Feb. 20, 1962 P. R. WEAVER 3,022,393

ACCELERATION SWITCH

Filed Dec. 23, 1959

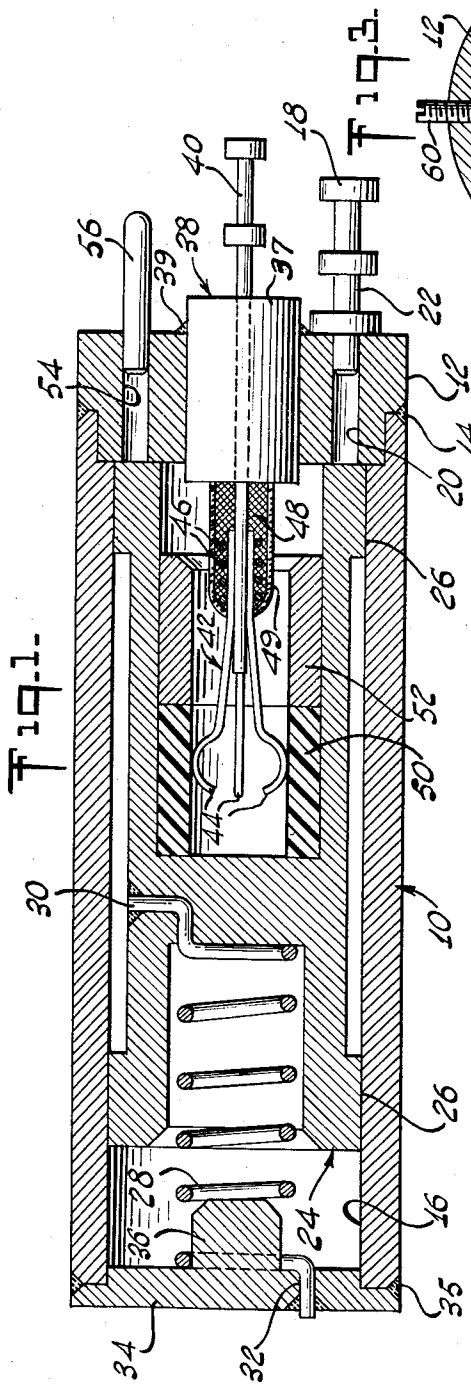


Fig. 1.

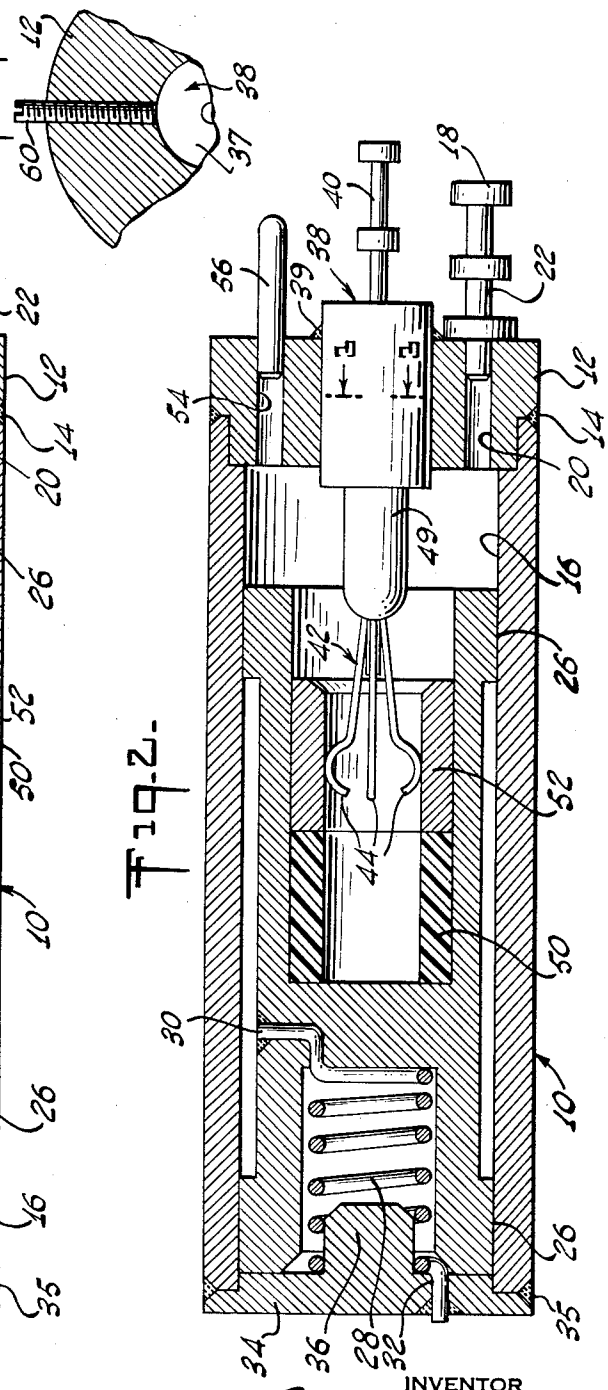


Fig. 2.

Fig. 3.

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United States Patent Office 3,022,393
Patented Feb. 20, 1962

3,022,393

ACCELERATION SWITCH

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Filed Dec. 23, 1959, Ser. No. 861,538
8 Claims. (Cl. 200—61.45)

This invention relates in general to electrical switches and in particular to a new and useful acceleration actuated electrical switch, having a functional and structural design particularly adapted for miniature sizes.

The present invention is particularly directed to electrical switches which are actuated by the force of acceleration. Such switches include a resiliently mounted mass which moves to effect either the making or breaking of electrical contact.

The present invention is an improvement in such types of switch and provides a unidirectional, single axis switch in which an electrical circuit is adapted to be closed and/or opened at a preset value of acceleration. An advantage of such a switch construction is that it can be mounted for response to acceleration in a predetermined direction. The mechanism is such that the parts are not subject to malfunctioning due to change of atmospheric conditions and the parts are easy to set for operation and easily accessible for repair and replacement.

In accordance with the present invention there is provided a switch including a cylindrical container having a contact mass-member slidable therein and biased in one direction by a resilient member of predetermined biasing force. The slidable contact mass-member is electrically connected, preferably, through the walls of the casing to a stationary contact. A second contact member is located so that a portion thereof extends within the cylinder and is engageable with a conductive portion of the mass-member whenever that member has been moved a sufficient distance against the force of the restraining resilient member, such as by an acceleration in the opposite direction.

In a preferred embodiment the mass-member is made hollow and includes an insulation collar and a conductive collar which are tightly fitted on the interior thereof. The fixed contact member includes outwardly biased resilient contact points which are in engagement with one of either of the insulation collar or conductive collar. The collars can be positioned so that either contact is normally made when the switch is at rest and is broken upon acceleration of the switch to a predetermined value; or the contact points are normally in contact with the insulation collar and are moved out of contact therewith upon acceleration of the switch to a predetermined amount.

Accordingly, it is an object of this invention to provide an improved acceleration switch.

A further object of the invention is to provide an acceleration switch including unidirectional means responsive to changes in acceleration to make or break an electric circuit.

A further object of the invention is to provide an acceleration switch including a conductive material mass slidable in a cylindrical casing of conductive material and biased in one direction by a coil spring and including spaced conductive and insulation portions on said mass, at least one of which is engaged by a stationary resilient contact member, whereby said mass is movable upon acceleration to present the other of said portions in contact with said stationary contact member.

A further object of the invention is to provide an acceleration switch which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the

invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects obtained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a longitudinal section of a miniature acceleration switch shown on an enlarged scale;

FIG. 2 is a view similar to FIG. 1 but with the parts in an operative contact making position; and

FIG. 3 is a section taken in the vicinity of the line 3—3.

Referring to the drawings in particular, the invention as embodied therein includes an outer cylindrical housing generally designated **10** which is closed at one end by a cap member **12** which is welded to the housing as at the location **14**. At least an inner face **16** of the housing **10** is made of conductive material which is in electrical contact with the cap member **12** and with a fixed contact terminal **18** which is inserted into an opening **20** in the cap member. The contact member **18** includes a rod portion **22** which is press-fitted into the opening **20** and which makes good electrical contact with the cap member **12**.

In accordance with the invention, there is provided a cylindrical or sleeve-like member or mass generally designated **24** which is slidable within the cylindrical housing **10** with portions **26** of the outer walls thereof in engagement with the inner wall **16** of the cylindrical housing **10**.

In accordance with the invention, the sliding mass **24** is biased to the right as shown in FIG. 1 by a compression spring **28**, one end of which, **30**, extends through a small passageway defined in the mass member **24** and is secured thereto as by soldering; and the other end of which extends into a small opening **32** in a disc-shaped cap piece **34** which is affixed to this end of the housing **10** by soldering as at **35**. The coil spring **28** is centered over an outstanding portion **36** of the cap piece **34** and biases the mass **24** to the right.

The cap **12** includes a large central opening which receives a fixed contact member and terminal generally designated **38**, inluding a central cylindrical portion **37** of insulation material. The contact **38** is soldered to housing **10** as at **39**. The contact member and terminal **38** includes a terminal portion **40** at the exterior of the housing **10** and a contact portion generally designated **42** which extends through the cylindrical portion **37** and into the housing **10** and a hollowed portion of the mass member **24**.

The contact member portion **42** includes a plurality of angularly spaced resilient contacts **44** having their inner ends held by a coil spring or wound wire **46** which is soldered and encapsulated by an epoxy resin material **48** and a resin dip **49**. The other ends **44** are curved and are biased outwardly or upwardly by the coil spring **46** into contact with an insulation material collar member **50** which is press-fitted into the interior of the hollowed portion of the mass **24**. A second collar member **52** of conductive material is located adjacent the collar member **50** and is also press-fitted into the hollowed portion of the mass **24** for movement therewith.

After the parts have been tightly sealed together, by soldering at the joints, the interior of the cylinder is evacuated of air and an inert gas is directed into the cylinder through a passage **54** and a metal plug **56** which is thereafter sealed by crimping the outer end. Thus, any movement of the mass **24** is gas dampened with a gas whose characteristics are well known when subject to various ambient conditions. The contact and terminal member **38** is normally anchored in position as by solder-

ing around the edges at 39 after the switch is calibrated by locating the contacts 44 and anchoring the contact member with a set screw 60 which extends through the member 37 and into contact with the contact and terminal member 40. In the case where set screw 60 is provided, adjustment may be made in respect to the location of the contacts 44 in order to change the acceleration force which will actuate the switch. In this latter case the member 38 would not be soldered in place and it is provided with line indications to provide a scale setting for the acceleration actuating value. The latter would be indicated by the reading on the scale on the member 38 which aligns with the edge of the member 12.

The switch may be set to operate as indicated in FIG. 1 in which case in the non-actuated position the contacts 44 are in contact with the insulation collar 50 on the mass 24. In this position when one line of an electric circuit is connected to the terminal 18 and the other is connected to the terminal 40, electrical contact will not be made and the circuit will be opened. When the device in which the switch is mounted is moved through an acceleration of a predetermined amount, the mass 24 will compress the spring 28, and, when a sufficient force of acceleration has been applied, the contacts 44 will contact the conductive collar 52 as the mass 24 is moved against the spring 28 to complete the circuit from the terminal member 18, the inner face 16 of the housing 10 and the mass 24 to the terminal 40. (See FIG. 2.)

It should be appreciated that the positions of the collars 50 and 52 may be reversed so that the contacts 44 will complete the electrical circuit when a switch is not subject to an acceleration force, and will disconnect the electrical circuit when the switch is subject to such force. The actual size of the switch of the present invention may be less than 1½" in length and less than ½" in diameter, and the instrument may still be machined for precise actuation at a preselected acceleration. The switch is of simple rugged construction which permits reliable operation of the parts with very little likelihood of failure. By choosing the correct coil spring it is possible to obtain repeated performance for many hours of operation. The switch has been tested and subjected to shock conditions of 50 times gravity without causing any damage to the operating mechanism.

Thus the invention provides a reliable lightweight, acceleration switch which may be made accurately in minute sizes for actuating equipment in response to a preset acceleration force without the need of electronic circuitry.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. An acceleration switch comprising an outer hollow housing member having a longitudinal axis and having a first contact terminal in electrical contact with at least the interior wall of said housing, a second contact terminal extending into said housing and disposed in a plane co-planar with said axis, and a mass member having a conductive portion in contact with the internal wall of said housing and having aligned conductive and non-conductive portions independently engageable with said second fixed contact member along a longitudinal locus parallel to said axis, means to bias said mass in one direction to bring said second fixed contact member into engagement with one of said conductive and non-conductive portions of said mass member, said mass member being movable against said biasing means upon acceleration to move the other of said conductive and non-conductive portions into contact with said contact member.

2. A switch comprising a hollow housing member having a longitudinal axis and an interior wall of conductive material, a first contact terminal extending out of said housing and being in electrical contact with said interior wall, a second contact terminal having a portion extending out of said housing and a portion extending into said housing and said portion being disposed in a plane co-planar with said axis, a mass slidable in said housing including a conductive portion in contact with said interior wall and separate conductive and non-conductive contact portions in alignment with said second contact, the co-planar contact portion of the second contact terminal operating to engage the separate conductive and non-conductive contact portions along the linear locus parallel to said axis, and resilient means biasing said mass in one direction to bring one of said conductive and non-conductive portions into contact with said portion of the second contact member, wherein said mass is movable against the force of said biasing to bring the other of said conductive and non-conductive contact portions into contact with said portion of the second contact member on said linear locus.

3. A switch according to claim 2, wherein said mass is a cylindrical member and said conductive and non-conductive contact portions are defined on the interior walls thereof as co-axial cylinders defining a cylindrical locus for the linear paths of movement of said co-planar portions of the second contact terminal.

4. A switch according to claim 2, wherein said mass is a hollow cylindrical member and wherein said resilient means includes a spring biased between an end wall of said housing and said cylindrical member.

5. An acceleration switch comprising a cylindrical housing of conductive material having a longitudinal main axis, a hollow cylindrical mass of conductive material slidable within said housing with the outer walls thereof in contact with the interior walls of said housing, means to bias said cylindrical member in one direction in said housing, a first contact member including resilient contact portions extending into said housing and into the interior of said hollow cylindrical mass, said contact member being insulated from said housing, a second contact member electrically connected to said housing and extending outwardly therefrom, a collar of insulation material positioned in said hollow cylindrical mass and having the inner surface of said collar in alignment with said contact member on a linear locus parallel to said axis, a collar of conductive material adjacent said insulation material collar and having its inner surface also in alignment with said contact member on said linear locus, said mass being biased by said spring to a location bringing said second contact member into engagement with said insulation material collar, said mass being movable against the force of said biasing upon an acceleration to position the conductive collar in electrical contact with said contact whereby the electrical circuit is completed through said collar, said mass and said housing to said first contact terminal.

6. An acceleration switch according to claim 5 wherein said first contact member resilient contact portions include a plurality of rod members having curved outer ends disposed in angularly spaced relationship with each curved outer end disposed within its own plane, and means to bias the inner ends of said contact portions together to hold the outer ends in proper planar positions to direct the desired pressure forces of those outer ends against the inner surfaces of the collars.

7. An acceleration switch comprising an outer hollow housing member having a generally longitudinal axis and having a first contact terminal in electrical contact with at least the interior wall of said housing, a second adjustable contact terminal having a resilient portion extending into said housing by a preselected amount, and a mass member having a conductive portion in contact with the internal wall of said housing and having aligned axially conductive and non-conductive portions independently engageable with said resilient portion of said second fixed contact member along a linear locus parallel to said

axis, means to bias said mass in one direction to bring said second fixed contact member into engagement with one of said conductive and non-conductive portions of said mass member, said mass member being movable against said biasing means upon acceleration to move the other of said conductive and non-conductive portions into contact with said contact member.

8. An acceleration switch according to claim 7, wherein said second contact member includes a portion slidable in said housing, and means to indicate the relative position of said second contact member in respect to said housing.

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