June 1, 1943. E. MARTIN 2,320,444

BOOSTER VALVE

Filed July 5, 1941 2 Sheets-Sheet 1

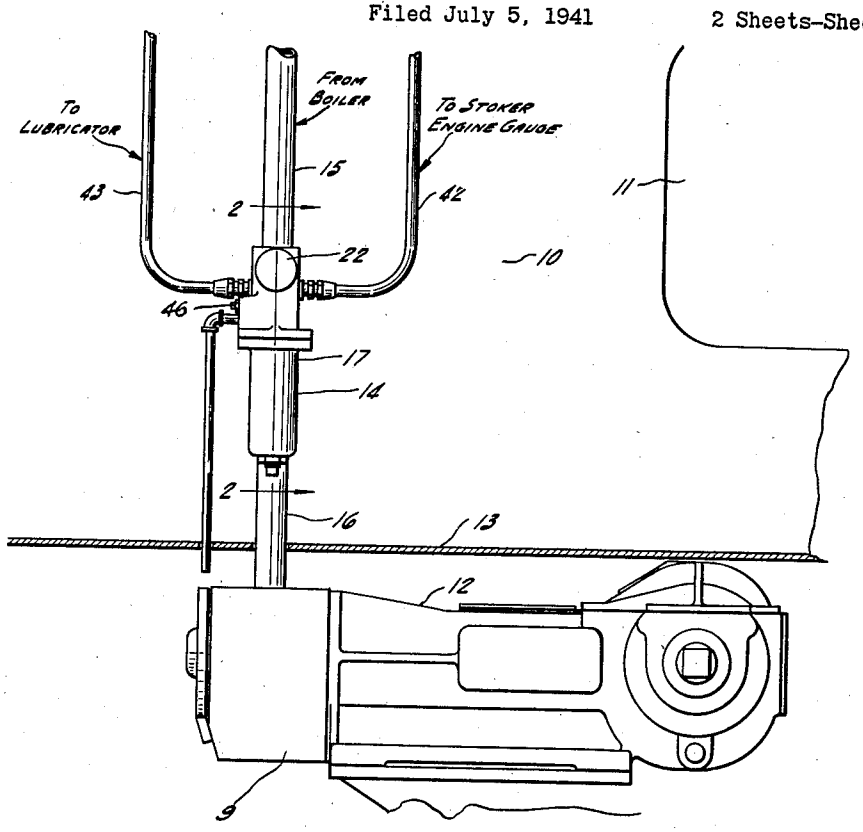


FIG. 1

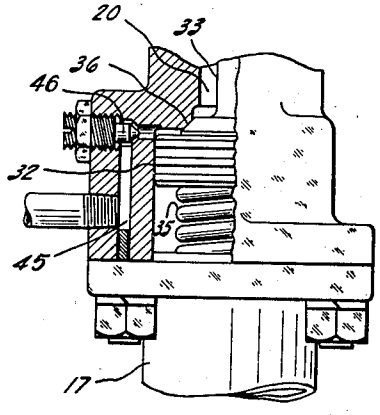


FIG. 4

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BOOSTER VALVE

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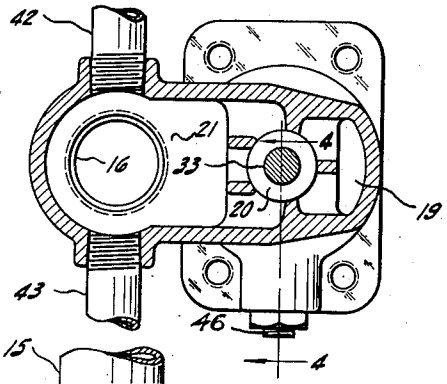


FIG. 3

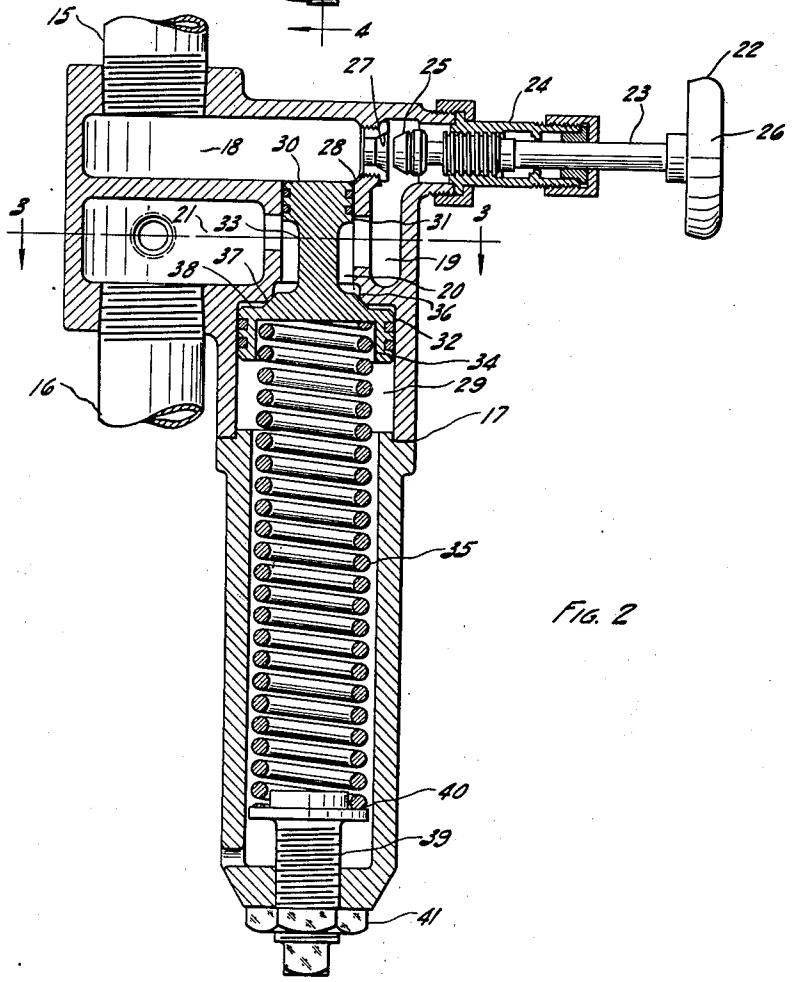


FIG. 2

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UNITED STATES PATENT OFFICE

2,320,444

BOOSTER VALVE

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Application July 5, 1941, Serial No. 401,152

6 Claims. (Cl. 121—143)

This invention relates to valves controlling the flow of pressure fluid to a pressure fluid operated engine that normally operates on pressures below that of the source of supply; and has for its primary object to provide an improved valve mechanism that will under certain conditions, as when the engine stalls due to an overload, automatically and sharply increase the fluid pressure to the engine, and automatically reduce to normal the fluid pressure to the engine when the overload on the engine has been relieved.

Another object is to provide a valve mechanism, of the type described, interposed in a pressure fluid line between a source of supply and a pressure fluid operated engine, which valve mechanism normally admits pressure fluid to the engine at a predetermined pressure below the pressure to the engine, during which time the upon stalling of the engine due to an overload, instantaneously and automatically function to admit fluid at the pressure of the source of supply to the engine when a predetermined back pressure has been built up in the line between the engine and the valve mechanism; and that will after a predetermined period of time automatically function to reduce to normal the fluid pressure to the engine during which time the overload on the engine would normally be relieved.

It is also a further general object of the invention to provide a valve mechanism as above described, that is positive and reliable in its action, consists of relatively few, simply constructed parts, and that can be manufactured at comparatively small cost.

With the above and other objects in view, the invention consists in the improved construction, combination and relative arrangement of the several parts as hereinafter more fully described, claimed and illustrated in the accompanying drawings, and wherein

Fig. 1 is a fragmentary vertical transverse sectional view through a locomotive looking toward the boiler backhead, with a stoker engine and the novel valve mechanism applied to the locomotive and shown in elevation;

Figure 2 is a sectional view of the novel valve mechanism taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 2; and

Figure 4 is a sectional view taken on the line 4—4 of Figure 3.

The invention is illustratel in the drawings and will be described as applied to the stoker engine of a locomotive, but it will be apparent that the novel valve mechanism is equally adaptable to engines for operating other devices and appliances.

Referring specifically to Figure 1, the locomotive boiler backhead is shown at 10, and it is provided with the conventional firing opening 11. A stoker engine 12, including a piston chamber 9 is suitably mounted on the locomotive beneath the cab deck 13. The stoker itself is not shown in the drawings and may be of any type well known in the art that employs conveying means for delivering coal from a tender or other source of supply to the locomotive firebox. The stoker engine 12 is of the multicylinder, double acting type and utilizes steam or other pressure fluid as an operating medium therefor.

Steam from the locomotive boiler, the backhead of which is shown at 10, is conducted to the novel valve mechanism 14 by means of an intake pipe 15 and thence to the engine 12 through pipe 16.

Referring now to Figures 2 and 4, inclusive, illustrating the detailed construction of the valve mechanism 14, it comprises an elongated body member 17 provided in its upper end with a chamber 18 to which chamber steam is supplied from the locomotive boiler through the intake pipe 15. While the stoker engine 12 normally operates on steam pressures considerably below boiler pressure, as an illustration the boiler pressure may be 250 pounds per square inch while the stoker engine may operate normally at 25 pounds per square inch, nevertheless for reasons to be brought out hereinafter, high pressure, preferably boiler pressure is maintained in chamber 18.

Pressure fluid passes from the chamber 18 into by-pass 19, thence through the bore or passage 20 into chamber 21, from which chamber 21 pressure fluid passes through pipe 16 to the stoker engine. The communication between the high pressure chamber 18 and the passage 19 is controlled by the throttle or control valve 22 which comprises a stem 23 threaded into a bonnet 24, the stem 23 having a valve member 25 at its inner end and the valve handle 26 at its outer end. A valve seat 27 is threaded into the internal wall 28 of the body member 17 between the chamber 18 and by-pass 19. Thus, when pressure fluid is present within the chamber 18, it will pass into the by-pass 19 and ultimately to the stoker engine at a pressure determined by the setting of the valve 22.

The bore or passage 20, which as stated above, provides communication between chamber 21 and by-pass 19, also opens at its upper end into chamber 18 and at its lower end into chamber 29. Mounted in the bore 20 is a reciprocating differential piston type valve 30. The valve 30 comprises the heads 31 and 32, the latter being larger than the former, connected by the stem 33. The outer face of the large piston head 32 is provided with a recess 34 in which is received the upper end of a thrust spring 35. During normal operation, the spring 35 holds the valve

30 in the position shown in Figure 2, the beveled surface 36 of the inner face of the large piston head 32 seating against the seat 37. In this position of the valve 30, pressure fluid passes from chamber 18 to the by-pass 19 at a pressure determined by the setting of the valve 22, thence through bore 20 around the valve stem 33 into the chamber 21 and then through pipe 16 to the stoker engine 12.

It will be observed that the bore 20 is enlarged at its lower end adjacent the seat 37 thereby causing the valve 30 to be unbalanced. In order to prevent the valve 30 from being moved downward during normal operation due to the fact that the area of the inner surface of the head 32 exposed to the fluid pressure in the bore is greater than the area of the inner surface of the head 31, the spring 35 is arranged to compensate for the weight of the valve 30 and the differential in pressure. The springs 35 thus overcomes the tendency for the valve 30 to open under normal operating conditions.

However, when the stoker engine 12 stalls, as may happen if the stoker conveyor becomes overloaded or choked, back pressures will build up in the pipe 16, the chamber 21 and the bore 20; the differential in pressure on the unbalanced valve 30 will increase and cause it to move downward. Downward movement of the valve 30 provides communication between the chamber 18 and 21 through the bore 20, admitting fluid at boiler pressure to the chamber 21 and to the stoker engine 12. This sudden charge of fluid at boiler pressure to the engine will in most cases cause resumed operation of the stoker conveyor. Downward movement of the valve 30 places the space between the heads 31 and 32 in communication with atmosphere through the passage 45 controlled by the needle valve 46, as shown in Figure 4. After a selected predetermined period of time, depending upon the setting of the needle valve 46, the spring 35 returns the valve 30 to the position shown in Figure 2. If the stoker engine has not resumed operation upon return of the valve 30 to the position shown in Figure 2, a pressure differential will again be set up between the valve heads 31 and 32 and the sequence of operations will be repeated.

Immediately upon initial downward movement of the valve 30, the beveled surface 36 moves away from the seat 37 permitting pressure fluid to act on the additional surface 38 of the inner surface of the head 32 causing the valve to open with a snap. In order to prevent the valve 30 from opening every time the engine 12 labors, short of stalling, the spring 35 is arranged to resist opening of valve 30 until a predetermined back pressure in the pipe 16, chamber 21 and bore 20 has been built up.

Assuming again, for purpose of illustration, that boiler pressure is 250 pounds per square inch and that the stoker engine 12 operates on 25 pounds per square inch. In the first place, the control valve 22 is adjusted to regulate the pressure fluid to the engine at 25 pounds per square inch. Since it is not desirable to have the booster valve 30 open every time the engine labors, it will be assumed for purpose of illustration, that it is desired to have the booster valve 30 open when a back pressure of 50 pounds per square inch is reached. For the booster valve 30 to operate under these conditions, the spring 35 must be arranged to balance the fluid pressure of 250 pounds per square inch in chamber 18, plus the weight of the valve 30, plus 50 pounds × the difference in square inches between the areas of the adjacent surfaces of the heads 31 and 32 exposed to the fluid pressure when in the position shown in Figure 2.

It will be apparent then, that by providing a spring of proper strength or by providing means for adjusting the compresison of the spring 35, the valve mechanism can be arranged to operate with different boiler pressures and at different back pressures. In the drawings means is shown for regulating the compression of spring 35, including an adjusting screw 39 threaded into the bottom of the body member 17 and having on its inner side a seat 40 arranged to receive the lower end of the spring 35 and on its outer side a lock nut 41. By turning the adjusting screw 39, the seat 40 can be raised or lowered to alter the compressive strength of the spring 35.

Communicating with the chamber 21 is a small lead 42 which conducts pressure fluid from the chamber to a guage (not shown), which indicates the engine operating pressure. Another small lead 43 provides communication between a suitable mechanical lubricator (not shown) and the chamber 21 for the purpose of supplying a small quantity of oil at regular intervals for lubricating the cylinder walls of the steam engine 12.

I claim:

1. A pressure fluid regulating device for a pressure fluid operated engine comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply and an outlet chamber from which pressure fluid is arranged to be delivered to said engine, a double headed unbalanced piston valve mounted for reciprocation in said body member to selectively close and open communication between said chambers, said piston valve being subjected on one side to fluid pressure in said inlet chamber urging said piston valve to its open position, resilient means reacting on the other side of said piston valve urging said piston valve to its closed position, a by-pass formed in said body member providing for passage of pressure fluid from said inlet chamber to said outlet chamber between the ends of said unbalanced piston valve and a control valve in said by-pass, said resilient means being arranged to permit movement of said unbalanced piston valve to its open position when a predetermined pressure above the pressure of the fluid admitted by the control valve is reached between the ends of said unbalanced piston valve.

2. In a pressure fluid regulating device for a pressure fluid operated engine, the combination comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply, an outlet chamber in said body member from which pressure fluid is arranged to be delivered to said engine, a passage formed in said body member establishing direct communication between said chambers, a by-pass formed in said body member connecting said inlet chamber with said passage, a double headed unbalanced piston valve slidably mounted in said passage, resilient means arranged to normally maintain said piston valve in a position closing said passage and providing communication from said by-pass to said outlet chamber between the ends of said unbalanced

piston valve, and a control valve in said by-pass for delivering pressure fluid to said outlet chamber at a predetermined pressure below the pressure in said inlet chamber, said resilient means being arranged to yield at a predetermined pressure above the pressure of the fluid normally passing between the ends of said unbalanced piston valve to permit movement of said unbalanced piston valve to open the passage between said chambers.

3. In a pressure fluid regulating device for a pressure fluid operated engine, the combination comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply, an outlet chamber in said body member from which pressure fluid is arranged to be delivered to said engine, a passage formed in said body member establishing communication between said chambers, a double headed unbalanced piston valve slidably mounted in said passage, a by-pass formed in said body member providing communication between said inlet chamber and said passage, a control valve in said by-pass for delivering pressure fluid to said passage at a predetermined pressure below the pressure in said inlet chamber, resilient means reacting on said piston valve for normally maintaining said valve in position closing the passage between said chambers and for effecting communication between said outlet chamber and said by-pass through said passage between the heads of said unbalanced piston valve, and means for adjusting said resilient means to provide for movement of said unbalanced piston valve to open said passage providing direct communication between said chambers when a selected predetermined pressure above the pressure admitted by the control valve is reached.

4. In a pressure fluid regulating device for a pressure fluid operated engine, the combination comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply, an outlet chamber in said body member from which pressure fluid is arranged to be delivered to said engine, a passage formed in said body member establishing communication between said chambers for the delivery of pressure fluid to said outlet chamber at the pressure in said inlet chamber, a double headed piston valve slidably mounted in said passage normally in position to interrupt communication between said chambers, a valve controlled by-pass formed in said body member for admitting pressure fluid to said outlet chamber from said inlet chamber through the ends of said piston valve when the said piston valve is in said normal position, the inner ends of said piston valve being formed to unbalance said valve and cause the piston valve to be urged from said normal position by the pressure fluid passing through the ends of said piston valve, resilient means arranged to hold said piston valve in normal position against the pressure in said inlet chamber on the outer end of said piston valve and the differential pressure between the inner ends of said piston valve, said resilient means being arranged to yield and permit movement of said piston valve from its normal position to a position opening the passage between said chambers when a predetermined differential pressure above the normal exists between the inner ends of said piston valve.

5. A pressure fluid regulating device for a pressure fluid operated engine comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply and an outlet chamber from which pressure fluid is arranged to be delivered to said engine, a double headed unbalanced piston valve mounted for reciprocation in said body member to selectively close and open communication between said chambers, said piston valve being subjected on one side to fluid pressure in said inlet chamber urging said piston valve to its open position, resilient means reacting on the other side of said piston valve urging said piston valve to its closed position, a by-pass formed in said body member providing for passage of pressure fluid from said inlet chamber to said outlet chamber between the ends of said unbalanced piston valve, a control valve in said by-pass, said resilient means being arranged to permit movement of said unbalanced piston valve to its open position when a predetermined pressure above the pressure of the fluid admitted by the control valve is reached between the ends of said unbalanced piston valve and slow release means for releasing the pressure fluid between the inner ends of said unbalanced piston valve providing for return of said piston valve to its closed position by said resilient means.

6. In a pressure fluid regulating device for a pressure fluid operated engine, the combination comprising a body member having therein an inlet chamber for receiving pressure fluid from a source of supply, an outlet chamber in said body member from which pressure fluid is arranged to be delivered to said engine, a passage formed in said body member establishing communication between said chambers for the delivery of pressure fluid to said outlet chamber at the pressure in said inlet chamber, a double headed piston valve slidably mounted in said passage normally in position to interrupt communication between said chambers, a valve controlled by-pass formed in said body member for admitting pressure fluid to said outlet chamber from said inlet chamber through the ends of said piston valve when the said piston valve is in said normal position, the inner ends of said piston valve being formed to unbalance said valve and cause the piston valve to be urged from said normal position by the pressure fluid passing through the ends of said piston valve, resilient means arranged to hold said piston valve in normal position against the pressure in said inlet chamber on the outer end of said piston valve and the differential pressure between the inner ends of said piston valve, said resilient means being arranged to yield and permit movement of said piston valve from its normal position to a position opening the passage between said chambers when a predetermined differential pressure above the normal exists between the inner ends of said piston valve and slow release means for releasing the pressure fluid between the inner ends of said unbalanced piston valve providing for return of said piston valve to its normal position by said resilient means.

EUGENE MARTIN.

CERTIFICATE OF CORRECTION.

Patent No. 2,320,444. June 1, 1943.

EUGENE MARTIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 18, strike out "to the engine, during which time the " and insert instead --of the source of supply; and that will,--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of August, A. D. 1943.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.