United States Patent

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[33] **Italy**
[31] **16321A/68**
Pat. 834,346

[54] **VALVE DEVICE FOR INTERCEPTING FAULTY CIRCUITS IN PNEUMATIC PLANTS WITH A PLURALITY OF CIRCUITS**
4 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **137/266,** 137/494
[51] **Int. Cl.** **F16k 31/12**
[50] **Field of Search** 137/509, 266

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ABSTRACT: A valve device for use in a pneumatic plant having several utilization circuits fed by a single compressor through a single regulator, which device serves to isolate a faulty circuit. The valve device comprises a piston controlled shutoff valve. The piston is spring biased to a valve-closed position and is moved against the spring bias to a valve-open position by normal operating pressure. A drop from normal operating pressure causes the piston to close the valve thereby isolating the faulty circuit.

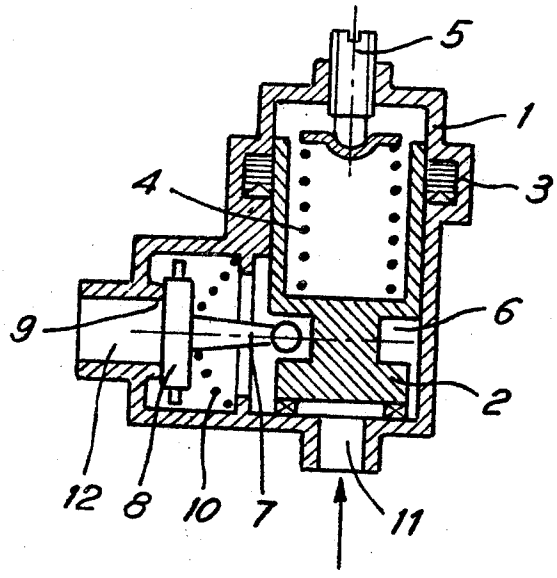

FIG. 1

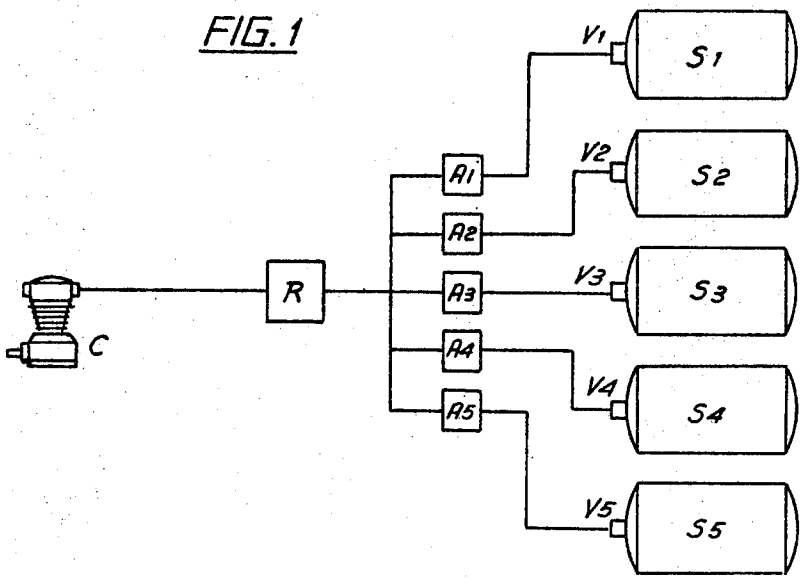

FIG. 2

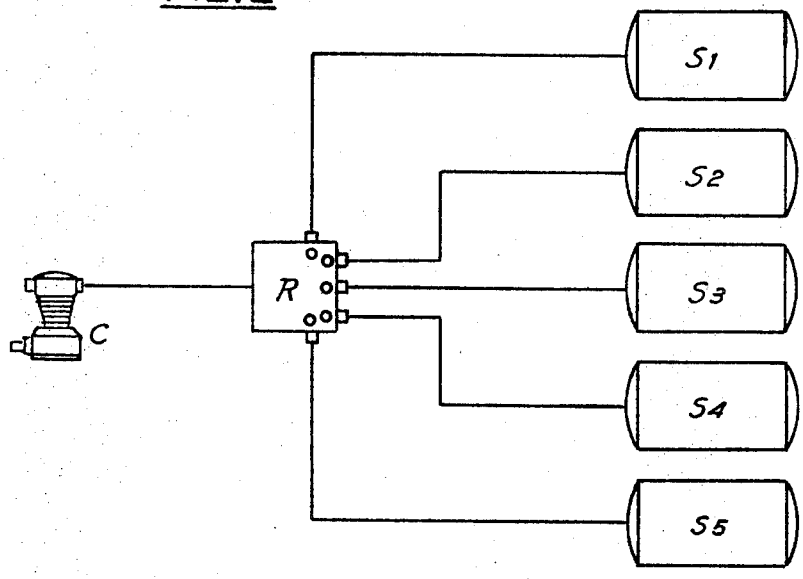

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FIG. 3

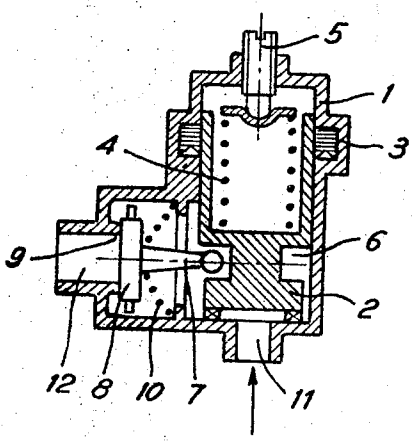


FIG. 4

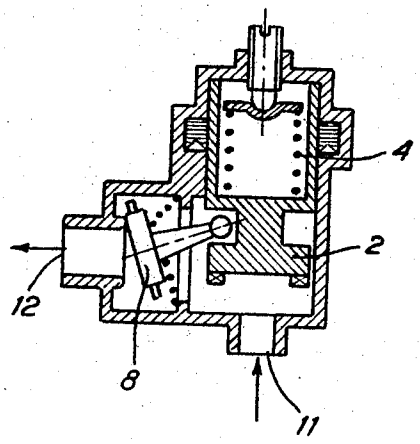
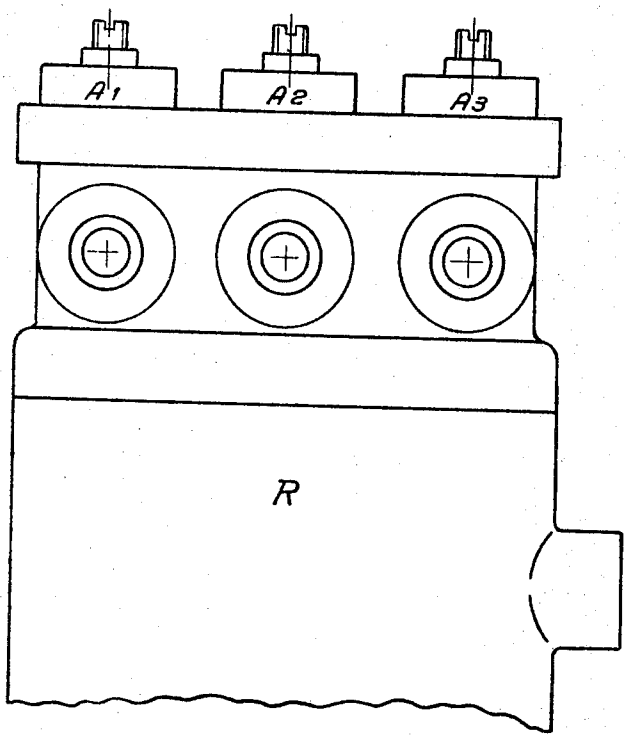


FIG. 5



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VALVE DEVICE FOR INTERCEPTING FAULTY CIRCUITS IN PNEUMATIC PLANTS WITH A PLURALITY OF CIRCUITS

In pneumatic plants with a plurality of circuits which are fed by one single compressor through one single pressure regulator, the failure of one circuit prevents the reinstatement of the working pressure in the undamaged circuits after evacuation of air therefrom, provided that the failure causes very small leakages, i.e. such as not to exhaust, by leakage, such fraction of the capacity of the compressor, as corresponds to the faulty circuit.

To prevent the above-mentioned drawback, several safety devices have already been proposed which, in case of a partial failure of a pneumatic circuit, provide for the pneumatic separation of the faulty circuit, or for the reduction of the capacity thereof, whereby all other circuits are maintained in efficiency, but at a pressure considerably lower than that obtainable in normal conditions.

The object of the present invention is to provide a device of simple structure, insertable at the input of each circuit, to effect the separation of the faulty circuit, as well as to obtain, in the other circuits, a pressure only slightly lower than that obtainable in the plant in normal conditions. It is further possible to insert the device in the pressure regulator, i.e. as many units thereof as there are pneumatic circuits branching off from said regulator.

The device according to the invention comprises a shutoff valve, controlled by a piston responsive to the feeding pressure in opposition to the adjustable load of a spring. The above-mentioned valve is open when the working conditions are normal and it closes when the air pressure decreases below a preestablished value, when a failure occurs within the circuit controlled by the device of this invention; whereas the maximum pressure obtainable in the other circuits is limited to the above-mentioned value, after evacuation of a certain quantity of pressurized air from the tanks.

The value of the pressure which causes the intervention of the device, can be established with an almost perfect exactitude, i.e. with a maximum difference of one-half of an atmosphere with respect to the working pressure of the plant.

The invention will be now described with reference to the attached drawings, wherein:

FIG. 1 is a schematic view of a pneumatic, fine circuit plant, provided with the device according to the present invention;

FIG. 2 shows a similar plant equipped with the devices according to the invention, said devices being inserted in the pressure regulator together with the shutoff valves;

FIG. 3 is a cross section of the device according to the invention in the position corresponding to both a rest condition and after failure of the circuit controlled thereby;

FIG. 4 is a section of the device according to the invention under normal operating conditions; and

FIG. 5 is a pressure regulator incorporating three of the devices of the present invention.

In FIGS. 1 and 2 the device of the invention is indicated with reference letter A, whereas the reference letters C, R, V and S indicate the compressor, the pressure regulator, the shutoff valves and the tanks of the various circuits, respectively.

Referring to FIG. 3, body 1 contains therein a piston 2 slidably moving through gasket 3 and pushed downward by the load of spring 4, said spring being adjustable by means of screw 5. Piston 2 has a seat 6 in which is housed the ball-shaped end of rod 7 of a valve 8. The valve 8 is biased against seat 9 by spring 10. Inlet 11 is connected to the pneumatic source and outlet 12 to the tank of the pneumatic circuit, by means of retaining valve (not shown in the FIG.).

The surface areas of the seat of valve 8 and of piston 2 near gasket 3, the length of rod 7 of valve 8, as well as the loads of springs 4 and 10 are mathematically related to determine the values of the operating pressures of the device.

FIG. 4 shows the device in positions feed the tank connected at 11 from the pneumatic source connected at 12.

The device operates as will be now explained in the following:

The pressurized air provided through inlet 11, pushes piston 2 upward, as soon as the pressure reaches a value which corresponds to the load of spring 4, plus the force required to move the ball-shaped end 7 of valve 8, said valve being adhered against seat 9, both by the pressurized air and by spring 10.

The dislocation of the end of rod 7 of valve 8, causes part of valve 8 to move away from seat 9 and thus allows the air to flow from inlet 11 into outlet 12 connected to the tank.

The air which flows through outlet 12 and fills the tank causes a gradual increase of the pressure downstream of valve 8, thus causing a reduction of the effort necessary to move the ball-shaped end of rod 7 of valve 8, a further dislocation of piston 2 and the maximum opening of valve 8.

When a failure occurs in the tank connected at 12 or in a branch of the circuit fed by said tank, the air pressure below piston 2 decreases to such a degree as to cause, below said piston 2, a thrust smaller than the load of spring 4. At this very moment piston 2 returns to its resting position, thus causing valve 8 to close and the shutoff of the damaged circuit.

In the other circuits, the pressure cannot increase over a value greater than that which causes the initial opening of valve 8, since at this point the excess pressure is discharged through the same valve, as well as through the failure which occurred in the circuit controlled by said valve. By advantageously selecting the diameters of piston 2 and of the seat of valve 8, the length of rod 7 and the loads of springs 4 and 10, it is possible to establish the value of the opening pressure of valve 8 at a level slightly lower than that of the value of the working pressure of the plant, thus reducing, by an acceptable quantity, the amount of energy prevailing in the undamaged circuits.

FIG. 5 shows the pressure regulator R for a three-circuit plant, incorporating devices A_1, A_2 and A_3 according to this invention.

The specification refers to a preferred embodiment of the invention. It is understood that it is possible to realize the invention in different manners, while remaining within the limits and aims of the present invention.

I claim:

1. In a pneumatic plant, and in particular a plant designed for installation in motor vehicles, having a compressed air source connected, through a pressure regulator, to a plurality of pneumatic circuits, each of which is provided with a corresponding tank, an intercepting device inserted between the compressed air source and each of tanks of said pneumatic circuits, said intercepting device comprising housing having an inlet connected to said compressed air source and an outlet connected to a pneumatic circuit, a gate valve mounted in said housing to close the outlet thus preventing communication between said compressed air source and the tank of the respective circuit; a piston movably mounted in said housing to close said inlet, means operatively connecting said piston to said gate valve, spring means biasing said valve and said piston to their closed positions, said piston being influenced, on one hand, by said spring means and, on the other hand, by the pressure from the compressed air source, in such a way that said gate valve is selectively opened and closed by the combined and differential actions of the pressures in the tank of the said circuit and of the pressure provided by said compressed air source.

2. An intercepting device according to claim 1, further comprising adjusting means for adjusting the force of the spring means acting on the piston.

3. An intercepting device according to claim 1, wherein said means connecting said gate valve to said piston comprises an arm integral with said gate valve and pivotally connected to said piston.

4. An intercepting device according to claim 3, further comprising a ball head formed on the free end of said arm and a slot provided in the periphery of the piston, said ball head engaging in said slot.