Dec. 18, 1962 J. W. LOGAN, JR., ET AL 3,068,900

VALVE ASSEMBLY

Original Filed June 26, 1959 2 Sheets-Sheet 1

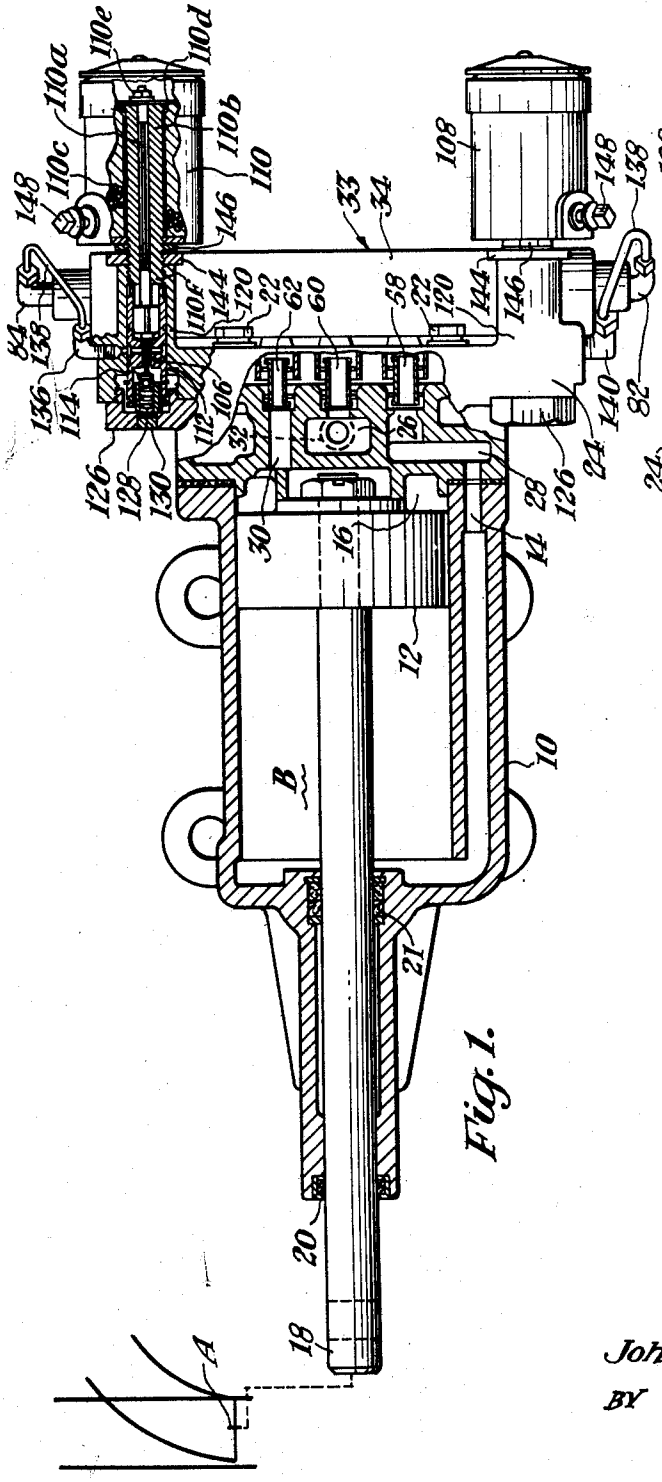

Fig. 1.

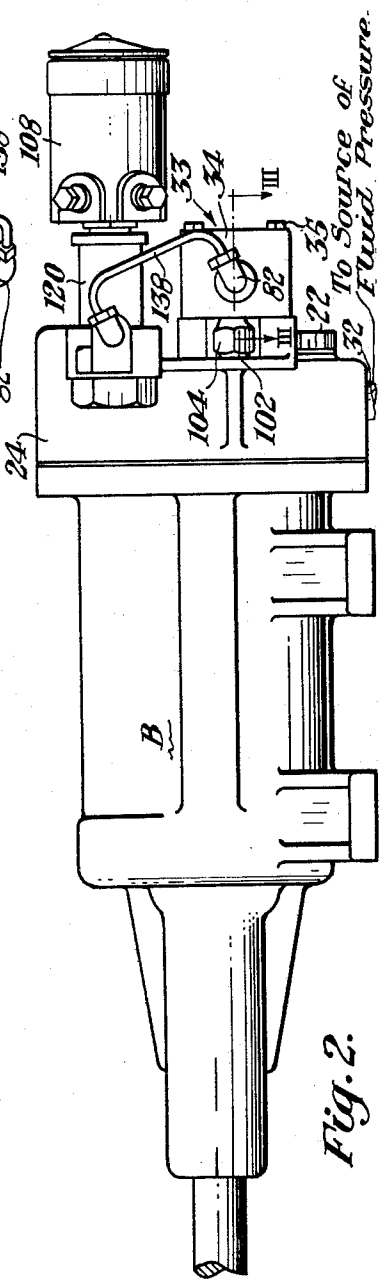

Fig. 2.

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Original Filed June 26, 1959 2 Sheets-Sheet 2

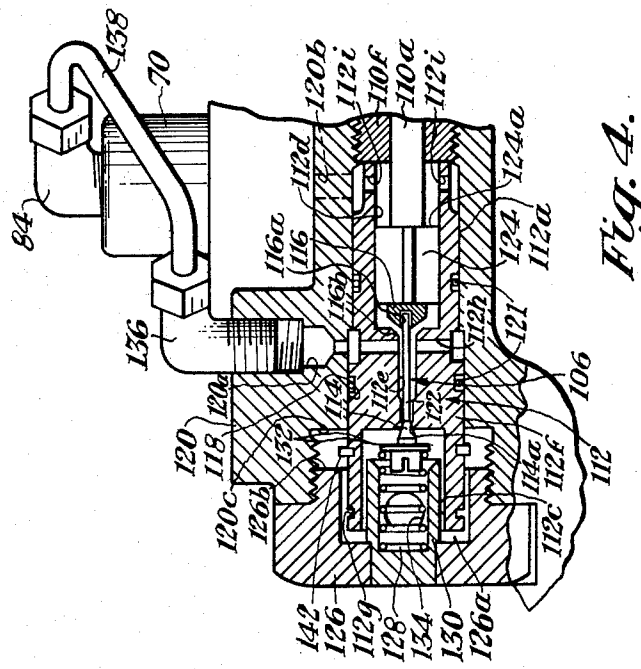

Fig. 4.

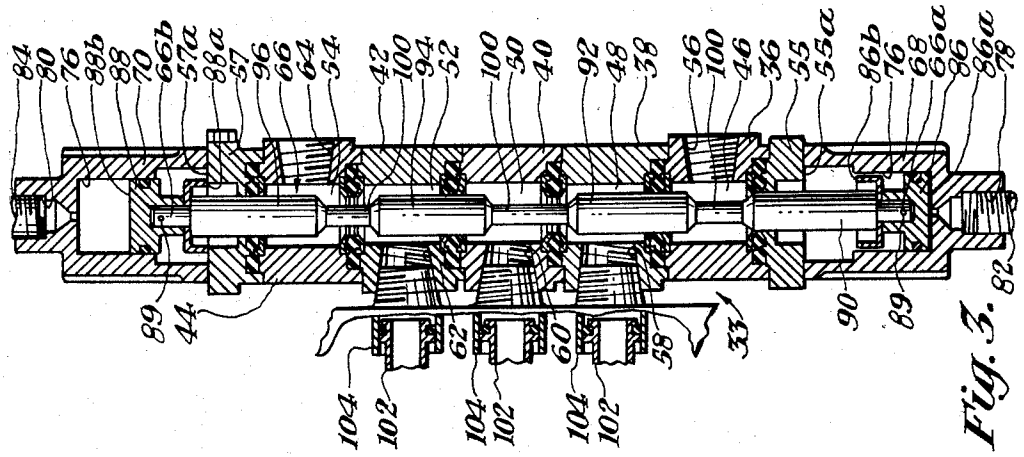

Fig. 3.

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VALVE ASSEMBLY

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Original application June 26, 1959, Ser. No. 823,136, now Patent No. 3,004,528, dated Oct. 17, 1961. Divided and this application June 23, 1960, Ser. No. 38,367
6 Claims. (Cl. 137—623)

Our invention relates to railway traffic controlling apparatus, and particularly to a valve assembly for use in connection with a railway switch machine of the type operated by fluid under pressure.

The present application is a division of our copending application for Letters Patent of the United States, Serial No. 823,136, filed on June 26, 1959, for Railway Traffic Controlling Apparatus, having issued on October 17, 1961 as Patent No. 3,004,528.

Railway switch machines embodying our invention are especially suitable for use in a railway classification yard to provide means for controlling track switches which route railway cars into selected turnout tracks leading to a number of classification tracks in the yard. The switch machines used in such an installation are respectively located normally a predetermined distance beyond the exit end of a car retarder mechanism employed for controlling the speed of the cars. In such a system, a track circuit, conveniently termed a detector track circuit, is connected in the control circuit of each switch machine and opens the control circuit thereof when the track circuit is occupied to prevent the respective switch from reversing position during movement of a car over the switch. The distance between two successive humped cars routed over the same switch is preferably kept as low as possible in order to achieve a high rate of humping. To a large extent this distance is determined by the length of the detector track circuit with the space allowed between cars becoming smaller as the track circuit length is reduced. For more economical operation of the yard, and to avoid complex problems which have been found to arise during installation of the car retarder mechanisms, it is advantageous to keep the detector track circuit entirely outside the car retarder area and, in one classification yard system contemplated, the entrance to the detector track circuit is located beyond the exit end of the car retarder mechanism. By thus placing the track circuit entrance at a point beyond the car retarder mechanism, the length available for the detector track circuit is shortened, and the spacing required between successive cars is minimized a corresponding extent.

The arrangement whereby the length of the detector track circuit is reduced allows satisfactory operation; however, by reducing the track circuit length, a second car which is traveling at a relatively high speed and simultaneously is closely spaced from a leading car routed over the same switch may enter the detector track circuit before the switch reverses position, thereby continuing to lock the switch in the same position and possibly causing the second car to be misrouted. To compensate for the reduction in the length of the track circuit and the corresponding reduction in the allowable spacing between cars, it is expedient to provide a switch operating mechanism capable of rapid operation so as to ensure the correct classification of cars.

One object, therefore, of our invention is to provide a fast direct acting railway switch machine whose speed of operation is such that the amount of time required to complete a switching movement in response to a control signal is appreciably reduced.

Another object of our invention is to provide a direct

acting railway switch machine which ensures rapid operation of the switch or mechanism to be controlled from its one position to its other position.

Still another object of our invention is the provision in a railway switch machine of an improved electromagnetically-operated valve which is designed for convenient installation and removal for inspection, maintenance and the like.

Yet another object of our invention is to provide a valve arrangement for use in connection with a railway switch machine, which valve arrangement is effective to materially reduce the amount of time required for performing field or shop overhauls or other maintenance work.

Another object of our invention is the provision in a railway switch machine of an improved electromagnetically-operated valve for controlling fluid under pressure, means normally being provided to enclose the valve within said machine, but which means can readily be removed to permit removal of the valve from the machine.

A general object of our invention is to provide a railway switch machine of the type described which allows field emergency repairs of essential parts without necessitating removal of the machine from its location in the track.

Other objects and characteristic features of our invention will become apparent as the description proceeds.

To attain the aforementioned objects of our invention we provide a conventional railway traffic controlling device, fluid pressure-actuated motor apparatus for controlling the device, and a spool-type slide valve arranged to control the admission of fluid under pressure from a suitable fluid pressure source to one or the other side of the motor piston. Two valve structures, each comprising cooperating pin and magnet valves reciprocably movable in a suitable bushing and operable by an electromagnet in a conventional manner, are provided for controlling the supply of fluid under pressure to the slide valve. By means of our invention, removal and replacement of the pin and magnet valves in the field is permitted without disturbance of the motor apparatus from its location.

We shall describe one form of apparatus embodying our invention, and shall then point out the novel features thereof in claims.

In the accompanying drawings:

FIG. 1 is a plan view partially in section showing a railway switch machine embodying our invention operatively connected with a railway switch.

FIG. 2 is an elevational view of the switch machine shown in FIG. 1.

FIG. 3 is a cross-sectioned view taken substantially along line III—III of FIG. 2 showing, to better advantage, the slide valve incorporated in the railway switch machine embodying our invention.

FIG. 4 is an enlarged view, partly in section, with certain of the parts removed, of the improved electromagnetically-operated valve structure embodying our invention.

Similar reference characters refer to similar parts in each of the several views.

Referring to FIG. 1 of the drawings, the reference character A designates a railway traffic controlling device, here shown as a railway switch. The switch is operated by a fluid pressure-actuated motor B, which motor, as here shown, comprises a cylinder **10** and a reciprocable piston **12** operable therein. Fluid under pressure, usually compressed air, is at times applied to one end or the other of cylinder **10** through passages **14** and **16** from a suitable source to be described. Secured to piston **12** at its one end is a piston rod **18**

slidably mounted in suitable packing rings 20 and 21, and operatively connected at its other end to switch A for moving switch A between normal and reverse positions.

As seen in FIGS. 1 and 2, cylinder 10 of motor B is connected by means of bolts 22 with a cylinder head 24 provided with three fluid passages 26, 28 and 30. The passage 26 is connected by means of a fluid passage, not shown, internally extending from passage 26 through the cylinder head to a pipe 32 (FIG. 2). The pipe 32 is connected to a suitable source of fluid under pressure, from which source the fluid under pressure for operating motor B is taken, and in a manner to be described in detail hereinafter. Passages 28 and 30 are directly connected, respectively, with passages 14 and 16 of motor B.

The passages 28 and 30 of cylinder head 22 are arranged to be opened and closed to fluid under pressure by a valve device 33, the housing 34 of which is secured directly to cylinder head 24 by means of bolts 35 (FIG. 2).

The valve device 33 is of the pneumatically-operated type, and is preferably of the type disclosed and claimed in Letters Patent of the United States No. 2,747,611, issued May 29, 1956 to Ellis E. Hewitt. This valve device, as shown in FIGS. 1 and 2, and particularly as shown in FIG. 3, comprises a plurality of identical adjoining casing sections designated by reference numerals 36, 39, 40, 42 and 44, each being provided with a chamber or bore, designated by the numerals 46, 48, 50, 52 and 54, respectively, the chambers all being aligned in coaxial relation with each other.

The casing sections 36, 38, 40, 42 and 44 are provided with screw-threaded ports or pipe-connecting bores 56, 58, 60, 62 and 64, respectively, which connect chambers 46, 48, 50, 52 and 54, respectively, to an external surface of the respective casing section.

A spool-type slide valve 66 extends coaxially through the several chambers 46, 48, 50, 52 and 54, and through a pair of cap portions 55 and 57. The valve 66 is provided with end portions 66*a* and 66*b* which project into cylindrical end caps 68 and 70, respectively, which end caps, cap portions, and casing sections are secured in any conventional manner herein not shown in abutting contact with each other. The end caps 68 and 70 are each formed interiorly with a concentric bore or chamber 76 and terminate, at one end of their respective bores 76, in screw-threaded ports 78 and 80, respectively. The screw-threaded portions 78 and 80 are shown connected with suitable pipe fittings 82 and 84, and the connections with the corresponding opposite ends of pipe fittings 82 and 84 will be described as the specification proceeds. Respectively located within bores 76 of end caps 68 and 70 for sliding movement therein are two pistons 86 and 88 fixedly attached, respectively, to the end portions 66*a* and 66*b* of valve 66 by any suitable means such as, for example, by passing a cottered pin or roll pin 89 through aligned holes provided in the piston and the corresponding ends, as herein shown. The lower position of valve 66, as viewed in FIG. 3, is defined by the engagement of one side 88*a* of piston 88 with a surface 57*a* of cap portion 57, in which position a face 86*a* of the other piston 86 substantially abuts against the bottom of the bore 76 in end cap 68. Similarly, the upper position of valve 66, as seen in FIG. 3, is defined by engagement of one side 86*b* of piston 86 with a surface 55*a* of cap portion 55, in which position a face 88*b* of the other piston 88 will substantially abut against the bottom of bore 76 in the other end cap 70. It will be understood, of course, that when the railway switch machine embodying our invention is installed adjacent a trackway for operation, valve device 33 and, consequently, valve 66 are disposed in a horizontal plane.

The valve 66 comprises four land portions 90, 92, 94, and 96 disposed for sliding and sealing contact in resilient O-rings 98 which are located between adjoining casing sections, and which are also located between cap portions 55 and 57 and the two outer casing sections 36 and 44 adjacent thereto, respectively. Land portions 90, 92, 94, and 96 are connected by reduced portions or grooves 100. Land portions 92 and 94 are of such length that when valve 66 is operated to its lower position, as described hereinabove, land portion 92 remains disposed in an interfering position between casing sections 36 and 38 for closing communication between chambers 46 and 48. At the same time, land portion 92 opens communication between chambers 48 and 50. Land portion 94 meantime is moved to a position to open communication between chambers 52 and 54, and to close communication between chambers 50 and 52. When valve 66 is operated to its upper position, as described hereinabove, land portion 92 will move from its previous position between casing sections 36 and 38 and thereby now open communication between chambers 46 and 48 while, at the same time, moving to an interfering position in which communication is closed between chambers 48 and 50. Land portion 94 will simultaneously move to a position to open communication between chambers 50 and 52, and to close communication between chambers 52 and 54. Hence, it can be seen that operating the valve 66 to its other end position closes the chambers that were open and opens the chambers that were closed. Due to the sliding friction between the land portions of valve 66 and the O-rings 98, valve 66 remains, when operated, in its upper and lower positions according as a fluid pressure force, preferably compressed air, acts, in a manner to be described in detail hereinafter, against piston 86 or 88, respectively.

The screw-threaded ports 56 and 64 of valve device 33 are merely open to atmosphere; ports 58 and 62 communicate respectively with passages 28 and 30 of cylinder head 24 by means of grommeted sleeves 102 which extend inside one end of threaded adapters 104, the adapters 104 in turn being screwed at their other end into ports 58 and 62; and port 60 communicates with passage 26 of cylinder head 24 by means of a similar sleeve and adapter. Thus, when valve 66 occupies the position in which it is shown in FIG. 3, fluid communication is established between passage 26 of cylinder head 24, port 60, chambers 50 and 48, and port 58 of valve device 33, and passage 28 of cylinder head 24 and passage 14 of motor B to admit fluid under pressure to the left-hand side of piston 12. At the same time, the right-hand side of piston 12 is directly connected with atmosphere through a fluid passageway including passage 16 of motor B, passage 30 of cylinder head 24, and port 62, chambers 52 and 54, and port 64 of valve device 33. It will be appreciated that by exposing directly to atmosphere that side of piston 12 opposite to the side to which fluid under pressure is applied each time a movement of switch A is effected, piston 12 encounters no appreciable fluid pressure resistance as it moves between the ends of cylinder 10 of motor B, thereby greatly reducing the time required for movement of piston 12 to consequently reduce the time required to operate switch A from one to the other of its positions.

A control over the speed of switch A may be desired to slightly retard the movement of switch A immediately prior to the time a reverse movement of the switch has fully been completed to avoid slamming the switch to thus protect the points thereof from damage. Hence, a choke device (not shown) may be provided and screwed into ports 56 and 64 of valve device 33 to regulate the flow of fluid under pressure from either side of piston 12 to atmosphere during movement of piston 12 in either direction of its stroke. The choke device may assume various forms well known in the art and may, for ex-

ample, as herein contemplated, comprise a bored plug (not shown) screwed into the ports **56** and **64**, with the diameter of the core in the plugs determining the rate of escape of fluid under pressure to atmosphere from the chambers **46** and **54** of valve device **33**.

In accordance with our invention, the admission of fluid under pressure to valve **66** is controlled by two identical valve structures, only one of which, herein designated **106**, is illustrated, which valve structures are operated, respectively, by identical electromagnets **108** and **110**, one or the other of which is energized according to the desired position of switch A. Inasmuch as the valve structures and their associated electromagnets are identical in operation and construction, we have chosen only to describe that valve structure and associated electromagnet which appears in the upper part of FIG. 1, which valve structure and a portion of the associated electromagnet we have for purposes of simplicity more clearly illustrated in FIG. 4.

Referring now to FIG. 4, the valve structure **106** is housed in a substantially cylindrical bushing **112** and includes detachably connected valves **114** and **116** which operate respectively as inlet and exhaust valves. The bushing **112** and the valves **114** and **116** when assembled together form a valve subassembly which can be regarded as a replaceable unit, as will be described hereinafter. Furthermore, it will be understood that in practice either one of the pair of valves **114** and **116** may serve as the inlet valve with the remaining one serving as the outlet valve depending upon the desired arrangement of the external connection to the ports controlled by the valves. The bushing **112** is mounted in an annular opening **118** provided in a housing or enclosure member **120** formed integrally with cylinder head **24** at one end thereof and is movable laterally within the opening for a purpose which will be made clear as the specification proceeds. The outer surface **112***a* of bushing **112** is provided with two spaced annular grooves in which O-rings **121** for sliding and fluid pressure sealing purposes are located. The bushing **112** is formed at one end with a longitudinal hole **112***c*, and is slightly reduced in diameter at its other end, which other end is provided with another longitudinal hole **112***d* in axial alignment with the hole **112***c*. The bases of holes **112***c* and **112***d* are communicably connected by an aperture **112***e* extending through an intermediate portion **112***f* of bushing **112**, which aperture is considerably smaller in diameter than either hole **112***c* or **112***d* and concentric therewith. The aperture **112***e* is suitably proportioned to loosely receive a stem **122** having its one end connected to pin valve **114**. The other end of stem **122** fits into a recess **116***a* provided centrally in valve **116**. It will be understood, however, that stem **122** may instead be provided on valve **116**, and a recess for receiving the stem then be provided in valve **114**. In either case, such an arrangement, whereby valves **114** and **116** are detachably connected to each other, permits the most troublesome parts of the switch machine embodying our invention to be independently examined and inspected when valves **114** and **116** are detached from each other, as will be described.

The valves **114** and **116**, as shown in FIG. 4, are in their respective normal positions, and cooperate respectively with valve seats **114***a* and **116***b* at the opposite ends of aperture **112***e* such that when one valve is seated the other is unseated. Guided by the inner surface of hole **112***d*, and formed integrally with valve **116**, is a generally triangular shaped member **124** which allows air to pass along its sides and against a plane surface **124***a* of which a tapered armature stem **110***a* of electromagnet **110** abuts.

Referring now specifically to FIG. 1, the electromagnet **110** is of standard construction and comprises briefly a hollow core **110***b* surrounded by a winding **110***c*. An armature **110***d* cooperates with armature stem **110***a*, the armature being held in juxtaposition to the armature stem by a lock nut **110***e*. The core **110***b* is provided outside the main body of the electromagnet with a threaded extending portion **110***f*, one end of which is threadably connected with one end of housing **120** to close one end of opening **118**. The other end of opening **118** is closed by a cap nut or plug **126** screwed into housing **120**. To bias valves **114** and **116** to their respective normal positions, a coil spring **128** contained in a cup **130** secured to cap nut **126** acts against an annular shoulder **132** on valve **114** in a direction to normally seat valve **114** and to unseat valve **116**, substantially as shown in FIG. 4. When electromagnet **108** becomes energized, valves **114** and **116** are operated, in opposition to the bias of spring **128**, to positions in which they become unseated and seated, respectively, as shown in FIG. 1.

In order to gain access to valves **114** and **116**, cap When electromagnet **108** becomes energized valves **114** and a screw driver or similar conventional tool, not shown, is applied to a groove **112***g* (FIG. 4) provided on one end of bushing **112**. To completely withdrawn bushing **112** and the valves **114** and **116** mounted therein from within opening **118**, a relatively light force is then applied to the screw driver, in a direction away from electromagnet **110**. With such an arrangement, both valves **114** and **116** are immediately accessible and when removed from the bushing they may be detached from each other, as previously mentioned. If the valves are found to be excessively worn due to repeated operation, either valve may be restored to condition for service or replaced, or discarded at the end of a predetermined duration of active service. Such an arrangement obviously simplifies maintenance procedure to correspondingly reduce the cost of maintenance. Furthermore, removably mounting the bushing as embodied in our present invention enables the bushing, and the valves therein, as a unit, to be used to replace, for example, a defective unit, thus making it possible to conveniently correct any valve problem without detaching the electromagnet from housing **120**.

The cap nut **126** closes a cavity **126***a* to which fluid under pressure is constantly supplied by means of a pipe connection **134**, best shown in FIG. 4, which may be coupled by any suitable means, not shown, to the source of fluid under pressure indicated in FIG. 2. The fluid under pressure for operating spool valve **66** is taken from this cavity and is intended to be applied through aperture **112***e* and a port **112***h* which extends through the intermediate portion **112***f* of bushing **112** to a transverse hole **120***a* bored in housing **120**, the aperture **112***e*, port **112***h*, and hole **120***a* all being connected in direct fluid communication with each other. This hole **120***a* receives one end of a pipe fitting **136**, which pipe fitting is clearly illustrated in FIG. 4, and at the upper part of FIG. 1. The other end of the pipe fitting **136** is connected by means of a pipe or tubing **138** with one end of pipe fitting **84**. It will be recalled that pipe fitting **84** has its other end connected with the port **80** in end cap **70** of valve device **33**. Moreover, a pipe fitting **140**, shown in the lower part of FIG. 1 connecting with the other housing **120**, is connected by a similar pipe or tubing **138**, and pipe fitting **82** with port **78** in end cap **68** at the other end of valve device **33**. The housing **120** is further provided adjacent its other end with another transverse hole **120***b* continually connected with atmosphere. With valves **114** and **116** in their respective normal positions, fluid communication is established between hole **120***b* and aperture **112***e* by means of holes **112***i* aligned with hole **120***b* and bored through the wall of bushing **112**.

The fluid under pressure charging cavity **126***a* may tend to force bushing **112** deeper into opening **118**. If the movement of bushing **112** in this direction is not arrested after a certain relatively small extent, the O-ring **121** nearest to the cap nut **126** may be displaced from its

present position to a position in which it becomes entangled in hole 120*a* in extension 120 and perhaps forced from its groove. To avoid the obvious consequent damage to the O-ring, bushing 112 is provided with a snap ring 142 (FIG. 4) which by its engagement with a flat inner surface 120*c* of housing 120, should lateral movement of the bushing become excessive, will limit movement of the bushing 112 into opening 118. Moreover, the extent of movement of bushing 112 in response to an oppositely directed force, such as, for example, a force produced by the impact of valve 116 against its seat, will be limited due to the other side of the snap ring acting against an inner surface 126*b* of cap nut 126.

To secure electromagnet 110 firmly in place against the housing 120 of cylinder head 24, the extending portion 110*f* of core 110*b* of the electromagnet 110 is provided with an adjustable lock nut 144. Initially, as extending portion 110*f* is screwed into opening 118, lock nut 144 is backed off to a position in which it abuts against a second lock nut 146, which lock nut 146 is also mounted on the extending portion 110*f*. Eventually, as the rotation of electromagnet 110 is continued, lock nut 144 in its backed-off position strikes extension 120 and the rotation of electromagnet 110 is arrested. Before the electromagnet is rigidly locked against movement, adjustment of the armature stem 110*a* relative to member 124 will generally be required to ensure a suitable working relationship between valves 114 and 116 and their respective valve seats when they are operated. To accomplish this adjustment, lock nut 110*e* securing stem 110*a* to armature 110*d* is somewhat loosened and the armature stem is moved along its longitudinal axis until the valves occupy the position in which they are shown in FIG. 4, whereupon lock nut 110*e* is retightened. Should it be necessary, electromagnet 110 is thereupon rotated in a reverse direction until terminals 148 are in positions best suited for connection with lead-in wires not shown. Because of the reverse rotation of the electromagnet following establishment of the operative connection between the armature stem and the valve assembly, a relatively slight separation will tend to occur between the inner end of the armature stem and member 124. However, the abutment between the armature stem and member 124 will immediately be reestablished as the armature stem moves since the bushing 112, in response to the fluid under pressure at its one end in cavity 126*a*, will be moved axially toward core extension 110 as the electromagnet is backed off. That is, when the positions of the terminals 148 relative to the lead-in wires are adjusted, bushing 112 will travel linearly an extent proportional to the angular distance of the electromagnet during its reverse rotation and the armature stem adjustment will, therefore, remain unchanged. It will readily be appreciated that, by allowing the bushing to float within its enclosure, contact between the actuating member of the electromagnet and the valve assembly will be assured absolutely regardless of angular adjustment of the electromagnet. It will further be appreciated that this mounting arrangement, and the ability of the bushing to drift freely within the limits hereinabove described, provides a convenient means for gaining access to the coil terminals of the electromagnet with lead-in wires whose length, for instance, may be so short that connection to the coil terminals would otherwise be difficult. After connection to terminals 148 of such lead-in wires, lock nut 144 is tightened against housing 120 to firmly lock the electromagnet in place.

The operation of this arrangement is as follows: When neither electromagnet is energized, valve 66 occupies one or the other of its operated positions according as fluid under pressure was last admitted to either one or the other end of valve device 33, substantially as described hereinabove.

Assuming now that the electromagnet 110 becomes energized, valve 114 is moved in a direction to become disengaged from seat 114*a*, and valve 116 simultaneously moves in the same direction to engage seat 116*a* and thereby close communication between aperture 112*e* and atmosphere. The opening of valve 114 admits fluid under pressure to aperture 112*e* and to the previously traced fluid path including pipe fitting 136, pipe 138, and pipe fitting 84 to port 80 of valve device 33. The admission of fluid under pressure to port 80 of valve device 33 causes movement of valve 66 in such direction as to cause fluid under pressure to be admitted to passage 14 of motor B, as hereinabove explained. Piston 12 of motor B will thereupon move to the right, as viewed in FIG. 1.

Fluid under a relatively lower pressure and created at the right-hand side of piston 12 by the sudden movement of piston 12 to its right will meantime pass to atmosphere, substantially as described hereinabove.

One feature of the valve apparatus embodying our invention is that the electromagnetically-operated valves are accessible at all times for servicing or maintenance purposes. That is, it is possible with this construction to remove the cap nuts which enclose the valve structures within their respective housings merely by applying to the cap nuts a standard tool of the type generally carried by signal maintainers. It can be seen that once the cap nut is removed, the bushing and the valve structure mounted therein may be removed for immediate inspection, there being no fixed attachment between the valve structure and the armature stem of the electromagnet operatively associated with each valve structure. In addition, once the electromagnet is fixedly mounted for operation and its terminals connected to the energizing source, it can be seen that the novel approach to the problem of simplifying valve adjustment removes the doubt that variations from the initial valve adjustment will occur.

Although we have herein shown and described only one form of valve assembly embodying our invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. A valve arrangement comprising, in combination, a cylinder, an axially movable bushing disposed in said cylinder, a valve disposed in said bushing concentric therewith and movable relative to said bushing between a first position and a second position, an electromagnet having an axially movable rod-like member, said rod-like member disposed in alignment with said bushing and having its one end abutting against said valve for moving it, whereby when said electromagnet is energized said rod-like member is moved from a nonactuated position to an actuated position to move said valve from its first to its second position, and means for applying fluid under pressure to a preselected end of said cylinder, whereby said fluid pressure will force said bushing axially toward said rod-like member to automatically maintain the abutment between said rod-like member and said valve.

2. In combination, an enclosure member having a substantially cylindrical opening, an axially movable bushing disposed in and aligned longitudinally of said opening, a valve in said bushing mounted for axial movement relative to said bushing between a first position and a second position, said bushing provided with a port controlled by said valve, actuable valve operating means having an axially movable rod-like member operatively connected with said valve for moving it, whereby when said valve operating means is actuated said rod-like member is moved from a nonactuated position to an actuated position to move said valve from its first to its second position, and means for applying compressed air to said enclosure member to move said bushing in a direction toward said rod-like member, said bushing responding

to said compressed air to hold said valve in operative connection with said rod-like member to permit immediate movement of said valve from its first to its second position in response to actuation of said valve operating means.

3. In a valve mounting arrangement, the combination comprising a mounting member provided with an opening extending longitudinally from one end to the other end of said mounting member, an axially movable bushing disposed in said opening and provided with at least one port, means for applying fluid under pressure to said mounting member at one end of said opening, valve means for controlling fluid communication to said port concentrically arranged in said bushing and movable relative to said bushing between a biased first position and a second position, an electromagnet adjustably rotatably secured to said mounting member at the other end of said opening and comprising a movable actuating member and electrical terminals adapted for connection with a source of current, means in said electromagnet for positioning said actuating member relative to said valve means such that one end of said actuating member normally abuts against said valve means for moving it from its first to its second position when said electromagnet is energized, said electromagnet being rotated relative to said mounting member in a reverse direction when said abutment is established until said terminals occupy any angular position best suited for connection with said source, and said bushing responding to said fluid under pressure during said reverse rotation and moving toward said other end of said opening to maintain the abutment between said valve means and said actuating member and ensure movement of said valve means in response to movement of said actuating member.

4. In a valve assembly for an electromagnetically operated valve, the combination comprising a generally elongated housing having an opening extending longitudinally through said housing from end to end, said opening being screw-threaded at both ends, a bushing disposed in said opening and axially movable with respect to said housing, said bushing having a first aperture extending longitudinally from one end to the other end of said bushing and a second aperture extending from said first aperture at a point intermediate its ends to a preselected point on the periphery of said bushing, a pair of sealing gaskets on said bushing one located on each side of said preselected point for sliding and sealing engagement with the adjacent boundary surface of the opening, valve means operable between a nonactuated position and an actuated position adapted to cooperate with the ends of said first aperture and effective in its nonactuated position for controlling munication between said one end of said bushing and said second aperture and in its actuated position for controlling communication between said other end of said bushing and said second aperture, means for actuating said valve means from its nonactuated to its actuated position screwed into said housing at one end of said opening, cap means for closing the other end of said opening also screwed into said housing, and means on said cap means for biasing said valve means to its nonactuated position.

5. In a valve assembly for a valve, the combination comprising a generally elongated housing provided with an opening extending from one end to the other end of said housing and being screw-threaded at both ends, a bushing disposed in said opening and having a first passageway extending therethrough concentric with the longitudinal axis of said bushing and a second passageway extending from said first passageway to the periphery of said bushing, sealing gaskets on said bushing one on each side of the peripheral opening of said second passageway, said gaskets disposed in sealing contact with the adjacent boundary surface of said opening but permitting sliding movement of said bushing relative to said housing, a first valve seat at one end of said first passageway and a second valve seat at its other end, a valve stem mounted in said first passageway and freely movable therein relative to said bushing, a first valve on one end of said stem adapted to cooperate with said first seat, a second valve adapted to cooperate with said second seat loosely mounted on the other end of said stem so as to be capable of being separated therefrom, said stem and said first and second valves being arranged such that when one of said valves is seated the other is unseated, cap means screwed into said housing at one end of said opening adjacent to said first valve for closing said one end of said opening, means on said cap means acting against said first valve for biasing said first valve closed and said second valve open, means for actuating said first and second valves screwed into said housing at the other end of said opening and having a longitudinally movable actuating member disposed in abutting engagement with said second valve, whereby when said valve actuating means is actuated said first valve is opened and said second valve is closed in response to movement of said actuating member, the arrangement being such that when said cap means is unscrewed from said housing said bushing including said first and second valves may readily be removed in endwise fashion from said housing, but that when only said valve actuating means is unscrewed only said second valve may be removed from said housing.

6. In a mounting arrangement for an electromagnet, the combination comprising a fixed mounting member having a plane surface at its one end and a screw-threaded hole normal to the plane surface thereof, said electromagnet comprising a main body and including a screw-threaded core extension, a lock nut adjustably mounted on said core extension, electrical terminals on the main body of said electromagnet adapted for connection with a source of current, said core extension being screwed inwardly into said screw-threaded hole until said terminals are in an angular position best suited for connection with said source, and said lock nut then being positioned to frictionally engage the plane surface of said mounting member in a manner to removably mount said electromagnet to said mounting member.

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