

[54] **VACUUM OPERATED ELECTRICAL SWITCH WITH CUP SHAPED DIAPHRAGM NORMALLY HOLDING CONTACTS CLOSED**

[72] Inventor: Ned C. Myers, Elkhart, Ind.

[73] Assignee: Robertshaw Controls Company, Richmond, Va.

[22] Filed: Aug. 6, 1970

[21] Appl. No.: 61,687

[52] U.S. Cl. 200/83 N, 200/83 B

[51] Int. Cl. H01h 35/34

[58] Field of Search. 200/83 N, 83 R, 83 B, 83 P

[56] **References Cited**

UNITED STATES PATENTS

3,300,703	1/1967	Gold et al.	200/83 B X
3,428,768	2/1969	Golden et al.	200/83
3,246,205	4/1966	Miller	200/83 X

FOREIGN PATENTS OR APPLICATIONS

687,706	1/1930	France	200/83 B
---------	--------	-------------	----------

1,470,613 1/1967 France.....200/83 N

OTHER PUBLICATIONS

"Fluidic Switch," IBM Technical Disclosure, Vol. 11, No. 8, Jan. 1969 (p. 1021) by M. Krakinowski

Primary Examiner—David Smith, Jr.

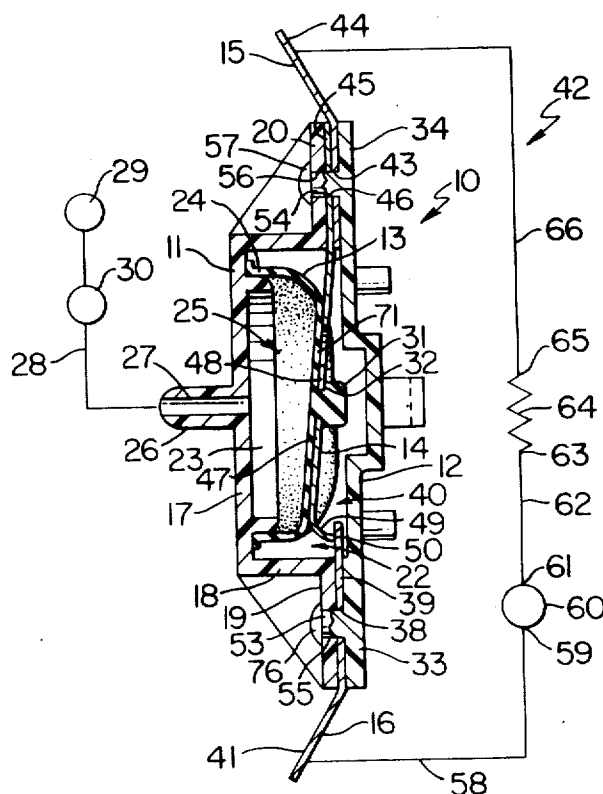
Assistant Examiner—Robert A. Vanderhye

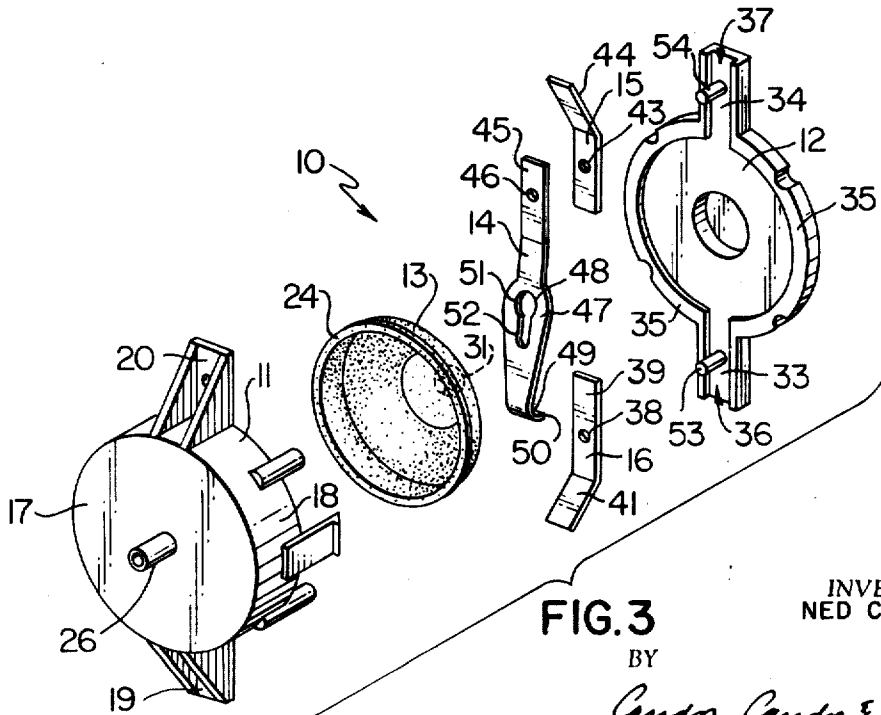
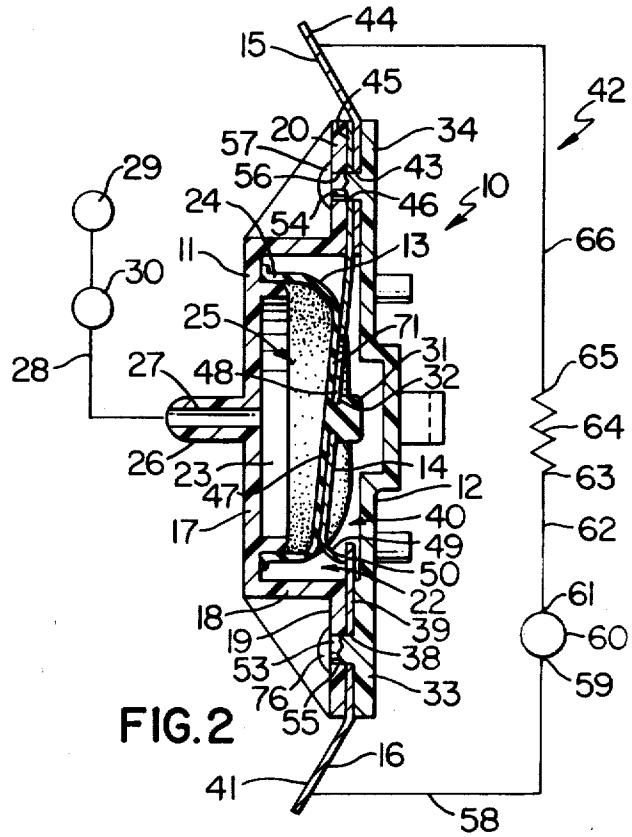
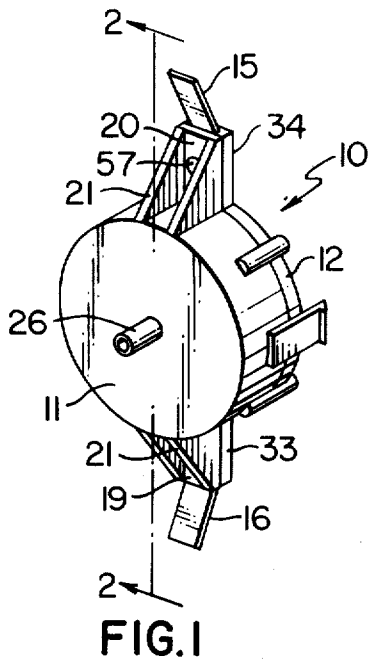
Attorney—Auzville Jackson, Jr., Robert L. Marben and Candor, Candor & Tassone

[57] **ABSTRACT**

A flexible diaphragm being carried by a support means and defining an actuating chamber therewith. A switch blade is carried by the support means and is movable relative thereto, the switch blade being interconnected to the diaphragm to move in unison therewith. A fixed contact blade is carried by the support means. The switch blade has a free end that is arcuate in cross-sectional configuration so as to be adapted to engage against the contact blade at the side edge of the switch blade when the diaphragm is in one position thereof relative to the support means.

11 Claims, 3 Drawing Figures





INVENTOR.
NED C. MYERS

BY
Cantor, Cantor & Tossone
HIS ATTORNEYS

VACUUM OPERATED ELECTRICAL SWITCH WITH CUP SHAPED DIAPHRAGM NORMALLY HOLDING CONTACTS CLOSED

This invention relates to a pneumatically operated electrical switch construction.

It is well known that various pneumatically operated electrical switch constructions have been provided wherein a pneumatic signal directed to an actuating chamber of the electrical switch construction causes a flexible diaphragm thereof to be moved by the resulting pressure differential across the same and thereby cause a switch blade to move relative to a fixed contact means to either open the circuit or close the circuit as the case may be.

Accordingly, it is a feature of this invention to provide an improved pneumatically operated electrical switch construction of the above type.

In particular, one embodiment of the pneumatically operated electrical switch construction of this invention comprises a support means carrying a flexible diaphragm defining an actuating chamber with the support means. A switch blade is carried by the support means and is movable relative thereto, the switch blade being interconnected to the diaphragm to move in unison therewith. A fixed blade is also carried by the support means to cooperate with the switch blade. The switch blade has a free end that is arcuate in cross section so that the end edge of the switch blade is adapted to engage against a flat surface of the contact blade when the diaphragm is in one position relative to the support means.

Such pneumatically operated electrical switch construction is made from a relatively small number of easily assembled parts.

Accordingly, it is an object of this invention to provide an improved pneumatically operated electrical switch construction having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a perspective view of the improved pneumatically operated electrical switch construction of this invention.

FIG. 2 is an enlarged cross-sectional view taken on line 2-2 of FIG. 1, FIG. 2 illustrating schematically a system utilizing the pneumatically operated electrical switch construction.

FIG. 3 is an exploded perspective view of the various parts of the pneumatically operated electrical switch construction of this invention.

While the various features of this invention are hereinafter described and illustrated as being particularly adapted to provide a vacuum operated electrical switch construction, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide other types of fluid operated electrical switch constructions and the like.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1-3, the improved pneumatically operated electrical switch construction of this in-

vention is generally indicated by the reference numeral 10 and comprises two housing members 11 and 12, a cup-shaped flexible diaphragm 13, a resilient conductive switch blade 14, a terminal member 15 and a contact member 16 all adapted to be assembled together to provide the electrical switch construction 10 as illustrated in FIG. 2 in a simple and effective manner.

The housing member 11 is substantially cup-shaped and is defined by a substantially flat circular end wall 17 interconnected at its outer periphery to a substantially cylindrical side wall means 18 having a pair of outwardly directed right angled ears 19 and 20 suitably reinforced by ribbing means 21 as illustrated, the ears 19 and 20 being diametrically opposed to each other and being adjacent the opened end 22 of the cup-shaped housing member 11. An annular flange 23 projects inwardly from the end wall 17 of the housing member 11 and is adapted to have the open end 24 of the cup-shaped diaphragm member 13 inserted around the same in the manner illustrated in FIG. 2 so that the flexible diaphragm 13 will cooperate with the housing member 11 to define an actuating chamber 25 therebetween. The end wall 17 also has an outwardly directed nipple extension 26 provided with a passage means 27 extending through the same to interconnect the exterior of the housing member 11 with the actuating chamber 25.

For example, the nipple extension 27 can be interconnected by suitable conduit means 28 to a vacuum source 29, such as a vacuum pump or the like, with the conduit means 28 having suitable selector means 30 disposed therein intermediate the vacuum source 29 and the pneumatically operated electrical switch construction 10 so as to interconnect the vacuum source 29 to the actuating member 25 when the selector means 30 is in one position thereof and to disconnect the vacuum source 29 from the chamber 25 while simultaneously interconnecting the atmosphere to the chamber 25 when the selector means 30 is in another position thereof.

The cup-shaped flexible diaphragm 13 has a cylindrical post means 31 extending from the closed end 71 thereof with the post means 31 having an annular groove 32 formed therein adjacent the end wall 71 of the diaphragm 13 for a purpose hereinafter described.

The housing member 12 is substantially flat and circular and is provided with a pair of ears or legs 33 and 34 extending diametrically therefrom to respectively cooperate with the ears 19 and 20 of the housing member 11. Flange means 35 are formed on the outer edges of the housing member 12 so as to define locating grooves 36 and 37 on the ears 33 and 34 for a purpose hereinafter described.

The contact member 16 has an opening 38 passing therethrough and has a substantially flat part 39 for projecting into a cavity 40 of the construction 10 which is defined between the housing members 11 and 12 when the same are secured together to define a support means for the electrical switch, the contact member 16 having another part 41 thereof angularly bent relative to the body of the contact member 16 to project outwardly from the housing members 11 and 12 and define an external terminal adapted to be interconnected in a suitable electrical system, such as system 42 in FIG. 2 for a purpose hereinafter described.

The terminal member 15 also has an opening 43 passing therethrough and a part 44 angularly bent relative to the body portion of the terminal member 15 so as to extend outwardly from the housing members 11 and 12 to be interconnected in the electrical system 42.

The switch blade 15 has one end 45 provided with an opening 46 passing therethrough and has an intermediate part 47 angularly bent relative to the part 45, the angularly bent part 47 having a keyhole shaped slot 48 passing therethrough and being provided with an arcuately bent free end 49 that terminates at an end edge 50 which is disposed at substantially a right angle relative to the switch blade 15 because of the arcuately bent free end 49 thereof for a purpose hereinafter described. The post means 31 of the flexible diaphragm 13 is adapted to be inserted through the large part 51 of the keyhole opening 48 and thereafter receive the small part 52 of the slot 48 in the annular groove 32 thereof so as to fasten the post means 31 to the switch blade 14.

The contact member 16 is adapted to be inserted in the locating groove 36 of the housing member 12 with a rivet-like portion or post 53 on the leg 33 of the housing member 12 projecting through the opening 38 thereof. Similarly, the part 45 of the terminal 15 and the part 45 of the switch blade 14 are adapted to be inserted in the locating recess 37 of the leg 34 while a rivet-like post means 54 of the leg 34 passes through the aligned openings 43 and 46 of the terminal 15 and the switch blade 14.

The ears 19 and 20 of the housing member 12 has openings 55 and 56 passing therethrough and respectively receive the post means 53 and 54 of the housing member 12 which are subsequently spun over or otherwise suitably deformed to form enlarged heads 76 and 57 as illustrated in FIG. 2 to securely fasten the housing members 11 and 12 together as well as to hold the contact member 16, terminal 15 and switch blade 14 in the assembled arrangement illustrated in FIG. 2.

Because the flexible diaphragm 13 has a natural tendency to assume a cup-shape and since the switch blade 14 is angularly bent into configuration illustrated in FIG. 2, the switch blade 14 has the end edge 50 urged against the flat surface of the part 39 of the contact member 16 and is maintained in such engagement by the natural resiliency of the switch blade 14 as force of the diaphragm 13 tending to assume its normal cup shape whereby excellent electrical contact is provided between the switch blade 14 and the contact member 16.

However, when a vacuum is created in the actuating chamber 25 by having the same interconnected to the vacuum source of pump 29, the flexible diaphragm 13 is caused to move to the left by the resulting pressure differential acting across the end wall 71 thereof so that the switch blade 14 moves to the left therewith to break electrical contact with the contact member 39 until the actuating chamber 25 again returns to substantially atmospheric condition.

In this manner, it can be seen that the pneumatically operated electrical switch construction 10 of this invention can readily be utilized in the electrical control system 42 to control the same by having its terminal part 41 interconnected by a lead 58 to one side 59 of a suitable electrical power source 60 that has its other side 61 interconnected by a lead 58 to one side 59 of a

suitable electrical power source 60 that has its other side 61 interconnected by a lead 62 to one side 63 of a load means 64. The other side 65 of the load means can be interconnected by a lead 66 to the part 44 of the terminal 15 as illustrated in FIG. 2. Thus, as long as the actuating chamber 25 of the pneumatically operated electrical switch construction 10 of this invention remains substantially at an atmospheric condition, electrical current is adapted to flow through the electrical switch construction 10 since the switch blade 14 is maintained in electrical contact with the contact member 16 so that the power source 60 is connected across the load means 64. However, when the vacuum source 29 is interconnected by the selector means 30 to the chamber 25, the flexible diaphragm 13 has its end wall 71 moved to the left to carry the switch blade 14 thereof away from the contact member 16 and thereby disconnect the power source 60 from across the load means 64.

Thus, it can be seen that the pneumatically operated electrical switch construction 10 of this invention can be formed of a relatively small number of easily assembled parts to function in an electrical control system in a simple and effective manner.

While the form of the invention now preferred has been disclosed as required by the patent statutes, other forms may be utilized all coming within the scope of the claims which follow.

What is claimed is:

1. A vacuum operated electrical switch construction comprising support means, a flexible diaphragm carried by said support means and defining a chamber therewith, a switch blade carried by said support means and being movable relative thereto, said switch blade being interconnected to said diaphragm to move in unison therewith, and a fixed contact blade carried by said support means said switch blade having a free end adapted to engage against said contact blade when said diaphragm is in one position relative to said support means, said diaphragm having a natural tendency to move to a certain position relative to said support means, said switch blade making contact with said contact blade before said diaphragm can reach said certain position thereof, said diaphragm having a natural tendency to assume a cup-shape at said certain position thereof, said switch blade contacting and deforming into said cup-shape when in engagement with said contact blade and thereby preventing said diaphragm from assuming a natural cup-shape thereof whereby the natural tendency of said diaphragm to assume said cup-shape assists in normally maintaining said switch blade in contact with said contact blade.

2. A vacuum operated electrical switch construction as set forth in claim 1 wherein said contact blade has a flat side, said free end of said switch blade having a straight end edge and being arcuate so that said end edge is adapted to engage said flat side of said contact blade when said diaphragm is in said one position thereof.

3. A vacuum operated electrical switch construction as set forth in claim 1 wherein said switch blade deforms at an angle into said cup-shape of said diaphragm when in engagement with said contact blade.

4. A vacuum operated electrical switch construction as set forth in claim 1 wherein said support means com-

5

6

prises two housing members secured together and defining a cavity therebetween, said diaphragm being disposed in said cavity.

5. A vacuum operated electrical switch construction as set forth in claim 4 wherein said contact blade is secured between engaging surfaces of said housing members, part of said contact blade extending into said cavity to be engaged by said switch blade and another part of said contact blade extending outwardly from said housing members to form a terminal.

6. A vacuum operated electrical switch construction as set forth in claim 5 wherein one of said housing members has a rivet-like portion riveted to the other housing member to secure the same together, said contact blade having an opening passing therethrough and receiving said rivet-like portion.

7. A vacuum operated electrical switch construction as set forth in claim 4 wherein said switch blade has the end thereof opposite to said free end thereof secured between engaging surfaces of said housing members.

8. A vacuum operated electrical switch construction as set forth in claim 7 wherein one of said housing

members has a rivet-like portion riveted to the other housing member to secure the same together, said switch blade having an opening passing therethrough and receiving said rivet-like portion.

9. A vacuum operated electrical switch construction as set forth in claim 8 wherein a terminal has a part thereof secured between said engaging surfaces of said housing members and another part thereof extending outwardly from said housing members, said secured part of said terminal also having an opening passing therethrough and receiving said rivet-like portion.

10. A vacuum operated electrical switch construction as set forth in claim 1 wherein said cup-shaped diaphragm has a post means extending from the closed end thereof, said switch blade being secured to said post means so as to move in unison therewith.

11. A vacuum operated electrical switch construction as set forth in claim 10 wherein said switch blade has a key-hole slot passing therethrough and receiving said post means to secure the same together.

* * * * *

25

30

35

40

45

50

55

60

65