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L. P. STOREY

RELIEF MECHANISM FOR PUMPS

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Fig. 1

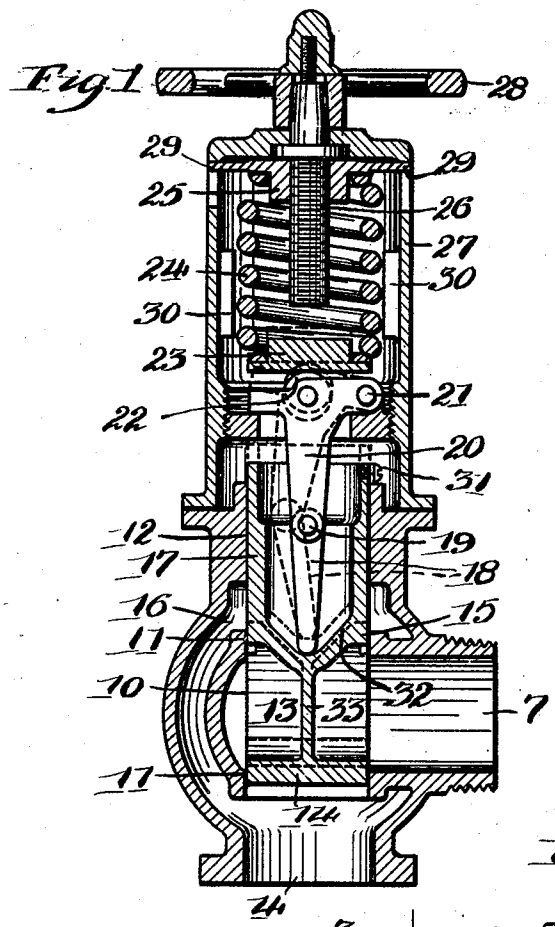


Fig. 2

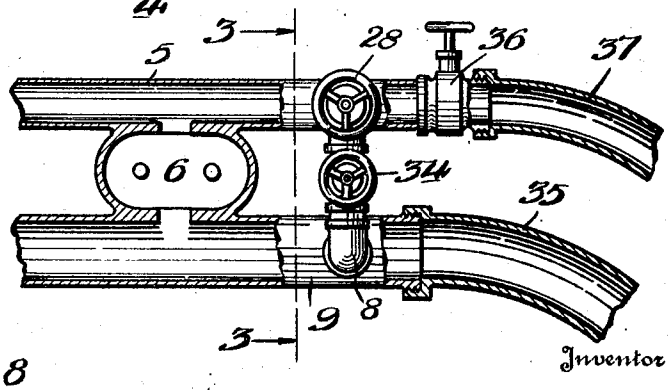
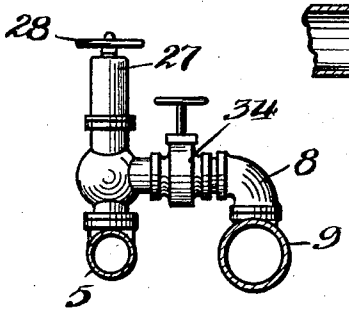


Fig. 3



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UNITED STATES PATENT OFFICE.

LEONIDAS P. STOREY, OF ST. PAUL, MINNESOTA, ASSIGNOR OF ONE-HALF TO WATEROUS FIRE ENGINE WORKS, A CORPORATION OF MINNESOTA.

RELIEF MECHANISM FOR PUMPS.

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This invention relates to relief mechanism adapted to operate automatically to by-pass fluid from the delivery to the intake conduit of a pump when the pressure in the delivery conduit is increased beyond a predetermined degree.

One important use of my invention is upon a high pressure pump of the type used in fire extinguishing apparatus. In such apparatus, a water control valve is commonly placed near the nozzle or delivery end of the hose, and is used to shut off the water at the will of the hose operator. The engine and pump are usually located at such a distance from the delivery nozzle that the pump cannot be shut off simultaneously with the nozzle control valve. Therefore, to avoid excessive pressure in the hose when the nozzle valve is closed, it is important to supply relief mechanism adapted to operate automatically by the increased pressure caused when the flow in the hose is stopped.

It is the object of this invention to provide novel and efficient mechanism for affording relief of this kind.

More particularly, it is my object to provide a spring actuated relief valve in which the normal tendency of the spring to permit deflection only in proportion to the load is compensated for in such a manner that the maximum deflection and valve opening is effected upon the application of a predetermined pressure.

A further object is to provide a relief valve which operates to by-pass fluid from the delivery to the intake conduit of a pump, independently of the pressure in the intake conduit.

This invention also includes certain other novel features of construction which will be more fully pointed out in the following specification and claims.

The invention will be best understood by reference to the accompanying drawings, in which Figure 1 is a central, vertical section through my improved valve; Fig. 2 is an end view of the valve, mounted upon a by-pass between the delivery and intake conduits of a pump, said pump being shown diagrammatically and Fig. 3 is a section taken on the line 3—3 of Fig. 2.

As shown in the drawings, my relief valve has an opening 4, adapted to be placed in communication with a delivery conduit 5 of a pump 6, shown diagrammatically in Fig. 2. Another opening 7 in the valve is adapted to communicate through a by-pass 8 with the intake or suction conduit 9 leading to the pump 6. Disposed opposite the opening 4, is a piston 10, having a close machine fit in bearings 11 and 12. An internal passageway 13 in the piston 10 is arranged to transmit fluid pressure applied through the opening 7 upon heads 14 and 15 formed in the piston. A passageway 16, communicating with the opening 14 is adapted to transmit fluid from said opening to an opening around the head 15 and into the chamber 13 in the piston when in open position. Thus, as will be readily understood, the piston 10 is in hydraulic balance, with the exception of the area of the head 14 exposed to the pressure in the delivery conduit 5.

Above the head 15 (as seen in Fig. 1), the piston 10 has a skirt 17, adapted to guide the same in the body of the valve, and forming a chamber to receive a toggle finger 18. The valve is adapted to be normally held in closed position by the toggle finger 18, the upper end of which is connected by a pin 19 with a crank 20. This crank 20 is pivoted at one side of the axis of the piston 10 upon a pin 21 and carries an anti-friction roller 22 in contact with a washer 23, adapted to be pressed downward by a coiled spring 24. The spring 24 bears at its upper end upon a member 25 having an axial bore threaded to receive a screw 26. This screw is freely revoluble in a suitable bearing in a bonnet 27 encasing the spring and is provided with a hand wheel 28, adapted to facilitate turning the screw to adjust the tension of the spring. To hold the member 25 against turning with the screw, fingers 29 are formed on the periphery of said member and engage suitable slots in opposite sides of the bonnet. A series of lugs 30 extend longitudinally in the bonnet 27 at suitable spaced intervals around its periphery to engage and center the spring 24 in said bonnet. The lower extremity of the finger 18 fits in the rounded apex of a conical recess 32 in the piston 10.

In use, the spring 24 normally operates to maintain the roller 22, pin 19 and toggle finger 18 in alignment, as shown in full lines in Fig. 1, and thereby retain the piston 10 in closed position. The pressure exerted by

the spring 24 is adjusted by means of the wheel 28 to permit opening of the valve when the pressure in the conduit 5 reaches a predetermined point. When this predetermined pressure is applied in the opening 4, the spring 24 will act like a dead weight by reason of my peculiar form of connecting link between the piston and spring. Thus, as the piston begins to move, it actuates the finger 18 to pivot the crank 20 upon the pin 21 so that the lower extremity of the crank 20 carries the pin 19 to one side of the axis of the piston 10. This shortens the link between piston and spring and increases the leverage exerted by the piston on the spring. The increased leverage is sufficient to offset the tendency of the spring to be deflected in proportion to the load, and the toggle finger 18 and crank 20 in moving to the dotted line position shown in Fig. 1 permit maximum opening of the valve. Fluid from the opening 4 is allowed to escape to the opening 7 around the periphery of the heads 14 and 15. Central webs 33 are formed in the piston to connect the head 14 to the head 15 and the valve is formed with an annular space connecting the several parts of the chamber 13. To limit downward or closing movement of the piston, a stop screw 31 is provided.

I also provide a manually operable valve 34 in the by-pass 8 to facilitate creating a vacuum in the intake conduit 9. This valve 34, when closed, insures against leakage of air back into the suction conduit. Thus, where water for fighting fires must be drawn from a lower level, such as a lake or other reservoir, a hose 35 is connected with the intake conduit 9, and the valve 34 is closed while the pump 6 is operated to replace the air in the intake conduit with water. Upon further operation of the pump, the valve 34 may be opened to bring the relief valve into operation. The pumps in common use also have a manually operable valve 36, located in the delivery conduit 5, adjacent to the outlet to which the hose 37 is connected. This valve 36 may be closed and the pump 6 operated until the water or other fluid is required in the hose 37. During the time the valve 36 is closed, the fluid is pumped from the intake conduit 9 into the delivery conduit 5 and the relief valve operates to allow flow of water through the by-pass 8, thus returning it to the intake side of the pump. As soon as the pressure is reduced, as by opening the valve 36, the spring 24 operates to close the relief valve and thus deliver the fluid to the hose 37.

As will now be readily understood, the operation of the piston 10 in the relief valve is independent of the pressure in the opening 7 leading to the intake conduit, and the piston operates to open the relief valve under a predetermined pressure in the delivery conduit, irrespective of whether there is a vacuum or a pressure in the intake opening 7. Further, the piston 10 opens the valve quickly as soon as the predetermined pressure has been reached, and the extent of opening of the valve is not proportional to the load applied to the piston. The extent of opening of the relief valve is dependent upon the volume of fluid to be passed and the piston may open slightly or to its fullest extent with practically no increase in pressure. This feature results in sensitive, quick operation. It will further be noted that the valve is self-contained, simple and durable, and, as there are no stuffing boxes, the friction of the parts is constant.

Having described my invention what I claim as new and desire to protect by Letters Patent is:

1. The combination in relief mechanism for a pump, of a fluid delivery conduit, a relief valve having inlet and outlet openings, said inlet opening communicating with the delivery conduit of said pump, a closure in said valve, a spring arranged to normally maintain said closure in closed position and adapted to permit opening of said valve when a predetermined pressure is applied in said delivery conduit, a lever and a toggle finger pivotally joined, end to end, and interposed between said spring and closure to transmit movement of said closure to said spring, and a laterally projecting portion of said lever having a pivotal support in the valve, said spring being arranged to normally maintain said finger in alignment with a portion of said lever and said lever and finger being arranged to be thrown out of alingment one with the other to thereby increase the leverage of said closure on said spring when said spring is deflected.

2. In a relief mechanism for a pump having a fluid delivery conduit, the combination with a relief valve having an intake opening communicating with said delivery conduit, a piston closure in said valve, a coiled spring arranged in axial alingnment with said piston and adapted to normally maintain the same in closed position and toggle members normally held in axial alignment with said spring and piston for transmitting movement of said piston to said spring whereby quick opening of the piston to maximum extent is permitted when a predetermined pressure is applied in said delivery conduit.

3. In a relief mechanism for a pump having fluid delivery and intake conduits, the combination with a relief valve having an intake opening communicating with said delivery conduit and an outlet opening communicating with said intake conduit, a piston closure in said valve, a coiled spring arranged in axial alignment with said piston and adapted to normally maintain the same in closed position, a chamber formed in said

piston in communication with said outlet opening and arranged to balance fluid pressure from said opening upon the piston, and toggle members normally held in axial alignment with said spring and piston for transmitting movement of said piston to said spring whereby quick opening of the piston to maximum extent is permitted when a predetermined pressure is applied in said delivery conduit.

In testimony whereof, I have hereunto signed my name to this specification.

LEONIDAS P. STOREY.