

April 24, 1928.

1,667,154

C. F. HEYWOOD

SAFETY VALVE

Filed April 28, 1926

2 Sheets-Sheet 1

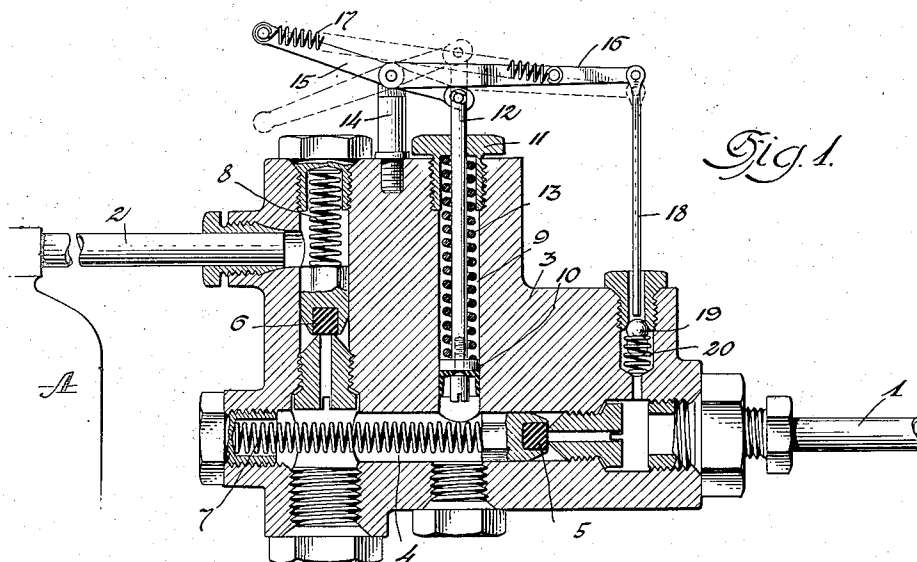


Fig. 1.

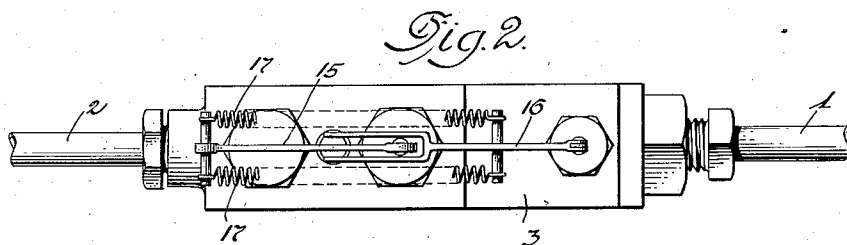


Fig. 2.

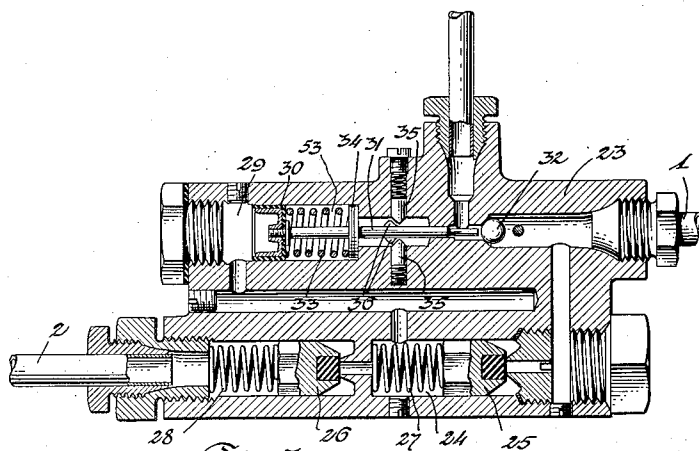


Fig. 3.

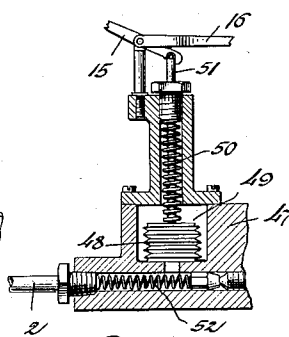


Fig. 4.

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2 Sheets-Sheet 2

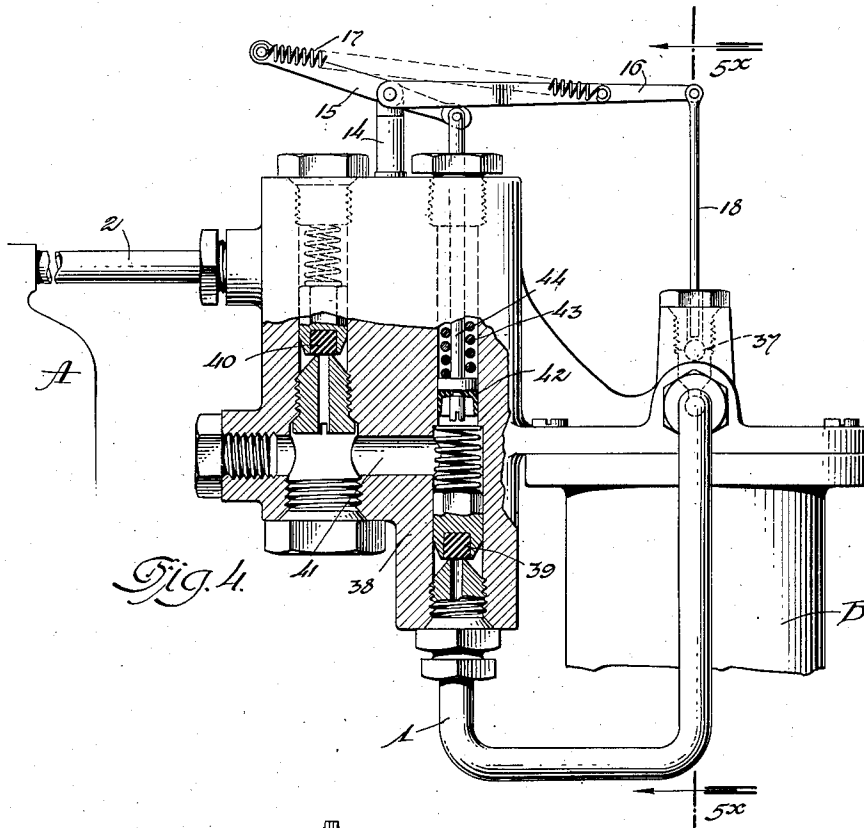


Fig. 4.

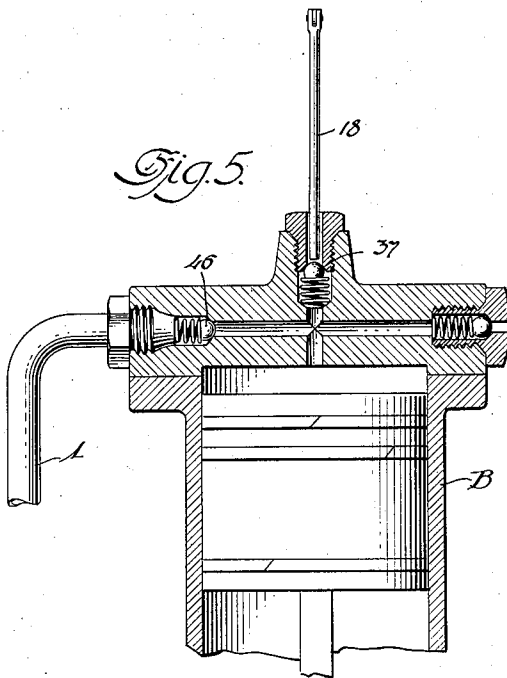


Fig. 5.

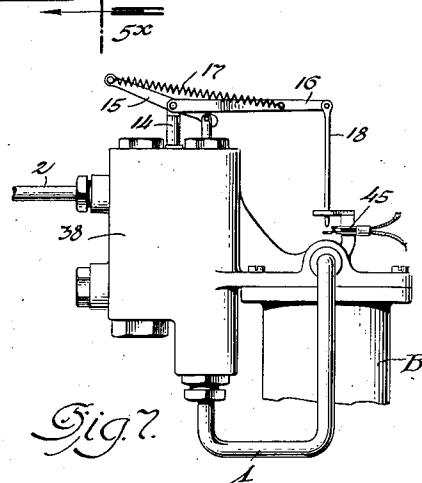


Fig. 7.

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UNITED STATES PATENT OFFICE.

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SAFETY VALVE.

Application filed April 28, 1926. Serial No. 105,338.

This invention relates to means for controlling the pumping of gaseous fluid into receivers so that the maximum pressure of such fluid in the receiver may be determined and maintained by a continuously operating pump without imposing any appreciable load on the pump when such desired maximum pressure in the receiver is attained, the said invention relating more especially to a form of safety valve which operates at a predetermined pressure in the receiver to provide a free discharge from the pump which reduces resistance to operation of the pump to a minimum when the required pressure is retained in the receiver and which will operate to shut off such free discharge from the pump immediately the pressure in the receiver drops whereby the pump then continues to function in recharging the receiver until the required pressure is again attained, and so on.

The object of the invention is to provide a device which will be quite sensitive in its operation and preform the described functions with but slight changes in pressure so that a practically constant pressure in the receiver will be readily maintained.

The invention more particularly contemplates a multiple valve device having a chamber wherein a small quantity of fluid is trapped between the pump and the receiver at a pressure equal to that in the receiver and adapted to operate a relief valve at a predetermined pressure to provide a free discharge from the pump, any reduction and pressure of the trapped fluid resulting in the closing of the relief valve so that discharge from the pump is again directed through the said chamber to raise the pressure therein, and in the receiver if necessary to the said predetermined extent and cause the re-opening of the relief valve when the said pressure is again so raised.

A further object of the invention is to provide a valve device for the purpose as specified in which a fluid chamber is provided with inlet and outlet check valves opening from a pump and into a receiver respectively, said fluid chamber communicating with a cylinder enclosing a piston movable against the resistance of a spring when a certain pressure is attained in the said chamber, a snap mechanism ensuring positive and rapid movement of said piston at such predetermined pressure and return of the piston

to its original position by said spring when the pressure in said chamber drops, and a relief valve opened by said piston when it is operated by the pressure in said chamber to permit a free discharge or by passing of the pump during such time as the pressure in said chamber is at the said predetermined level.

Still further objects subsidiary to or resulting from the aforesaid objects, or from the construction or operation of the invention as it may be carried into effect, will become apparent as the said invention is hereinafter further disclosed.

In carrying the said invention into effect I may utilize the novel construction and arrangement of parts more particularly described and ascertained hereinafter, by way of example, having reference to the accompanying drawings, wherein—

Figure 1 is a sectional elevation of the improved valve device;

Figure 2 is a plan of the same;

Figure 3 is a sectional elevation of a modified form of the device;

Figure 4 is an elevation partly in section, showing a further modified form of the device as applied to a pump which is indicated in fragmentary form;

Figure 5 is a section of the pump head taken on the line 5*-5*, Figure 4,

Figure 6 is a fragmentary sectional view of a still further modified form of the device, and

Figure 7 is an elevation of the device, Figure 4 illustrating a different application of its use.

Similar characters of reference indicate similar parts in the several figures of the drawings.

Referring first to Figures 1 and 2, 1 indicates the pressure line of a pump, 2 the inlet pipe of a receiver A, and 3 a valve casing in which is a chamber 4 through which fluid must pass from the pressure line 1 to the pipe 2 of the receiver, the said chamber being provided at its inlet and outlet ends with check valves 5 and 6 respectively held against their seats by springs 7 and 8.

The valve casing is bored at 9 to form a cylinder in which a piston 10 is reciprocable, the upper end of the bore being closed by an adjustable cap 11 through which extends a piston rod 12 and by the adjustment of this cap 11 the pressure of a spring 13

against the said piston 10 may be regulated. Mounted on the upper end of the said casing 3 is a post 14 on which is fulcrumed a lever 15, one end of which is connected to the outer end of the piston rod 12, so that the said lever may be rocked on its fulcrum by the said piston rod when the piston 10 is reciprocated in one or other direction, and 16 is a further lever swingable on the said post 14 and connected to the free end of the lever 15 by a tension spring 17 forming a snap mechanism which results in the quick raising or lowering of the lever 16 as the free end of the lever 15 is moved upwardly or downwardly beyond an alignment with the said lever 16 so that the spring 17 is caused to pull on one or other side of the lever 16, this being a well known form of snap mechanism.

To the outer end of the lever 16 is connected a rod 18 adapted to open a relief valve 19 when the said lever 16 is depressed, the said relief valve being normally closed by the spring 20 when the said lever 16 is raised. This relief valve is situated so that it is connected with the fluid line in advance of the check valve 5, so that if it be opened fluid may freely escape therethrough instead of meeting with the resistance of the said check valve 5 and such pressure as may be behind the said check valve as a result of fluid under pressure trapped in the said chamber 4.

The operation of the device is quite simple. Presuming that it is desired to maintain a pressure of two hundred pounds per square inch in the receiver A, the compression of the spring 13 is regulated so that the piston 10 may move in the cylinder 9 when a pressure of two hundred pounds is attained in the chamber 4, which pressure would, of course, result when a similar pressure was reached in the said receiver A. This pressure in the chamber 4 would then force the piston 10 upwardly in the cylinder 9 so that the lever 16 would be depressed through the agency of the lever 15 and spring 17, thereby opening the relief valve 19 which would permit the pump to continue operation with a free exhaust past the relief valve 19 and consequently practically no load.

Immediately, however, pressure dropped in the chamber 4 either due to a lowered pressure in the receiver A which would cause some of the fluid from the chamber 4 to escape to the receiver or due to any leakage of fluid from the said chamber 4 the spring 13 would bring the piston 10 back to its normal position, thereby operating the snap mechanism to raise the lever 16 and permit the relief valve to close so that fluid under pressure from the pump would then be forced past the check valve 5 into the chamber 4, again raising the pressure there-

in to the desired extent whereupon the snap mechanism would be operated in the manner described to again open the relief valve.

In actual practice it is found that the device may easily be adjusted to operate under slight variations of pressure, so much so that where slight leakage is to be contended with after a required pressure has been built up in the receiver and the relief valve is open, the mechanism will operate to close the relief valve, whereupon a single impulse from the pump will be sufficient to raise the pressure in the chamber 4 to compensate for such leakage and the relief valve will again close almost instantly.

The arrangement shown in Figure 3 is practically the same as that shown in Figures 1 and 2, except for design, a different form of snap mechanism housed in the casing instead of external thereto being used, and in this figure, 23 is the casing, 24 the chamber corresponding to the chamber 4, 25 and 26 the inlet and outlet check valves of the said chamber, 27 and 28 the springs thereof, 29 the cylinder corresponding to the cylinder 9.

30 is the piston which in this case has a piston rod 31 extending into the proximity of a relief valve 32 which it is adapted to unseat when the piston is subjected to a pressure of fluid in the chamber 24 exceeding the resistance of a spring 33 within the cylinder 29 for the same purposes hereinbefore described in connection with the operation of the relief valve 19.

34 are washers within the cylinder which are inserted therein to determine the compression of the spring and thereby determine the fluid pressure required to operate the said piston.

The snap mechanism in this case comprises spring pressed tumblers 35 between which abutments 36 on the piston rod are required to pass in one or other direction.

In the modification, Figures 4 and 5, the design is changed so that the relief valve 37 is in the cylinder head of the pump instead of in the pressure line thereof as in the previous examples; and the valve casing 38 is formed integral with said cylinder head. 39 and 40 are the check valves at the inlet and outlet ends of the fluid chamber 41, and 42, 43 and 44 the piston, piston spring and piston rod of the device respectively. The snap mechanism is indicated as in Figures 1 and 2.

A device of the type described is very convenient in maintaining pressure in or controlling the replenishing of receivers from which fluid is drawn from time to time and which it is desired shall be automatically recharged from a continuously operating pump as it ensures the pressure being maintained in the receiver at any desired point without imposing any appreciable load on

the pump after such pressure is attained. As will be apparent the construction of the device is very simple, may be cheaply manufactured, and it is efficient and reliable in its operation.

The check valves 39 and 40 may be dispensed with where the special sensibility of the apparatus which may be secured by their use is not so important, the exhaust valve 46 of the pump then being the inlet valve of the device, or the valve 39 may be retained where the exhaust valve of the pump is not considered sufficiently reliable to prevent leakage back from the receiver to the pump, and in Figure 6 I indicate the casing 47 of the device as enclosing an expansible chamber or bellows 48, the upper movable member 49 of which is maintained normally depressed by a spring 50 and is provided with a rod 51 actuating the snap mechanism. The expansible chamber 48 may of course be absolutely leak proof which is one reason why an outlet check valve from the chamber 52 may be dispensed with as in the said Figure 6.

Although it is generally intended to be used in controlling a relief valve as previously described the device may be used to control the action of other devices, the operation of which it is desired shall be dependent upon certain pressure being maintained in a receiver as for instance, in the example shown in Figure 7 wherein the device is indicated as controlling the action of a switch 45 which may be that of an electric motor operating the pump, the depressing and raising of the lever 16 resulting in the opening and closing of the switch as will be readily apparent.

This invention may be developed within the scope of the following claims without departing from the essential features of the said invention, and it is desired that the specification and drawings be read as merely illustrative and not in a limiting sense, except as necessitated by the prior art.

What I claim is:—

1. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber therein, a relief valve permitting when open free discharge from a pump to eliminate load thereon, a pressure-movable member exposed to the pressure in said chamber, a linkage extending from said member and adapted to engage said relief valve to open the same, and a spring backing said member and adapted to resist the normal pressure in said chamber.

2. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber, therein, a relief valve permitting when open free dis-

charge from a pump to eliminate load thereon, and a snap mechanism operable by predetermined pressure in said chamber to open said relief valve.

3. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber therein, a relief valve permitting when open free discharge from a pump to eliminate load thereon, yieldable means operable by predetermined pressure in said chamber, a member movable by said means when so operated to open said relief valve, a snap mechanism effecting a positive operation of said member, and resilient means effecting a reverse movement of said yieldable means and said mechanism when pressure in said chamber drops below a predetermined pressure.

4. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber therein, a relief valve permitting when open free discharge from a pump to eliminate load thereon, a cylinder in connection with said chamber, a piston movable in said cylinder by fluid pressure in said chamber, a spring back determining the pressure required to move said piston and returning said piston to its normal position following such movement when the pressure chamber drops below a predetermined pressure, and a linkage extending from said piston and adapted to engage said relief valve to open said valve when said piston is moved by fluid pressure in said chamber.

5. A combination according to claim 4 wherein the means resisting the movement of the piston includes a snap mechanism ensuring rapid and positive movement in one or other direction when the pressure in said chamber exceeds or drops below predetermined limits.

6. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber therein, a relief valve permitting when open free discharge from a pump to eliminate load thereon, yieldable means operable by predetermined pressure in said chamber, a member movable by said means when so operated to open said relief valve, a snap mechanism effecting a positive operation of said member, resilient means effecting a reverse movement of said yieldable means and said mechanism when pressure in said chamber drops below a predetermined pressure, and means for adjusting the resistance of said resilient means whereby the pressure controlling the operation of said yieldable means is determined.

7. Pressure regulating means comprising a valve device adapted for arrangement in

a pressure line from a pump to a receiver, said device having a chamber therein, a relief valve permitting when open free discharge from a pump to eliminate load thereon, a snap mechanism operable by predetermined pressure in said chamber to open said relief valve, and means effecting the reverse operation of said snap mechanism when pressure in said chamber drops below a predetermined pressure.

8. In a device of the class described, a casing having a chamber therein, a movable member exposed to pressure in said chamber, resilient means maintaining said member in a normal unmoved position except when predetermined pressure is exceeded in said chamber, an inlet check valve to said chamber, a normally closed relief valve, and a snap mechanism connected to said movable

member, said member being adapted to effect the opening of said relief valve through the medium of said snap mechanism upon the operation of said member by pressure in said chamber.

9. Pressure regulating means comprising a valve device adapted for arrangement in a pressure line from a pump to a receiver, said device having a chamber therein, a controlling element governing the flow into said chamber, a pressure-movable element exposed to the pressure in said chamber, a linkage extending from said member and adapted to operate said controlling element, and a spring backing said member and adapted to resist the normal pressure in said chamber.

In testimony whereof I affix my signature.
CHARLES F. HEYWOOD.