

Dec. 6, 1966

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3,289,690

CONTROL VALVE

Filed Feb. 12, 1963

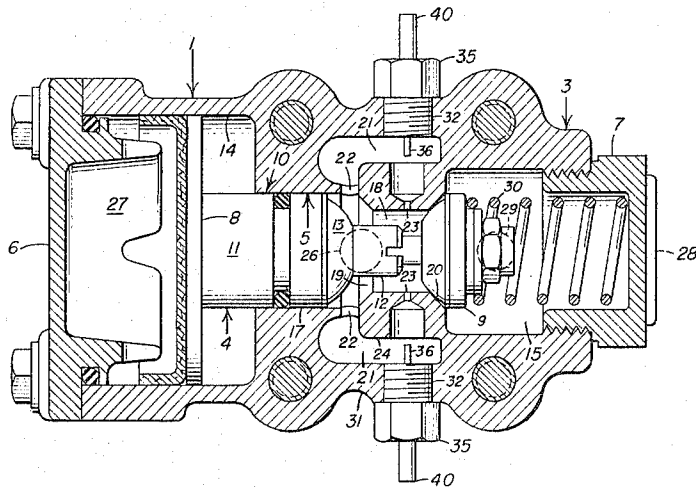


FIG. 2

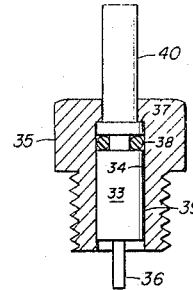


FIG. 3

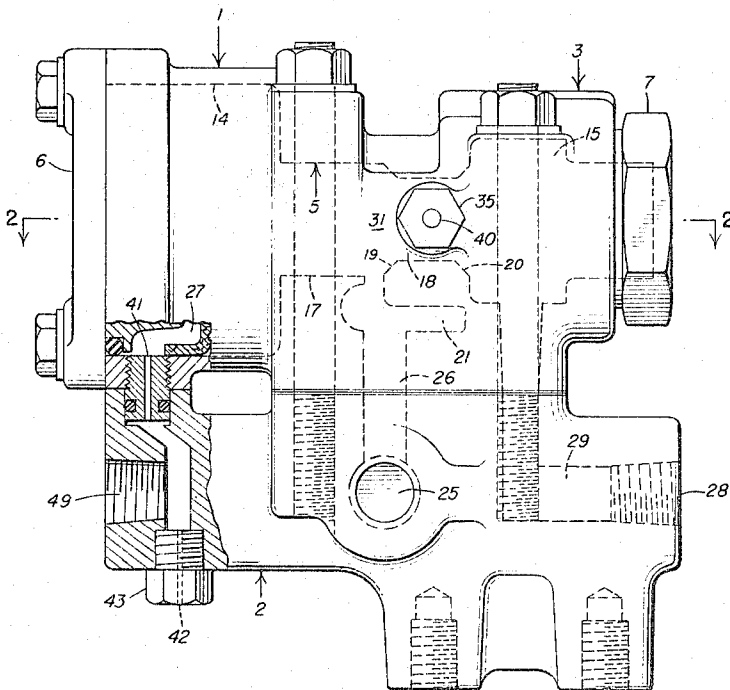


FIG. 4

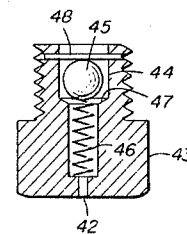


FIG. 5

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3,289,690 CONTROL VALVE

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Filed Feb. 12, 1963, Ser. No. 258,050
4 Claims. (Cl. 137-244)

This invention relates to control valves and has for its primary object the provision of an improved control valve wherein any accumulation of dirt or other foreign matter, which otherwise might interfere with operation of the valve, is readily removed.

Another object of the invention is to provide a control valve which not only is readily cleanable of foreign matter but makes use of applied air for restoring it to operating condition after cleaning.

An additional object of the invention is to provide a sander control valve having sanding and cleanout orifices for sequentially supplying to a sand trap an initial cleanout blast, sanding air and a final cleanout blast, wherein a sanding orifice is cleanable without use of any tools or other extraneous means and without removing any part of the valve.

A further object of the invention is to provide a control valve wherein the cavity into which the actuating air is introduced is automatically drained without interference with the normal operation of the valve.

Other objects and advantages of the invention will appear hereinafter in the detailed description, be particularly pointed out in the appended claims and be illustrated in the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a preferred embodiment of the control valve of the present invention with portions broken away and shown in section to more clearly illustrate certain of the details of construction;

FIGURE 2 is a horizontal sectional view taken along lines 2-2 of FIGURE 1;

FIGURE 3 is a cross-sectional view on an enlarged scale, showing the details of a plug mounting a plunger; and

FIGURE 4 is a cross-sectional view on the scale of FIGURE 3 of a plug containing a drain for the actuating air cavity.

Referring now in detail to the drawings in which like reference characters designate like parts, the control valve of the present invention is basically a valve having spaced ports the flow of fluid between which is controlled by a piston actuated or moved in at least one direction by fluid pressure with the latter in moving the piston dead ended or confined within the valve. In the preferred embodiment, illustrated as exemplary of the invention, the valve is designed particularly for use in a locomotive sanding system for controlling the operation of one or, preferably, a pair or plurality of sand traps, in which it supplies to each trap air at sanding pressure, preceded and followed by relatively high pressure, short duration blasts of cleanout air.

The preferred control valve is comprised of a body or casing 1 conveniently formed in two parts, one a mounting bracket 2 permanently mountable on a locomotive (not shown) and containing the various ports to which pipe connections to the valve are made, and the other a main part or housing 3, housing or containing as its fluid flow controlling piston a differential piston 4. The differential piston 4 slides or reciprocates in a generally cylindrical bore 5 in and extending through the housing 3 and normally closed at one end by a removable cap 6 and at the other by a removable plug 7.

The differential piston 4 has large and small heads 8

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and 9, respectively, connected and axially spaced by a stem 10 having a part or enlargement 11 adjoining the large head and a neck or relatively restricted part 12 adjoining the small head. The preferred piston 4 also has a third or intermediate head 13 between and spaced from the other heads and formed on the end of the large part 11 of the stem 10 contiguous or adjacent to the small head 9.

The several parts of the piston 4 are mounted or received in parts of different diameter or cross-section of the bore 5. The large head 8 slides in a cylinder 14 of corresponding diameter formed in the bore adjacent the cap 6; the small head 9 moves freely in a cavity or recess 15 of somewhat larger diameter which forms part of the bore adjacent the plug 7; and the large part 11 of the stem 10 slides in an intermediate part or bore 17 of substantially the same cross-section forming part of the bore 5 between the cylinder 14 and the cavity. The intermediate or middle and small heads, 13 and 9, face toward each other and are separated by a passage 18 of reduced cross-section formed in the bore 5 between the intermediate bore 17 and the cavity 15 and having at opposite ends oppositely facing valve seats 19 and 20 in which these heads are alternately seatable.

The housing 3 has formed in it, outwardly of the bore 5, a pair or plurality of outlet chambers or cavities 21 which are spaced radially from the bore and extend therealong beyond either side of the inner or intermediate seat 19. Each of the chambers 21 is connected to or communicates with the bore through a cleanout orifice or opening 22 opening onto the intermediate bore 17 on the cylinder side of the intermediate seat and also through a relatively restricted sanding orifice or opening 23 piercing or drilled through the intervening side wall 24 of the passage 18 between the seats 19 and 20. Each chamber is at all times connected to or communicates with one of a pair of outlet ports 25 formed in the mounting bracket 2 through an outlet way or passage 26. Thus, for each sand trap (not shown) it is designed to control, the control valve preferably will have an outlet chamber 21, outlet passage 26 and outlet port 25 and that cavity and its outlet passage and port will be separate from any other outlet cavity, passage and port formed in the body 1.

In the housing 3 between the large head 8 of the piston 4 and the cap 6 is a cavity 27 into which actuating air is introducible under control of an automatically or manually operated operating valve (not shown) conveniently located on the locomotive. Air for operating the one or more sand traps controlled by the control valve, on the contrary, is always available in the operating air inlet cavity 15 mounting the small head 9 to which it is introduced through a corresponding inlet port 28 in the mounting bracket 2 and way or passage 29 in the body 1. However, even though always available in the inlet cavity 15, operating air normally is prevented or blocked from entering the passage 18 in the bore 5 between the seats 19 and 20 by the seating of the small head in the related, confronting or outer seat 20 under force of a return spring 30 acting between the small head and the plug 7 closing the adjoining end of the bore. Thus, in normal or non-operating condition, the control valve, although itself open to operating air under reservoir pressure, will shut or cut off the one or more sand traps to which it is connected from that air. On application of actuating air to the large head 8 this normal condition changes, the resultant force on the piston 4 overcoming the force of the return spring 30 and moving the small head 9 away from its seat 20.

On the initial unseating of the small head 9, the operating air is free to pass to each outlet chamber 21 through

both the cleanout and sanding orifices 22 and 23 connecting it to the bore 5, but as the piston continues to move under the force of the actuating air, the intermediate head 13 will reach or contact and seat in its seat 19 and not only arrest the movement of the piston but block or shut off the one or more cleanout orifices 22 from the operating air. At that time the operating air can pass to an outlet chamber 21 only through the latter's sanding orifice 23 and it is during this interval that the actual sanding operation is performed. Then, when the sanding operation is discontinued by shutting off the actuating air, the return spring 30 takes over and returns the piston 4 to normal position, in process momentarily reopening each cleanout orifice to the operating air for applying the final cleanout blast to the associated sand trap.

While similar in its operation to a conventional sander control valve, such as shown in my Patent No. 2,589,794 issued on March 18, 1952, the construction of the control valve of the present invention particularly lends itself to cleaning, an operation that must be performed periodically to free or clear the sanding orifices of accumulations of dirt or other foreign matter and drain water from the heretofore blind actuating air cavity. Conveniently formed as a radial drilling in the side wall 24 separating the passage 18 in the bore 5 from each outlet chamber 21, for which purpose the housing 3 has in its outer wall 31 in alignment with the orifice, an aperture 32 through which a drill can be inserted, each sanding orifice 23 is made cleanable by a plunger 33 slidably mounted in and extending through a central bore or aperture 34 in a plug 35 normally closing the access aperture and having on its inner end a pin or tip 36 of substantially the diameter of the orifice. Retractable, except for its tip 36, into its plug 35 against an annular abutment, shoulder or stop 37 on the plug intermediate the ends of the bore 34 therein and with an O-ring or like gasket 38 sealing circumferentially between it and the plug 35, each plunger in retracted position will effectively seal against leakage of operating air from the outlet chamber through the plug. While its main or body part 39 is contained within the plug by the annular abutment 37, each plunger 33 has a handle 40 of lesser or reduced diameter which extends through the abutment and projects outwardly beyond the plug, such that an operator by pushing against the handle can push the pin 36 at the inner end of the plunger into and clear the adjoining sanding orifice 23. A suitable spring or other resilient means might be employed to return each plunger to retracted position at the end of the cleaning operation, but this is not necessary since the plunger is projected into the sanding orifice 23 counter the direction of air flow therethrough and on subsequent operation of the valve, has its inner end exposed to the initial blast of air entering the passage or bore part 18 from the inlet cavity 15 through the lower valve seat 20. This air by acting on the inner end of the plunger will apply automatically the force required to return the plunger to retracted position. With the plunger so retractable, any chance of its interference with a sanding operation by blocking the related sanding orifice is eliminated and the responsibility of maintenance personnel is correspondingly reduced.

Another possible source of difficulty in a conventional control valve, such as shown in Patent No. 2,589,794, is the water or other liquid or foreign matter dumped or released by the actuating air as the latter expands on entry into the valve body. Since, as opposed to an outlet chamber 21, the air does not sweep through the actuating air cavity 27 but is dead-ended or confined therein during movement of the piston in response to it, both entering and exhausting from the latter through the same port or orifice 41 alternately serving as an inlet and an outlet, the air itself in exhausting cannot remove the matter it previously has dumped. Consequently, if, as in the

conventional control valve, the actuating air cavity 27 were blind, any matter dumped by the actuating air would remain and accumulate in the cavity and could be removed only by removing the cap 6. This happenstance is avoided in the valve of this invention by providing the actuating air cavity 27 with a drain or bleed port 42 so constructed and located as to drain or bleed any matter deposited in the cavity without interfering with the action of the air in actuating the piston 4 in the operation of the valve.

In the preferred construction, the actuating air cavity is given a definite bottom or low point, conveniently by mounting the valve such that the body 2 is horizontally rather than vertically disposed and connecting the bleed port to this bottom either directly or through the mounting bracket 2, depending on whether the housing 3 is mounted beside or, as illustrated, on top of the bracket. To facilitate maintenance, both the drain port 42 and the means for closing that port during the operation of the valve are contained in a plug 43. Preferably disposed axially and in the outer end portion of the plug 43, the drain port or orifice 42 is located outwardly of and connects to the interior of the cavity 27 through an axially aligned recess 44 in the plug. In this recess 44 is contained a spring-pressed ball or like valve element 45 normally held by a spring or like yieldable means 46 in open position away from a seat 47 in the recess leading to the drain port and against a retainer pin 48 driven or extending radially or transversely across the recess inwardly of the ball. While sufficing normally to hold the drain port 42 open, the spring 46 is made of insufficient strength to resist seating of the ball 45 by the pressure on the latter of the actuating air. The spring-pressed ball 45 thus is a one-way or check valve, which, in the normal position assumed when the control valve is not being operated, is open, but closes under the force of the actuating air as the latter is applied to the valve.

The drain port 42 may have its own passage through the bracket 2 connecting to the bottom of the cavity 27 with the pressure for closing it during operation of the valve derived from the interior of the cavity. However, it is preferred to connect the drain port 42 to the bottom of the cavity 27 through the actuating air orifice 41 so that the actuating air and water or other matter deposited by the air in the cavity will both pass through the orifice. This is accomplished by positioning the actuating air orifice 41 to open onto the bottom of the cavity, as by forming the orifice as an axial bore in a vertically directed plug 47 threaded into the bottom of the housing 3 and extending into the mounting bracket 2. With the orifice 41 so positioned, there is provided in the mounting bracket below the plug 43 a downwardly extending passage or sump 48 open at its upper end to the orifice and connecting thereto both the drain port 42 and the aperture 49 in the mounting bracket through which the actuating air passes. The drain port 42 is connected to the bottom or lower end of the passage 48 by threading the drain plug 43 into the bottom of the mounting bracket 2 and the actuating air aperture 49 is formed in the end of the bracket and connected to a side of the passage intermediate the latter's ends. With this arrangement, any matter deposited in the cavity during a given operation of the control valve will either flow by gravity through the orifice 41 to the bottom of the passage 48 while the actuating air is being applied or, if too viscous, be sucked or drawn into the passage by the actuating air as the air is bled from the cavity at the completion of a valve operation. In turn, the matter accumulated in the bottom of the passage 48 at the completion of a given operation will drain by gravity through the drain port 42 on opening of the drain valve 45 and any that remains will be ejected through the port at the start of a succeeding operation by the full line pressure applied to the passage in the instant before the drain valve 45 is closed by that pressure.

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From the above detailed description, it will be apparent that there has been provided an improved control valve, which while effective in operation, is practically trouble-free in maintenance. It should be understood that the described and disclosed embodiment is merely exemplary of the invention and that all modifications are intended to be included that do not depart from the spirit of the invention or the scope of the appended claims.

Having described my invention, I claim:

1. In a control valve having a body, an outlet chamber in said body, an air-actuated piston reciprocable in a bore in said body for controlling passage of air from a part of said bore to said outlet chamber and a cavity in said body for receiving air for actuating said piston, the combination of a passage in said body for passing said actuating air to and from said cavity, an orifice in said body between said bore part and outlet chamber, a plunger shiftably mounted in said body in alignment with said orifice, said plunger having a part projectable into said orifice counter the direction of air flow therethrough for cleaning foreign matter therefrom, a drain port in said body and connected to and cooperating with said passage for draining said cavity, and a normally open check valve for closing said port without interfering with flow of air through said passage, said plunger and check valve on actuation of said control valve being exposed and automatically responsive to air applied respectively to said bore part and to said cavity for retracting said part from said orifice and closing said port.

2. In a sander control valve having a body, a bore in said body, an outlet chamber in said body, a cleanout orifice connecting said bore to said chamber, a piston reciprocable in said bore for controlling passage of air from a part of said bore to said outlet chamber, and a cavity in said body for receiving air for actuating said piston, the combination of a passage in said body for passing said actuating air into and out of said cavity, a restricted sanding orifice in said body connecting said bore part to said outlet chamber, a plunger slidably mounted in and projecting outwardly from said body and shiftable therein in alignment with said restricted orifice, said plunger being projectable into said restricted orifice opposite the direction of air flow therethrough for cleaning foreign matter therefrom, a drain port in said body and connected to and cooperating with said passage for draining said cavity, and a normally open check valve for closing said port without interfering with flow of air through

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said passage, said plunger and check valve on actuation of said control valve being exposed and automatically responsive to air respectively in said bore part and in said cavity for retracting said plunger from said orifice and closing said port.

3. In a control valve having a body, a bore in said body, an outlet port in said body and an orifice in said body communicating a part of said bore with said outlet port, the improvement comprising a plunger mounted on and projecting outwardly from said body and slidable therein in alignment with said orifice, said plunger being projectable into said orifice counter the direction of air flow therethrough for cleaning foreign matter therefrom, said plunger on actuation of said valve being automatically responsive to air introduced into said bore part for retracting from said orifice.

4. In a control valve having a body, a bore in said body, an outlet port in said body and an orifice in said body communicating a part of said bore with said outlet port, the combination of an aperture in and opening outwardly of said body and aligned with said orifice, a plug normally closing said aperture, a plunger extending through said plug and slidable therein in alignment with said orifice, means in said plug for limiting outward relative movement of said plunger, sealing means between said plunger and plug, and a tip on an inner end portion of said plunger and on inward movement thereof projecting into said orifice counter the direction of air flow therethrough for cleaning foreign matter therefrom, said plunger in cleaning position automatically being exposed to air applied to said bore part on actuation of said valve and moving outwardly in response thereto to retract said tip from said orifice.

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