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(54) Switch valve.

(57) In a multiway valve having a housing (1) with connectors (2, 3, 4) for an auxiliary-source supply line, for a main-source supply line and for a delivery line to for example a breathing mask respectively, a differential piston (5) is movable between two end positions dependent on sufficient main source air pressure acting on the larger end part (6) of the piston (5), the smaller part (7) thereof being loaded by the auxiliary air pressure, said piston (5) when loaded by sufficient main source pressure automatically moves towards and remains in that end position in which the connecting passage (11) from the auxiliary supply line connector (2) to the delivery line connector (4) is closed off and said piston (5) automatically moves towards and remains in the other end position, in which the connecting passage (10) between the main supply line connector (3) and said delivery line connector (4) is closed off, as soon as the main supply pressure drops below a predetermined level.

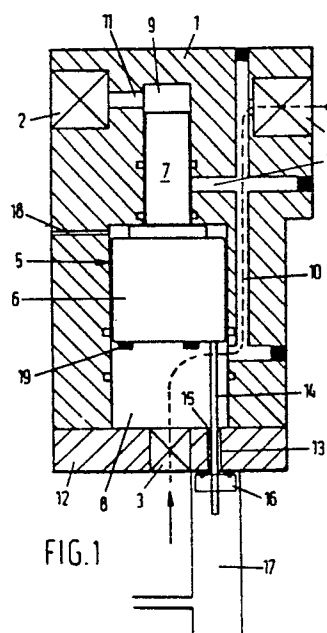


FIG.1

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Switch valve.

The invention relates to a switch valve, in particular to a multiway valve for connecting an apparatus to different fluid supplies.

For example, when the supply of air or oxygen to a breathing apparatus, as used by the fire department, or in cleaning operations within storage tanks and the like, through a supply hose from a remote main source, is interrupted, it must be possible to immediately switch over to an auxiliary source such as an auxiliary supply carried in a tank by the user of a breathing apparatus. Especially in the case of a sudden drop in supply pressure from the main source, for example because the supply hose is run over and damaged by a vehicle, immediate switch to the auxiliary supply is necessary.

There is therefore a need for an automatic valve which switches to the auxiliary supply when the main-source pressure drops. A known automatically switching valve which functions this way is provided in the housing thereof with check valves in the respective connecting passages between the air inlet connections and the outlet connection to the breathing apparatus and as soon as the pressure in the main-source supply line drops below the pressure in the auxiliary-source supply line the valve in the auxiliary-source supply line opens and the valve in the main-source supply line closes.

A problem with this known switch valve is that depending on the type, portable compressed air tanks used in practice are adjusted to different working pressures which may vary from 5-8 bar and it is therefore possible that the main-source pressure, at least the pressure of the air supplied from the source, is too low in relation to the auxiliary supply pressure, so that from the start, only air from the auxiliary tank is supplied to the breathing apparatus. In particular in the fire department there is no opportunity to perform pressure measurements beforehand in order to establish whether there is sufficient main-source pressure in relation to the pressure in the reserve tanks.

The object of the invention is an automatically switching valve whereby this disadvantage is obviated.

For this purpose, in a switch valve comprising a housing having connection means for a main-source supply-line, for an auxiliary-source supply-line, and for a delivery line to a breathing apparatus as well as pressure responsive control means in connecting passages extending between the respective supply line connections with the delivery line connection, according to the invention, said control means comprise a differential piston the smaller part of which is loadable by the auxiliary-

source pressure and the larger part by the main-source pressure, and which piston in each of its end positions closes off one of the said connecting passages and clears the other passage.

In the switch valve according to the invention a relatively low main-source pressure is sufficient to accomplish a piston displacement in the sense of interrupting the supply from the reserve tank. It is for example possible to select the ratio of the piston diameters such that even a nine times higher auxiliary-source pressure than the main-source supply pressure acting on the larger piston end face will move the piston to the end position closing off the auxiliary-source supply line, so that it is guaranteed that irrespective of the adjusted working pressure of the reserve tank, the reserve supply is only tapped when the main-source pressure falls off entirely or substantially entirely.

In order to conserve the auxiliary source and to assure that sufficient flow is always provided to the delivery line it can be very important to be able to switch completely from one source to the other and back automatically, as is accomplished by the present valve.

In order to avoid that during switching from main source to reserve tank, air entrapped in the cylinder space of the larger piston part prevents a complete piston stroke, according to the invention a venting bore can be provided in the end wall concerned, through which a rod connected to the piston extends so as to leave an annular passage, said rod carrying a valve which in the end position of the piston which is determined by the main-source pressure closes off said annular passage.

It is to be noted that a switch valve of the subject kind, comprising a piston for selectively closing off mains air supply passages and emergency air supply passages towards a delivery line is known per se from GB-A-2,058,580. This known valve, however, must be manually reset to switch back to the main supply after the auxiliary supply has been activated. The switching is not automatically back and forth between the auxiliary and main sources and the piston is neither of the differential type nor loadable by the main source pressure.

US-A-4,499,914 discloses the use of a differential piston in a shuttle valve which is part of a complicated selector valve device for use in an aircraft on board oxygen generation system with high pressure oxygen backup, for blending several gaseous components to provide an optimized breathable air supply. In this known device the switching of the shuttle valve is not directly controlled by the presence of sufficient mains air

pressure, but by pressure supplied to the shuttle valve by the main blending valve. Further this known valve differs from the valve according to the subject invention in that the larger end of the differential piston is not exposed to the mains air pressure and the known piston is not directly loadable by the auxiliary pressure either, but by a spring.

For better understanding of the invention one embodiment of the switch valve will be described, by way of example, with reference to the accompanying drawings.

Fig. 1 is a schematic sectional view of the switch valve during supply from the main source; and

Fig. 2 is a view similar to Fig. 1 of the valve in the situation corresponding to supply from the auxiliary source.

According to the drawings the switch valve comprises a housing 1 with a connection 2 for a reserve tank, a connection 3 for a remote main source, and a connection 4 for a breathing apparatus comprising a breathing mask.

In the housing 1 a differential piston 5 is displaceable between end positions depicted in Fig. 1 and Fig. 2. The differential piston 5 has a larger cylinder part 6 and a smaller cylinder part 7 and is movable within fitting cylinder spaces 8 and 9 respectively. The cylinder space 8 is positioned in the connecting path 10 between the main-source connection 3 and the outlet connection 4 to the breathing mask and the cylinder space 9 is situated in the connecting path 11 between reserve tank connection 2 and mask connection 4.

In the end wall 12 of the cylinder space 8 a venting bore 13 is provided. A rod 14 extends through bore 13 leaving an annular channel 15. Rod 14 carries a valve 16 for closing annular channel 15 on the outside. Valve 16 may be arranged within an enclosure 17. A venting bore 18 for cylinder space 8 is provided on the other side of the larger piston part 6.

The operation of the switch valve is as follows:

In the high position depicted in Fig. 1 differential piston 5 is under the influence of the main-source pressure supplied through connection 3. Valve 16 closes off annular channel 15. The smaller piston part 7 prevents air flow from the reserve tank through connection 2 and connecting passage 11 to the mask connection 4. Breathing-air is supplied through connection 3 and connecting passage 10 to mask connection 4.

In the case of interruption of the air supply through connection 3 the pressure of the reserve tank on the end face of the smaller piston part 7 prevails and the differential piston 5 is displaced to the low position depicted in Fig. 2. Air entrapped in cylinder space 8 below the larger piston part 6 can escape through annular passage 15 so that the differential piston 5 is able to move entirely to the low position depicted in Fig. 2. In this position the connecting passage 10 is closed off by the larger piston part 6 and the connecting passage 11 between reserve tank connection 2 and mask connection 4 is opened.

The switch from the situation depicted in Fig. 1 to the situation according to Fig. 2 takes place when the main-source pressure P_s becomes so low that breathing becomes difficult. Depending on the specific apparatus and the adjustment thereof, this pressure will, in general, vary from at least 0.5 to 1 bar above atmosphere pressure. At such low source pressures, the piston 5 moves downwards, thereby allowing air and/or oxygen from the auxiliary tank to flow through connection 2 to the mask connection 4. Once the source pressure P_s increases again to a given minimum pressure, the piston will again move upwards, and operation of the device will return to the mode depicted in Fig. 1 wherein air and/or oxygen is fed from the source to the breathing apparatus.

To prevent oscillation of the piston 5 during operation it is desirable that the pressure required to move the piston upwards be somewhat different from that at which the piston will fall downwards. In general, the pressure required to move the piston from its down position upwards to its up position is 2.5 bars above atmospheric pressure. This difference in source pressures is created by the provision of bore 13. In fact, when the piston 5 is in the down position, bore 13 is open and air and/or oxygen flowing through connection 3 is able to escape through the restricted opening 13 and through enclosure 17. Alternatively, when the piston is in its up position, the bore 13 is closed and all the air and/or oxygen flowing through connection 3 acts on the bottom surface of the larger piston part 6.

By providing the larger piston part 6 on its end face with projections 19 defining the lowest position of the differential piston 5 it is always ensured that pressure supplied through source connection 3 can act on the entire end face of piston part 6.

Claims

1. Switch valve comprising a housing (1) having connection means (3) for a main-source supply line (2), for an auxiliary-source supply line, and (4) for a delivery line to a breathing apparatus, as well as pressure-responsive control means (5) in connecting passages (10, 11) extending between the respective supply-line connections (2, 3) with the delivery-line connection (4), characterized in that said control means comprise a differential piston - (5) the smaller part (7) of which is loadable by the auxiliary-source pressure and the larger part (6) thereof by the main-source pressure, and which

piston (5) in each of its end positions closes off one of said connecting passages (10, 11) and clears the other passage (11, 10).

5 2. Switch valve according to claim 1, characterized in that a venting bore (13) is provided in at least the wall (12) bounding the cylinder space (8) opposite to the larger end face of the piston (5), a rod (14) connected to the piston (5) extending through
10 said venting bore (13) leaving an annular passage, said rod (14) carrying a valve (16) which in the end position of the piston determined by the main-source pressure, closes off said annular passage -
15 (13).

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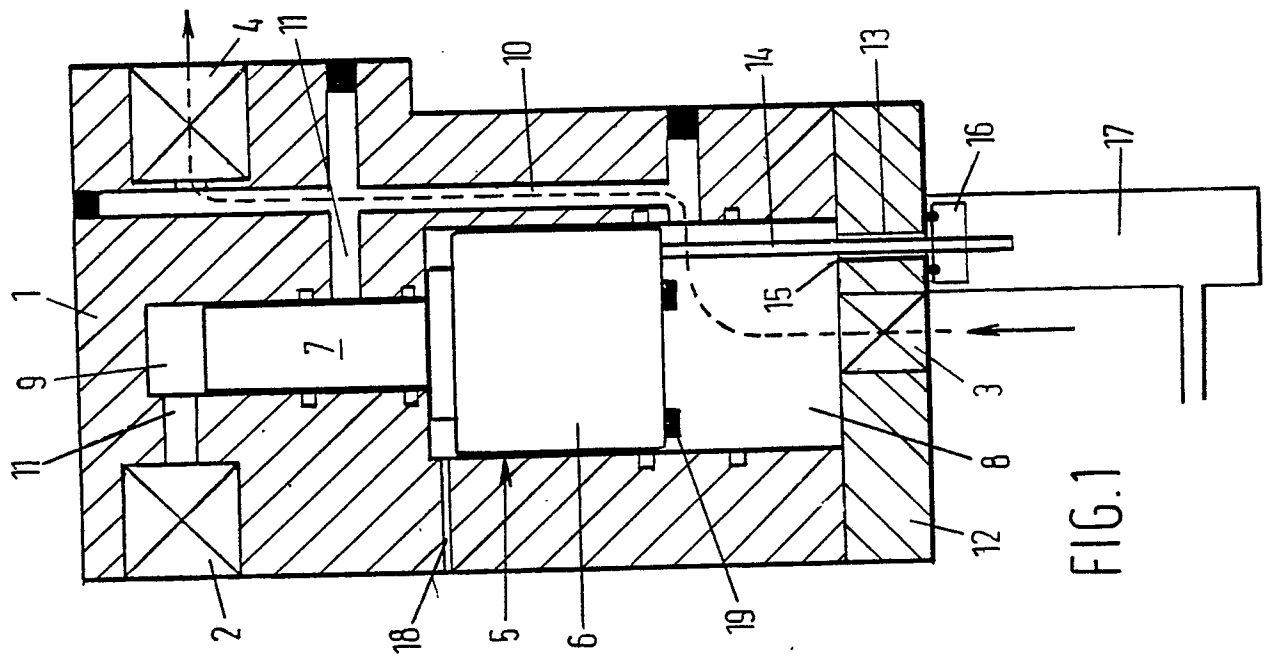
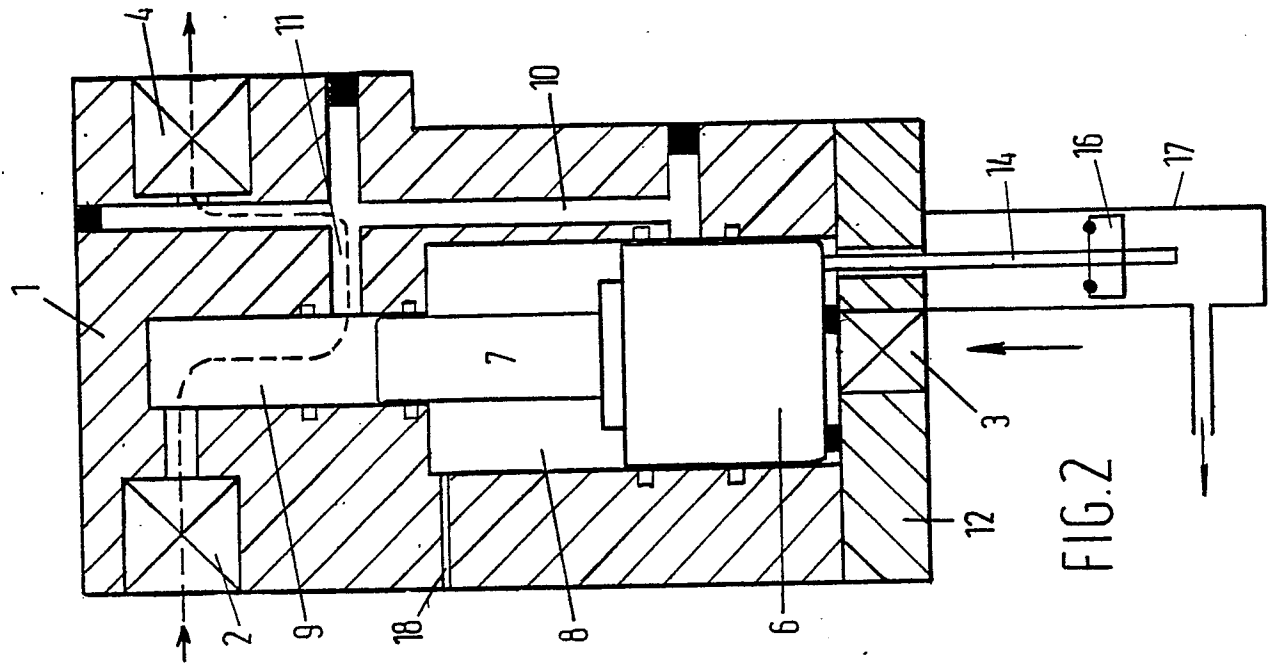
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US-A-4 499 914 (SCHEBLER) * Column 4, line 65 - column 5, line 44; figure 1 * ---	1	A 62 B 9/02
Y	US-A-3 618 636 (GRIMLAND) * Claim 1; figures 1-3 * ---	1	
A	FR-A-2 232 715 (ZAHNRADFABRIK FRIEDRICHSHAFEN AG) * Claims 1-5; figure 2 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A 62 B F 16 K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13-08-1986	Examiner ERNST R.T.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			