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[56]

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[54] **AIR START VALVE**
6 Claims, 3 Drawing Figs.

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[51] Int. Cl. F16k 1/54
[50] Field of Search 137/630.15,
630.19

ABSTRACT: A fluid-actuated air valve adapted to apply operating air in two pressure stages to an air motor by a pair of normally closed operating heads mounted on a common stem and automatically opening in sequence in response to fluid pressure applied to a common actuated head.

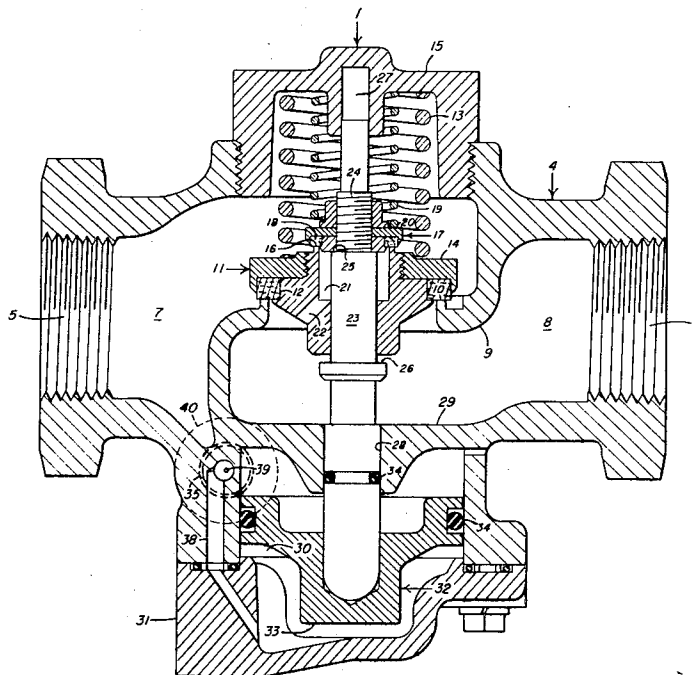


FIG. 2

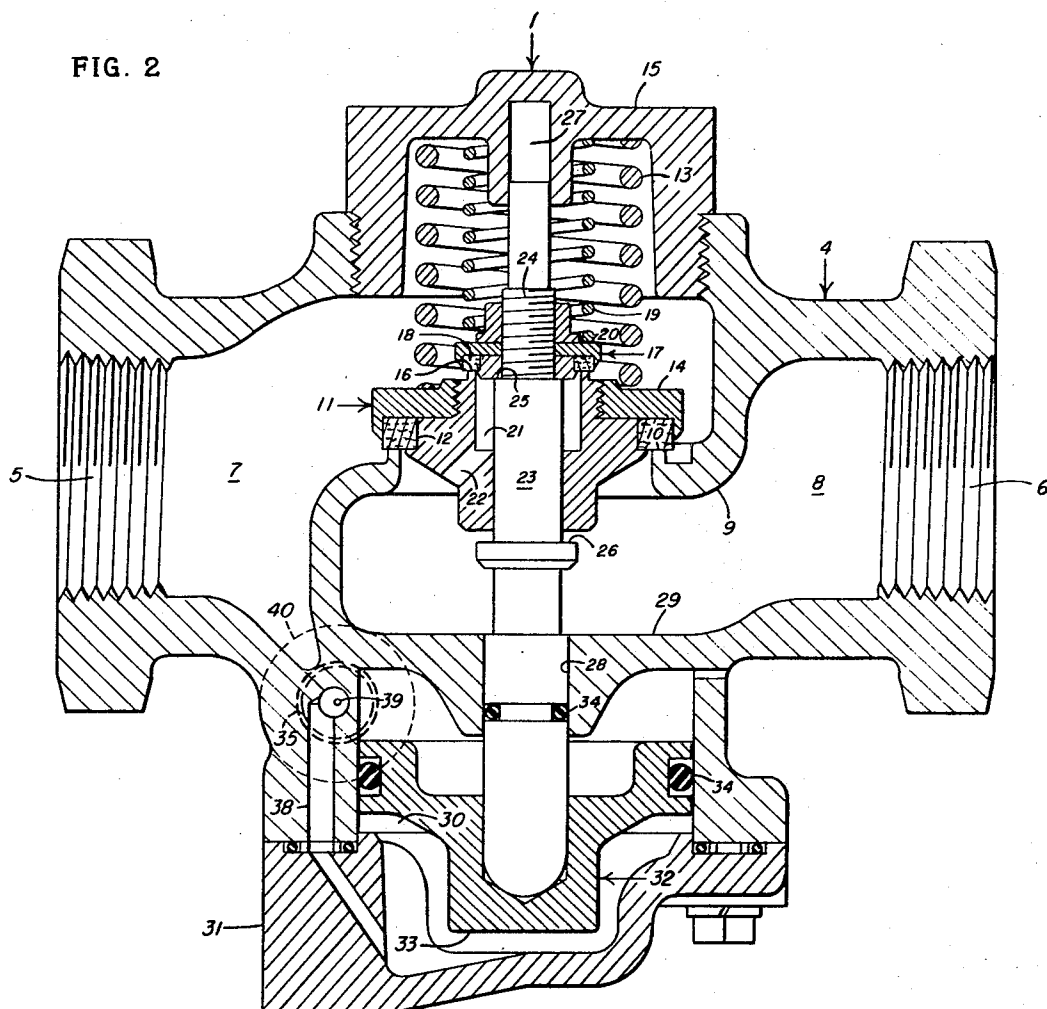


FIG. 1

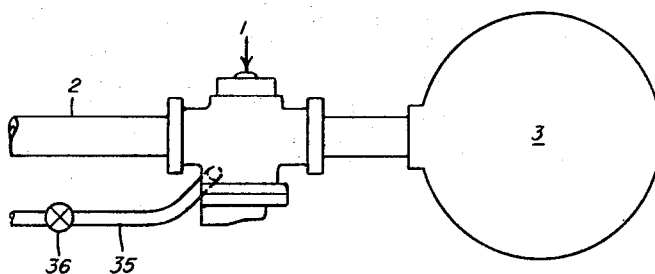
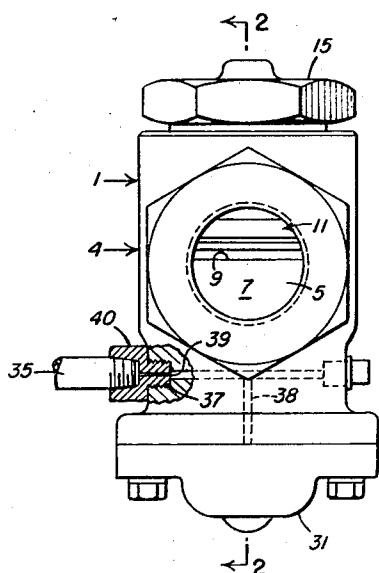


FIG. 3

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AIR START VALVE

BACKGROUND OF THE INVENTION

An air motor, such as used for starting a diesel engine of a diesel locomotive, ordinarily has on its rotor, vanes that collapse when the motor is stopped and must be projected before the motor can develop sufficient torque to crank and start the engine. Both the initial projection of the vanes and the subsequent turning of the rotor at full torque are produced by operating air applied to the motor. However, if, as in the usual installation, the operating air is applied through a pilot-controlled operating valve capable of delivering operating air only at full pressure and volume, breakage of the vanes or other damage to the air motor can readily result. Recognizing this, it has heretofore been proposed to deliver air to the motor through separate, individually valved lines, one a low pressure pilot line of the initial delivery and the other a main supply line equipped with a delayed action valve responsive in opening to pressure from the pilot line. The present invention affords a more practical solution for the same problem.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide an improved fluid-actuated valve for the operating air supply line of an air motor, which upon actuation will automatically supply through the line a first stage of low pressure starting air and second stage of operating air at full pressure and volume.

Another object of the invention is to provide an improved operating valve of the character described, wherein the two pressure stages are produced by a single valve assembly having low and high-pressure operating heads mounted on a common stem and automatically unseated in sequence by actuating pressure applied to a common actuating head.

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 DESCRIPTION

FIG. 1 is an end elevational view of a preferred embodiment of the improved operating valve of the present invention;

FIG. 2 is a vertical sectional view on an enlarged scale taken along line 2—2 of FIG. 1; and

FIG. 3 is a somewhat schematic plan view combining the operating valve of FIG. 1 with an air start motor and a control valve.

DETAILED DESCRIPTION

Referring now in detail to the drawings in which like reference characters designate like parts, the improved two-stage operating valve of the first invention, designated as 1, is designed for connection in an operating air supply line 2 of an air start motor 3, such as used for starting a diesel engine (not shown) of a diesel locomotive (also not shown).

Of the poppet type, the improved operating valve 1 preferably is a straight-way valve comprised of a body or casing 4 having at opposite ends for connection in the operating air supply line 2 inlet and outlet ports 5 and 6 opening inwardly onto inlet and outlet passages or passageways 7 and 8, respectively, the latter separated by a central web or wall 9 in and integral with the body and communicable or connectable through a centrally apertured main or primary valve seat 10 formed in a horizontal intermediate portion of the web and opening or facing upwardly into the inlet passage. The main or primary valve seat 10 is closeable from above by a disk-type main valve, valve element or operating head 11 mounting or carrying an annular sealing gasket 12 for sealing engagement with the seat and normally held closed or in seat-closing position by a main coil return spring 13 yieldably acting downwardly against the valve's upper face 14 and conveniently received or seated in and reacting upwardly against a spring cap 15 threaded into the top of the body 4.

Concentric with but smaller than the main valve seat 10 and formed in the upper face 14 of the main valve 11, is a secondary or auxiliary valve seat 16. Also facing or opening inwardly into the inlet passage 7, the secondary seat 16 is closeable by a disk-type secondary or auxiliary valve, valve element or operating head 17 carrying or mounting an annular sealing gasket 18 sealingly engageable with the seat and this valve is yieldably urged into and normally held in seated or seat-closing position by a secondary or auxiliary coil return spring 19 within or inside and concentric with but weaker than the main spring 13. The secondary spring 19 is also received or seated in the spring cap 15 and acts therebetween and an upper or outwardly facing face or surface 20 on the secondary valve 17. Communication or connection of the inlet and outlet passages 7 and 8 through the secondary seat 16 is restricted relative to that through the main seat 10, this restricted or metered communication suitably being provided by an annular axial recess 21 in the main valve 11 which opens upwardly through the secondary seat onto the inlet passage and at its bottom within the main valve is in open connection or communication with the outlet passage 8 through an obliquely disposed, restricted passage or orifice 22 extending therebetween through the intervening portion of the main valve.

The main and secondary valves 11 and 17 are both mounted on the same or a common valve stem or spindle 23 concentric or coaxial therewith and with the main seat 10, the main valve slidably for limited axial sliding, shifting or lost motion and the secondary valve threadedly for threading or screwing downwardly on a reduced threaded intermediate portion 24 of the stem against an upwardly facing shoulder 25 at the bottom of that portion. Limited in upward movement on the stem 23 relative to the secondary valve 17 by that valve, the main valve 11 is limited in downward movement relative thereto by an upwardly facing outstanding annular shoulder, abutment or stop 26 integral or rigid with the stem and normally spaced below the main valve.

Guidingly or slideably received at its upper end in a central socket 27 in the spring cap 15, the common valve stem 23, below the lower shoulder or stop 26, is guidingly or slidably received in and extends through a guide aperture or opening 28 through the bottom wall 29 of both the outlet passage 8 and the body 4 into a pressure chamber 30. Concentric with the stem 23 and extending downwardly below the bottom wall 29, the pressure chamber 30 is closed at the bottom by a cover or cap 31 bolted or otherwise releasably attached to and in operation forming part of the body 4.

Contained or riding and reciprocable or shiftable vertically in the pressure chamber 30 and fixed, as by swedging, to the lower end of the valve stem 23, is an actuating head 32 having an underface or bottom surface 33 of greater cross-sectional area than the surfaces presented by the main and secondary operating valves 11 and 17 to the inlet passage 7. O-rings or like suitable sealing gaskets 34 on the actuating head 32 and the stem 23, effectively seal against leakage therepast in the pressure chamber 30 and the guide aperture 28, respectively.

Designed for fluid actuation, the single valve assembly comprised of the operating heads 11 and 17, actuating head 32 and common stem 23, is so actuated by fluid pressure introduced into the pressure chamber 30 below the actuating head, while eliminating any back pressure by venting the pressure chamber to atmosphere above the head. Supplied separately from the valve body 4 through an actuating air supply line 35 under control of a manually or otherwise suitably actuated control or pilot valve 36, the actuating air, for convenience in installation, presumably is admissible from either side into the valve body 4 through either of a pair of inlet ports 37 in opposite sides of the body, one connected to the actuating air line and the other plugged in a given installation. Internally, each of the inlet ports 37 is connected or open to a passageway 38 leading downwardly therefrom through the lower part of the body 4 and the cover 31 to the pressure chamber 30 below the actuating head 32. In the fluid connection between the pressure chamber and the actuating air line

35, the actuating air is forced to pass through a restricted orifice 39, which, most conveniently, is formed in a fitting or coupling 40 releasably connecting the line 35 to the valve body 4 for ready replacement by an interchangeable fitting having an orifice of different diameter or cross-sectional area.

In operating the valve 1 for starting the air start motor 3 to start the associated diesel engine (not shown), the control valve 36 is manually or otherwise opened to supply actuating air to the supply line 35. As admitted or supplied to that line, the actuating air will be at the full pressure of the source, usually on the order of about 150 p.s.i. However, the flow of the actuating air from the line 35 to the pressure chamber 30 is intentionally choked, throttled or restricted by forcing it to pass through the restricted orifice 39 so as to produce a progressive or gradual rather than an abrupt buildup of the pressure in the chamber to that in the line.

With the delayed pressure buildup in the pressure chamber 30 and a lost motion connection between the valve stem 23 and the main valve 11, as a result of the normal spacing of the stop 26 below that valve, but none between the stem and the secondary valve 17, and the secondary spring 19 weaker than the primary spring 13, the secondary valve will be unseated before the main valve. Once the secondary valve is unseated, operating air can pass through the supply line 2 to the air start motor 3, but only to the extent permitted by the restricted passage 22 connecting the secondary seat 16 to the outlet passage and port 8 and 6. By contrast, upon the subsequent unseating of the main valve 11, the inlet and outlet ports 5 and 6 are in full communication and full operating pressure, usually in the range from 150 to 220 p.s.i., will be delivered to the air motor through the then open main seat 10. The combined action of the gradual pressure buildup in the pressure chamber 30, the lost motion connection between the valve stem 23 and the main valve 11, the relative weakness of the secondary spring 19 and the choking, throttling or restricting of the flow through the supply line 2 by the restricted passage 22 when only the secondary valve 17 is unseated, on opening of the control valve 36, will automatically cause operating air to be delivered to the air start motor 3 in two pressure stages. One, a first or low-pressure starting stage sufficient to initiate or start operation of the motor, but insufficient to damage it, and the other, a second or full pressure operating state, the latter operating the air motor under full power until the associated diesel engine is started.

Required only to start or initiate operation of the air start motor 3, the first or low pressure stage can and preferably is very short or brief, a duration of about $\frac{3}{4}$ secs. having been found adequate to protect the air motor from damage. In the preferred valve, a short duration first pressure stage is produced by using as the secondary spring 19, one opening or yielding under a pressure of about 5-10 p.s.i. and as the main

spring 13 one opening or yielding under a pressure of around 100 p.s.i. The valve assembly acting as a differential piston in opening the valve 1, the presented area of the actuating head 32 must be sufficient, relative to the combined presented areas of the main and secondary valves 11 and 16, to overcome, when subjected to full actuating air pressure, both the resistance of the springs 13 and 19 and the opposing pressure of the operating air on the two valves.

From the above detailed description it will be apparent that there has been provided an improved air start valve for automatically delivering pressure in two stages to an air start motor. 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 and the appended claims.

Having now described my invention, I claim:

1. The combination with an air motor and a line for supplying operating air thereto, of an operating valve in said line, said operating valve comprising a body having inlet and outlet ports, main and auxiliary valve seats in said body between said ports for respectively full and restricted communication therebetween, main and auxiliary operating heads in said body for closing respectively said main seat and said auxiliary seat, a main spring and a weaker auxiliary spring acting respectively on said main head and as the sole biasing spring force on said auxiliary head for normally holding said heads in seat closing position, an actuating head mounted in a pressure chamber in said body for shifting therein in response to air pressure supplied thereto, a valve stem fixed to said actuating and auxiliary operating heads and lost-motion mounting said main operating head for automatically opening first said auxiliary seat and then said main seat on said shifting of said actuating head, and restricted means for delaying the pressure buildup in said pressure chamber, said springs and restricted means cooperating for determining the interval between opening of said auxiliary and main seats.

2. The combination according to claim 1, including valve means for controlling the supply of actuating pressure to the pressure chamber, and wherein the restricted means is positioned therebetween.

3. The combination of claim 2, wherein the springs are coil springs coaxial with each other and the stem.

4. The combination of claim 3, wherein the seats are coaxial with each other and the stem.

5. The combination of claim 4, wherein the auxiliary seat is formed in the main valve.

6. The combination of claim 2, wherein the restricted means is a restricted orifice in a fitting removably mounted in the body and releasably connecting thereto an actuating air supply line from the control valve.

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