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A. L. HARVEY ET AL

PRESSURE REGULATOR SYSTEM

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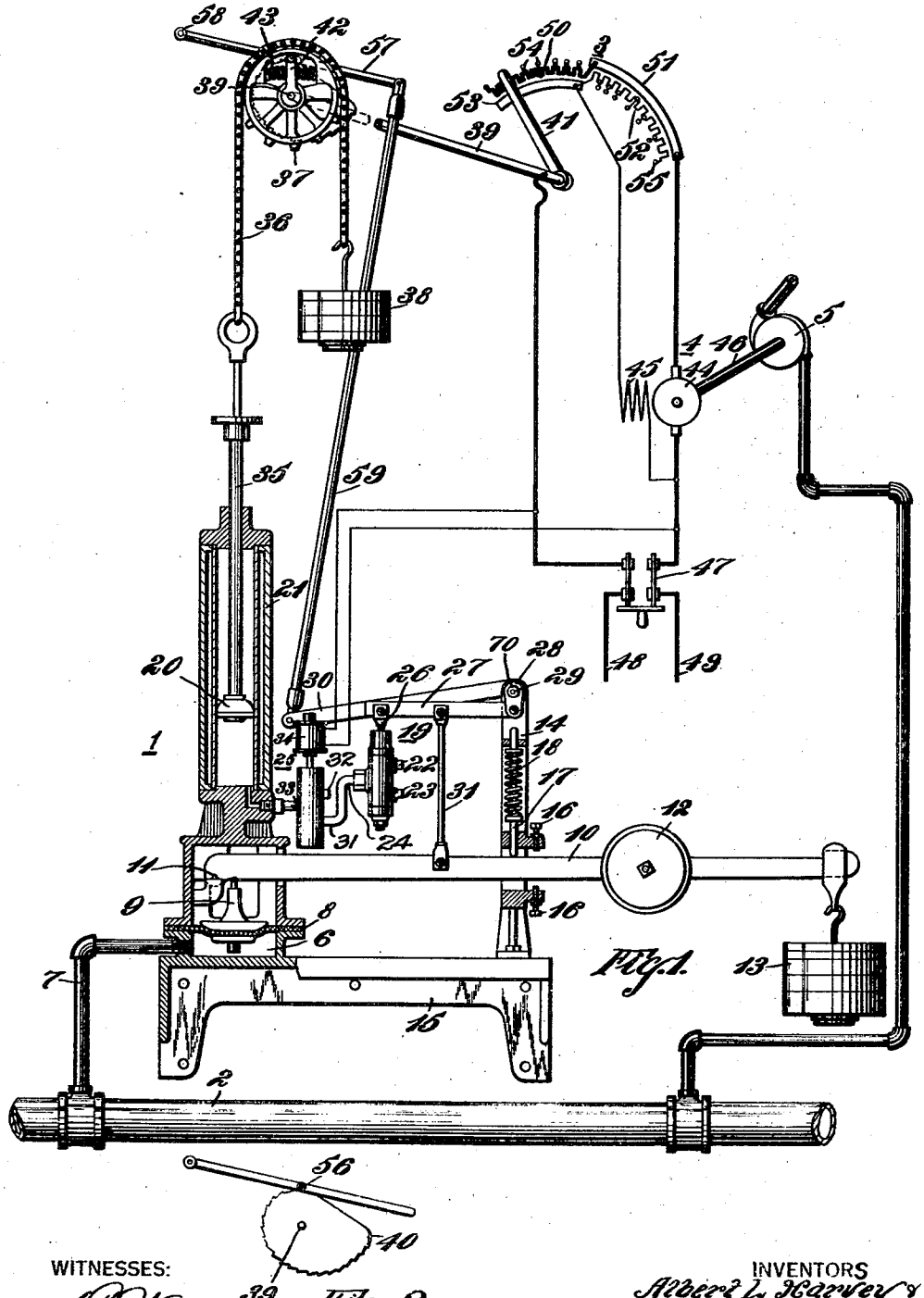


Fig. 1.

Fig. 2.

WITNESSES:

J. P. Wurm

W. B. Wells

INVENTORS

Albert L. Harvey &
Edgar M. Bouton.

BY

Wesley Gloar

ATTORNEY

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UNITED STATES PATENT OFFICE.

ALBERT L. HARVEY AND EDGAR M. BOUTON, OF WILKINSBURG, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

PRESSURE-REGULATOR SYSTEM.

Application filed October 9, 1920. Serial No. 415,817.

To all whom it may concern:

Be it known that we, ALBERT L. HARVEY, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, and EDGAR M. BOUTON, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Pressure-Regulator Systems, of which the following is a specification.

Our invention relates to pressure-regulator systems and particularly to fluid-pressure-regulator systems.

One object of our invention is to provide a pressure-regulator system that shall operate a motor-controlling mechanism in definite steps and in accordance with the variations of pressure in a fluid system.

Another object of our invention is to provide a pressure-regulator system of the above indicated character that shall control the pressure obtaining in a fluid system and that shall be provided with means for so reacting on a pressure-regulating device as to prevent hunting action.

In many industries, it is desirable to maintain the pressure in a fluid system substantially constant without producing a so-called hunting action. Moreover, it is desirable to rapidly accelerate a motor-operated pump to correct any variations of pressure in the fluid system.

In a fluid-pressure system constructed in accordance with our invention, a fluid-pressure device is operated directly in accordance with the pressure obtaining in the fluid system to be regulated. The pressure device operates a rheostat which is provided with resistors in circuit with the armature and field-magnet winding of the pump motor. Such device effects operation of the rheostat at varying rates, in accordance with the variation of the pressure in the fluid system. The rheostat is so constructed as to first vary the resistance included in circuit with the armature of the motor and then to vary the resistance included in circuit with the field-magnet winding of the motor. By such means, a very rapid acceleration of the motor is effected.

A cam member, which is operated in accordance with the operation of the fluid-pressure device, serves to accentuate the various rheostat positions and also to react on the fluid-pressure device in such manner as to prevent so-called hunting action. Such cam member is provided with shoulder portions which effect a somewhat abrupt reaction on the fluid-pressure device.

Although we have illustrated our invention for controlling the pressure obtaining in a fluid system we do not desire our invention to be limited to such operation. Our invention is applicable for governing the steam pressure of a boiler by controlling the flue draft of such boiler and, moreover, is equally well applicable for controlling the stoker motors of the boiler.

In the accompanying drawing, Figure 1 is a diagrammatic view of a regulator system constructed in accordance with our invention, and Fig. 2 is a detail view of the cam member.

Referring to the drawing, a fluid-pressure device 1 is operated in accordance with the pressure obtaining in a fluid system 2 for operating a rheostat 3 which is included in circuit with a motor 4. The motor 4 operates a pump 5 which is connected to the fluid system 2. The fluid-pressure device 1 comprises a chamber 6 which is connected to the fluid-pressure system 2 by means of a pipe 7. The chamber 6 is covered by a diaphragm 8 which carries a pin 9. The pin 9 operates a main lever 10 which is pivotally mounted at 11. Two weight members 12 and 13 are mounted on the lever 10 for adjusting the operation of the fluid-pressure device.

A bracket 14, which is mounted upon the base 15 of the device, carries two screw members 16 which limit the movement of the main lever 10. The bracket 14 also carries a pin 17 which is biased into engagement with the lever 10 by means of a spring member 18. The spring member 18, operating on the pin 17, exerts a force on the main lever 10 in opposition to the action of the diaphragm 8 and the pin member 9.

A main valve 19 is selectively operated by the lever 10 for controlling the operation of a piston 20 within a cylinder 21. The valve 19 is provided with an inlet port 22, which is connected to any suitable source of fluid pressure, an outlet port 23 and a

port 24, which is connected, by an auxiliary valve 25, to the cylinder 21. A valve stem 26 is operated by a valve lever 27 for connecting the port 24 with either the inlet port 22 or the outlet port 23. The opposite end of the valve lever 27 is connected to a link 28. The link 28 is supported on an eccentric member 70, which is rigidly mounted on a shaft 29. The shaft 29 is supported upon the bracket 14 and carries a lever 30 for a purpose to be hereinafter set forth. A link 31 is provided between the valve lever 27 and the main lever 10 in order to effect operation of the valve 19 in accordance with the fluid pressure obtaining in the system 2.

The auxiliary valve 25 is provided with an inlet port 31, an outlet port 32 and a port 33, which is connected to the cylinder 21. The valve is operated by an electromagnet 34 which is connected across the terminals of the motor 4. The auxiliary valve serves to prevent further operation of the fluid-pressure device 1 and to insure resistance in the motor circuit, upon failure of the supply circuit which is connected to the motor 4. For a complete description of the construction and operation of the auxiliary valve, reference may be made to the companion application of A. L. Harvey, Serial No. 412,584, filed Sept. 24, 1920.

The piston rod 35, which is connected to the piston 20, is attached to a chain 36, which passes over a sprocket wheel 37. A weight member 38 is attached to the end of the chain 36 for counter-balancing a portion of the weight of the piston 20 and the rod 35. The sprocket wheel 37 is rotatably mounted on a shaft 39 which carries a cam member 40 and the contact arm 41 of the rheostat 3. An arm 42, which is keyed to the shaft 39, is joined to the sprocket wheel 37 by spring members 43. The spring members 43 and the arm 42 serve to effect a resilient connection between the shaft 39 and the sprocket wheel 37.

The motor 4 comprises an armature 44 and a field-magnet winding 45. The armature 44 is preferably connected to the pump 5 by means of the armature shaft 46. The motor is connected, by a suitable switch 47, to a supply circuit comprising conductors 48 and 49.

The rheostat 3 comprises a resistor 50, which is adapted to be connected, through a contact segment 51, to the armature 44 of the motor, and a resistor 52, which is adapted to be connected through a contact segment 53 to the field-magnet winding 45 of the motor. The resistor 50 is provided with a plurality of contact terminals 54, and the resistor 52 is provided with a plurality of contact terminals 55. The rheostat arm 41, when rotated in a clockwise direction, first successively short-circuits portions of the resistor 50, which is in circuit with the armature 44 and then successively short-circuits portions of the restistor 52, which is in circuit with the field-magnet winding 45. The resistance steps of the resistor 50 successively decrease, as the contact arm 41 is moved in a clockwise direction, and the resistance steps of the resistor 52 successively increase, as the contact arm 41 is moved in a clockwise direction. By so disposing the resistance steps of the rheostat, a very rapid acceleration of the pump motor may be effected.

The cam member 40 is rigidly mounted on the shaft 39 and is provided with a notched cam surface, as shown in Fig. 2 of the drawing. A roller 56, which is mounted on a lever 57, rests upon the cam surface of the cam member and effects operation of the lever 57 in accordance with the rotative movement of the cam member. The lever 57 is pivotally mounted at 58 and is connected, by a link member 59, to the lever 30.

The surfaces between the notches on the cam member 40 are segments of circles having a center in the axis of rotation of the shaft 39, and, accordingly, no movement whatsoever of the lever 57 is effected except when a notch in the cam surface is encountered. The notches in the cam surface are disposed to correspond to the contact points of the rheostat 3. Thus, when the contact arm of the rheostat is in engagement with one of the contact terminals, the roller 56, which is mounted on the lever 57, engages a notch on the cam member 40.

The movement of the lever 57, which is effected by the cam member 40, causes a movement of rotation of the shaft 29 and the eccentric member 70 which is connected to it. The rotative movement of the eccentric member operates the link 28 and changes the setting of the valve 19 to prevent further operation of the piston 20. Such operation of the valve 19 prevents overtravel of the various moving parts and the consequent hunting action.

If the pressure obtaining in the fluid-system tube is below normal value, the diaphragm and the pin 9 attached to it are lowered to permit movement of the main lever 10 in a clockwise direction. Such movement of the lever 10 moves the valve stem 26 downwardly a short distance to connect the port 24 of the valve with the inlet port 22. Thereupon, fluid pressure is applied to the cylinder 21 for raising the piston 20. The upward movement of the piston 20 serves to effect rotation of the sprocket wheel 37, cam member 40 and rheostat arm 41 in a clockwise direction. The clockwise rotation of the rheostat arm 41 short-circuits the resistor 50, which is included in circuit with the armature 44 and then inserts a resistor

52 in circuit with the field-magnet winding 45. Such operation of the rheostat increases the speed of the motor 4 for so operating the pump 5 as to increase the pressure in the fluid system 2 to normal value.

When the cam member 40 is rotated, the notch or shoulder portions engage the roller 56 for raising the lever 57. Such movement of the lever 57 effects movement of the shaft 29 and the eccentric member 70 in a clockwise direction. The clockwise movement of the eccentric member tends to raise the valve stem 26 for limiting the supply of fluid pressure to the cylinder 21 to prevent further operation of the piston 20.

The notches or shoulder portions formed in the cam member 40 effect operation of the shaft 29 and the link 28 somewhat in a step-by-step manner in order to prevent stopping of the piston 20 when the rheostat arm 49 is not in full engagement with a rheostat contact terminal. The shoulder portions on the cam member 40 not only serve to effect operation of the valve 19 but also accentuate the positions of the rheostat 3.

If the pressure in the fluid system 2 is raised above normal value, the main lever 10 is moved in a counter-clockwise direction to raise the valve stem 26. Such movement of the valve stem 26 connects the port 24 with the outlet port 23 for permitting a partial release of the fluid pressure contained in the cylinder 21.

Thereupon, the piston 20 and the piston rod 35 are lowered to effect a movement of rotation of the cam member 40 and of the rheostat arm 41 in a counter-clockwise direction. The counter-clockwise rotation of the rheostat arm 41 decreases the resistance included in circuit with the field-magnet winding 45 and increases the resistance included in circuit with the armature 44. Thus, the speed of the motor 4 and of the pump 5 are decreased to decrease the fluid pressure obtaining in the system 2.

The counter-clockwise rotation of the cam member 40 effects movement of the shaft 29 and the eccentric member 70 in a counter-clockwise direction. Such movement of the shaft 29 and the eccentric member lowers the valve stem 26 to prevent further release of the fluid pressure contained in the cylinder 21.

In case the supply circuit, comprising conductors 48 and 49, is de-energized, the electromagnet 34 is operated to release the auxiliary valve 25. The auxiliary valve 25 permits the exhausting of the fluid pressure contained in the cylinder 21. Thereupon, the piston 20 is moved to its lowermost position, and the contact arm 41 of the rheostat 3 is moved to an extreme position for insuring that the resistor 50 shall be in circuit with the motor armature 44 to prevent any injury to the motor upon energization of the supply circuit.

Modifications in the system and in the arrangement and location of the parts may be made within the spirit and scope of our invention, and such modifications are intended to be covered by the appended claims.

We claim as our invention:—

1. In a pressure-regulator system, the combination with a fluid system, means for controlling the pressure obtaining in said system, and a pressure device operated in accordance with the pressure obtaining in the fluid system, of a cam member operated by said device for accentuating the positions of said controlling means.

2. In a pressure-regulator system, the combination with a motor-controlling means, and a fluid-pressure-operated device, of a cam member operated by said pressure device for accentuating the positions of said motor-controlling means, and means associated with said cam member for so reacting on said pressure device as to change its setting.

3. In a pressure-regulator system, the combination with a motor-controlling rheostat, and a fluid-pressure device, of a cam member for effecting operation of said rheostat in definite steps in accordance with the operation of said pressure device, and means directly controlled by said cam member for so reacting on said pressure device as to change its setting.

4. In a pressure-regulator system, the combination with a fluid-pressure system, a motor-controlling mechanism, and a pressure device operated in accordance with the pressure obtaining in said fluid system, of a cam member operated by said device for accentuating the positions of said motor-controlling mechanism and for effecting the operation of said device in abrupt steps.

5. In a pressure-regulator system, the combination with a fluid system, means comprising a motor-controlling device for governing the pressure obtaining in said fluid system, and a pressure device operated in accordance with the pressure obtaining in said fluid system for operating said device, of a cam member operated by said device for accentuating the positions of said motor-controlling device, and means actuated by said cam member for reacting on said pressure device to prevent hunting action.

6. In a pressure-regulator system, the combination with a fluid system, a pump for controlling the pressure in said fluid system, a motor for operating said pump, and a rheostat having resistors in circuit with the armature and the field-magnet winding of the motor, of means comprising a pressure device for operating said rheostat in accordance with the pressure obtaining in the fluid system, said means including a cam member operated by said device for accentuating

the positions of said rheostat and for opposing further operation of the pressure device.

7. In a pressure-regulator system, the combination with a fluid system, a rheostat, and a fluid-pressure device operated in accordance with the pressure obtaining in said fluid system for operating said rheostat, of means comprising a cam member operated by said device for accentuating the positions of said rheostat.

8. In a pressure-regulator system, the combination with a fluid-pressure system, a pump for controlling the pressure in said system, a motor for operating said pump, and a rheostat having resistors in the circuit of the armature and the field-magnet winding of said motor, of a pressure device operated in accordance with the pressure obtaining in said fluid system for operating said rheostat, and a cam member for accentuating the positions of said rheostat and for reacting on said device to change its setting.

In testimony whereof, we have hereunto subscribed our names this 7th day of October, 1920.

ALBERT L. HARVEY.
EDGAR M. BOUTON.