Aug. 14, 1962 J. H. FLATT ETAL 3,049,602

VACUUM SWITCH

Filed Sept. 9, 1959 2 Sheets-Sheet 1

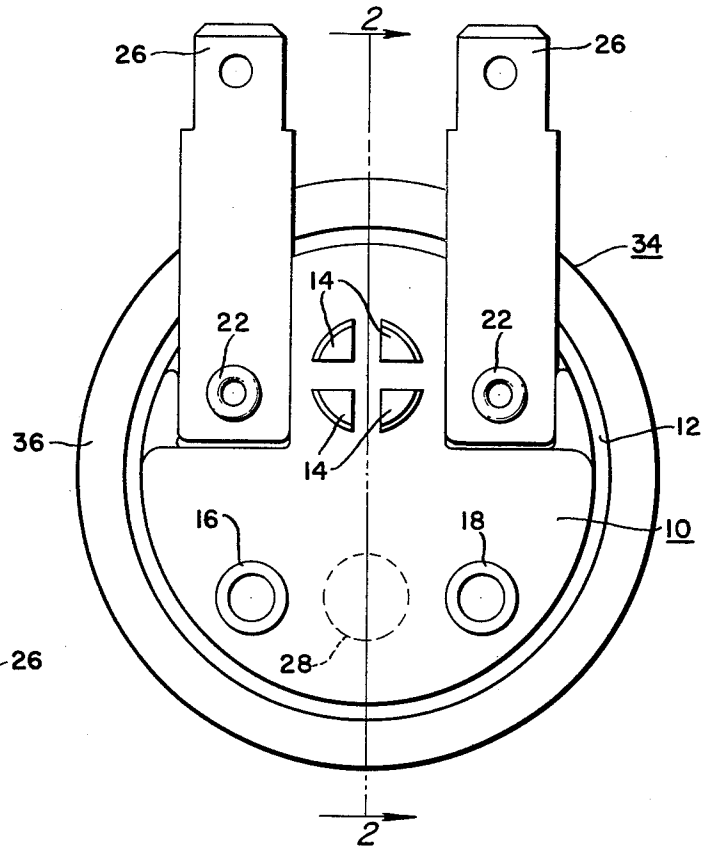


Fig. 1

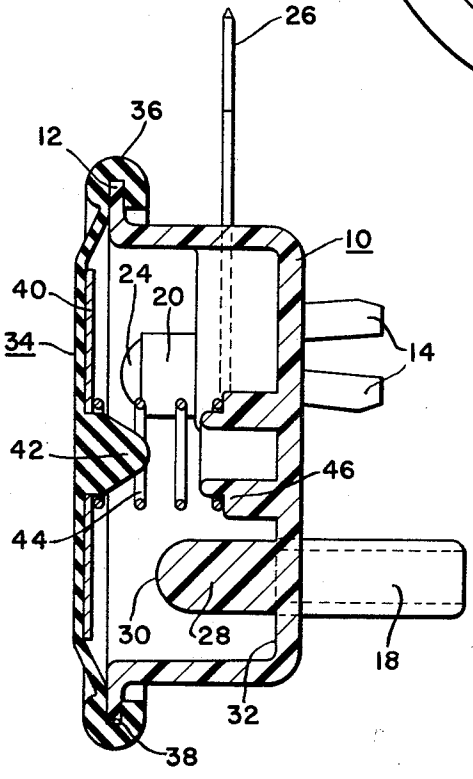


Fig. 2

INVENTORS
James H. Flatt
BY Kenneth W. Young
C. R. Meland
Their Attorney

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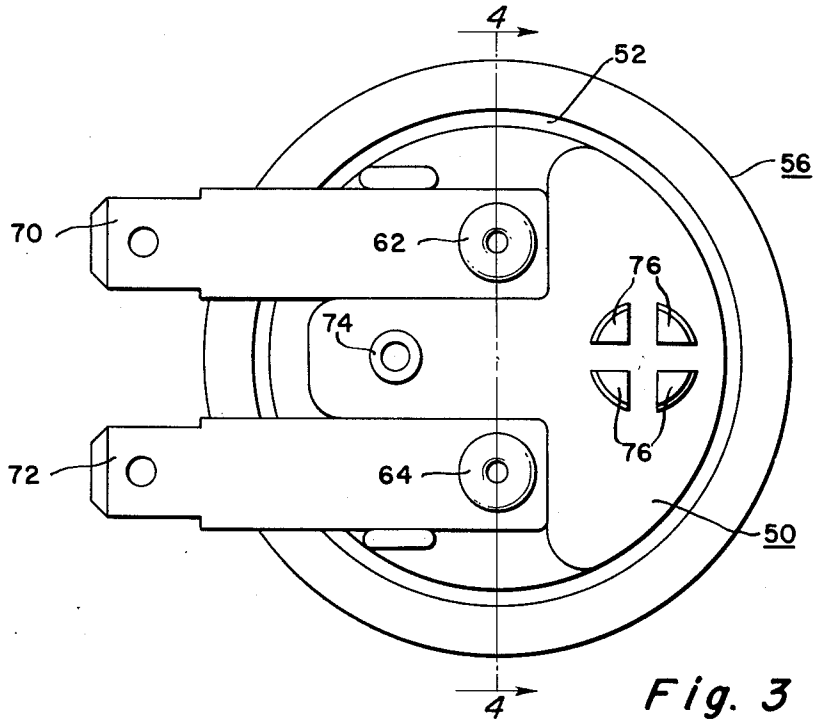


Fig. 3

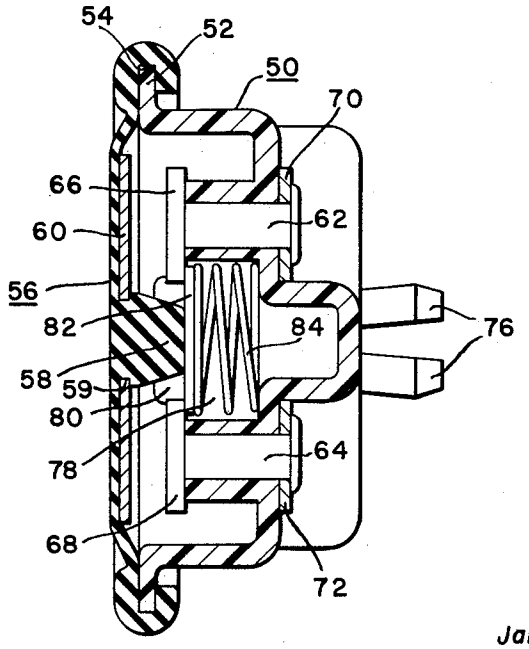


Fig. 4

INVENTORS
James H. Flatt
BY Kenneth W. Young

C. R. Meland
Their Attorney

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VACUUM SWITCH

James H. Flatt and Kenneth W. Young, Anderson, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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This invention relates to electric switches and more particularly to fluid pressure switches that are actuated by vacuum and the like.

One of the objects of this invention is to provide a pressure switch that is comprised of a minimum number of parts but which is reliable and durable in operation.

Another object of this invention is to provide a pressure switch that is formed essentially of two easily assembled parts, namely, a case or housing assembly and a diaphragm that is snapped over a portion of the case or housing assembly. In carrying this object forward, the case is formed from a moldable plastic material such as nylon and has an integral tube for connection to a vacuum source and has integral attaching means that are adapted to be snapped into an aperture in a mounting plate.

Still another object of this invention is to provide a pressure switch including a case or housing and a diaphragm fitted thereto, the diaphragm carrying a metal plate which in one embodiment of the invention serves at times to connect fixed contacts supported by the case and in another embodiment of this invention serves to add rigidity to the diaphragm.

A further object of this invention is to provide a pressure switch including a housing carrying a diaphragm, the diaphragm in turn carrying a metal contact plate which engages a pair of spaced contacts carried by the housing and a post formed integral with the housing. In carrying this object forward the contacts are located at the same distance from the "at rest" position of the metal plate while the end of the post is located at a greater distance. This causes a tilting of the contact plate as it first engages the contacts and then tilts to engage the end of the post when the switch is connected with vacuum. It has been found that this tilting causes the plate to rotate slightly during each actuation of the switch so that a wiping action is present and a different part of the contact plate is presented to the contacts during each actuation of the switch.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein preferred embodiments in the invention are clearly shown.

In the drawings:

FIGURE 1 is a plan view of an electric switch made in accordance with this invention.

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1.

FIGURE 3 is a plan view of a modified electric switch made in accordance with this invention.

FIGURE 4 is a sectional view taken along line 4—4 of FIGURE 3.

Referring now to the drawings and more particularly to FIGURES 1 and 2, it is seen that the electric switch includes a case or housing generally designated by reference numeral **10**. This case or housing is preferably formed from a plastic moldable material such as nylon but could be formed of any other electric insulating material. The housing **10** has a circumferentially extending flange designated by reference numeral **12** and has outwardly flared projecting teeth designated by reference numeral **14** which are formed as sectors as is clearly apparent from FIGURE 1. The teeth **14** are formed integral with the housing **10** and are adapted to be forcibly

inserted within an aperture in a mounting plate whereupon they snap outwardly to secure the electric switch to a mounting plate. The housing **10** also has integral tubular portions **16** and **18** which serve as passage means for connecting the interior of the case or housing **10** with a vacuum source. The tubes **16** are adapted to be fitted with tubular connectors for connecting a vacuum source to the interior of the housing **10**.

The housing **10** at its interior is formed with tubular portions **20** which receive the rivets **22**. Each rivet **22** has a head portion **24** which serves as a fixed electrical contact and it is seen that the rivets **22** also hold the male terminal connectors **26** in place with respect to the housing **10**. The housing **10** is also formed with a post or projection designated by reference numeral **28** which extends in the same direction as tubular extensions **20** of the housing. It is to be particularly noted that the end **30** of the post **28** is not in the same vertical plane as the contact **24** but is closer to the wall **32** of the housing than are the ends of the contacts **24**. The contacts **24** are located at the same distance from the wall **32** of housing **10** and it can be seen that the contacts **24** and post **28** are located radially of the longitudinal axis of the housing **10**.

A diaphragm formed of a suitable elastomeric material such as rubber is generally designated by reference numeral **34** and is provided with a circumferentially extending portion **36** formed with an annular groove **38** that embraces the circumferentially extending flange **12** of housing **10**. The diaphragm carries an annular shaped metal contact plate **40** which has a central aperture embracing a projecting portion **42** of the diaphgram. A spring **44** is interposed between the metal contact plate **40** and a projecting portion **46** of the housing **10**. The spring **44** normally holds the contact plate **40** in the position illustrated in FIGURE 2 and out of contact with the fixed contacts **24**.

In operation of the switch illustrated in FIGURES 1 and 2, one of the integrally formed tubes **16** or **18** is connected with a vacuum source while the other tube is connected with some other device that is adapted to be operated by vacuum. The chamber defined by the diaphragm **34** and the housing **10** thus forms a transfer chamber or junction for another vacuum operated device. It, of course, will be appreciated by those skilled in the are that one of the tubes need not be used since it is only necessary that the interior of the diaphragm **34** and housing **10** be connected with vacuum to operate the switch.

When the chamber defined by the diaphragm and housing is connected with vacuum the diaphragm is pulled rightwardly in FIGURE 2 and the contact plate **40** first engages the contacts **24**. As the diaphgram continues to move rightwardly it will begin to tilt since it is only engaged by contacts **24** and will come to its final position when the contact plate **40** engages the end **30** of post **28**. In this final closed position of the switch the contact plate **40** will be tilted along a plane that includes the ends of contacts **24** and the end **30** of post **28**. This tilting action is, of course, due to the fact that the contacts **24** are located closer to the plate **40** than is the end **30** of post **28** during the "at rest" position of contactor **40**. It has been found that this tilting action causes a slight rotation of the metal contact plate **40** during each closure of the switch. This rotation tends to cause a wiping action between the contact plate **40** and the contacts **24** and a different part of the contact plate **40** is thus presented to the contacts **24** during each closure of the switch.

Referring now to FIGURES 3 and 4, a modified switch made in accordance with this invention is illustrated. In this switch the case or housing is generally designated by reference numeral **50** and is once more preferably

formed of a plastic moldable material such as nylon. The case or housing 50 has a circumferentially extending flange 52 that is fitted in a groove 54 formed in the diaphragm 56. The diaphragm as in the previous switch is formed of an elastomeric material such as rubber and has a central projecting portion 58. The diaphragm carries a metal plate 60 having an inner edge fitted within a groove 59 which in embodiment of FIGURES 3 and 4 serves to lend rigidity to the diaphragm but does not serve to conduct current.

The housing 50 has openings which respectively receive rivets 62 and 64 having heads 66 and 68. The rivets 62 and 64 serve to hold the male terminal connectors 70 and 72 in place with respect to the housing 50. The housing 50 is formed with a tubular portion 74 which serves to connect the interior of the housing with a vacuum source and has a plurality of outwardly flared projecting portions 76 which are adapted to be received within an aperture in a mounting plate.

As can be seen from FIGURE 4, the housing 50 is formed with a chamber or recess 78 located in alignment with the projecting portion 58 of diaphragm 56. The chamber is surrounded in two places by projecting portions 80 which extend above the ends of contacts 66 and 68. It is to be observed that the edges of contacts 66 and 68 extend over the chamber 78 and engage a metal contact plate 82. A spring 84 interposed between the housing and the metal contact plate 82 urges the contact plate into engagement with the edge portions of contacts 66 and 68 as clearly apparent from FIGURE 4.

It will be apparent from an inspection of FIGURE 4 that the switch of this embodiment is a normally closed switch with the metal contact plate 82 contacting portions of contacts 66 and 68. The spring 84 normally urges the contactor 82 into engagement with the fixed contacts 66 and 68 and also serves to move the diaphragm 56 leftwardly when no vacuum is applied to the chamber defined by the housing 50 and diaphragm 56. When vacuum is applied to the interior of diaphragm 56 and housing 50, the diaphragm 56 is moved rightwardly in FIGURE 4 and the projecting portion 58 moves the contactor 82 out of engagement with contacts 66 and 68. As has been noted hereinbefore, when vacuum is no longer applied to the interior of the switch, the spring 84 moves the diaphragm 56 back to its position illustrated in FIGURE 4 and reconnects the contacts 66 and 68.

When vacuum is applied to the interior of the switch, the metal plate 60 cannot connect the contacts 66 and 68 as it is stopped in its movement by the projecting portions 80 which are formed integral with the housing 50. The plate 60 serves to lend rigidity to the diaphragm 56 but does not serve to conduct electrical current.

It is to be observed that in each embodiment of the switch, the switch is formed essentially of two parts, namely, a case or housing assembly and a diaphragm that is assembled to the case or housing assembly by merely snapping the flanged portion of the case or housing into the circumferentially extending groove of the diaphragm. It is also to be observed that in each embodiment of the invention, integral means are formed on the case or housing for connection with a vacuum source and integral attaching means are provided for projection into an aperture formed in a mounting plate.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An electric switch comprising, a casing formed of electrical insulating material, said casing having a circumferentially extending flange, a diaphragm having a circumferentially extending slot receiving said flange and forming a chamber with said casing, a metal contact plate carried by and rotatable with respect to said diaphragm, a pair of fixed contacts supported by said casing, a post integrally formed with said casing, said contacts and said post being spaced at different distances from said contact plate when said contact plate is at rest, and passage means in said casing for connecting said chamber with a source of vacuum, said post and said contacts causing said contactor to tilt when it engages said contacts and the end of said post.

2. An electric switch comprising, a casing formed of electrical insulating material, a diaphragm secured to said casing carrying a metal contact plate, said casing and diaphragm forming a chamber that is adapted to be connected with a source of vacuum, and means including a pair of electrical contacts forming three points of contact for a common side of said contact plate when said contact plate is moved by said diaphragm under the influence of vacuum, at least one of the points of contact being spaced a greater distance from the at rest position of said contact plate than another of said points.

3. An electric switch comprising, a casing formed of electrical insulating material, a diaphragm secured to said casing and forming a chamber therewith which is adapted to be connected to a source of vacuum, said diaphragm having a central projection, an integral contact plate having a central opening receiving said projection and engaging said diaphragm, and means including a pair of electrical contacts forming three points of contact for engaging a common side of said contact plate when said diaphragm moves said contact plate in one direction, at least one of said points being spaced a greater distance from the at rest position of said contact plate than another of said points.

4. An electric switch comprising, a casing formed of electrical insulating material, a diaphragm secured to said casing and forming a chamber therewith which is adapted to be connected to a source of vacuum, said diaphragm having an integral projection, a contact plate having a central opening receiving said projection and engaging said diaphragm, means including a pair of electrical contacts forming three points of contact engaging a common side of said contact plate when said diaphragm moves said contact plate in one direction, at least one of said points being spaced a greater distance from the at rest position of said contact plate than another of said points, and a spring interposed between said casing and said contact plate for urging said contact plate away from said points of contact.

5. An electric switch comprising, a casing formed of electrical insulating material, a diaphragm secured to said casing, a metal contact plate rotatably secured to said diaphragm, said casing and diaphragm forming a chamber that is adapted to be connected with a source of vacuum, and means including a pair of electrical contacts forming three points of contact for a common side of said contact plate when said contact plate is moved by said diaphragm under the influence of vacuum, at least one of the points of contact being spaced a greater distance from the at rest position of said contact plate than another of said points.

6. An electric switch comprising, a casing formed of electrical insulating material, a diaphragm secured to said casing having an integral projection, a metal contact plate rotatably supported on said projection, said casing and diaphragm forming a chamber that is adapted to be connected with a source of vacuum, and means including a pair of electrical contacts forming three points of contact for a common side of said contact plate when said contact plate is moved by said diaphragm under the influence of vacuum, at least one of the points of contact being spaced a greater distance from the at rest position of said contact plate than another of said points.

7. An electrical switch comprising, a casing, a diaphragm secured to said casing and forming therewith a chamber that is adapted to be connected to a source of vacuum, a contact plate carried by said diaphragm, and means including a pair of electrical contacts forming three points of contact that engage a common side of said

contact plate when said contact plate is moved by said diaphragm under the influence of vacuum, at least one of said points being spaced a greater distance from the at rest position of said contact plate than another of said points.

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