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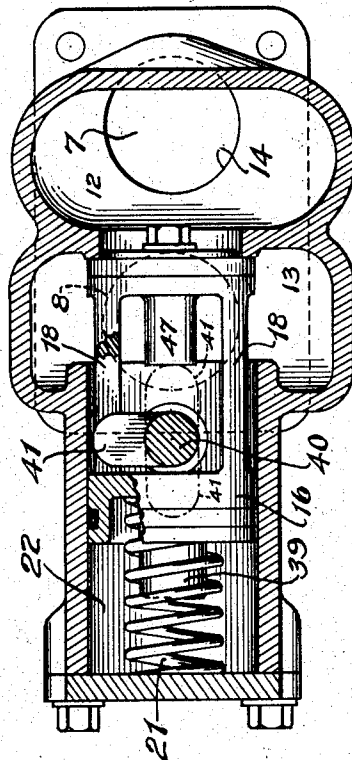
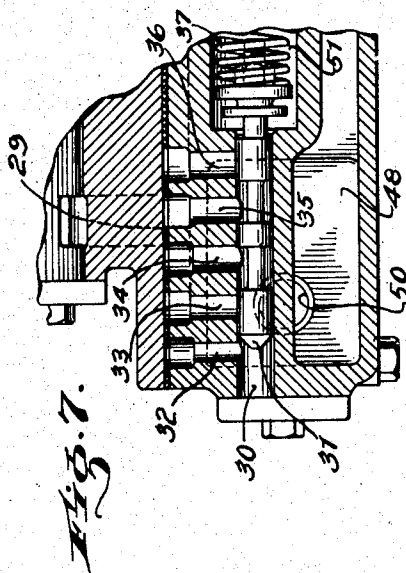
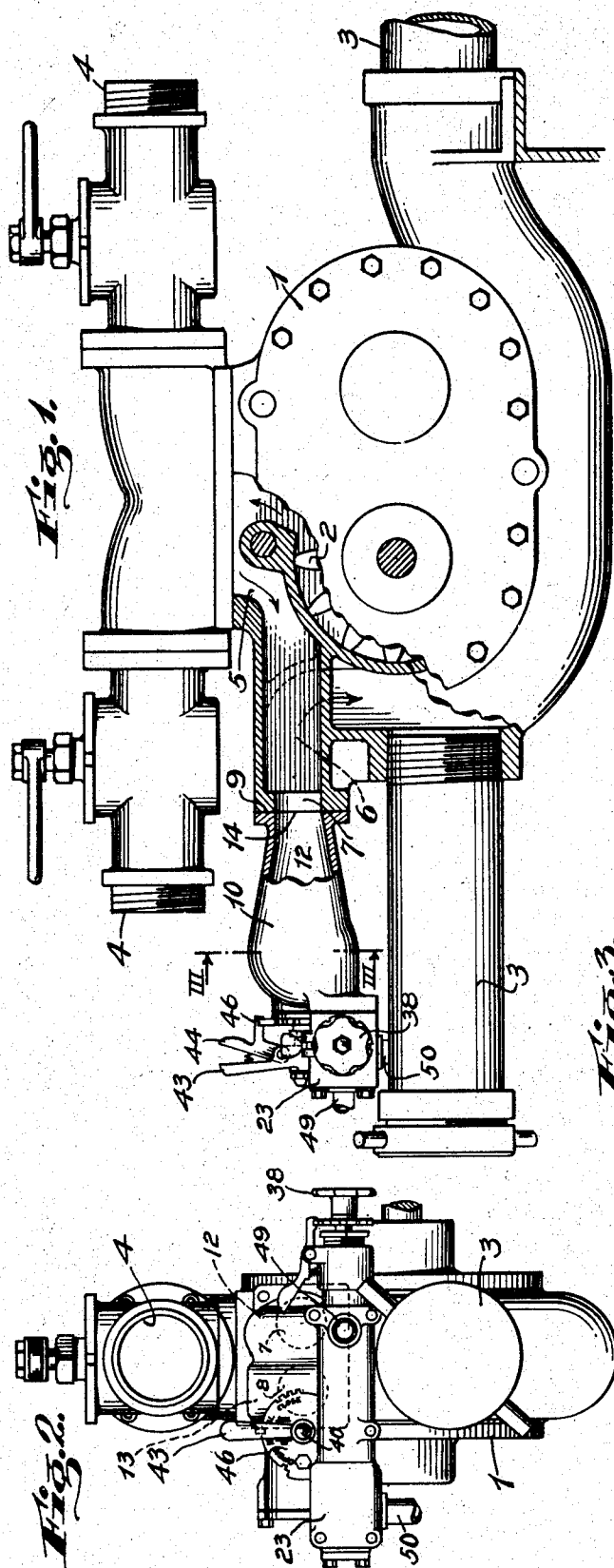
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2,021,613

PUMPING SYSTEM

Filed Jan. 6, 1933

2 Sheets-Sheet 1.



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2 Sheets-Sheet 2

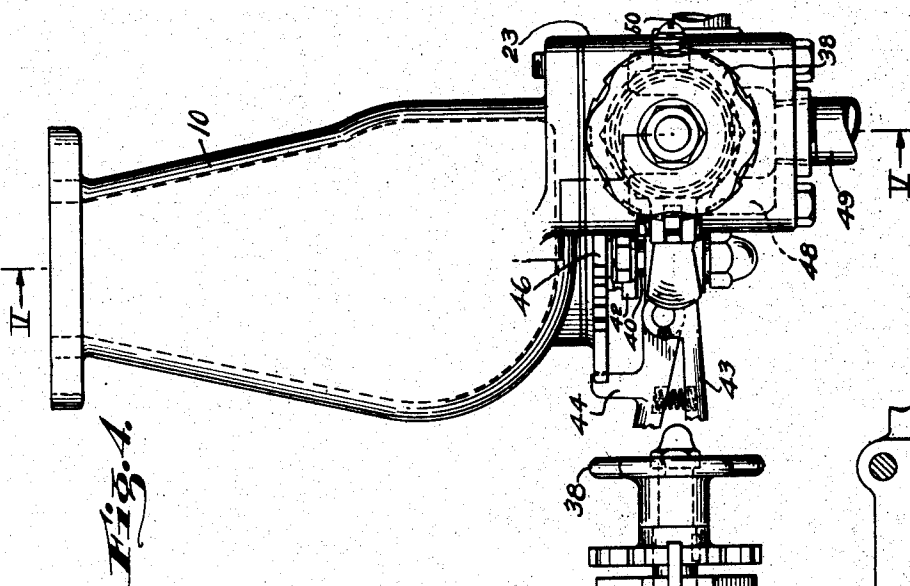


Fig. 4.

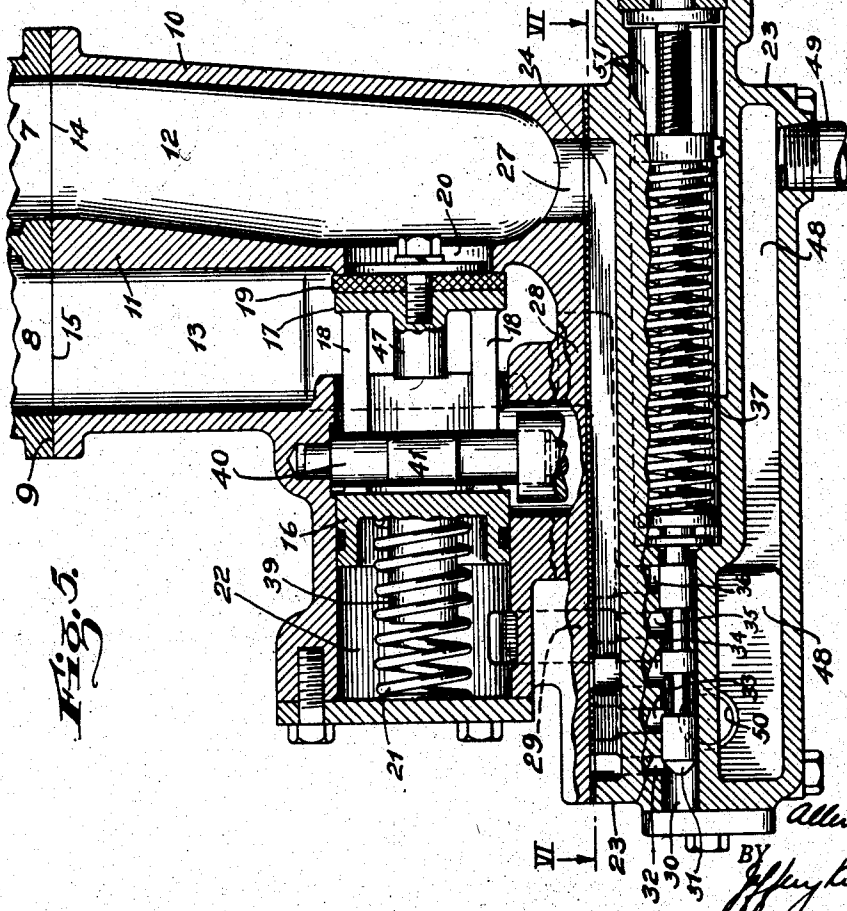


Fig. 5.

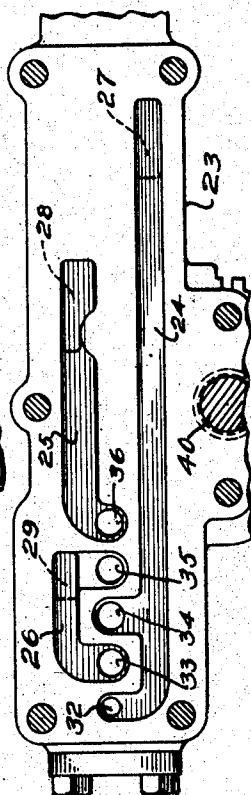


Fig. 6.

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UNITED STATES PATENT OFFICE

2,021,613

PUMPING SYSTEM

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Application January 6, 1933, Serial No. 650,400

3 Claims. (Cl. 103—42)

The invention relates generally to pumping systems, such as automotive pumpers for fire department use, in which a pump is operated to furnish water under high pressure to a number of hose lines. Customarily each line terminates in a nozzle furnished with a valve by which the fireman handling it can control the discharge and shut off the water stream, the other lines meanwhile continuing in action. To guard against the pressure increase which would otherwise result from shutting off one or more of the lines and which might raise the pressure at the remaining active nozzles to such a point and with such suddenness as to jeopardize the safety of fireman handling them from a ladder or other precarious footing, it is necessary to provide a relief valve which automatically limits the maximum pressure which can obtain in the high pressure side of the system, thereby avoiding the dangers incident to sudden or undue pressure increase which might result from the foregoing or other causes.

The object of the invention is a compact relief valve which, in its preferred form, may be readily attached to the pump or removed from it, as a unit, and which is reliable in action, sufficiently sensitive to allow only a minimum and safe increase above the normal operating pressure, and relatively stable and non-pulsating, the pump being so organized as to facilitate the mounting of the unit and, more particularly, serving to cooperate with it to the best advantage and so to position it as to ensure its protection against injury, while locating it for convenient access to the several unit controls and parts, all as more particularly pointed out below with reference to the accompanying drawings in which:

Fig. 1 is an elevation, partly broken out, of a pump and the relief valve connected to it.

Fig. 2 is an end view of the same, being a "side view" as this type of pump is customarily mounted i. e. transversely of the truck chassis.

Fig. 3 is a section on the line III—III of Fig. 1.

Fig. 4 is an enlarged view of the relief valve detached from the pump.

Fig. 5 is a section on the line V—V of Fig. 4.

Fig. 6 is a section on the line VI—VI of Fig. 5, and

Fig. 7 is a section corresponding to Fig. 5 but with the parts in a different position.

The pump 1 will be recognized as a type commonly used on fire apparatus, having rotary impellers 2, intakes 3 for connection to a hydrant or other water supply and outlets 4 to which the hose lines are coupled, and while this type

lends itself readily to the attachment of the relief valve it is by no means essential.

The pump casing is cored to provide passages 5 and 6 opening respectively from the discharge side of the pump and to the intake side, the passages including laterally extending parallel sections with adjacent outlets 7 and 8 in the end 9 of the pump casing, which is faced off to provide a seat for the relief valve structure intermediate the parallel inlet and outlet passage of the pump, the function of the relief valve being to short-circuit the pump by permitting the water to discharge from passage 5, the high pressure side of the system, back to passage 6, the low pressure side, in response to predetermined pressure in the former.

In its preferred form the relief valve structure is organized as a unit, comprising a hollow body portion 10 (Fig. 5) having an internal dividing wall 11 forming high and low pressure chambers, 12 and 13 respectively, with outlets 14 and 15 adjacent each other in one end of the body, which is flanged and faced off to seat on the complementary face 9 of the pump housing to which it can readily be bolted, to support the entire valve structure, the outlets 14 and 15 then registering respectively with outlets 7 and 8. As a result of this construction of pump housing and relief valve unit the latter is convenient of access, may be readily applied to the pump or removed from it, and in the latter event a closure plate can be bolted over the seat face 9, thereby sealing passages 5 and 6 and enabling the pump to be put into service again without delay, or an entire unit may as readily be substituted for the one removed.

The relief valve proper, also known as the churn valve, comprises heads 16 and 17 united by cage bars 18, the head 17 carrying a sealing disc 19 which normally engages a seat on the dividing wall 11 to close port 20 which gives access from the high to the low pressure side of the system. Head 16 comprises a piston which, as below described, reciprocates in a control chamber or cylinder 22, moving to the left to open port 20 whenever the pressure on the face of the valve exposed to chamber 12 exceeds that on the back of the valve, that is, in the control chamber 22, the pressure in the latter being determined by a pilot valve controlled by the pressure on the high 50 pressure side and adjusted to operate when the predetermined limit pressure is reached. A spring 21 and a bumper extension 39 serve respectively to cushion and limit the opening of the churn valve.

The lower end (as viewed in Fig. 5) of the body 10 is faced off flat to receive and provided a seat for a pilot valve housing 23, the face of the housing (Fig. 6) being channelled to provide ducts 24, 25 and 26 which communicate respectively with the high pressure chamber 12 (through port 27), the low pressure chamber 13 (through port 28) and the control chamber (through port 29). Mounted in a longitudinal bore 30 is a slide valve 31 and opening laterally of the bore are a number of control ports 32, 33, 34, 35 and 36 which are designed to provide communication as follows: 32, from the high pressure duct 24 to the end of the pilot valve bore, whereby the pilot valve is forced to the right when the pressure is sufficient to overcome the resistance of spring 37, the tension of which may be adjusted by the hand wheel 38; 33, from the bore 30 to duct 26 and thence through port 29 to the control chamber 22; 34, from the valve bore to high pressure duct 24; 35, from the valve bore to duct 26 and thence, through port 29, to the control chamber 22; and 36, from the valve bore, to the low pressure duct 25. In its normal position (Fig. 5) the pilot valve therefore serves to connect the back of the relief valve (chamber 22) with the high pressure side of the pump and, the area of head 16 subject to this pressure being greater than that of disc 19, the relief valve is held firmly against its seat to close port 20 and the entire output of the pump is delivered to the outlets 4 and the hose lines.

The tension of spring 37, which is housed in a chamber 51 comprising an enlarged extension of bore 30, is so adjusted that it yields when the discharge pressure exceeds normal by say 5-10 pounds, the pilot valve being moved to the right by such pressure increase, applied to it through port 27, duct 24 and port 32 to bore 30.

The pilot valve and the lateral ports are so related that the valve has three control positions, in the first of which, as already described, it serves to maintain the churn valve closed. The second position (which results from movement of the valve to the right in response to excess pressure) is illustrated in Fig. 7 wherein it will be seen that ports 33 and 34, which formerly were in communication (through bore 30) are cut off from each other, so that the high pressure in duct 24 is no longer communicated to the back of the churn valve. In its third position, resulting from continued movement to the right, the pilot valve places ports 35 and 36 in communication and so vents the back of the churn valve (chamber 22) to the low pressure chamber 13, whereupon the churn valve is opened by the pressure on disc 19 and the pressure on the hose lines relieved by the shunting of part of the pump output through passage 5, chamber 60, port 20, chamber 13 and passage 6 to the pump intake. As soon as the normal output pressure is restored, the pilot valve resumes its original position (Fig. 5) under the action of spring 37, in its return movement first shutting off the control chamber connection to the low pressure side of the system and then opening that chamber to the high pressure side, thereby balancing the pressure on the ends of the churn valve which is closed by spring 21. At no time, therefore, is the control chamber in communication with both the high and the low pressure sides of the system, which arrangement I have found eliminates serious disadvantages of the relief valves heretofore in use, namely, a tendency to surge back and forth, produc-

ing a wide fluctuation of pressure in the hose lines, and, more particularly, a large initial pressure increase which, while not as great as would occur if no relief valve were used, is nevertheless sufficient to constitute a source of danger to the firemen. On the other hand, when the relief valve is controlled as above described, it opens promptly (the movement of the pilot valve from its left hand, through the intermediate, to its right hand position consuming only a fraction of a second) and immediately assumes a relatively stable position, moving back from port 20 a distance determined by the amount of water discharged into the suction side, the distance increasing as a second or third hose line is shut off. A pressure rise of as little as fifteen pounds is sufficient to render a hose line unmanageable if the pump is normally delivering at as high as 65 or 70 lbs. pressure and, due to the failure of relief valves heretofore to keep the pressure 20 variation within reasonable limits, it has been necessary, whenever the men were required to handle the hoses from ladders, roof ridges, or other precarious positions, to operate the pump at a pressure fifteen or more pounds below normal, so that even when increased by that amount, the pressure would not be excessive. But with the construction above described, the pressure rise which results from the closing of a hose line is so slight (about 7 lbs. with the pump discharging 640 gallons per minute at 80 lbs. pressure) that no such allowance need be made and maximum efficiency may be maintained at all times.

The churn valve is also subject to manual control and to this end a shaft 40, carrying a cam 41, is mounted transversely of the valve and intermediate its heads 16 and 17, the shaft passing between the cage bars 18 which are so spaced that the valve clears the shaft throughout normal, automatic movement of the former. One end of shaft 40 is extended, through a stuffing box 42 (Fig. 4) to the outside of the valve body and there carries a control handle 43 having a spring latch 44 engageable in one or another of the notches in quadrant 46, the handle normally occupying the position indicated in Figs. 2 and 4 and the cam 41 the position shown in Figs. 3 and 5. When the handle is swung to the left from the position shown in Fig. 2, shaft 40 is rotated and cam 41 moved to the left hand position indicated in dotted lines in Fig. 3, engaging the inner face of head 16 and moving back the churn valve to open port 20. When latch 44 is engaged in the notch marked "open" the churn valve is therefore locked in such position. When the handle is swung to the right from its Fig. 2 position, the cam is moved to the right hand dotted line position of Fig. 3 in which it engages an abutment 47 on the rear face of head 17, obstructing movement of the valve from its closed position, if it is then closed, or moving it to its closed position if it is open. When latch 44 is engaged in one of the notches marked "close" the churn valve is therefore locked in its closed position.

The arrangement of bore 30 and the several ports in the pilot valve housing 23 is such that they are readily guarded against stoppage by freezing by means of a jacket 48 which constitutes the entire outer end of the housing (Fig. 5) and substantially encloses the bore 30 (as indicated in dotted outline in Fig. 4) and is arranged in heat exchanging relation to the ports and also the spring chamber, the inlet and outlet pipes 49 and 50 serving to connect the jacket 75

in an engine exhaust or hot water circuit, whereby the entire housing can be readily heated.

I claim:

- 5 1. The combination with a rotary pump having a suction intake and a discharge outlet disposed one above the other in parallel relation, of a seat face intermediate them, adjacent outlets in said seat face, said outlets communicating respectively with said suction intake and discharge outlet, and a removable relief valve unit
10 adapted to be applied bodily to and to engage said seat face and controlling the flow from the discharge outlet to the intake by way of said adjacent outlets.
- 15 2. The combination with a pump having a horizontally disposed suction intake and a horizontally disposed discharge outlet for connection respectively to a source of water supply and hose lines, of a passage opening from said intake, a
20 passage opening from said discharge outlet, said passages terminating in adjacent outlets faced off to provide a seat, a relief valve unit having two chambers with outlets adapted to register with said adjacent outlets when the unit is applied to said seat, the latter, and the unit, being
25 located intermediate said horizontally disposed

intake and discharge outlet, and a relief valve in said unit controlling the water flow from one of said chambers to the other.

3. The combination with a pump having a horizontally disposed suction intake and a horizontally disposed discharge outlet for connection
5 respectively to a source of water supply and hose lines, the pump casing being cored to provide passages opening from said intake and outlet and terminating in adjacent outlets faced off to provide a seat on the casing intermediate the suction intake and discharge outlet of the pump, a relief valve housing having one of its faces adapted to engage said seat and its opposite face providing a seat for a pilot valve housing, said
10 relief valve housing having low and high pressure chambers communicating respectively with the said adjacent outlets from said passages, a relief valve in its said housing controlling the flow from the high to the low pressure chamber
15 and a pilot valve in said pilot valve housing adapted to respond to predetermined pressure in said high pressure chamber and controlling the movement of said relief valve.

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