Feb. 3, 1970 A. ESPASA FANES 3,493,704

IMPACT RESPONSIVE ELECTRICAL ACTUATOR

Filed July 28, 1967 3 Sheets-Sheet 1

FIG. 1

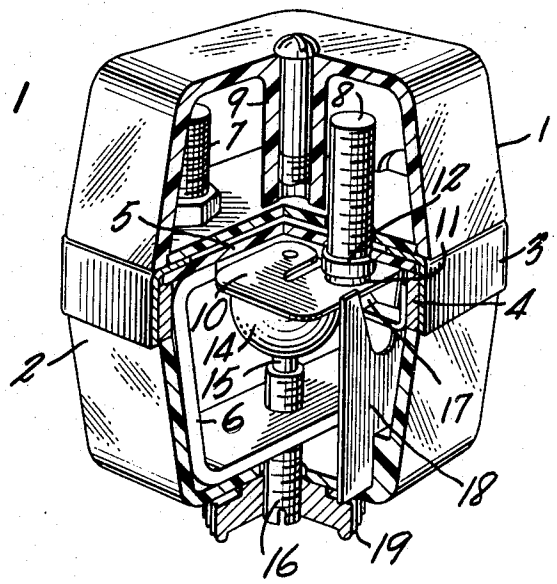
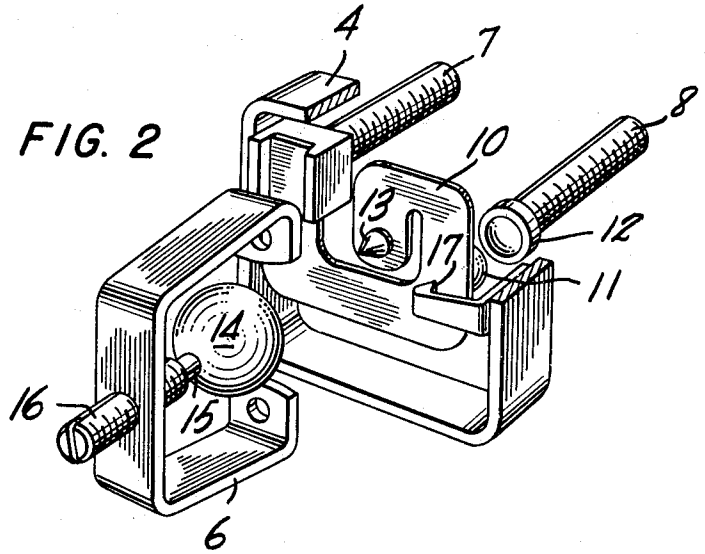


FIG. 2



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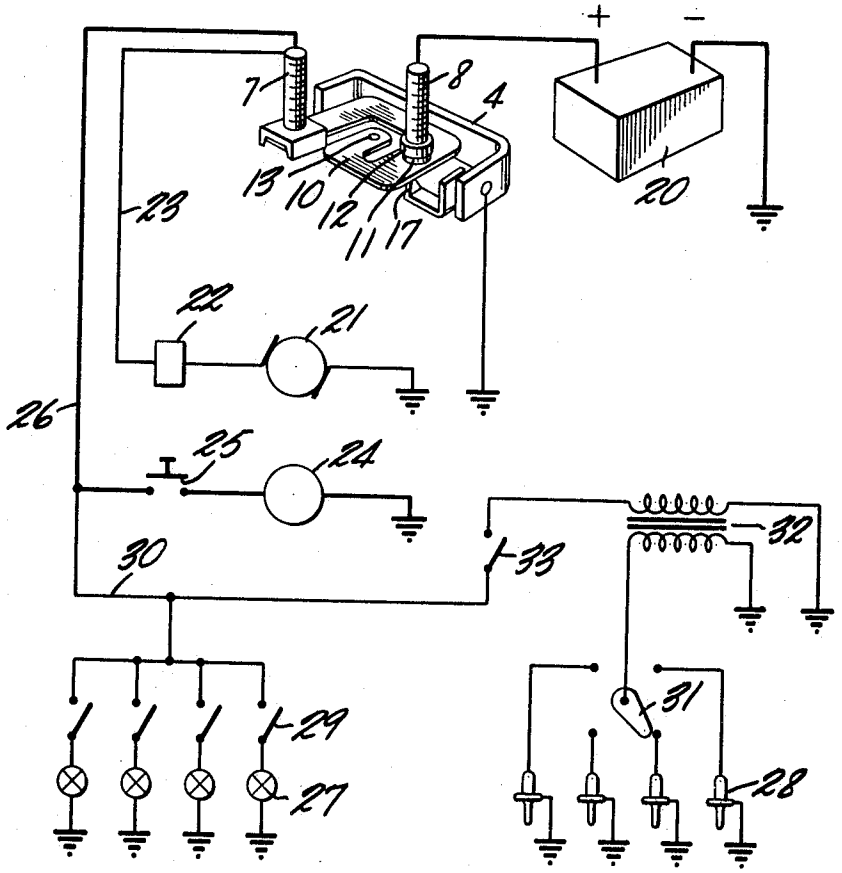
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Filed July 28, 1967 3 Sheets-Sheet 2

FIG. 3



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IMPACT RESPONSIVE ELECTRICAL ACTUATOR

Filed July 28, 1967 3 Sheets-Sheet 3

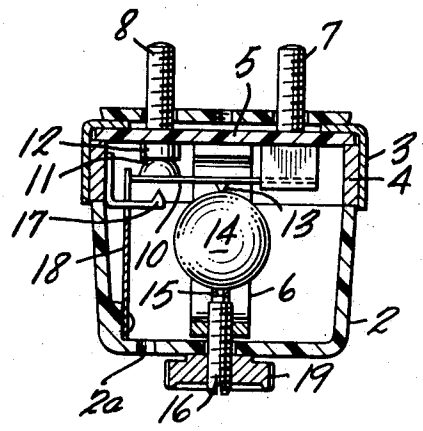


FIG. 4

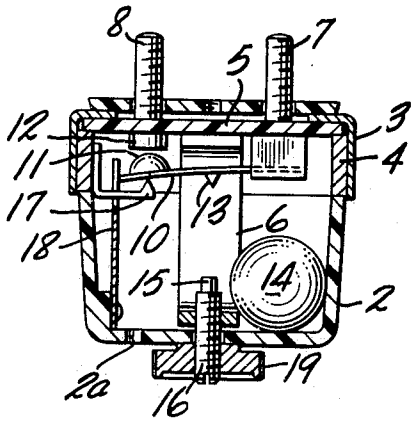


FIG. 5

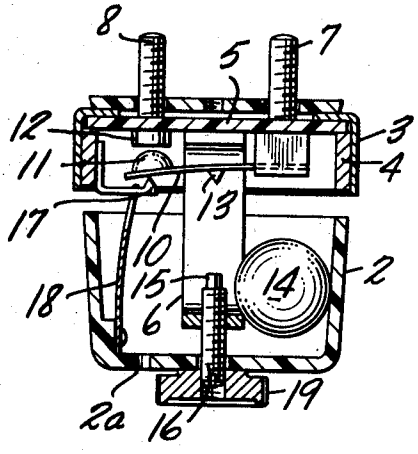


FIG. 6

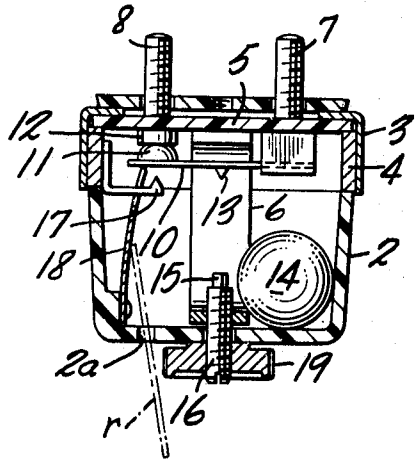


FIG. 7

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United States Patent Office

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3,493,704

IMPACT RESPONSIVE ELECTRICAL ACTUATOR

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Claims priority, application Spain, Sept. 1, 1966,
330,815; Apr. 4, 1967, 338,871
Int. Cl. H01h 35/02; G08b 21/00
U.S. Cl. 200—61.45 8 Claims

ABSTRACT OF THE DISCLOSURE

The specification discloses an electrical safety interruptor which includes a mass suspended between a pair of supports which engage relatively small portions of opposite convex surfaces of the mass. One of the supports is carried by a switch biased to open position but held in closed position when the mass is seated between the supports. When the mass is displaced from its properly seated position due to impact the supports cooperate in dislodging the mass to permit the switch to open and engage a grounded contact. A reset device permits temporary reclosing of the switch without reseating the mass between the supports.

This invention relates to an electrical safety interruptor which, when subjected to impact, opens an electrical circuit.

Safety devices of this type have heretofore been proposed for use in automobiles and other vehicles to cut out the electrical system and prevent fire when the vehicle has been in a collision. The ignition of gasoline and other combustibles by a spark from the vehicle's electrical system endangers life and property following a collision. The present invention provides an electrical safety interruptor of novel structure which provides advantages and features which previously proposed electrical safety interruptors do not possess.

In the electrical safety interruptor of the present invention a mass defined in part by opposite convex surfaces, and preferably a round mass, is held between a pair of supports at least one of which is biased toward the other and both of which engage relatively small portions of the convex surfaces of the mass. The biased support is connected to an electrical contact which is held closed when the mass is interposed between the supports. Upon severe impact of the degree that would result from a collision the mass is dislodged between the supports and the electrical contact is displaced to break the circuit.

In a preferred embodiment of the electrical safety interruptor of the present invention at least one of the supports is a pointed element which, due to the bias between the supports, assists in dislodging the mass when the center of gravity of the mass is displaced even a small distance from the axis between the supports. By designing the supports in this manner to assist in dislodging the mass it is possible to use a mass substantially lighter than would have to be used in safety devices which rely solely on inertia to dislodge the mass.

In a preferred embodiment of the invention a grounded contact is provided to engage the movable contact opened upon dislodgment of the mass. Thus, when the electrical safety interruptor of the present invention is used in a vehicle the entire electrical system of the vehicle, including the generator, starter, spark plugs, etc., are all grounded automatically, minimizing the possibility of a fire-igniting or explosion-producing spark.

Also, in a preferred embodiment of the invention provision is made for temporarily resetting the electrical safety interruptor in the event that it is safe to do so. This feature permits the electrical safety interruptor to be reset easily, quickly and without resetting the dislodged mass.

These and other features of the electrical safety interruptor of the present invention will be apparent from the detailed description which follows and from the accompanying drawings in which:

FIGURE 1 is a perspective view, partly cut away, of an electrical safety interruptor embodying the present invention;

FIGURE 2 is a perspective exploded view of certain parts of the electrical safety interruptor;

FIGURE 3 is a circuit diagram illustrating the electrical safety interruptor installed in the electrical system of a vehicle; and

FIGURES 4, 5, 6 and 7 are elevational views in cross-section of the electrical safety interruptor illustrating its operation.

The electrical safety interruptor of the present invention is enclosed within a housing made up of upper and lower sections **1** and **2**, respectively, and an intermediate section **3**. The upper and lower sections are preferably made of a transparent insulating plastic material, and the intermediate section is preferably metal. The housing sections are suitably connected together with the lower section **2** being removable in a manner to be described.

The housing accommodates therein a metal piece **4** supported within the intermediate housing section **3**, an insulating plate **5** supported by the piece **4**, and a substantially U-shaped bracket **6** depending within the lower portion of the housing from the insulating plate **5**.

The electrical safety interruptor of the present invention functions as an electrical connection between two terminals **7** and **8** during normal operation of the electrical system of the vehicle. It also disconnects the terminals and grounds one, the terminal **7** in the circuit diagram of FIGURE 3, when the vehicle has been subjected to a severe impact.

The terminals **7** and **8** are accommodated within the upper portion of the housing and are separated by a partition **9** therein to insure their separation in the event that the housing is crushed or seriously damaged. The terminals **7** and **8** are normally electrically connected by a resilient-conducting leaf spring switch **10** accommodated within the lower portion of the housing beneath the insulting plate **5**. The leaf spring switch is flat and spiral shaped in the sense that it winds from one terminal to the other and then winds back again so that the opposite end is intermediate the terminals. The leaf spring switch is connected to the lower end of the terminal **7**, carries on its upper face a contact **11** directly beneath a contact **12** of the terminal **8**, and then turns around and carries a tapered or pointed stud **13** on the lower face of the opposite end intermediate the terminals **7** and **8**.

The left spring switch **10** is biased to maintain the contacts **11** and **12** separated, but during the normal operation of the vehicle the contacts **11** and **12** are maintained closed by a relatively heavy, dislodgable mass, preferably having oppositely disposed convex surfaces and in the form illustrated in the drawings as a heavy ball **14**, located directly below and in engagement with the pointed stud **13**. The ball **14** rests on the upper end of a tubular seat **15** which extends upwardly from a screw **16** threaded through the base of the U-shaped piece **6**. The threaded screw **16** is adjustable to position the seat to the precise position necessary to insure that the ball will maintain the contacts **11** and **12** are closed. In properly seated position, the center of gravity of the ball is on an axis line between the pointed stud **13** and the tubular seat **15**. When the ball **14** is dislodged from the seat **15** and drops into the lower portion of the housing, the bias of the leaf spring switch **10** opens the contacts **11** and **12**.

The piece 4 supports a contact 17 which is disposed directly underneath the contact 11. The contact 17 is grounded so that when the ball 14 is dislodged the bias of the leaf spring switch 10 connects the terminal 7 to the grounded contact 17.

In the operation of the electrical safety interruptor, if the vehicle is in a collision the impact will dislodge the ball 14. As soon as the center of gravity of the ball 14 is offset from the axis between the pointed stud 13 and the tubular seat 15, the bias of the switch 10 acts to assist the displacement of the ball. When the ball 14 is dislodged from its seated position, the circuit between the terminals 7 and 8 is broken and the terminal 7 is grounded.

In the event that the vehicle is capable of being driven after a collision and there is no spillage of gasoline which presents a fire hazard, the switch can be temporarily reset without restoring the ball 14 to its position between the supports 13 and 15. The resetting device is a leaf spring 18 mounted at its lower end within the lower housing section 2. The upper end of the spring 18 is biased lightly against the edge of the switch 10. As best shown in FIGURE 1, the spring 18 is cut away in the vicinity of the grounded contact 17. The bias of the leaf spring switch 10 toward the grounded contact 17 is much greater than the very light pressure exerted by the spring 18 against the edge of the switch, so that the reset spring does not interfere with the operation of he switch when the ball 14 is dislodged.

The reset spring will move into position beneath the switch 10 upon separation of the lower housing section 2 as illustrated in FIGURE 6. The lower housing section 2 is held in place by a nut or knob 19 which is threaded onto the bottom of the screw 16. When the nut 19 is screwed toward the lower end of the screw 16 the lower housing section 2 can be dropped to the position illustrated in FIGURE 6, permitting the bias of the reset spring 18 to move the upper end thereof beneath the switch 10. The lower housing section 2 can then be raised to its closed position and the reset spring wlll hold the contacts 11 and 12 closed. The reset spring will hold the switch 10 closed until the vehicle is inspected and the ball 14 is reseated between the supports 13 and 15.

A hole 2*a* is provided in the bottom of the cover section 2 to permit the insertion of a rod *r* within the housing to insure that the reset spring is pushed out from beneath the leaf spring switch 10 after the ball has been reseated between its supports.

The electrical safety interruptor described above is shown in FIGURE 3 installed in the electrical system of a vehicle. In this electrical system the terminal 8 is connected to the positive pole of the battery 20. The generator 21 is connected to the terminal 7 in series with a voltage regulator 22 by a conductor 23. The starter 24 is also connected to the terminal 7 in series with a cut-out switch 25 by a conductor 26.

The vehicle's lights 27 and spark plugs 28 are also shown connected to the terminal 7 of the electrical safety interruptor. As illustrated in FIGURE 3, the vehicle's lights 27 are connected through switches 29 to a conductor 30 which is connected to the terminal 7 through the conductor 26. The spark plugs 28 are actuated in proper synchronism by the distributor 31 which is connected to the conductor 30 through a coil 32 and a switch 33.

A feature of the electrical safety system of the present invention lies in providing a relatively small seat for the ball, preferably the circular tubular seat 15 having a diameter approximately 1/20 of the diameter of the ball, from which the ball may be readily discharged, and further in providing the pointed stud 13 directly above the center of the seat and biased downwardly with appreciable force so that the pointed stud will tend to assist in displacing the ball from its seat when the impact of the collision is great enough to displace the ball from its properly seated position. This feature of the present invention makes possible the use of balls of much lighter mass than prior art electrical safety interruptors using balls dislodgable solely by inertia. The noval support for the ball in this electrical safety interruptor assists in ejecting the ball from between its supports upon even the slightest movement of the center of gravity of the ball from the axis defined by the pointed stud 13 and the circular seat 15. The support will, nevertheless, prevent unseating of the ball as a result of acceleration and deceleration of the vehicle when there is no collision impact.

The invention is shown and described in a single preferred embodiment and by way of example, and many modifications and variations may be made therein without departing from the spirit of the invention.

I claim:

1. An impact responsive electrical actuator comprising a pair of spaced apart terminals, a flat spiral shaped leaf spring conducting bridge which is connected to one terminal, extends to a position adjacent the other terminal and then turns around and ends at a position intermediate the terminals, a pair of spaced apart vertically aligned support means, one carried by the portion of the leaf spring conducting bridge intermediate the terminals and the other spaced apart from the first, said leaf spring conducting bridge being normally biased to open position, and displaceable means interposed between said support means to hold said leaf spring conducting bridge in position to connect said terminals until the displaceable means is dislodged from between the support means and the leaf spring conducting bridge is permitted to move to open position.

2. An electrical actuator as set forth in claim 1 including a contact against which the leaf spring conducting bridge is biased in open position.

3. An electrical actuator as set forth in claim 1 including actuatable means independent of said displaceable means to hold said leaf spring conducting bridge in closed position.

4. An impact responsive electrical actuator comprising a pair of spaced apart terminals, a biased leaf spring conducting bridge connected to one of said terminals and extending to a position adjacent but normally biased away from the other of said terminals, a pair of spaced apart, oppositely disposed, vertically aligned upstanding and depending support means, one carried by and extending from the leaf spring conducting bridge and the other spaced apart but extending toward the other, one of said support means being a tubular seat and the other being a pointed element coaxial with the tubular seat, and a displaceable ball supported between said support means to maintain the spring conducting bridge closed when the center of gravity thereof is supported on the axis therebetween and to permit the spring conducting bridge to open when it is displaced from between said support means, the said upstanding and depending support means engaging relatively small areas of opposite sides of the displaceable ball, the pointed element serving to urge the displaceable ball from supported position when the center of gravity of the displaceable ball is displaced from the axis through the oppositely disposed support means.

5. An electrical actuator as set forth in claim 4 including a contact against which the leaf spring conducting bridge is biased in open position.

6. An electrical actuator as set forth in claim 4 including actuatable means independent of said displaceable means to hold said leaf spring conductor in closed position.

7. An impact responsive electrical actuator comprising a pair of spaced apart terminals, a biased leaf spring conducting bridge connected to one of said terminals and extending to a position adjacent but normally biased away from the other of said terminals, a pair of spaced apart, oppositely disposed, coaxial, vertically aligned support

means, one carried by the leaf spring conducting bridge and the other spaced apart therefrom, displaceable means supported between said support means to maintain the spring conducting bridge closed when it is supported therebetween and to permit the spring conducting bridge to open when the center of gravity thereof is displaced from between said support means, and reset means independent of said displaceable means to hold said leaf spring conducting bridge in closed position.

8. An electrical actuator as set forth in claim 7 in which said reset means is an adjustable element which normally is in inoperative position but which is movable to operative position to shift the leaf spring conducting bridge to closed position.

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U.S. Cl. X.R.

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