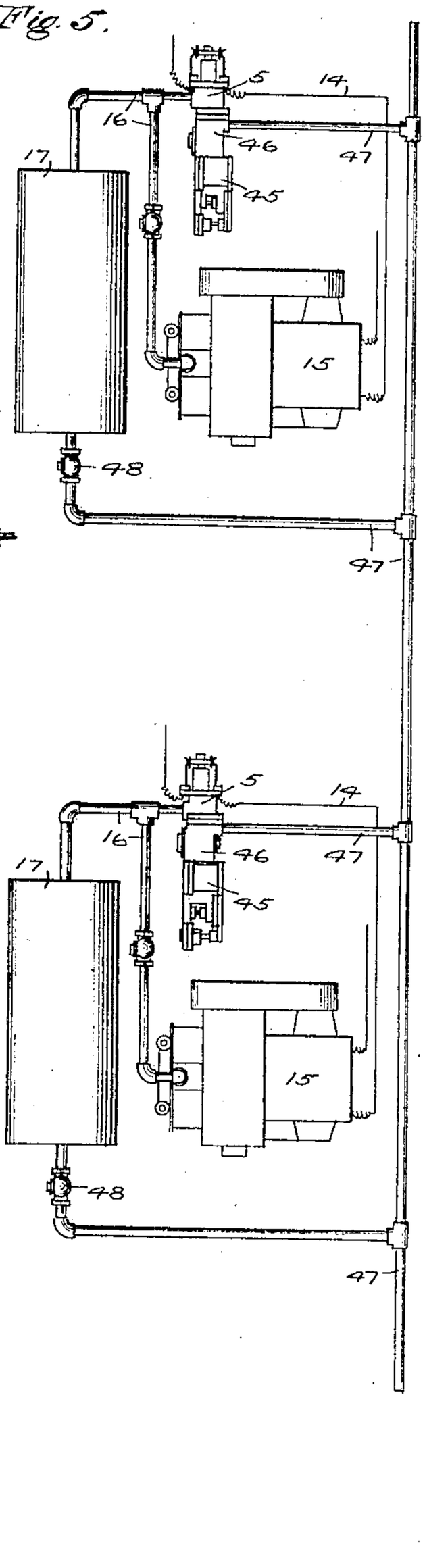


Fig. 5.



WITNESSES

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UNITED STATES PATENT OFFICE.

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ELECTRIC PUMP-GOVERNOR.

No. 879,699. Specification of Letters Patent. Patented Feb. 18, 1908.

Application filed September 21, 1905, Serial No. 279,462. Renewed June 28, 1907. Serial No. 381,311.

To all whom it may concern:

Be it known that I, WALTER V. TURNER, a citizen of the United States, residing in Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Electric Pump-Governors, of which the following is a specification.

This invention relates to pressure governors for pumps, and more particularly to that class of governors in which valve mechanism governed by the pump pressure is employed for supplying fluid under pressure to a piston or other movable abutment for actuating a switch, valve, clutch, belt shifter, or other controlling device for the pump. Heretofore, with certain governors of this type, difficulty has been found in determining the cutting in point of the governor and in maintaining this point substantially constant. This has made the governor uncertain and unreliable in its action, and one of the objects of my invention is to provide an improved governor in which the degree of pressure at which the device cuts in the pump, as well as the cutting out pressure, may be accurately determined and adjusted to any amount desired, while the corresponding range of the governor, that is the difference between the cutting out pressure and the cutting in pressure, may also be set for any desired amount and maintained substantially constant throughout long periods of working. This feature of my invention comprises a valve mechanism having an adjustable load device, such as a spring, adapted to operate when the pump pressure diminishes to a predetermined point, to positively release the fluid under pressure from the main actuating piston of the controlling device and cause the pump to cut in. A preferred form of construction for this purpose may comprise a main valve controlling an exhaust port from the cylinder of the actuating piston, and a regulating valve operated by the pump pressure and the low tension load device for governing the action of the main valve whereby a quick and positive movement of the main valve may be secured.

Another feature of my invention comprises a regulating valve operated by the pump pressure, and a high tension load device for governing the action of a main valve in supplying fluid under pressure to the actuating piston and thereby secure a quick and positive movement of the same for cutting out the pump. A single main valve may be used for both functions by providing a piston or abutment having opposite heads or faces for operating the same and arranging the two regulating valves so as to govern the pressures acting on said differential faces of the movable abutment.

A further object of my invention is to provide an improved differential governor, which may be applied where two or more pumps are employed for compressing air or other fluid into a common receptacle, such as a pipe line connecting all of the pump reservoirs, and adapted to operate to cut in its pump, either upon a certain decrease in its reservoir pressure or upon a certain increase in the pressure of the common receptacle or reservoir pipe line. According to the preferred construction, this feature of my invention comprises an auxiliary regulating valve device operated by the opposing fluid pressures of the common receptacle and of the pump reservoir for also varying the pressure on the abutment of the main valve to cause the same to move to open the port for supplying fluid under pressure to the actuating piston and thereby set the pump into action.

Another feature of my invention comprises means operated by a preliminary movement of the abutment to produce a further quick and complete movement of the main valve, whereby the port for supplying fluid under pressure to the actuating piston shall be suddenly opened to its widest extent to furnish a large volume of fluid and actuate the piston of the controlling device to cut out the pump with a rapid snap-like movement.

In the accompanying drawings, Figure 1 is a horizontal section of a governor device embodying my improvements and adapted for single or independent pumps; Fig. 2 a fragmentary sectional view showing a slight modification of the main valve; Fig. 3 a small diagram, in plan, showing the governor connected up with its pump and reservoir; Fig. 4 a horizontal section of a differential governor device having the auxiliary valve mechanism for use in connection with each of a plurality of pumps supplying a common receptacle; and Fig. 5 a plan, in diagram, illustrating the method of connecting up two differential governors with their pumps, reservoirs and reservoir pipe line.

As shown in the drawings, the construction comprises a casing 5, having a cylin-

drical chamber 6, containing piston 7, rod 8 and spring 9, the rod carrying the movable part of an electric switch having contact bars 10 and 11 for making contact with stationary fingers 12 and 13 respectively of the electric circuit 14 for supplying current to the electric motor-driven pump 15 which may operate to compress air or other fluid through pipe 16 into a reservoir 17. The pipe 16 also communicates by a port 18 with the main valve chamber 19 in the valve casing 45 containing the main slide valve 24 having a cavity 25 and controlling supply port 26 leading to the cylinder of the actuating piston 7, and exhaust port 27 leading to the atmosphere. A movable abutment having the two piston heads 22 and 23, operating respectively in chambers 21 and 20, is provided for actuating the main slide valve 24, and the piston heads are made of a loose sliding fit, or have small perforations through the same for permitting the pressure to equalize from the valve chamber to the chambers 20 and 21 on the outer side of said heads. In order to facilitate the manner of assembling the parts one piston head, 22, is preferably made of a smaller diameter than the other.

The regulating device for controlling the pressure in chamber 20 on piston head 23 comprises the diaphragm 32 the chamber 29 of which is subject to fluid under pressure from the valve chamber admitted through port 28, adjustable spring 33, stem 34, and regulating valve 35 which governs the release of fluid from the chamber 20 through port 36 to the atmosphere. The low tension regulating device comprises diaphragm 38, adjustable spring 40, stem 41 and regulating valve 43, which controls the release of fluid from chamber 21 through port 30 to the atmosphere.

The spring 33 being set by adjustable nut 39 to the high degree of tension at which it is desired that the pump shall cut out, and spring 40 being adjusted by nut 41 to the desired low pressure at which the pump is to cut in, the operation of the improved governor is as follows:—When there is little or no pressure in the reservoir, and consequently in the diaphragm chambers, the spring 33 holds the stem 34 away from the regulating valve 35 and said valve is normally held closed by a light spring 44, and the spring 40 holds the regulating valve 43 open.

There being no pressure in the cylinder 6, the spring 9 holds the actuating piston 7 at its inner position with the switch closed, whereupon the current flows through circuit 14 and starts the pump into action to compress air or other fluid into the reservoir. As the pressure rises in the reservoir, and also in the valve chamber 19, it equalizes around the head 23 into chamber 20, but as chamber 21 is open to the atmosphere through port 30, the pressure exerted upon the inner side of the head 22 moves the main slide valve 24 to the position shown in Fig. 1, in which the cavity 25 connects the port 26 with the exhaust port 27.

As the pressure continues to increase and reaches the point at which the spring 40 is adjusted, the valve 43 will be closed, thereby permitting an equalization of pressures upon opposite sides of the head 22, but this will effect no change in the position of the main valve, as both piston heads will then be balanced as to fluid pressure. When the pressure increases to the point at which the high tension spring 33 is adjusted, the regulating valve 35 is opened by the stem 34, thereby releasing the pressure from chamber 20 and causing the movement of the pistons and main valve to the opposite position to open port 26 and supply fluid under pressure to cylinder 6, so that the actuating piston 7 is instantly forced outward to open the switch and stop the pump. At the same time the cavity 25 of the main valve connects the diaphragm chamber 29 through port 28 with the exhaust port 27, whereupon the spring 33 moves the stem 34 to permit the closing of the regulating valve 35 and prevent further leakage of compressed air through port 36. The pressures then equalize upon the faces of the piston heads and the main valve remains in this position until the reservoir pressure diminishes to the point at which the low tension spring 40 is adjusted. It will be noticed that during this period the port 26 remains open, so that the full pressure continues to be exerted upon the actuating piston 7 and holds the same in its outer position against its spring 9 and with the switch open. When the pressure on diaphragm 38 diminishes to such a point that the spring 40 operates to open the regulating valve 43, the pressure is released from the chamber 21 on the outer face of head 22 and the main valve is instantly moved back to its first position, in which the cylinder 6 is open to the atmosphere through port 26, cavity 25 and exhaust port 27, whereupon the spring 9 immediately returns the piston to its inner position, thus closing the switch and starting the pump. By this means the cutting in point of the governor is positively defined in the same manner as the cutting out point and the pump cannot possibly start at an undesirable time nor until the predetermined range or drop in pressure has occurred.

The port 30 may be so located as to be closed when the piston moves to its last mentioned position and thereby prevent even the very slight leakage which might occur through this port during the short period of time that the pump is increasing the pressure sufficiently to close the regulating valve 43.

The construction as shown in Fig. 1 is found to operate satisfactorily for all ordinary con-

ditions, but if it be desired to secure a quicker movement of the main valve in opening the port 26, a port 54, as illustrated in Fig. 2, may lead from the chamber 20 to the valve seat and a small slide valve 55 may be located on the main slide valve 24 and have a small movement relative thereto, the small slide valve being provided with a cavity 56 for connecting ports 57 and 58 in the main slide valve. When the pump pressure increases to the point of slightly opening the regulating valve 35 and the piston head 23 starts toward the left, the first part of the movement brings the small valve to such position that the cavity 56 connects ports 57 and 58 and thereby opens direct communication from chamber 20 to the exhaust port 27 and the atmosphere, so that the abutment with the main valve instantly moves to its extreme position and gives a sudden and full opening to port 26, whereupon the piston 7 is thrown out with a quick snap-like movement to open the switch and cut out the pump. In this position the port 54 is closed by the main valve 24, so that there is no further leakage through this port. Upon the return movement of the abutment the small valve is first moved upon the main valve to close the port 58, so that there can be no further venting of chamber 20 until the regulating valve 35 is again opened. In ordinary service, however, this modified construction is not necessary, since the resistance to be overcome in moving the main valve, due to friction, is greatest at the time of starting, consequently after the valve begins to move, due to the venting of chamber 20, it moves promptly to the end of its stroke and makes a quick opening of port 26, thereby permitting a sufficiently rapid rise in pressure on the actuating piston 7 to throw the switch with the necessary snap-like movement.

Where two or more pumps or compressors are employed for supplying a common receptacle, as is the case in the air brake system of a train of motor cars where the main reservoirs of all the cars are connected together by a common pipe line, it is highly desirable that each governor should operate to cut in its pump when any one pump begins to operate in order to evenly distribute the work upon the pumps. In Figs. 4 and 5, I have illustrated a differential governor for this purpose, the construction of which corresponds in all respects with that shown in Fig. 1, with the exception of an auxiliary valve device 46 which may conveniently be designed to be clamped in between the valve casing section 45 and section 5 of the single governor. Fig. 5 shows two sets of pumps, reservoirs and governors with the reservoirs connected to the common pipe line 47 and a check valve 48 located between each reservoir and said pipe line to prevent back flow from the pipe line to the reservoir. The auxiliary valve device comprises a chamber 50 communicating with the pipe 47, and a chamber 49 communicating with the reservoir through port 18 and pipe 16, said chambers being separated by the diaphragm 53 having a stem for operating the small additional regulating valve 51, which also controls the release of fluid from the chamber 21 through the port 30 to the atmosphere. A light spring 52 may be employed for normally assisting the reservoir pressure acting on the diaphragm 53 to hold the additional regulating valve 51 closed.

If all the governors are set exactly alike to cut in at the same pressure, then the form of device shown in Fig. 4 operates precisely the same as already described with reference to Fig. 1, since the additional regulating valve 51 remains closed. But when the several governors are not set exactly alike, and one governor operates to cut in its pump before the others, the pressure in the one reservoir and the reservoir pipe line begins to increase while the pressure in the other reservoirs where the pumps have not started remains stationary, since the check valves prevent back flow from the reservoir pipe line to the reservoirs. These governors then stand in the cut out position with the main valve 24 at the left and the port 26 open from the valve chamber to the cylinder of the actuating piston 7. As the pressure then increases in the reservoir pipe line 47 from the one pump that has started working, the pressure correspondingly rises in the chamber 50 of the auxiliary regulating device of the other governors and causes the diaphragm 53 to move out against the reservoir pressure in chamber 49 and the light spring 52 and open the auxiliary regulating valve 51, which releases the pressure from chamber 21 through port 30 to the atmosphere, whereupon the main valve 24 moves to the right and the governor acts to cut in the pump in the same manner as when operated by the low tension regulating valve 43. In this way the governors are also controlled by the difference in pressure between the reservoir and the pipe line, and when one pump cuts in all will cut in and continue to operate until the governor set to the highest pressure cuts out, after which each governor acts to cut out its pump. By this means the work is substantially equally distributed among all the compressors or pumps, while without this feature it will be seen that the pump having the governor first cutting in would be required to perform nearly all the work and be greatly overloaded, it being impossible in actual practice to adjust all of the governors to cut in at exactly the same pressure.

While I have described my improvements in connection with an electric switch, with which they are particularly well adapted to be used in governing the motor of the pump,

the invention is not limited to any special form of controlling device, since it will be obvious that it may be applied equally well in connection with governor valves, relief valves, belt shifters, clutches, or other pump controlling devices.

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

1. A pressure governor comprising a controlling device, an actuating piston for the same, means governed by the pump for supplying fluid to said piston and a low tension regulating means operating when the pump pressure diminishes to a certain point to positively release fluid under pressure from the actuating piston to cause the pump to cut in.

2. A pressure governor comprising a controlling device and a piston for actuating the same, a main valve for controlling the release of fluid under pressure from the actuating piston, and a low tension regulating valve device for causing the movement of the main valve when the pump pressure diminishes to a predetermined point.

3. A pressure governor comprising a controlling device and a piston for actuating the same, a main valve for controlling the release of fluid under pressure from the actuating piston, a movable abutment for operating a high tension regulating means governed by the pump pressure to cause the pump to cut out, and a low tension regulating valve means for varying the pressure on said abutment when the pump pressure diminishes to a predetermined point.

4. A pressure governor comprising a controlling device and an actuating piston, a main valve and abutment for controlling the pressure on said actuating piston, a regulating valve means operated by the pump pressure for governing the release of fluid under pressure from one side of said abutment, and another regulating valve device for governing the release of fluid from the opposite side of the abutment.

5. A pressure governor comprising a controlling device and actuating piston, a low tension regulating means for causing the movement of the piston to cut in the pump, and a high tension regulating means for causing the movement of the piston to cut out the pump.

6. A pressure governor comprising a controlling device and actuating piston, a main valve for controlling the pressure on said piston, and a low tension regulating valve means and a high tension regulating valve means both operated by the pump pressure for governing the action of the main valve.

7. A pressure governor comprising a controlling device and actuating piston, a main valve for controlling the pressure on said piston, a movable abutment for actuating said main valve, a low tension regulating valve means operated by the pump pressure for governing the pressure on one face of said abutment, and a high tension regulating valve means operated by the pump pressure for governing the pressure on another face of the movable abutment.

8. A pressure governor comprising a controlling device and actuating piston, a main valve for controlling the pressure on said piston, a movable abutment subject to the pump pressure for actuating said main valve, a low tension regulating valve means governing the release of fluid from one face of said abutment, and a high tension regulating valve means governing the release of fluid from another face of said abutment.

9. A pressure governor comprising a controlling device and actuating piston, a main valve with abutment subject to pump pressure for governing the pressure on said piston, means for permitting an equalization of pressure around said abutment, a regulating valve for releasing fluid from one side of the abutment, and a diaphragm subject to the opposing pressures of the pump and an adjustable spring for operating the regulating valve.

10. A pressure governor comprising a controlling device and actuating piston, a main valve with abutment subject to pump pressure for governing the pressure on said piston, means for permitting an equalization of pressure around said abutment, a regulating valve for releasing fluid from one side of the abutment, means operated by the movement of the abutment for closing the outlet through the release port, and a diaphragm subject to the pump pressure for operating the regulating valve.

11. A pressure governor comprising a controlling device and actuating piston, a main valve with abutment subject to pump pressure for governing the pressure on said piston, means for permitting an equalization of pressure around said abutment, a regulating valve for releasing fluid from one side of the abutment, a diaphragm for operating the regulating valve, and means operated by the movement of the abutment for releasing pressure from the diaphragm chamber.

12. A pressure governor comprising a controlling device and an actuating piston, a movable abutment and valve for controlling a supply port to the actuating piston, a regulating valve means governed by the pump pressure for releasing fluid from one side of said abutment, and means operated by the preliminary movement of the abutment for venting fluid under pressure from one face of said abutment to cause a quick movement of the valve.

13. A pressure governor comprising a controlling device and an actuating piston, a valve and abutment governed by variations in pump pressure for controlling the pressure

on said actuating piston, and means operated by the preliminary movement of said abutment to cause quick movement of the valve.

14. A pressure governor comprising a controlling device and an actuating piston, a main valve and abutment governed by pump pressure for controlling the fluid pressure on said actuating piston, and an auxiliary valve, having movement relative to said main valve and operated by the preliminary movement of said abutment to cause quick movement of said main valve.

15. A pressure governor comprising a controlling device and an actuating piston, a main valve and abutment governed by pump pressure for controlling the fluid pressure on said actuating piston, and an auxiliary valve, having movement relative to said main valve and operated by the preliminary movement of said abutment to vent fluid under pressure from one face of said abutment to cause quick movement of the main valve.

16. A pressure governor comprising a controlling device and an actuating piston therefor, a movable abutment and main valve for controlling the pressure on said piston, a regulating valve device operated by the pump pressure for varying the pressure on said abutment, and means subject to the opposing pressure from different pumps for also governing the pressure on said abutment.

17. A pressure governor comprising a controlling device and an actuating piston therefor, a movable abutment and main valve actuated in both directions by fluid pressure for controlling the pressure on said piston, and means subject to the opposing pressure from different pumps for governing the pressure on said abutment.

18. A pressure governor comprising a controlling device and an actuating piston therefor, a movable abutment and main valve for controlling the pressure on said piston, a regulating valve device operated by the pump pressure for varying the pressure on said abutment, and an auxiliary regulating valve device subject to the opposing pressure from different pumps for also governing the pressure on said abutment.

19. A pressure governor comprising a controlling device and an actuating piston, a movable abutment and main valve for controlling the pressure on said piston, a low tension regulating valve operated by the pump pressure and a spring for varying the pressure on said abutment, and an auxiliary regulating valve means subject to the opposing pressure from different pumps for also governing the pressure on said abutment.

20. A pressure governor comprising a controlling device and an actuating piston, a movable abutment and main valve for controlling the pressure on said piston, low tension and high tension regulating valves operated by the pump pressure for governing the pressure on said abutment, and an auxiliary regulating valve means subject to the opposing pressures from different pumps for also varying the pressure on said abutment.

21. A pressure governor comprising a controlling device and an actuating piston, a main valve and movable abutment subject on one side to the pump pressure for governing the pressure on said actuating piston, means for permitting an equalization of pressure around the abutment, and a regulating valve operated by the opposing pressures from different pumps for controlling the release of pressure from the other side of said abutment.

22. A pressure governor comprising a controlling device and an actuating piston, a main valve and movable abutment subject on one side to the pump pressure for governing the pressure on said actuating piston, means for permitting an equalization of pressures around the abutment, a regulating valve means operated by the pump pressure for releasing fluid under pressure from the other side of the abutment, and an auxiliary regulating valve operated by the opposing pressures from different pumps for also controlling the release of fluid from one side of the abutment.

23. A pressure governor comprising a controlling device and an actuating piston therefor, a movable abutment and main valve for controlling the supply of fluid to and its release from said piston, and a regulating valve device operated by the pump pressure for governing the pressure on said abutment.

In testimony whereof I have hereunto set my hand.

WALTER V. TURNER

Witnesses:
R. F. EMERY,
J. B. MACDONALD.