

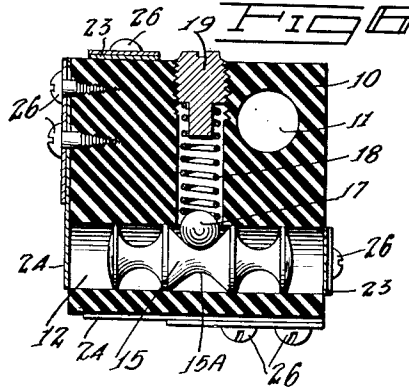
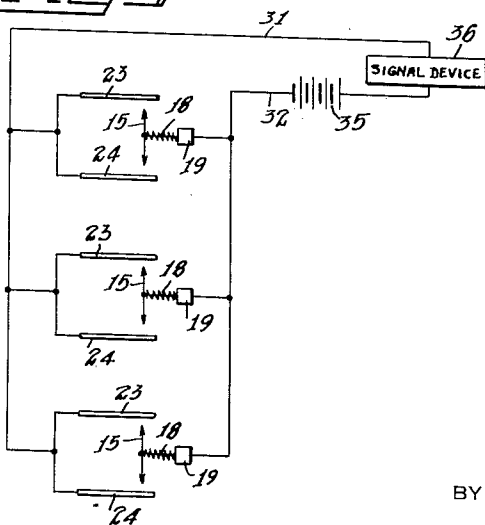
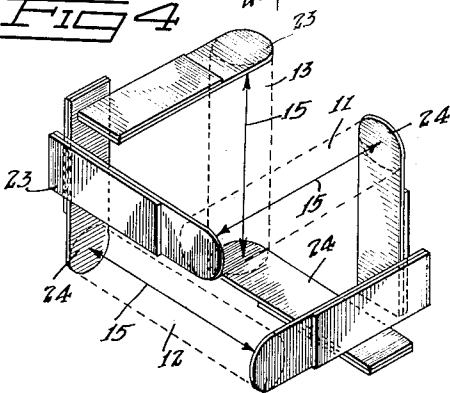
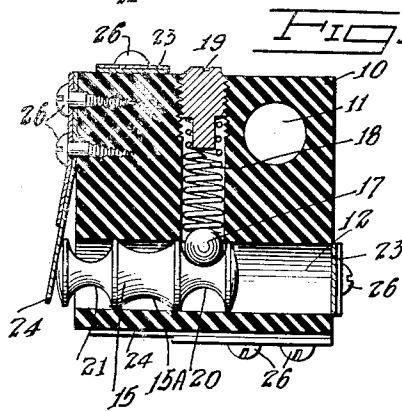
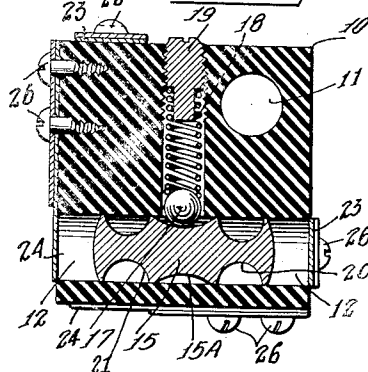
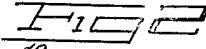
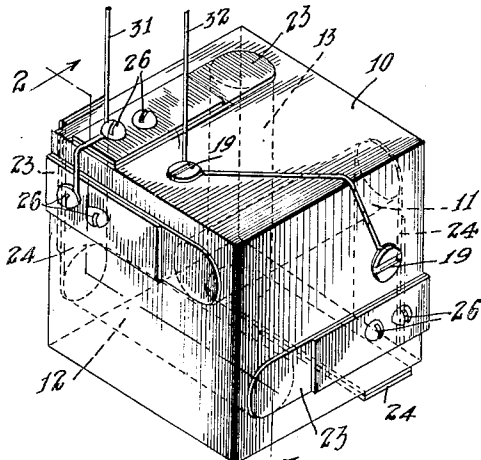
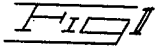
Oct. 30, 1951

J. P. HOLMAN
INERTIA SWITCH

2,573,199

Filed June 17, 1949

2 SHEETS--SHEET 1



INVENTOR.

James P. Holman

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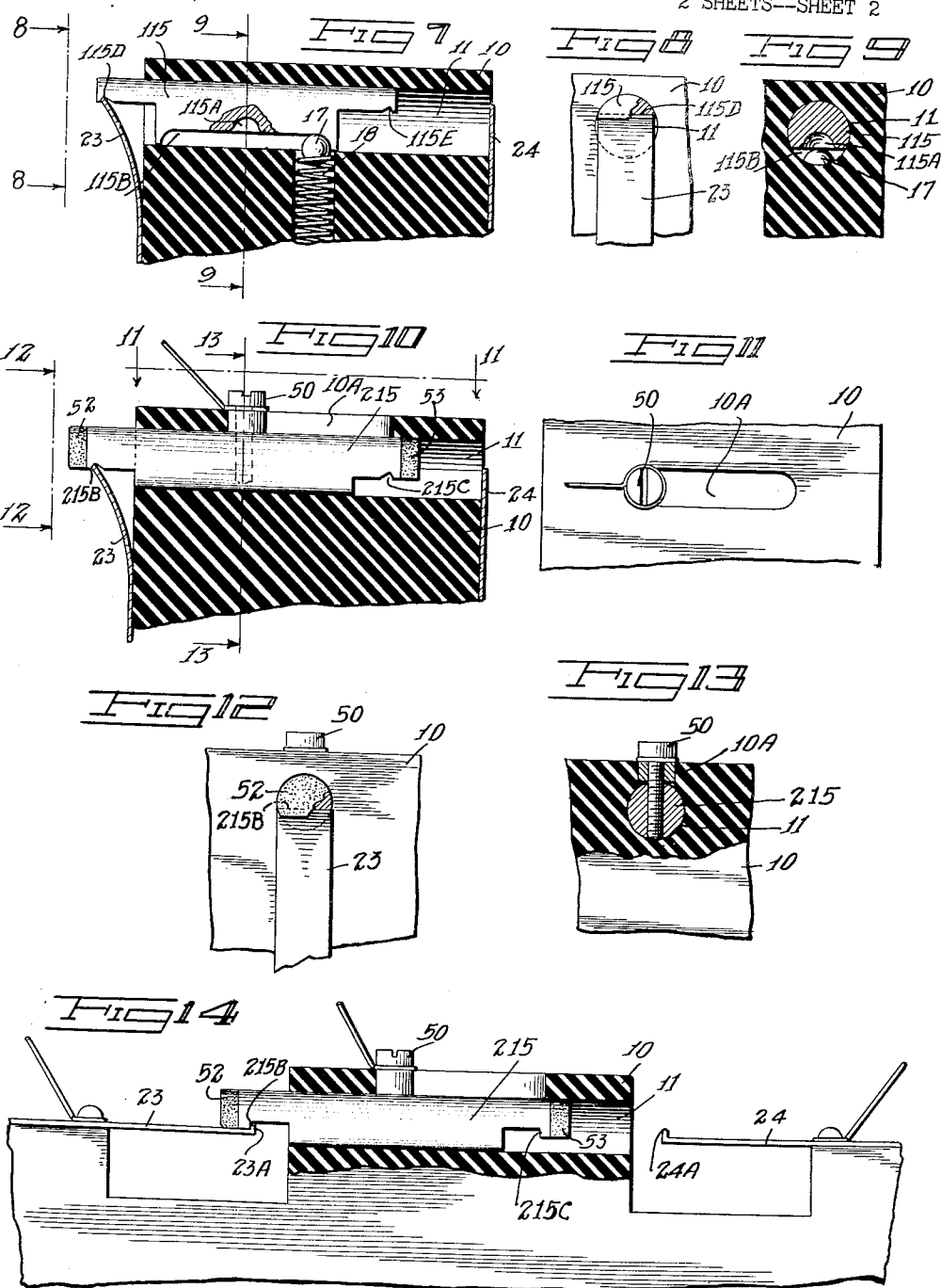
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2 SHEETS--SHEET 2



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UNITED STATES PATENT OFFICE

2,573,199

INERTIA SWITCH

James P. Holman, Pomona, Calif.

Application June 17, 1949, Serial No. 99,825

7 Claims. (Cl. 200—52)

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The present invention relates to an improved impact operated switch particularly useful in aircraft to energize a signaling circuit upon collision or crackup of the aircraft, and is particularly useful in the arrangement shown in my copending patent application, Serial No. 702,609, filed October 11, 1946, for Telltale Radio Signal Device.

In arrangements for energizing signaling circuits upon impact or collision of an associated aircraft it is desirable that a switch be provided which is fool-proof in operation and which is operated regardless of the direction of impact or collision forces.

It is therefore an object of the present invention to provide an improved switch for achieving the above mentioned desirable results.

A specific object of the present invention is to provide an improved switch incorporating three impact sensitive members each being movable under the influence of impact forces in three mutually perpendicular directions.

Another object of the present invention is to provide an improved switch characterized by the fact that once a switch element is moved to actuated position under the influence of impact forces it is securely maintained in a switch closing position.

Another specific object of the present invention is to provide an improved switch of this character characterized by its simplicity and ease and economy in manufacture, the individual parts of which may be easily and quickly assembled.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. This invention itself, both as to its organization and manner of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

Figure 1 is a perspective view of an improved switch embodying features of the present invention,

Figure 2 is a sectional view taken substantially on the line 2—2 of Figure 1,

Figure 3 is a sectional view corresponding to the sectional view shown in Figure 2 but with the impact actuating hammer moved from its normal position shown in Figure 2 to its contact making position shown in Figure 3,

Figure 4 is a perspective view showing in greater clarity the switch contacts mounted on the outside of the cube shown in Figure 1, and

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positioned for contact with any one of three impact actuated hammers or switch elements extending in three mutually perpendicular directions,

Figure 5 is a schematic view of the electrical circuit formed by the switch shown in Figure 1 connected to an external battery source,

Figure 6 is a sectional view corresponding to the sectional view shown in Figure 2 but of a modified structure embodying features of the present invention,

Figure 7 is another sectional view corresponding to the sectional view shown in Figure 3 showing an additional modified structure,

Figures 8 and 9 are views taken substantially in the direction indicated by the arrows 8—8 and 9—9 in Figure 7,

Figure 10 is another sectional view corresponding to the sectional view shown in Figure 3 of another modified structure embodying features of the present invention,

Figures 11, 12 and 13 are views taken substantially in the direction indicated by the lines 11—11, 12—12 and 13—13 in Figure 10, and

Figure 14 shows still another modified structure embodying features of the present invention and corresponds to the sectional view shown in Figure 3.

The switch arrangements shown herein are intended for mounting on an aircraft, and each such switch arrangement shown herein includes three impact actuated hammers or switch elements, each movable under the influence of impact forces thereon in three corresponding mutually perpendicular directions to circuit closing position, so as to close an energizing circuit to operate a distress signal in the manner exemplified in my above mentioned copending patent application.

The switch shown in Figures 1—5 inclusive is in the form of an insulating cube 10 through which is drilled or bored three mutually perpendicularly extending holes or cylindrical apertures 11, 12 and 13, within each of which there is slidably disposed a corresponding impact actuated hammer or switch element 15, the switch element 15 being normally maintained in a central position in the corresponding cylindrical apertures 11, 12, 13 by a spring pressed ball 17, to thereby maintain the composite switch in normally open position.

Specifically, the impact actuated hammer 15 is generally cylindrical in shape, with an annular concave groove 15A normally contacted by the ball 17 pressed thereagainst by the coil compress-

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sion spring 18 having one of its ends contacting the ball 17 and the other one of its ends abutting a shoulder on the screw threaded plug 19 threaded into the insulating cube 10.

This groove 15A may take different forms and shapes and, as shown in Figure 2, may be shallow for substantially only a point contact with the ball 17, or, as shown in the modified structure shown in Figure 6, the annular groove 15A may have a radius at the bottom thereof corresponding to the radius of the spring pressed ball 17, so that the ball may be more firmly maintained in the annular groove with the net result that greater impact forces must be exerted on the hammer 15 to cause it to move from the position shown in Figure 2 to its position shown in Figure 3.

In other words, when the hammer or switch element 15 is subjected to sufficiently large impact forces, it moves in the cylindrical aperture 12 against the frictional force imposed by the spring pressed ball 17. In such initial movement of the switch element 15 from its normal position shown in Figure 2, the ball 17 is cammed upwardly and, in further movement of the switch element 15 the ball 17 enters either the annular end groove 20 or 21, depending upon the direction of the impact forces and the resulting movement of the switch element 15, to thereby securely lock such switch element 15 in switch closing position in corresponding contact engagement with the switch contact 23 or 24, as the case may be.

The switch contacts 23, 24 are mounted by mounting screws 26 on the cube 10 as cantilevers, and with their free ends normally closing the ends of the cylindrical openings 12, as shown in Figure 2. Such switch contacts 23, 24 have sufficient resiliency to be moved to the corresponding position shown in Figure 3 when the switch element 15 is moved to its circuit closing position. In other words, when the switch element 15 is in its circuit closing position an end thereof projects slightly out of the cube 10 to make positive switch engaging contact with either the switch contact 23 or 24, as the case may be.

It is noted, from an inspection of Figures 1, 4 and 5, that the anchored ends of the switch contacts 23, 24 are interconnected electrically, so that they may be conveniently connected as, for example, by soldering to an electrical conductor 31. On the other hand, each one of the threaded plugs 19 is interconnected for convenient connection to the other electrical conductor 32, the conductors 31, 32 being connected through the battery 35 to the signaling device 36 to energize the same when one of the three hammers designated as 15 engages either one of its corresponding switch contacts 23, 24, it being noted that the hammer 15 is metallic as well as the ball 17, spring 18 and plug 19, so that electrical current may be conducted from the plug 19 to either one of the switch contacts 23, 24, as the case may be, when the switch is moved to circuit closing position under the influence of impact forces.

In the modified arrangement shown in Figures 7, 8 and 9, the cube 10 again is cylindrically apertured at 11 to slidably receive the modified hammer or switch contact 115. Here again, the spring 18 serves to press the ball 17 into engagement with the impact actuated switch element 115 and with the ball 17 normally spring pressed in the hemispherically shaped de-

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tent 115A in the switch element 115. In order to prevent turning of the switch element 115 about its longitudinal axis, the switch element 115 is grooved longitudinally at 115B, so as to slidably receive the ball 17 and to cooperate therewith to provide guided movement of the switch element 115. It is noted further that the ends of the switch element 115 are modified to include triangularly shaped grooves 115D, 115E within which the upper edge of the cantilever supported switch contacts 23, 24 are adapted to enter, to thereby latch the member 115 in a position corresponding to the position shown in Figure 7 in circuit closing position.

In the latched position shown in Figure 7 it is clearly evident that the metallic elements 17, 18, 115 and 23 constitute a closed circuit through which an electric current may flow to energize a signaling device in the manner indicated in Figure 5.

In the modified arrangement shown in Figures 10, 11, 12 and 13, the impact actuated hammer or switch element 215 again takes on a different form and shape, and is adapted to be latched in circuit closing position by either the switch contact 23 or 24, as the case may be, in the manner shown in Figure 7. Instead of using a spring pressed ball in Figure 10, the impact actuated switch element 215 is maintained normally in a generally central position inside the cube 10 by a bolt 50 threaded into the hammer 215, and frictionally engaging the walls of the cooperating guide slot 10A in the cube 10, the guide slot 10A being sufficiently elongated to allow either the latching groove 215B or 215C, as the case may be, to be brought into cooperating latching engagement with the corresponding switch contact element 23 or 24.

It is noted that this threaded bolt 50 also prevents the generally cylindrically shaped element 215 from turning about its longitudinal axis in the cylindrical opening 11 in the cube 10. If desired, the metallic switch element 215 may have mounted on its opposite ends insulation 52, 53 to prevent the flow of electric current through the composite switch when the element 215 is in its normal position. As a matter of fact, in such normal position the insulation 52, 53 may be of sufficient thickness so as to contact the switch elements 23, 24, in which case such resilient cantilever supported switch elements 23, 24 normally maintain the switch element 215 centrally within the cylindrical opening 11.

In the modified arrangement shown in Figure 14, the impact actuated switch element 215 is of the form shown in Figure 10 and is maintained in its cylindrical aperture 11 in the block 10, in the same manner as is shown in Figure 10, by the bolt 50 and switch elements 23, 24. Comparing Figures 10 and 14, the switch elements 23, 24 are shaped somewhat differently in Figure 14 and are supported somewhat differently. In other words, in Figure 14 the switch elements 23, 24 extend generally parallel with the axis of the impact actuated hammer 215 and are hooked at 23A and 24A respectively for cooperating latching engagement with the latching notches 215B, 215C in Figure 14.

While the particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the

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appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. An impact actuated switch comprising: an impact actuated switch element slidably mounted in a housing, a spring pressed ball within said housing normally engaging said impact actuated switch element to normally maintain it in circuit opening position, and cooperating switch contacts at opposite ends of said impact actuated switch element for electrical engagement therewith, said switch element having reentrant portions near each one of its ends and latch means including one or the other of said reentrant portions to maintain said switch element in engagement with a corresponding one of said switch contacts.

2. In an impact actuated switch of the character described, a housing, a generally cylindrically shaped impact actuated switch element slidably mounted in said housing, said switch element being centrally grooved and having a pair of annular end grooves, a spring pressed ball mounted within said housing and normally engaging the central groove of said switch element to hold said element in a central position, said ball being movable into one or the other of said annular end grooves after said switch element moves in one or the other of its corresponding longitudinal directions a predetermined distance under the influence of impact forces, switch contacts engageable by said switch element when moved in either direction said predetermined distance, and means establishing an electrical circuit through said ball and switch element to said switch contacts.

3. An impact actuated switch comprising: a housing, three impact actuated switch elements movably mounted in said housing for limited linear movement in three mutually perpendicular directions with respect to said housing, means normally maintaining each of said impact actuated switch elements in circuit opening position, and cooperating switch contacts mounted on said housing in the path of movement of said impact actuated switch elements for electrical contact therewith, whereby at least one of said switch elements is moved into circuit closing position upon application of impact forces thereto above a predetermined magnitude regardless of the direction of said forces with respect to said housing.

4. An impact actuated switch of the character described comprising: a housing, three mutually perpendicularly extending impact actuated switch elements mounted for movement in three mutually perpendicular directions in and with respect to said housing, means resisting movement of said switch element away from a central position within said housing out of switch engaging position, switch contact elements near the ends of movement of each of said impact actuated switch elements for engagement thereby,

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and latching means automatically operative to latch said impact actuated switch element in circuit closing position with one of said contacts after said impact actuated switch element is moved under the influence of impact forces thereon to thereby latch the switch in circuit closing position, whereby at least one of said switch elements is moved into circuit closing position upon application of impact forces greater than a predetermined magnitude regardless of the direction of said impact forces with respect to said housing.

5. In an impact actuated switch of the character described, an impact actuated movable switch element, means normally maintaining such switch element in circuit opening position, said means being ineffective when impact forces act on said switch element above a predetermined magnitude, a first and a second switch contact spaced respectively from opposite ends of said impact actuated element against one of which said switch element moves in engagement upon the occurrence of impact forces along the longitudinal axis thereof, greater than said predetermined magnitude, and automatically operated latching means for latching said switch element in engagement with either said first or said second switch contact after it is moved by impact forces greater than forces of said predetermined magnitude depending upon the particular direction of said impact forces.

6. The invention defined in claim 5, characterized by the fact that said latching means comprises a spring pressed ball movable into an annular groove in the switch element, said switch element being metallic and elongated with a second annular groove centrally located for engagement with said spring pressed ball to hold the same in normal circuit opening position.

7. The invention defined in claim 5, characterized by the fact that said latching means comprises a cantilever supported spring element on said housing engageable in a reentrant portion of the switch element after said switch element is moved to circuit closing position, said spring element constituting the corresponding one of said switch contacts.

JAMES P. HOLMAN.

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