

[54] FLUIDIC SELECTOR VALVE

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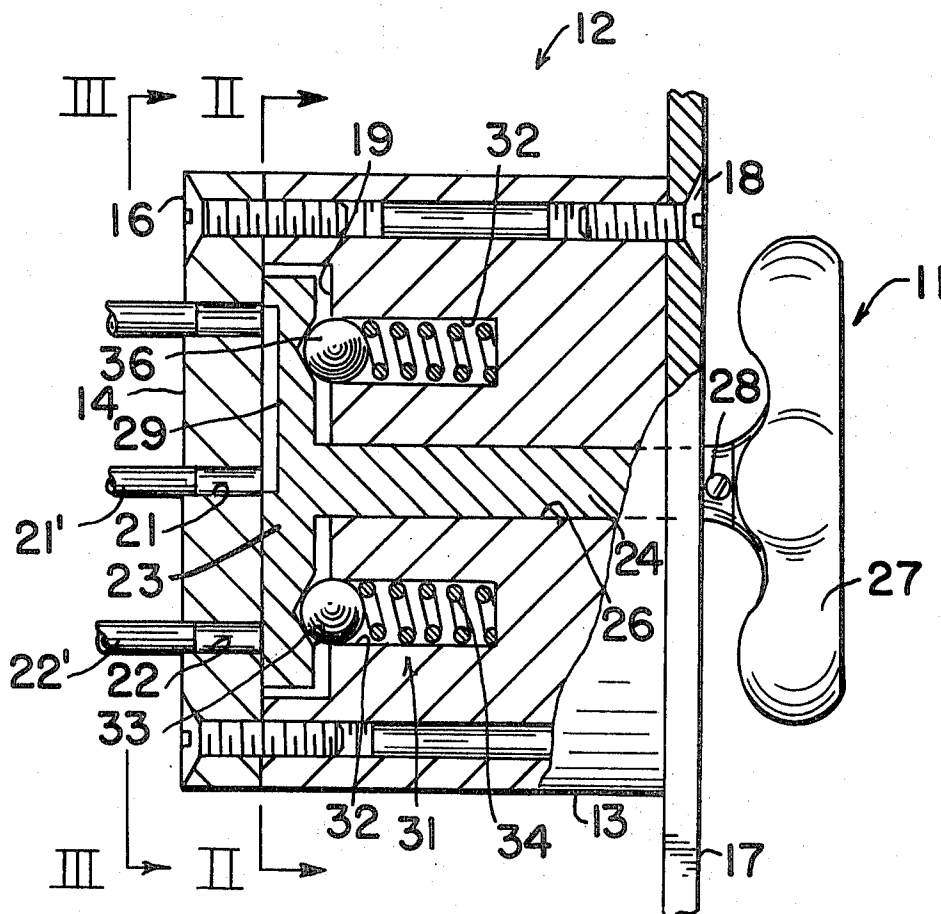
[57] ABSTRACT

A fluidic switch for connecting a first fluid signal line with any selected one of a plurality of additional signal lines has a housing forming a chamber with an end wall having a first port and a plurality of additional ports spaced equiangularly therearound. A rotatable plate is disposed in the chamber and has a radial fluid passage which is permanently communicated with the first port and which may be selectively communicated with any of the additional ports by rotation of the plate through control means extending externally of the housing. Sealing of the contacting surfaces of the plate and end wall is accomplished by the same means which provides a detenting action at each of the several switch positions. Specifically a plurality of springs act between the housing and the plate to urge the plate against the end wall with the spring force being transmitted to plate through spherical elements which seat in indentations in the plate surface at each of the positions of the switch to yieldably resist rotation of the plate.

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1 Claim, 3 Drawing Figures



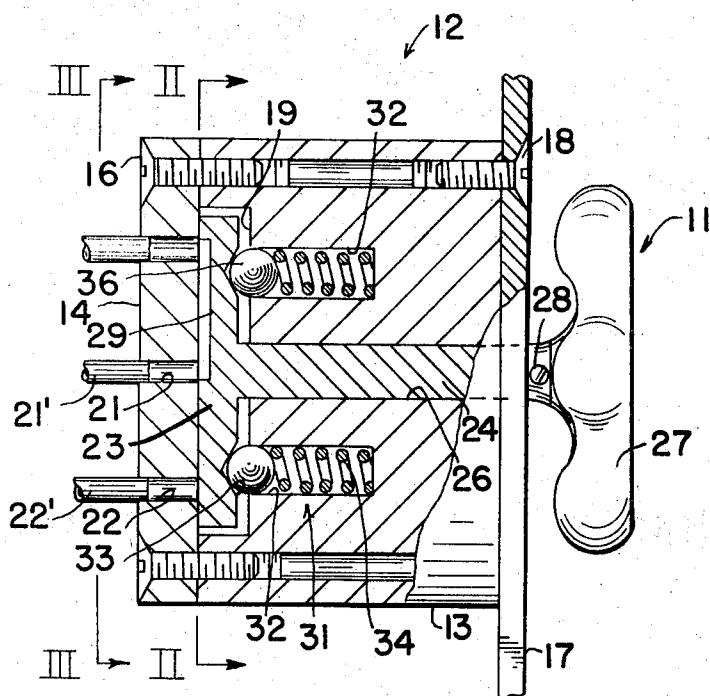


Fig. 1

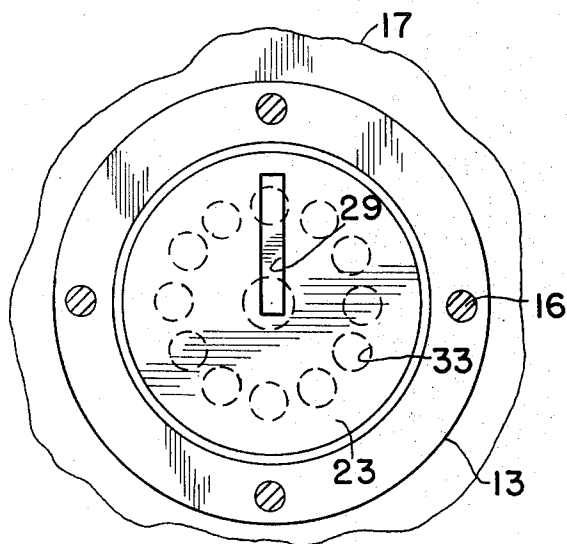


Fig. 2

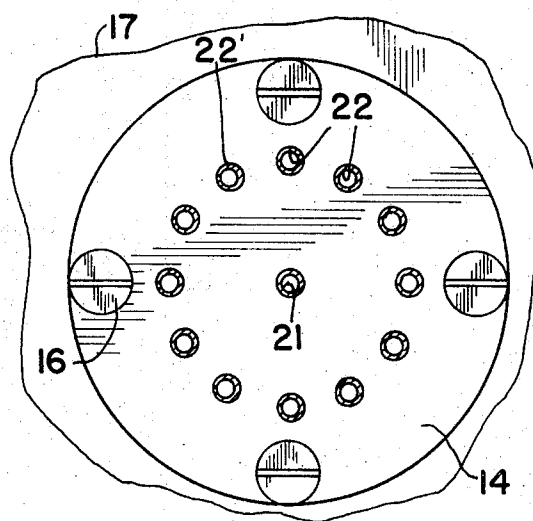


Fig. 3

FLUIDIC SELECTOR VALVE

BACKGROUND OF THE INVENTION

This invention relates to valves and more particularly to selector valves for connecting a fluid line with any selected one of a plurality of additional fluid lines and which are particularly adapted for use as components of fluidic circuits in which fluid flows are primarily digital information transmitting mediums.

Digital circuits for performing data processing operations, computations and machinery control functions commonly employ electronic components and process information in the form of electrical signals. There are certain situations in which the use of electronic elements is either undesirable or in some cases unworkable. Inasmuch as many of the properties of a fluid system are analogous to those of an electrical system and since most of the primary circuit elements of an electronic system have an analog device in fluid systems, fluidic circuits have been developed to perform data processing and digital control functions in situations where an electrical circuit is undesirable.

In a fluidic circuit, the fluid serves primarily as an information transmitting medium rather than as a working fluid as in older forms of hydraulic or pneumatic systems. Consequently, fluidic circuits usually operate at lower pressures and with smaller flow volume. Very small and light fluid lines may be used and sealing requirements and the like are less severe. The bulk, complexity and costs of older forms of valves are usually undesirable in fluidic circuits and efforts have therefore been made to develop compact, light and economical components specifically adapted for fluidic circuitry.

One of the common components of a digital circuit is a selector switch for connecting a first signal line with any selected one of a plurality of additional signal lines. In a fluidic system this takes the form of a valve having a first port and having a control knob or the like which may be turned to selectively connect the first port with any of a plurality of additional ports. It has become customary in the art to apply terms derived from electronics to fluidic circuit elements and thus a device of the kind under discussion is often referred to as a switch although it is also a form of valve and the two terms will be used interchangeably herein.

U.S. Pat. No. 3,613,505 discloses an example of a fluidic circuit which employs selector switches. In this prior patent a loader vehicle of the kind used to manipulate earth or other materials has a fluidic circuit which automatically stops upward and downward motion of the loader bucket at predetermined positions as determined by the settings of two fluidic selector switches. The two selector switches control the action of fluidic binary counters which count successive increments of motion of the loader bucket. Many other forms of fluidic circuit also employ selector switches.

While efforts have heretofore been made to develop selector valves or switches specifically adapted to fluidic circuit usage, these have retained some of the undesirable bulk, complexity and cost of valve designs used in older forms of fluid system in which higher pressures, larger flows and larger diameter flow conduits may be present.

SUMMARY OF THE INVENTION

This invention is a selector valve suitable for usage in

fluidic circuits which may be readily and economically manufactured using a small number of parts. A housing has a chamber with an end wall in which a first port is situated together with a plurality of additional ports spaced apart angularly around the first port. A rotatable plate disposed in the chamber against the end wall has a fluid passage communicating with the first port which may be selectively communicated with ones of the additional ports by turning the plate against the end wall through control means extending externally from the housing. Spring means exert a force urging the plate against the end wall to perform both a sealing function and a detenting function for holding the valve at selected positions.

Accordingly, it is an object of this invention to provide a compact, simple and reliable low cost selector valve.

The invention, together with further objects and advantages thereof, will best be understood by reference to the following description of a preferred embodiment taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a side view, partially in axial section, of a fluidic selector valve embodying the invention,

FIG. 2 is a cross section view of the valve assembly of FIG. 1 taken along line II—II thereof, and

FIG. 3 is an end view of the assembly of FIG. 1 taken along line III—III thereof.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, a selector valve assembly 11 has a housing 12 formed of a cylindrical member 13 and a circular end wall member 14 secured to one end thereof in coaxial relation thereon by suitable means such as screws 16. Various means may be employed to support the housing assembly 12 which in this example is secured to a panel 17 of an operator's control console. In this example, the end of cylinder 13 remote from end wall member 14 is disposed against panel 17 and additional screws 18 extend therethrough to secure the housing to the wall.

Cylindrical member 13 has a circular cavity 19 in the end adjacent end wall member 14 which defines a chamber that is preferably coaxial with the housing member 13.

To provide for fluid connections to the valve assembly 11, a first port 21 transpierces end wall 14 at the center thereof and a plurality of additional ports 22 also transpierce the end wall. The additional ports 22 of which there are twelve in this particular example, are angularly spaced apart relative to first port 21. Ports 22 are preferably equiangularly spaced around the first port 21 and are preferably equidistant therefrom.

Considering now the means by which first port 21 may be communicated with any selected one of the additional ports 22, a rotatable circular plate 23 is disposed in chamber 19 in coaxial relation therein against end wall member 14. Plate 23 has a stem portion 24 extending axially therefrom through a conforming axial passage 26 in cylindrical member 13 and through panel 17. A suitable control knob 27 is secured to the end of stem 24, by means such as a set screw 28, to facilitate manual operation of the valve.

Rotatable plate 23 has a radially directed slot 29 in the end adjacent end wall member 14 which slot extends from the axis of the plate radially outward thereon a distance corresponding to the spacing of additional ports 22 from first port 21. Thus, slot 29 is permanently communicated with first port 21 and may be selectively communicated with any of the additional ports 22 by turning of plate 23 through control knob 27.

In order to avoid fluid leakage from between plate 23 and end wall member 14, it is desirable that the plate continually be urged against the end wall with a force sufficient to inhibit leakage but insufficient to make operation of the switch unduly difficult. Further it is highly desirable that a detent action be provided which yieldably resists turning of plate 23 out of any of the positions at which slot 29 communicates with a selected one of the additional ports 22. In addition to preventing the valve from shifting away from a selected position such a detenting action also aids an operator in positioning the valve precisely since the arrival of the valve at each position can be felt through the control knob 27 while turning the knob. In the present invention both the sealing function and the detenting action are provided by the same means 31.

In particular, a pair of cylindrical bores 32 are formed in member 13 and are situated on opposite sides of passage 26 in parallel relation thereto and equidistantly therefrom each such bore having an opening at cavity 19. A series of indentations 33 are formed in the surface of rotatable plate 23 which faces the bores 32, the indentations being spaced from the rotary axis of plate 23 a distance corresponding to the spacing of the axes of bores 32 therefrom. Indentations 33 are equal in number to the number of ports 22 and are angularly positioned on plate 23 to locate a pair of the indentations adjacent the two bores 32 when port 21 is communicated with any selected one of the additional ports 22. One of a pair of compression springs 34 is disposed in each bore 32 together with one of a pair of spherical elements 36 through which the spring acts against the adjacent surface of rotatable plate 23 to urge the plate into tight contact with end wall member 14.

In operation, a fluid flow conduit 21' may be connected to port 21 and individual ones of an additional plurality of conduits 22' may be connected to the additional ports 22 in order to functionally couple the valve assembly 11 into a fluidic circuit which may take a variety of forms and may, for example, be of the kind described in the hereinbefore identified prior U.S. patent. In that example and in many other instances, a valve assembly 11 of this form is utilized to selectively transmit fluid pressure from first port 21 to a selected one of the additional conduits 22', however, it will be apparent that the valve may also be utilized to transmit fluid pressures from any selected one of the conduits 22' to the first conduit 21'. In either case, springs 34 acting through spherical elements 36 function at all times to urge plate 23 against end wall member 14 and thereby inhibit leakage. Moreover, detenting is provided for in that whenever knob 27 is turned to connect

first port 21 with a specific one of the additional ports 22 spherical elements 36 seat in the adjacent pair of indentations 33. Seating of spherical elements 36 in this manner acts to prevent angular drift of plate 23 away from the selected position after knob 27 is released since turning of plate 23 away from the selected position requires that elements 36 lift out of indentations 33 and this motion is resisted by springs 34. The detenting action further enables an operator to feel when knob 27 is precisely positioned to communicate port 21 with a selected one of additional ports 22 as the resistance to turning of knob 27 increases abruptly at each such position.

It will be apparent that an off or open switch position may be provided by omitting one or more of the ports 22 and that more complex valving functions can be provided for by adding additional slots such as slot 29 to plate 23. Thus while the invention has been described with respect to a specific example, it will be apparent that variations are possible and it is not intended to limit the invention except as defined in the following claims.

What is claimed is:

1. In a selector valve for communicating a first fluid conduit with selected ones of a plurality of additional conduits, the combination comprising:

a housing having a chamber with an end wall having a first port for connection with said first fluid conduit and having a plurality of spaced apart additional ports for connection with individual ones of said additional conduits, said first port and said additional ports all extending to a single interior surface of said end wall,

a rotatable plate disposed in said chamber against said interior surface of said end wall and having a flow passage which is communicated with said first port and which may be communicated with selected ones of said additional ports by turning of said plate,

said plate having a plurality of indentations in the surface thereof which is opposite from the surface thereof that contacts said interior surface of said end wall,

means coupled to said plate and extending externally from said housing for selectively turning said plate,

movable detent means disposed adjacent said plate for seating in said indentations to yieldably resist turning of said plate at a plurality of predetermined angular positions thereof which angular positions are those at which said first port is communicated with predetermined ones of said additional ports, resilient spring means extending between said housing and said detent means and exerting force against said plate through said detent means for urging said detent means towards said plate for seating in said indentations and for simultaneously urging said plate against said interior surface of said end wall to inhibit fluid leakage at all of said ports.

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