

[54] PNEUMATIC LOGIC VALVE

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251/16

[51] Int. Cl. F16k 7/17

[58] **Field of Search**..... 137/496, 500, 501,
137/503; 251/16, 22

[56] **References Cited**

UNITED STATES PATENTS

842,279	1/1907	Walker	251/16
1,854,467	4/1932	Fourness	137/496
1,838,343	12/1931	Widell	137/503
3,390,696	7/1968	Dawson	137/496
1,768,305	6/1930	Bentley	251/16

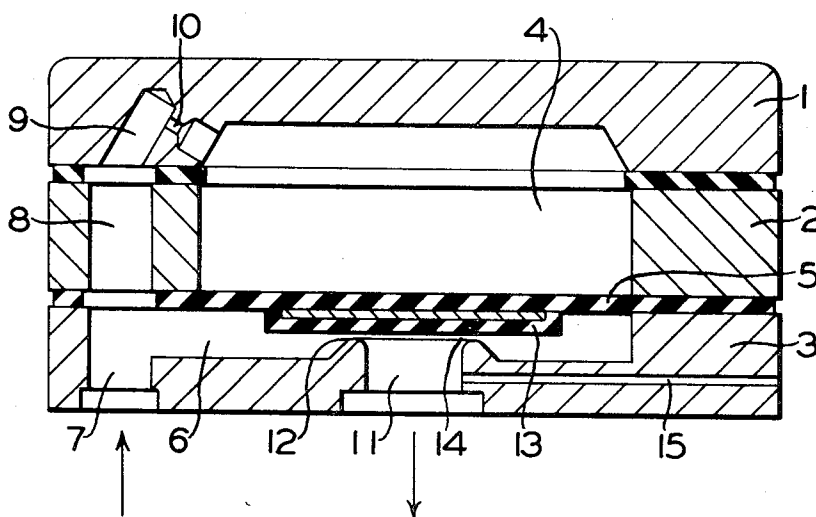
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[57] **ABSTRACT**

A fluid pressure logic valve device for producing an output signal of limited duration, regardless of the duration of the input signal, by utilizing the drop in pressure characteristic of fluid pressure flowing through a constricted opening, such constriction, through which supply pressure for the output signal flows, being formed by the proximity of an adjacent side of a valve member to a cooperating valve seat, the valve member being subjected on the opposite side, at a controlled rate, to the same fluid pressure supplied for the output signal. As the pressure acting on the opposite side of the valve member tends to approach or exceed the differential pressure value between the upstream and downstream areas of the constriction and acting on the one side of the valve member, said valve member tends to close, thereby further constricting the flow path, further reducing the set fluid pressure acting on said one side of the valve member, and thus causing positive seating of said valve member to cut off the output signal. Continuance and duration of the input signal is of no consequence once the valve member is in its cut-off position.

7 Claims, 2 Drawing Figures



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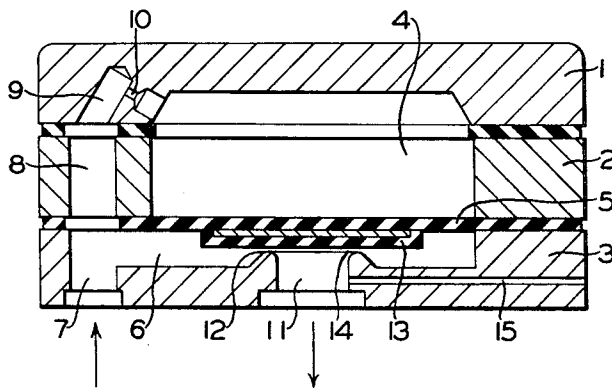


FIG. 1

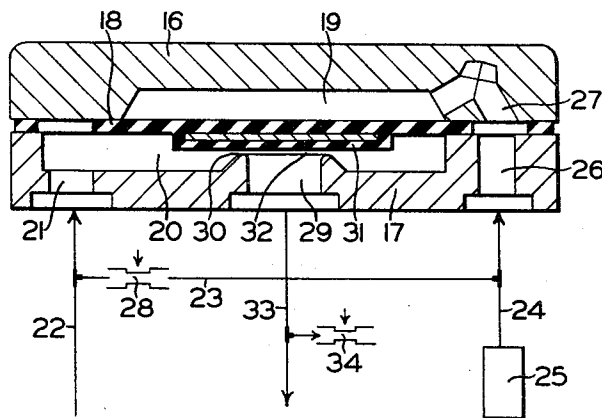


FIG. 2

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PNEUMATIC LOGIC VALVE

BACKGROUND AND SUMMARY OF THE INVENTION

Some systems, wherein a logic valve device of the type herein disclosed is used, require an output signal of predetermined, relatively short duration for effecting the desired control function. Heretofore, in some instances, it has been necessary to use a combination of two or more logic valve devices for obtaining the desired control signal. For example, when fluid pressure is supplied to the output of a primary logic valve device to effect an output signal, such fluid pressure may also be supplied to a pilot valve device which is thereby actuated to effect supply of cut-off pressure to the primary device for cutting off the output signal. If it is desired to limit the output signal to a certain duration, a timing device must also be used in conjunction with the pilot valve device.

The object of the present invention, therefore, is to provide a self-contained logic valve device capable of producing an output signal of prescribed duration irrespective of the duration of the input signal for actuating the valve device.

The invention comprises a diaphragm-valve element clamped between two casing sections to thus provide a timing chamber or volume on one side of the diaphragm-valve member and a fluid pressure supply chamber on the opposite side, said supply chamber having an output passageway leading therefrom with a valve seat surrounding the end adjacent the supply chamber. Both the supply chamber and the timing chamber are supplied with fluid pressure from a common source with the timing chamber being supplied at a restricted rate via choke means. The diaphragm-valve member is disposed with such proximity relative to the valve seat surrounding the output passageway as to form a constriction via which fluid pressure must flow from the supply chamber to the output passageway when an output signal is initiated. As is well known, the pressure of fluid is reduced on the downstream side of a constriction through which the pressurized fluid flows, thus a pressure differential or average pressure results to act on the adjacent or supply side of the diaphragm-valve member. As the pressure acting on the side of the diaphragm-valve member adjacent the timing chamber, or the timing side, approaches or slightly exceeds the average pressure acting on the supply side, the diaphragm-valve member starts to move toward the valve seat to further constrict the opening therebetween and thus effect a further reduction in the pressure acting on the supply side of the diaphragm-valve member and finally positive seating thereof on the valve seat to terminate the output signal. Thus, irrespective of the duration of the input signal, the duration of the output signal is determined by the degree of input pressure, the size of the timing chamber, the flow capacity of the choke means through which the timing chamber is charged, and the degree of constriction provided between the diaphragm-valve and the valve seat.

In the drawing,

FIG. 1 is an elevational view, in section, of a logic valve device embodying the invention; and

FIG. 2 is an elevational view, partly in section and partly diagrammatical, of a modified form of the logic valve device shown in FIG. 1.

DESCRIPTION AND OPERATION

As viewed in the drawing, the logic valve device shown in FIG. 1 comprises an upper casing section 1, an intermediate casing section 2, and a lower casing section 3. Upper casing section 1 and intermediate casing section 2 are sealingly clamped together (by suitable means not shown) to cooperatively form internally thereof, partly in one casing section and partly in the other, a control chamber 4, which also acts as a timing volume or chamber as will hereinafter be explained. A diaphragm-valve member 5 is sealingly clamped between intermediate casing section 2 and lower casing section 3 and thereby separates control chamber 4 from a supply chamber 6 formed in lower casing section 3.

Fluid pressure may be supplied (as indicated by the arrow) to supply chamber 6 via a fluid pressure supply port or inlet 7 formed in lower casing section 3, said supply port being communicated to control chamber 4 via communicating passageways 8 and 9 formed in intermediate and upper casing sections 2 and 1, respectively. A choke 10 of prescribed flow capacity is interposed in passageway 9 for restricting supply of fluid pressure to said control chamber accordingly.

A fluid pressure delivery passageway or outlet 11 is coaxially formed in lower casing section 3 for providing means via which a fluid pressure control impulse may be delivered (as indicated by the arrow) to a device (not shown) to be controlled thereby. An annular valve seat 12 is surroundingly formed at the inner end of delivery passageway 11 in axially-spaced relation and parallel with a central valve portion 13 of the diaphragm-valve member 5. The axial distance between valve portion 13 and valve seat 12 is of predetermined limitation so as to provide therebetween a constriction or restricted gap 14 through which fluid pressure must flow from supply chamber 6 to outlet 11. Delivery passageway 11 is vented to atmosphere, for a purpose to be hereinafter disclosed, via a bleed port 15 of restricted flow capacity.

Operation of the logic valve device shown in FIG. 1 is effected by supplying fluid pressure to inlet 7 which fluid pressure flows simultaneously to control chamber 4, via passageways 8 and 9 and choke 10, and to supply chamber 6, whence such fluid pressure flows through constriction 14 to outlet 11 to provide a control impulse for the device (not shown) to be controlled thereby. As is known to those skilled in the art, the pressure of fluid flowing through a constriction is effectively reduced on the downstream side as compared to the pressure of said fluid on the upstream side. Thus, as fluid pressure from supply chamber 6 passes through the constriction or gap 14, the pressure on the downstream side adjacent outlet 11 is reduced relative to the pressure on the upstream side of said constriction adjacent the supply chamber. As a result of such reduction of pressure on the downstream side of gap 14, fluid pressure building up in chamber 4 becomes effective for deflecting diaphragm-valve 5 downwardly toward valve seat 12 for further restricting the gap between the central valve portion 13 and said valve seat. Further constriction of gap 14 causes further reduction of pressure on the downstream side thereof and further effectiveness of control pressure on the opposite side of diaphragm-valve 5 until positive sealing or movement of central valve portion 13 to a seated or cut-off position

on valve seat 12 occurs. Seating of valve portion 13 on valve seat 12 terminates delivery of the control impulse, the duration of which is normally relatively short and is determined by the pressure of fluid supplied to inlet 7, the volume of control chamber 4, the flow capacity of choke 10, and the dimension of gap 14.

The bleed port 15, being tapped off the outlet 11, assures flow of fluid pressure to said outlet as long as the central valve portion 13 is in an unseated position relative to valve seat 12. Once seated, the valve portion 13 is retained in its seated or cut-off position on valve seat 12 by higher pressure in control chamber 4 until input 7, and therefore said control chamber, is vented. Of course, the output pressure is also relieved via bleed port 15 once valve portion 13 is seated on valve seat 12. With input 7 vented, diaphragm-valve 5 resumes a normal unseated position relative to valve seat 12 to thereby reset the logic valve device for subsequent operation.

The modified logic valve device shown in FIG. 2 differs from the valve device shown in FIG. 1 in that the structural features corresponding to timing volume 4, choke 10, and bleed port 15 formed internally of the several casing sections 1, 2, and 3 in the device shown in FIG. 1, are adjustably located externally of the device and represented diagrammatically in FIG. 2, thereby permitting adjustment thereof for varying the duration of the control impulse accordingly.

The logic valve device, as viewed in FIG. 2, comprises an upper casing section 16 and a lower casing section 17 with a diaphragm-valve member 18 sealingly clamped therebetween to thereby separate a fluid pressure control chamber 19, formed in the upper casing section, from a fluid pressure supply chamber 20 formed in the lower casing section.

Lower casing section 17 is provided with fluid pressure supply passage means comprising an inlet 21 (corresponding to inlet 7 in FIG. 1) via which fluid pressure from a supply conduit 22 may be supplied to supply chamber 20, as indicated by the arrow on said conduit. The fluid pressure supply means further comprises a conduit 23 connected at one end to conduit 22 and at the other end to a conduit 24, one end of said conduit 24 being connected to a timing volume 25 (corresponding to control chamber or timing volume 4 in FIG. 1) and the other end being connected to a control pressure passageway or input 26 formed in lower casing section 17. Input 26 connects to control chamber 19 via a registering passageway 27 formed in upper casing section 16. A variable choke 28 (corresponding to choke 10 in FIG. 1) is interposed in conduit 23 for controlling the rate of fluid pressure flow to and buildup in control chamber 19 and timing volume 25. Since the timing volume 25 is located externally of the casing, such timing volume may be conveniently replaced by one of different size to produce the desired timing.

Lower casing section 17 is also provided with a fluid pressure delivery or outlet 29 (corresponding to outlet 11 in FIG. 1) with an annular valve seat 30 formed at the inner end thereof. Similarly to the arrangement of valve seat 12 relative to the central valve portion 13 in FIG. 1, valve seat 30 is disposed relative to a central valve portion 31 of the diaphragm-valve member 18 to provide a constriction or restricted gap 32 through which fluid pressure must flow from supply chamber 20 to outlet 29. A conduit 33 connects outlet 29 with a device (not shown) to be controlled by the control im-

pulse delivered thereto from outlet 29. A variable choke 34 is tapped off conduit 33 and performs a similar function as the bleed port 15 in the device shown in FIG. 1.

Since the operation of the logic valve device shown in FIG. 2 is similar to that of the device shown in FIG. 1, it is not deemed necessary to describe said operation in detail. Fluid pressure supplied to conduit 22 flows simultaneously to supply chamber 20 via inlet 21 and to control chamber 19 and timing volume 25 at a controlled rate via choke 28, conduit 23 and conduit 24. Fluid pressure flows through constriction 32 to outlet 29 and conduit 33 to provide a control pressure impulse until movement of valve portion 31 to a seated position on valve seat 30 occurs in a manner similar to that described above in connection with the device shown in FIG. 1. Choke 34 assures continued flow of fluid pressure through gap 32 as long as central valve portion 31 is in an unseated position relative to valve seat 30 and also provides for dissipation of the control impulse subsequently to seating of said central valve portion on said valve seat, which central valve portion remains in a seated position until fluid pressure in supply conduit 22, and therefore in control chamber 19 and timing volume 25, is vented.

Having now described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A logic valve device comprising:

- a. a casing having formed therein a fluid pressure control chamber comprising a timing volume and a fluid pressure supply chamber;
- b. a diaphragm-valve member fixed in said casing for sealingly isolating said control chamber from said supply chamber;
- c. supply passage means via which fluid pressure may be supplied simultaneously to said control chamber and said supply chamber;
- d. an outlet in said casing normally communicating with said supply chamber via a flow area disposed between said diaphragm-valve member and said outlet and via which outlet a fluid pressure impulse may be delivered; and
- e. an annular valve seat surrounding one end of said outlet and axially spaced apart from one side of said diaphragm-valve member adjacent the flow area and in such proximity thereto as to form a constricting gap in said flow area for providing an effective reduction of fluid pressure on the downstream side of said flow area and, therefore, a resulting reduction of fluid pressure acting on said one side of said diaphragm-valve member for rendering buildup of fluid pressure in the control chamber and acting on the opposite side of said diaphragm-valve member effective for moving said diaphragm-valve member to a cut-off position relative to said valve seat and in which flow of fluid pressure through said flow area to said outlet is cut off.

2. A logic valve device, as set forth in claim 1, further characterized by choke means of predetermined flow capacity interposed in said supply passage means for delaying buildup of fluid pressure in said control chamber and consequent cut off of fluid pressure flow to said outlet accordingly.

3. A logic valve device, as set forth in claim 2, wherein the flow capacity of said choke means is variable.

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4. A logic valve device, as set forth in claim 2, wherein said diaphragm-valve member normally occupies an unseated position relative to said valve seat and in which unseated position of said diaphragm-valve member said supply chamber is in communication with said outlet, said diaphragm-valve member being operable responsively to buildup of fluid pressure acting on said opposite side of said diaphragm-valve member to a value sufficient for overcoming the pressure acting on said one side, as determined by the differential pressure between the upstream side and downstream side of said flow area, to a seated position on said valve seat for effecting said cut off of fluid pressure to the outlet.

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5. A logic valve device, as set forth in claim 4, further characterized by an atmospheric bleed port tapped off said outlet for assuring flow of fluid pressure through said constriction means as long as said diaphragm-valve member is in its said unseated position.

6. A logic valve device, as set forth in claim 5, wherein said timing volume, said choke means, and said bleed port are disposed externally of said casing.

7. A logic valve device, as set forth in claim 6, wherein the size of said timing volume and the respective flow capacities of said choke means and bleed port are variable.

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