

No. 767,138.

PATENTED AUG. 9, 1904.

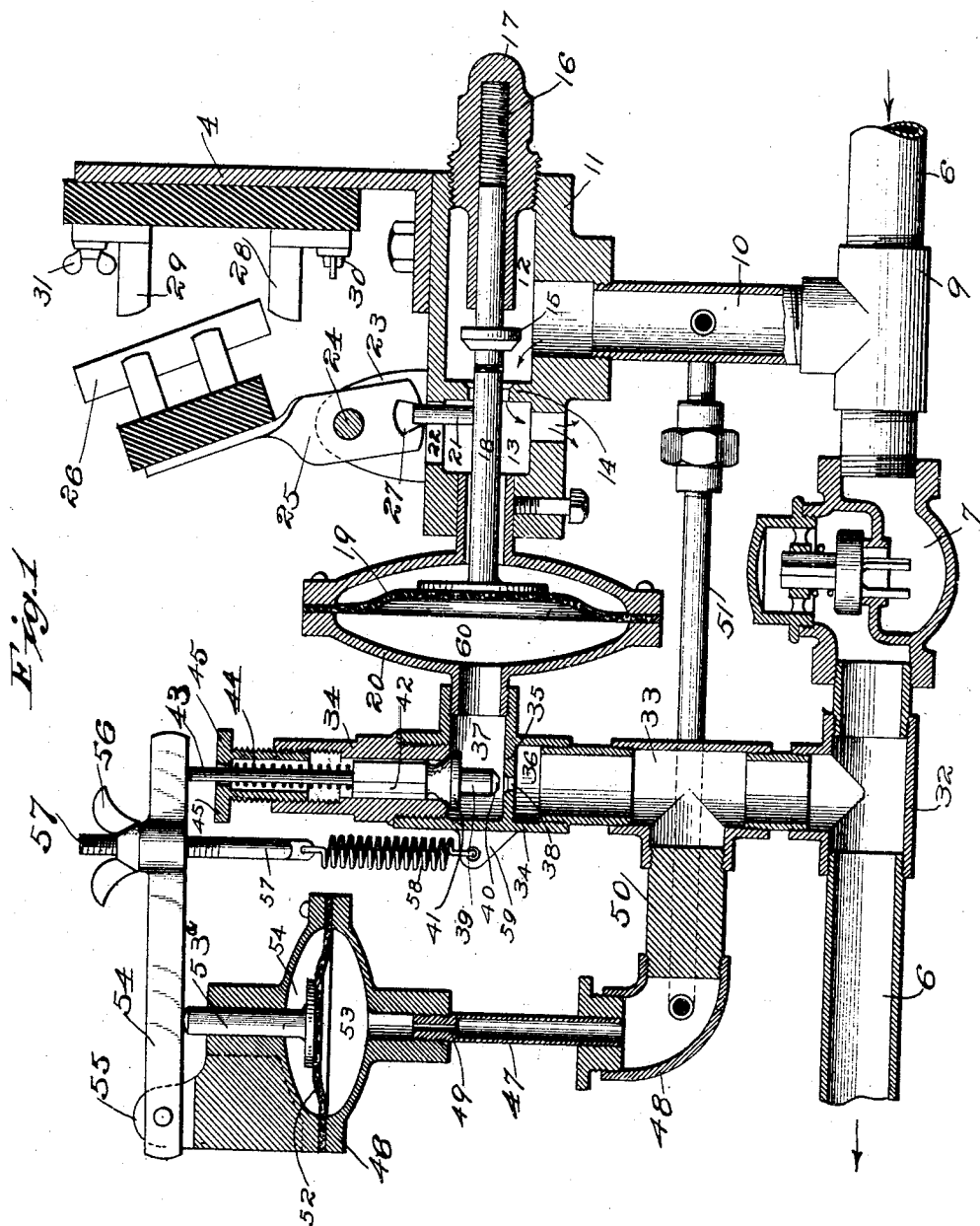
A. S. COMSTOCK.

PRESSURE REGULATED CONTROLLING DEVICE.

APPLICATION FILED APR. 14, 1904.

NO MODEL.

3 SHEETS--SHEET 1.



Witnesses

Wm. Drury

Oliver D. Plummer

Inventory:
A. S. Leonard
By Raymond C. Smith
Attys

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3 SHEETS—SHEET 2.

Fig. 2.

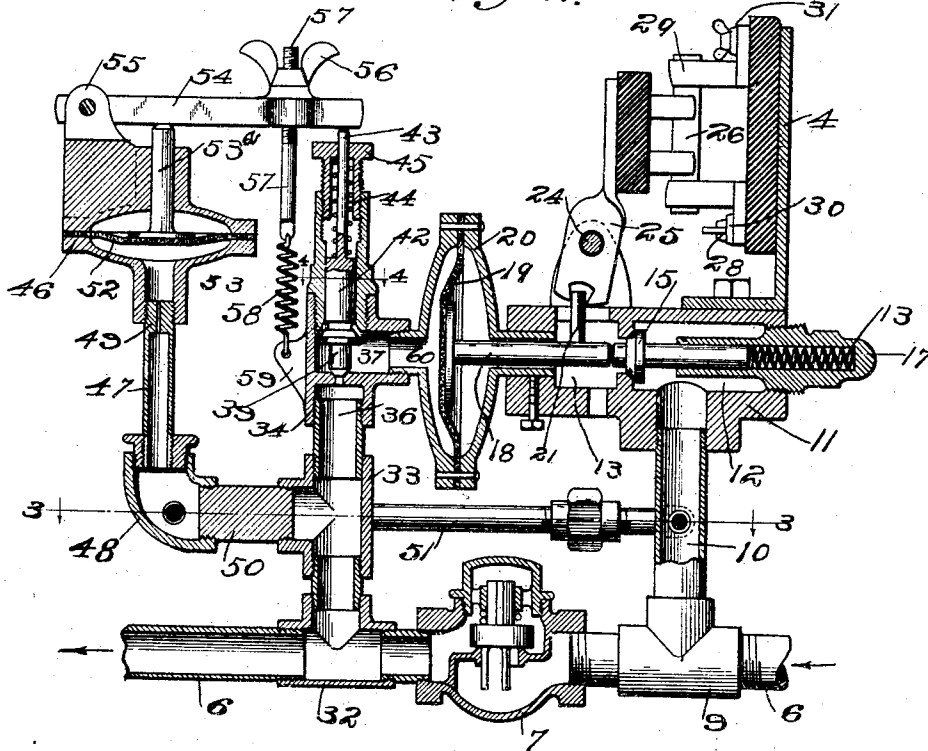


Fig. 3.

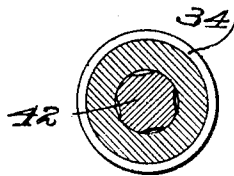
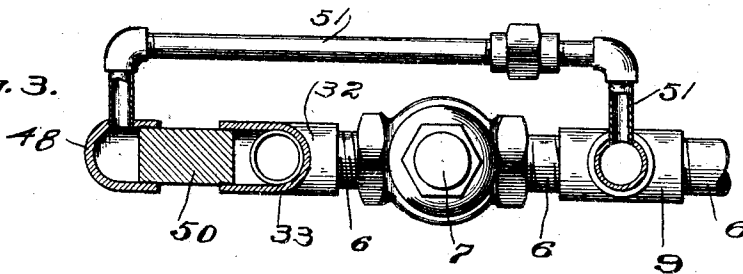


Fig. 4.

Witnesses:

Edw. J. Smith
Oliver S. Hunt

Inventor:
A. S. Comstock
By Raymond H. Hunt
Attys

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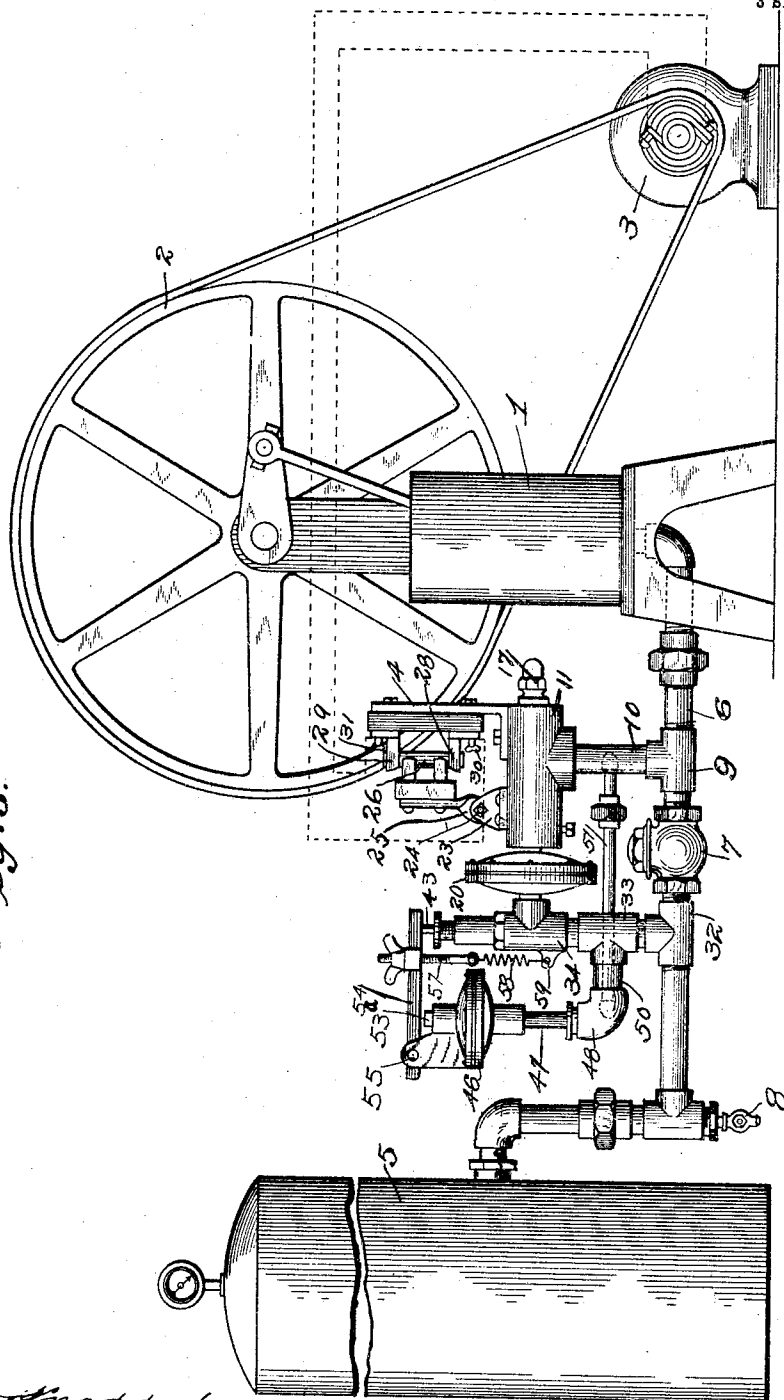
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NO MODEL.

3 SHEETS—SHEET 3.

Fig. 5.



Witnesses:

W. H. Drury
Chas. H. Plummer

Inventor:
A. S. Comstock
By *Raymond H. Smith*
Atty

UNITED STATES PATENT OFFICE.

ALPHONSO S. COMSTOCK, OF EVANSTON, ILLINOIS.

PRESSURE-REGULATED CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 767,138, dated August 9, 1904.

Application filed April 14, 1904. Serial No. 203,173. (No model.)

To all whom it may concern:

Be it known that I, ALPHONSO S. COMSTOCK, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Pressure-Regulated Controlling Devices, of which the following is a specification.

My invention relates to improvements in pressure-unloading devices, and especially in apparatus for automatically unloading an air-compressor and for simultaneously shutting the power off from the pump, and is particularly well adapted for use in connection with electrically-operated air-compressors.

One object of my invention is to simultaneously unload the pump and shut the power off from the motor.

Another object of my invention is to provide means for insuring the restarting of the pump at any desired difference in pressure between the point at which the apparatus blows off and the point at which it is desired to restart the same.

Another object of my invention is to provide adjustable means for controlling the apparatus, so that when the pump is unloaded and a vent is provided to the atmosphere that vent shall be closed at any desired point in the reduction of the pressure consequent upon the opening of such vent.

These and such other objects as may hereinafter appear are attained by my invention, which is typically embodied in the apparatus shown in the accompanying drawings.

Like numerals of reference indicate the same parts in the several figures of the drawings, in which—

Figure 1 is a longitudinal sectional view of my apparatus in open position—i. e., with the pump in free communication with the atmosphere and with the current shut off from the motor. Fig. 2 is a like view of the parts in reverse position—to wit, with the pump in operation and the vent to the atmosphere closed. Fig. 3 is a horizontal sectional detail on the line 3 3 of Fig. 2, looking in the direction indicated by the arrows. Fig. 4 is an enlarged horizontal sectional detail on the line 4 4 of Fig. 2, looking in the direction indi-

cated by the arrows; and Fig. 5 is a representation of an electrically-driven air-pump connected with an air-tank and fitted with my improved apparatus.

Referring by number to the accompanying drawings, and especially to Fig. 5, 1 indicates an air-compressor of any familiar type provided with a fly-wheel 2 and driven by a motor 3. The wires conveying power to the motor 3 are connected with a switch 4, which in the drawings is shown as a two-point double-break switch, but which may be a switch of any convenient or desired form.

Leading from the air-compressor 1 to the tank 5 is a main 6, provided with a check-valve 7 and with a hand-operated drip-cock 8. Connected with the main 6 by a T 9 is an outlet-pipe 10. The T 9 is preferably arranged between the pump 1 and the check-valve 7. The pipe 10 communicates with a valve-casing 11, which is divided into a valve-chamber 12 and an outlet-chamber 13 by a partition 14, which affords a seat for the valve 15. The valve 15 is normally held to its seat by yielding means—such, for example, as the spring 16—which can be conveniently mounted within the plug 17, which closes one end of the valve-chamber 12.

Extending through the outlet-chamber 13 is a stem 18, which abuts at one end against the valve 15 and is provided with a broad bearing at its opposite end against a flexible diaphragm 19, mounted within a diaphragm-casing 20. The stem 18 is provided with a pin 21, which extends upwardly through a slot 22, opening from the outlet-chamber 13.

The casing 11 carries upon its upper surface standards 23, which support a pivot 24, upon which is journaled the stem 25, which carries a bridge 26 of the switch 4. The lower end of the stem 25 is provided with a notch 27, arranged to engage the pin or tooth 21 upon the stem 18. The bridge 26 is arranged to make contact with and be clamped between the usual spring-terminals 28 29, which are provided, respectively, with the binding-posts 30 31. The wires or mains from the dynamo are connected with the binding-posts 31, and the wires leading to the motor are connected with the binding-posts 30. Connected with the main

6 and preferably between the check-valve 7 and the tank is a second T 32, from which connections 33 lead to a valve-casing 34. This casing 34 is divided by a partition 35 into an outer chamber 36 and a valve-chamber 37, connecting with each other through a small port 38. The port 38 is normally closed by a double-acting valve 39, which is mounted within the valve-chamber 37. The lower end 40 of the valve 39 is arranged to close the port 38, while the upper valve-face 41 of the valve 39 is adapted to close the passage leading from the valve-chamber 37 to the atmosphere. I have found that in order to obtain the most satisfactory and reliable results the area of the valve end 40 should be much smaller than the area of the valve-face 41. The valve 39 is so proportioned that when the valve-face 40 is seated to close the port 38 the valve-face 41 will be unseated and there will be a free opening from the valve-chamber 37 to the atmosphere. On the other hand, when the valve-face 40 is unseated from the port 38 the valve-face 41 will be seated, so that the opening from the valve-chamber 37 to the atmosphere will be closed while the valve-chamber 37 will be in free communication through the connection 33 and the T 32 with the pressure in the main 6.

The upper portion 41 of the valve 39 is preferably formed so as to constitute a guide for the travel of the valve within the passage leading from the valve-chamber 37 to the atmosphere. This portion 42 of the valve is cut away, as shown in detail in the cross-sectional view shown in Fig. 4, so as to allow a free passage of air through the passage leading from the valve-chamber 37 to the atmosphere and past the portion 42 of the valve 39. The valve 39 is also provided with a projecting valve-stem 43. The valve 39 is normally held in position where the valve-face 40 closes the port 38 by the tension of a spring 44, which surrounds the valve-stem 43 and abuts against the shoulder formed where the valve enlarges from the valve-stem 43 to the larger portion 42. The valve-stem 43 projects longitudinally through and outside of a hollow plug 45, within which is mounted the spring 44. This plug 45 is screw-threaded into the upper end of the casing 34 and serves to adjust the tension of the spring 44.

Since the port 38 will be opened by fluid-pressure within the connection 33 when such pressure against the valve-face 40 is sufficient to overcome the tension of the spring 44, it will be understood that the pressure at which the port 38 will be opened will be determined by the adjustment of the adjusting-plug 45. It is well known, however, that with all blow-off valves the valve will reseal only after a large reduction in the pressure, so that while a valve may be blown off at a pressure of thirty pounds the pressure must fall far below thirty pounds with a simple blow-off valve before the valve will be reseated. This

of course will result in a very objectionable reduction in pressure where it is desired to maintain the pressure at approximately the point at which the valve blows off or at a minimum pressure of a definite amount below the point at which the valve is set to blow off.

To insure the reclosing of the valve 39, so as to close the port 38 at any desired reduction in pressure below the point at which the valve is set to blow off, I provide supplemental mechanism, as follows: 46 is a diaphragm-casing communicating by means of a pipe 47 with a casing 48. To insure the gradual action of the apparatus, the inlet to the pressure side of the diaphragm-casing 46 should be of restricted area, or the passage through the connection 47 may be restricted, as at 49, in any convenient manner. Although as a convenient means of supporting the diaphragm-casing 46 and connected parts I connect the casing 48 with the casing 33 by means of a plug 50, it should be understood that there is no direct communication between the casing 33 and the casing 48, but that the plug 50 is merely an imperforate connection or a piece of pipe having the passage therethrough stopped up.

By means of a by-pass or shunt-pipe 51 I establish communication between the connecting-pipe 10 and the casing 48, so that the casing 48 will at all times be subjected to pump-pressure and likewise the pressure side of the diaphragm-casing 46 will be subjected to pump-pressure, although by reason of the restricted passage at 49 there will be an appreciable time in adjusting the conditions within the pressure side of the casing 46 to the variations of pump-pressure.

Clamped across the diaphragm-casing 46, so as to divide it into a pressure-chamber 53 and an atmospheric chamber 54, is a flexible diaphragm 52. Resting upon the diaphragm 52 is a stem 53^a, which projects through the diaphragm-casing 46.

54 is a pivoted lever which is preferably mounted, as shown—to wit, pivoted at one end to a suitable lug 55 formed upon the casing 46. The free end of the lever 54 is adapted to rest upon the upper end of the valve-stem 43 with a yielding pressure, which may be varied at will by means of a thumb-nut 56. This nut 56 is screwed upon a stem 57, which extends through the lever-arm 54. Secured to the opposite end of the stem 57 is a spring 58, which is anchored at 59 to a rigid part of the structure. By means of the thumb-nut 56 the tension of the spring 58 is so adjusted that the pressure within the diaphragm pressure-chamber 53 will operate the diaphragm 52 and lift the lever 54 out of contact with the valve-stem 43 before the pressure within the connection 33 will cause the valve 39 to unseat from the port 38.

Consequently the operation of my device is as follows: Assuming that the spring 58 has

been so adjusted that its tension will be overcome by a pressure of twenty-eight pounds within the air-pressure pipe and assuming that the spring 44 has been adjusted so that its resistance will be overcome by a pressure of thirty pounds within the pipes and against the valve-face 40, the operation of my apparatus will be as follows: Starting with the parts in the position shown in Figs. 2 and 5, the motor will start the pump into operation and the pump will cause a flow of compressed air through main 6, past check-valve 7, and into the tank. When the pressure within the pipe 51 reaches twenty-eight pounds or shortly thereafter, the pressure within the chamber 53 of the diaphragm-casing will reach twenty-eight pounds and will raise the flexible diaphragm 52, carrying with it the stem 53^a and the lever 54, against the tension of the spring 58, thereby carrying the lever 54 out of contact with the valve-stem 43. Now as the pressure continues to increase it will reach thirty pounds within the tank and will unseat the valve-face 40 from the port 38, and immediately the inrush of air to the port 38 and against the enlarged under surface of the valve-face 41 will force the valve-face 41 to close the passage leading from the valve-chamber 37 to the atmosphere. The pressure within the pipes will then have free access to the pressure-chamber 60 of the diaphragm-casing 20 and will expand the diaphragm 19, carrying with it the stem 18, against the valve 15 and the resistance of the spring 16. This will simultaneously unseat the valve 15 from the port connecting the valve-chamber 12 with the outlet-chamber 13, thus affording a free vent from the pump to the atmosphere, and will carry the pin 21 upon the stem 18 laterally toward the switch 4, thereby swinging the stem 25 upon the pivot 24 in a direction to carry the bridge 26 out of engagement with the spring-terminals 28 29, thereby causing a double break in the circuit and shutting off the power from the pump. I thus have the motive force shut off from the pump, and as the pump gradually comes to a standstill it will pump to the atmosphere through the main 6, T 9, pipe 10, valve-chamber 12, and outlet-chamber 13, as indicated by the arrows in Fig. 1. The check-valve 7, however, prevents any loss of pressure from the tank backward through said outlet, and therefore so long as the tank-pressure remains above thirty pounds not only will the flexible diaphragm 52 be held in expanded position, but the valve 39 will be held in the position shown in Fig. 1, so that full tank-pressure will be maintained in the pressure-chamber 60 of the diaphragm-casing 20, and accordingly by means of the stem 18, interposed between the valve 15 and the diaphragm 19, the valve 15 will be held off its seat and against the expansion of the spring 16. This condition will continue until the consumption or escape of air from the tank

reduces the pressure to below twenty-eight pounds, because, as is well known, although the valve 39 will be originally lifted from the port 38 by thirty-pounds pressure it will not return to its seat unaided until the pressure has dropped far below thirty pounds. With my device, however, when the tank-pressure drops below twenty-eight pounds the tension of the spring 58 will overcome the pressure exerted in the pressure-chamber 53 against the diaphragm 52, and will thus draw the arm 54 downwardly. The arm 54 being in contact with the valve-stem 43 the tension of the spring 58 will serve to supplement the expansive force of the spring 44, and the valve 39 will thus be promptly closed against the port 38 as soon as the tank-pressure drops below twenty-eight pounds or such other pressure for which the spring 58 has been adjusted by means of the thumb-nut 56 and threaded stem 57. As soon as the valve-face 40 of the valve 39 is seated to close the ports 38 all communication between the pressure-chamber 60 of the diaphragm-casing 20 and the pump or the tank is shut off, while at the same time the unseating of the valve-face 41 from the port leading from the valve-chamber 37 to the atmosphere will leave a free vent from the valve-chamber 60, past the flattened sides of the portion 42 of the valve 39, and through the cap 45. The flexible diaphragm 19 being thus relieved from pressure from the chamber 60 the spring 16 will seat the valve 15, thus closing the vent from the pump to the atmosphere, and will also force the stem 18 to its original position, carrying with it the pin 21, which gives a reverse swing to the stem 25, snaps the bridges 26 into contact with the spring-terminals 28 and 29, thereby closing the circuit, switching on the power, and starting the pump. As the pump starts there is an entire freedom from pressure within the pipes between the pump and the check-valve 7 and between the pump and the valve 15, so that the pump is started and the fly-wheel acquires momentum before any perceptible load, due to the compression of the air within the pipes, is put upon the mechanism. This not only makes more certain and prompt the starting of the mechanism, but where, as illustrated, an electric motor is used it makes it practical to use a high-power motor with mechanism of this sort upon a power-circuit which is common to a plurality of motors, where otherwise such an arrangement is commonly forbidden by the authorities and by the power companies for the reason that with this embodiment of my invention the momentum which is acquired by the apparatus before encountering any substantial load enables the apparatus to be started without any great increase of power over the normal power required to run the mechanism, and there is therefore no sudden and great lowering of the voltage of the circuit, due to the sudden ex-

traordinary load put upon it in starting the mechanism. Ordinarily where such mechanism is interposed in a circuit common to a plurality of devices the installation of a starting-box is insisted upon for the reason explained; but with my apparatus no starting-box is needed, because the increase of power required when starting the mechanism is so slight as to be entirely free from objections of this nature.

From the foregoing explanation it will be seen that the diaphragm 19 and its associated parts constitutes a pressure-motor arranged to open the valve 15 and the diaphragm 52 and its associated parts constitutes a pressure-motor arranged to lift the lever-arm 54. For convenience I have therefore used the term "pressure-motor" in the claims as indicating these structures, which serve to open the valve 15 and to lift the lever-arm 54, respectively, under suitable conditions. Of course the exact form of pressure-motor shown is merely illustrative and equivalent forms may be substituted therefor.

It will be understood that I have shown and explained my device in its preferred form and that various alterations in detail may be made as a matter of shop convenience or mere mechanical skill without departing from the spirit of my invention, which contemplates all such changes.

While I have especially designed my apparatus for use in connection with air-compressing machinery, it will be readily understood that it has a wider field of usefulness and is adapted for use wherever it is desired to unload pressure at a predetermined point and to have the exhaust-port again closed after a slight reduction in pressure. So, also, my device will work equally well as an unloading device where the pump is driven by other than electrical power and may be manufactured for such purpose without the electric switch.

I claim—

1. The combination with a source of pressure, of a pressure-motor, means connecting the pressure-motor with said source of pressure, a valve arranged to normally shut off pressure from said motor and to be opened by a given pressure to admit pressure to said motor, supplemental means for holding said valve in a position to shut off pressure from said motor, a second pressure-motor arranged to be operated by a lower pressure than that required to open said valve, said second motor being arranged to operate under pressure to relieve said valve from the action of said supplemental means, and connections between the source of pressure and said second pressure-motor.

2. The combination with a pump, of a tank, a conduit connecting the pump with the tank, a vent leading from the pump to the atmosphere, a spring-pressed valve arranged to close said vent, a pressure-motor arranged to be ac-

tuated by tank-pressure to open said valve, a second valve arranged to alternately shut off tank-pressure from said motor and open a vent from said motor to the atmosphere, and vice versa, a spring arranged to normally hold said valve in position to exclude tank-pressure from said motor, a second spring arranged to also hold said valve normally so closed, a second pressure-motor arranged to communicate with pump-pressure, and means interposed between said second motor and said second spring, all so arranged that said second motor will be operated against the energy of said second spring to relieve said last-named valve from the action of said spring before said valve will be unseated by tank-pressure.

3. The combination with a pump and a tank, of a conduit connecting the same, a pressure-motor, a valve arranged to normally shut off pressure from said motor and to be actuated by a predetermined pressure to admit pressure to said motor, supplemental means for normally holding said valve in a position to shut off pressure from said motor, and a second pressure-motor arranged to be operated by a lower pressure than that required to open said valve, said second motor being so arranged that, when actuated by pressure, it will relieve said valve from the action of said supplemental means.

4. The combination with a pump, of a pressure-motor communicating therewith and adapted to be operated by pump-pressure, a valve arranged to normally close communication between the pump and said pressure-motor and to be actuated by a given pressure so as to admit pump-pressure to said motor, means for returning said valve to said normal position, and supplemental means for returning said valve to said normal position, and a second motor in communication with pump-pressure and arranged to be actuated by a lower pressure than that required to unseat said valve from its normal position, said second motor being so arranged that, when actuated by pump-pressure, it will relieve said valve from the action of said supplemental means.

5. The combination with an air-compressor, of an electric motor arranged to drive said compressor, an electric circuit arranged to convey an electrical current to said motor, a switch interposed in said circuit, a pressure-motor communicating with said compressor and arranged to be actuated by pump-pressure, means arranged to be actuated by the operation of said pressure-motor to open and close said switch, a valve for normally excluding pump-pressure from said pressure-motor, said valve being arranged to be opened by pump-pressure, means for returning said valve to its closed position, supplemental means for returning said valve to its closed position, a second pressure-motor in communication with said pump and arranged to be

actuated by a lower pressure than that required to unseat said valve from its normal position and arranged, when so actuated, to operate said supplemental valve-closing means, so as to relieve said valve from the action of said supplemental means.

6. The combination with an air-compressor, of a casing in free communication therewith, an outlet leading from the interior of said casing to the atmosphere, a valve yieldingly seated to close said outlet, a motor-casing, a pressure-motor mounted within said casing, means interposed between said pressure-motor and said valve, whereby said valve may be unseated by the operation of said motor, a tank, a conduit connecting the pump with the tank, a check-valve interposed in said conduit, a valve-casing communicating with the pressure side of the motor-casing and provided with a port arranged to admit tank-pressure and with a second port communicat-

ing with the atmosphere, a valve arranged within said casing to alternately close said ports and normally held by spring-pressure so as to close communication between said valve-casing and the tank, a spring arranged to hold said valve so seated, a second spring, means, interposed between said second spring and said valve, whereby said second spring also serves to hold said valve so seated, a second motor-casing, means for conducting pump-pressure to said second motor-casing, a pressure-motor mounted in said casing, and means interposed between said motor and said last-named spring so that said motor will operate against the tension of said last-named spring to relieve said valve from the action of said spring, substantially as described.

ALPHONSO S. COMSTOCK.

Witnesses:

O. R. BARNETT,
M. E. SHIELDS.