

Aug. 16, 1966

E. R. BASILE ET AL
PNEUMATIC TRANSDUCER

3,267,233

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2 Sheets-Sheet 1

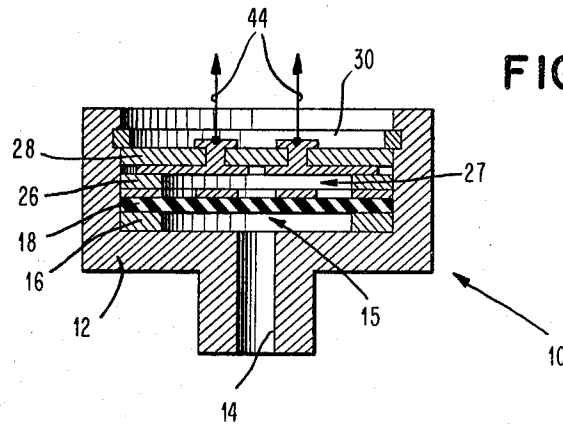


FIG. 1

FIG. 2a

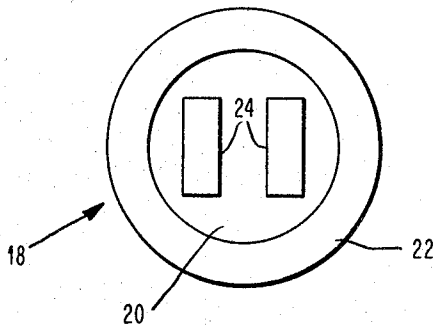


FIG. 3a

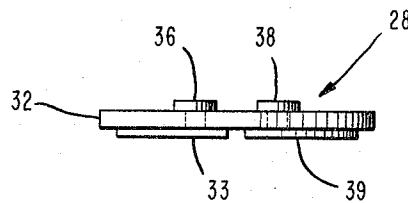


FIG. 3b

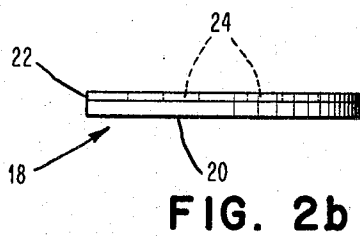
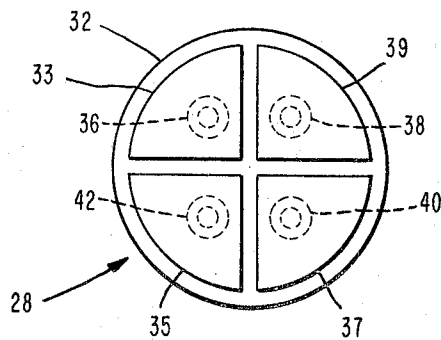


FIG. 2b

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FIG. 4

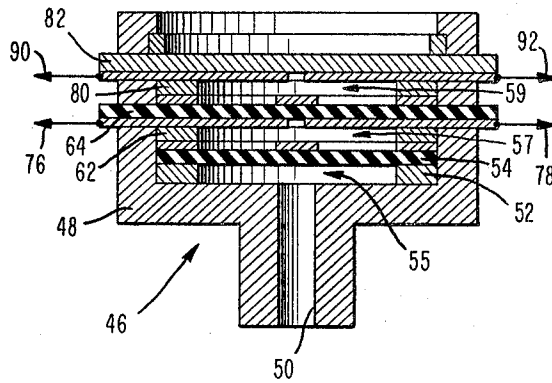


FIG. 4a

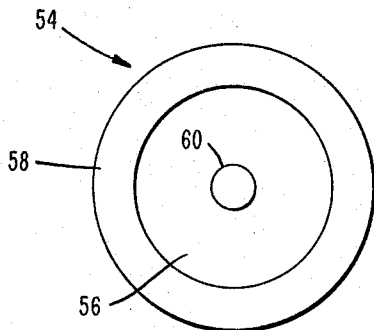


FIG. 4b

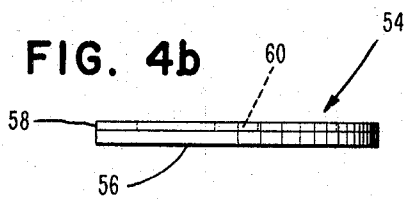


FIG. 5a

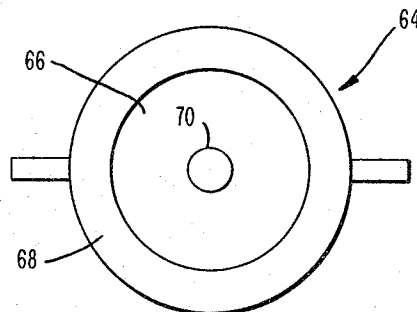


FIG. 5b

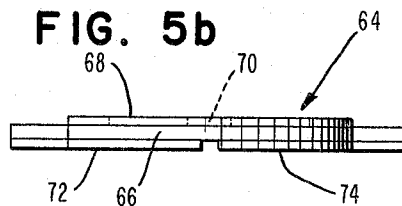


FIG. 5c

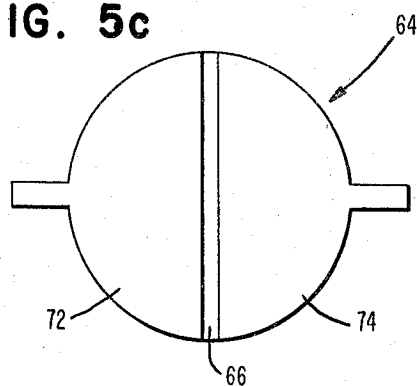


FIG. 6a

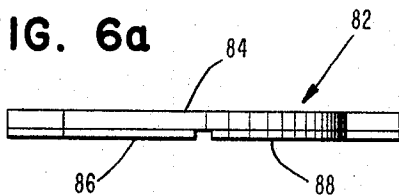
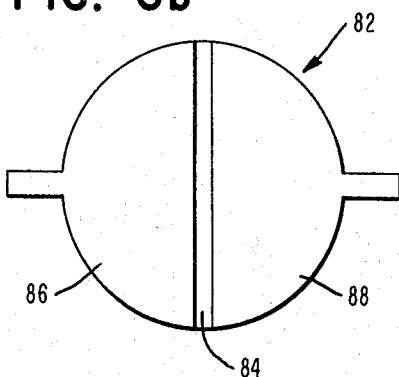


FIG. 6b



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PNEUMATIC TRANSDUCER

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2 Claims. (Cl. 200—83)

This invention relates to switching devices, and more particularly to switches which may be operated by fluid pressure.

Switches involving the use of flexible diaphragms responsive to fluid pressure are well known. Such devices generally involve a flexible membrane disposed to be urged against a flexible metal contact to cause the contact to engage a second electrical contact. Because the diaphragm and the movable contact generally involve two separate elements, fluid pressure sufficient to move both the diaphragm and the electrical contact must be employed. Generally, the electrical contact is relatively stiff and requires a high amount of pressure to cause it to flex. In addition, the use of separate elements produce manufacturing problems related to the assembly of the switches.

In many applications, it is desirable to have the fluid pressure switch operate more than one external surface. Also, in some cases, it may be desirable to utilize some fluid switches to operate a plurality of external surfaces with a predetermined time lag between the operation of the circuits.

One of the important uses to which fluid switches are related involve punching cards. In these applications, a hole in the card may be detected by the presence of a fluid passing therethrough. Such a fluid may be used to close a switch indicating the presence of a hole in the card. Such pressure switches used in the detection of a hole in the card, for example, must be of relatively high sensitivity and fast acting.

It is an object of this invention to provide an improved switching device.

It is further object of this invention to provide an improved switching device for use in fluid control systems.

It is still a further object of this invention to provide an improved multi-switching device for use in fluid control systems.

It is still a further object of this invention to provide an improved switching device of relatively high sensitivity.

In accordance with the present invention, a switching device is provided and includes a flexible diaphragm having metallized portions. Electrical contacts are normally spaced from the metallized portions of the flexible diaphragm. Conduit means are provided to direct fluid against the diaphragm to cause the metallized portions to engage the electrical contacts to produce a switching operation.

Other objects and advantages of the present invention will be apparent and suggest themselves to those skilled in the art, from a reading of the following specification and claims, in conjunction with the accompanying drawings, in which:

FIGURE 1 is a sectional view of a pneumatic switch in accordance with the present invention;

FIGURE 2a is a top view of a diaphragm forming part of the device of FIGURE 1;

FIGURE 2b is a side view of the diaphragms of FIGURE 2a;

FIGURE 3a is a side view of the contact board forming a part of the device illustrated in FIGURE 1;

FIGURE 3b is a top view of the contact board of FIGURE 3a;

FIGURE 4 is a cross sectional view of a switching

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device of another embodiment of the present invention;

FIGURE 4a is a top view of a diaphragm forming part of the device illustrated in FIGURE 4;

FIGURE 4b is a side view of the diaphragm illustrated in FIGURE 4a;

FIGURE 5a is a top view of a diaphragm forming another portion of the device illustrated in FIGURE 4;

FIGURE 5b is a side view of the device illustrated in FIGURE 5a;

FIGURE 5c is a bottom view of the device illustrated in FIGURE 5a;

FIGURE 6a is a contact board forming a portion of the device of FIGURE 4, and

FIGURE 6b is a bottom view of the contact board of FIGURE 6a.

Referring to FIGURES 1, 2 and 3, a pneumatic switch 10 includes a housing 12. The housing 12 is cylindrical in shape and includes an extension 14 which provides a fluid inlet for the switch.

A number of elements are disposed within the housing 12 in a stacked relationship. A gasket 16 is provided to receive a metallized membrane diaphragm 18. The gasket 16 acts as a spacer element to provide a first chamber 15 on the bottom side of the diaphragm 18. In addition, the gasket 16 is used for sealing.

The diaphragm 18 includes a flexible membrane 20, which may for example, be Mylar, having a circular metal surface 22 disposed about its periphery. A pair of metallized surfaces 24 are also part of the surface of the diaphragm 18. The portions 22 and 24 may be metal which is disposed on the member 20 by means of spraying, printed circuit techniques or other suitable methods.

A second spacer element 26 is disposed between the diaphragm 18 and a contact board 28. The spacer 26 provides a second chamber 27 between the diaphragm 18 and the contact board 28.

The top portion of the contact board 28 includes four circular contacts 36, 38, 40 and 42 connected to four larger contacts 34. The main portion of the contact board 28 may be a suitable insulating material. The contact 36 and 38 may be connected to suitable utilization circuits by means of output leads 44. Contacts 40 and 42 may likewise be connected to suitable utilization circuits not illustrated.

Consider the operation of the switching device illustrated when a fluid pulse is connected to the inlet 14. The fluid source may for example, be from a card reading or card sorting device in which a fluid is directed through a hole in the card into the inlet 14.

When fluid is directed into the chamber 15, pressure is exerted against the diaphragm 18. This pressure causes the diaphragm to flex and move the surfaces 44 into physical engagement with the lower contacts 34 of the contact board 28. When this occurs, it is seen that contact 33 will be electrically connected to contact 35 and contact 37 will be electrically connected to the contact 39. Thus, it is seen that the single actuation of the diaphragm 18 may be used to control the operation of a number of switches.

The metallized surface on the diaphragm 18 may be externally thin. Because of this, the actual switch contacts form a relatively small part of the mass to be moved by the fluid pressure. Thus, a switch of relatively high sensitivity is possible.

Referring particularly to FIGURES 4, 5 and 6, a modified embodiment of the present invention is illustrated. A switching device 46 includes a housing 48 having a fluid inlet 50. A gasket or spacer element 52 is provided between a housing and a metallized flexible diaphragm 54 to provide a chamber 55. A second spacer element 62 is provided between the diaphragm 54 and a second diaphragm 64 to provide a chamber 57. The spacer

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element 80 is connected between the diaphragm 64 and a contact board 82 to provide a third chamber 59.

The diaphragm 54 includes a membrane which may be Mylar having metallized surfaces 58 and 60 thereon. The diaphragm 64 also comprises a membrane 66 having metallized portions 68 and 70 thereon. The bottom portion of the diaphragm 64 includes metallized conductor surfaces 72 and 74. The contact board 82 includes an inlet, a solid base 84 having electrical contacts 86 and 88.

In considering the operation of the device of FIGURE 4, a source of fluid is connected through the inlet 50 into the chamber 55. The pressure is exerted on the underside of the diaphragm 54 to cause the metallized surface 60 to be moved into engagement with contacts 72 and 74 of the diaphragm 64. The contacts 72 and 74 may be connected to an appropriate utilization circuit through inlets 76 and 78. Thus, up to this point, it is seen that the device illustrated has provided a switching operation similar to the one described in connection with FIGURE 1.

If pressure is continued to be applied into the chamber 55 and is of sufficient level, it will cause the diaphragm 64 to flex and cause the surface 70 to engage the contacts 86 and 88. The contacts 86 and 88 may be connected to a suitable utilization circuit through leads 90 and 92. Thus it is seen that the engagement of the surface 70 with the contacts 86 and 88 provides a second switching action.

It is seen that the second switching action occurs after the first switching action. Such an operation as described, wherein a time delay is provided between switching operations, may be especially useful in connection with operating relays, for example. Also, in using fluid devices, it may be desirable to have one switch operate when the pressure of the fluid is at one level and a second switch to operate when the fluid pressure is at a second or higher level.

It is seen that the present invention has provided a switch of relatively high sensitivity in which the mass of the movable contact is minimized. By providing multi-contact, the present invention has made it possible to use a single fluid source to actuate a plurality of external electrical circuits.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A switching device comprising a housing, a first

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metal laminated flexible membrane disposed within said housing to form a first chamber with said housing, a fluid inlet connected to said housing and leading into said first chamber, a second membrane metallized on both sides connected to form a second chamber within said housing between said first and second membranes, a solid insulator element having metal surfaces connected within said housing to form a third chamber with said second membrane, and means for applying fluid through said fluid inlet into said first chamber to cause said first membrane to be forced against said second member to cause a first switching action and subsequently to cause said second membrane to contact said solid insulator to cause a second switching action.

2. A switching device comprising a housing, a first metal laminated flexible membrane disposed within said housing to form a first chamber with said housing, a fluid inlet connected to said housing and leading into said first chamber, a second membrane metallized on both sides connected to form a second chamber within said housing between said first and second membranes, one of said sides of said second membrane having a plurality of metallized surfaces, an insulator element having a plurality of metal surfaces connected within said housing to form a third chamber with said second membrane, and means for applying fluid through said fluid inlet into said first chamber to cause said first membrane to be forced against said second member to cause a first switching action when the pressure from said fluid exceeds a first predetermined level and subsequently to cause said second membrane to contact said solid insulator to cause a second switching action when the pressure of said fluid exceeds a second predetermined level.

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