United States Patent [19]

Baland

[11] **3,836,738**

[45] **Sept. 17, 1974**

[54] **IMPACT SWITCH WITH INERTIA OPERATED TOGGLE LINKAGE ACTUATOR MECHANISM**

[76] Inventor: **Raymond W. Baland,** 2208 Milam, Amarillo, Tex. 79109

[22] Filed: **Apr. 13, 1973**

[21] Appl. No.: **350,989**

[52] **U.S. Cl.**.... **200/61.45 R,** 200/61.53, 200/153 G, 200/153 H

[51] **Int. Cl.**..... **H01h 35/02,** H01h 3/46

[58] **Field of Search**..... 200/52 R, 61.08, 61.44, 200/61.45 R, 61.52, 61.53, 153 G, 153 V, 153 SC, 153 H; 102/73 R; 340/61

[56] **References Cited**

UNITED STATES PATENTS

3,349,208 10/1967 Cataldo et al. ..... 200/153 G

3,728,508 4/1973 Netzel..... 200/153 V

Primary Examiner—James R. Scott

Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] **ABSTRACT**

An impact-responsive, inertia-actuated switch includes a pair of arms at least one of which is pivoted at its end for swinging movement toward and away from the other arm and a toggle linkage connected between the arms. Upon impact or high deceleration an inertia member connected to the toggle linkage causes the latter to move over-center against a spring bias, and the resulting movement of the pivoted arm engages or disengages a pair of electrical contact members carried by the arms. The switch has special utility as the actuator in an automatic crash signal device for aircraft.

5 Claims, 3 Drawing Figures

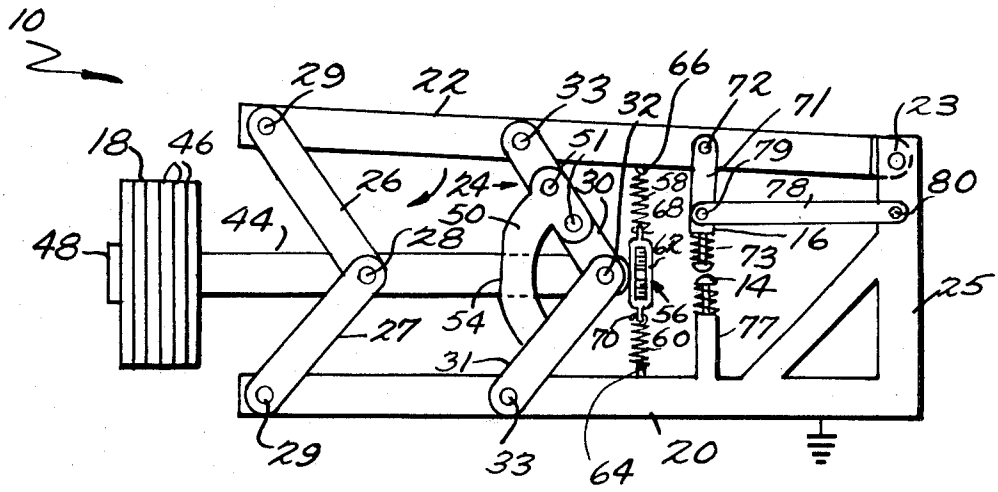


Fig. 1.

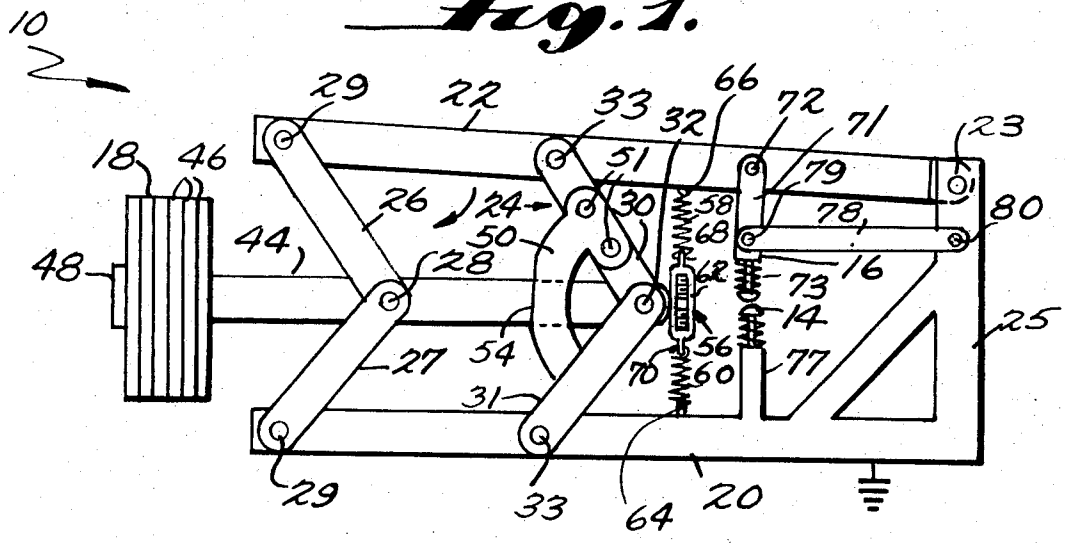


Fig. 2.

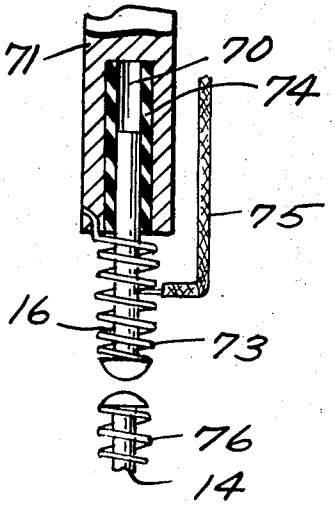
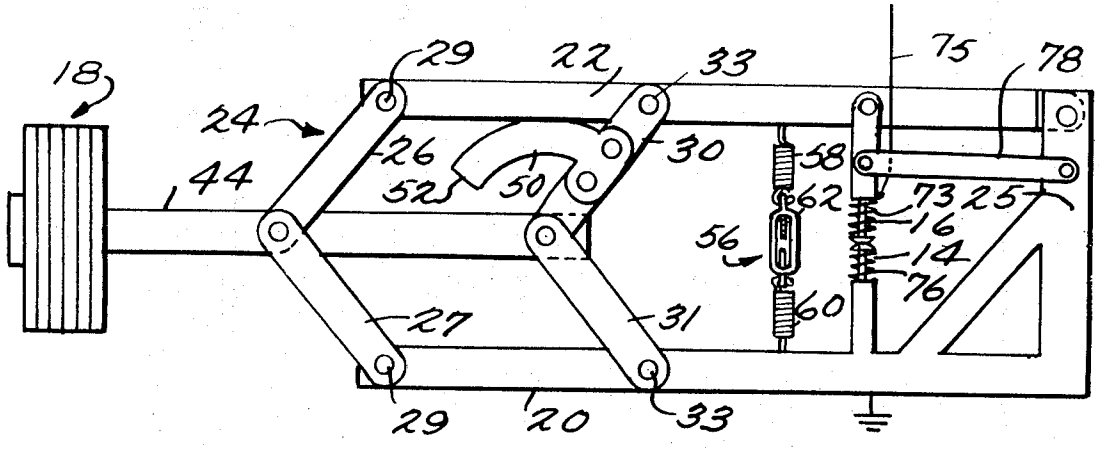


Fig. 3.



IMPACT SWITCH WITH INERTIA OPERATED TOGGLE LINKAGE ACTUATOR MECHANISM

BACKGROUND OF THE INVENTION AND BRIEF DESCRIPTION OF THE PRIOR ART

Several prior art devices have been developed for insuring that a transmitting device emits signals after an airplane has crashed, for the purpose of indicating the location of the aircraft.

One such device is illustrated in the U.S. Pat. to Camp, No. 2,473,050, wherein there is disclosed a signalling device that is thrown outwardly from a crashed plane. A disadvantage that can occur with the use of this device is that it can be damaged during either the throw-off process or the crash of the plane.

Another known type of impact switch is that illustrated in the U.S. Pat. of Fey, No. 3,335,239, wherein an impact switch is housed within a flexible plastic shell. However, due to the flexible walls, this type of switch might not provide sufficient strength and ruggedness during a high-impact.

A still further prior art impact responsive switch is illustrated in the U.S. Patent to Gallistel et al., 3,226,504. However, the switch in this patent is complicated in design and construction and thusly expensive to manufacture.

SUMMARY OF THE INVENTION

The present invention provides an improved inertia responsive switch that is inexpensive in manufacture, durable in construction, and efficient in operation. The inertia responsive switch comprises a linkage system made of relatively strong material, switch terminals operatively arranged with the linkage system and effective to move between open and closed positions, and an inertia member operatively connected to the linkage system so as to effectuate an opening or closing of the switch terminals when the inertia responsive member moves relative to the linkage system upon impact or high deceleration of the switch. In the preferred embodiment the switch closes to complete a circuit effective to actuate a transmitter that emits a signal giving the location of the crash.

The linkage system further includes a stop that limits the relative movement of the inertia-responsive member to prevent it from pulling the linkage system from its mounting or otherwise interfering or interrupting the effective contact of the switch terminals.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the inertia-responsive switch made in accordance with the principles of the invention and showing the switch in its inoperative position prior to impact;

FIG. 2 is a fragmentary view, on an enlarged scale, of part of FIG. 1; and

FIG. 3 is another view of the inertia-responsive switch, but shown in a position wherein the switch is closed after impact of a vehicle carrying th switch.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is illustrated a preferred embodiment of an impact-responsive switch **10** made in accordance with the principles of the invention. The switch is basically comprised of a pair of switch arms **20** and **22**, at least one of which is pivotally mounted for swinging movement toward and away from the other, spring loaded switch contacts **14** and **16** carried by the arms and an inertia element **18** carried by a toggle linkage system **24** which is connected between the arms **20** and **22.**

While the switch is capable of many uses, for illustrative purposes only, the switch to be described is used in combination with a conventional distress signal transmitter.

As seen in FIG. **1**, the impact-responsive switch **10** is shown in an open position with the terminals **14** and **16** not contacting each other. The linkage system disclosed is preferably constructed from high-strength material (e.g., steel). Therefore, the linkage system is capable of withstanding the high loads that are exerted during a crash of the airplane and acting as a ground for the switch.

The switch arms **20** and **22** are supported in any suitable manner which permits at least one of them to swing relative to the other. As shown, one end of the arm **22** is pivotally connected at **23** to a foot portion **25** which is integral with or fixed to the corresponding end of the arm **20.**

The toggle linkage system **24** includes first and second pairs of toggle links, the first pair of links **26, 27** being pivotally connected together by a pin **28** and **20, 22** pivotally connected to the switch arms **20,22** by pins **29.** The second pair of toggle links **30, 31** are similarly connected together by a pin **32** and are similarly connected to the arms **20, 22** by pins **33** at a location inwardly of the first pair of toggle links.

The inertia element **18** is connected to the first and second pairs of toggle links by a rod **44.** The rod **44** is attached to the toggle system **24** at the location of the pins **28** and **30.** The inertia element **28** may be comprised of a plurality of plates **46,** each of which is mounted on a threaded end portion of the rod **44** and held in position by a nut **48.** The number of plates **46** can be selectively varied so as to adjust the mass of the element **18,** thereby permitting a change in parameters of the inertia switch **10.**

As viewed in FIGS. **1** and **3,** an arcuate stop member **50** is securely attached by, for example, rivets **51** to the intermediate portion of the link **30.** In this particular embodiment, the stop is shown in a generally arcuate configuration; however, it is to be understood that other constructions are conceivable within the scope of the invention. The stop has a generally flat forward end **52** and a generally flat intermediate surface **54.** The forward surface is effective to contact an intermediate portion of the link **31** when the system is in its cocked or open position as shown in FIG. **1.** The intermediate surface **54** is effective to contact the arm **20** when the system is in its actuated or closed position as shown in FIG. **3.**

In the open position of the switch **10** the engagement of the stop surface **52** with the link **31** limits the movement of the arm **22** toward the arm **20** thereby preventing engagement of the contacts **14** and **16.** In the closed position of the switch the engagement of the stop surface **54** with the arm **22** limits the movement of that arm toward the arm **20** so as to prevent destruction of the contacts **14** and **16** by crushing.

The switch arm **22** is biased toward the switch arm **20** by an adjustable bias means **56** which includes a pair of springs **58, 60** and a turnbuckle **62** that interconnects the springs. The springs are coaxially and linearly arranged in such a manner that their opposite ends **64** and **66,** respectively, are attached to the arms **20** and **22,** as by conventional hooks. The turnbuckle interconnects the adjacent ends **68** and **70** of the springs for adjusting the forces exerted by each of the springs.

The springs **58, 60** normally maintain the inertia element **18** in the preimpact position as shown in FIG. **1.** The turnbuckle **62** can be manipulated to vary the force of the springs so as to determine the magnitude of deceleration required to commence the longitudinal movement of the inertia element **18** in response to a crash. This is a safety feature which permits a control of the switch so that it will not be actuated when an airplane lands or an automotive vehicle suddenly brakes.

The contact **16** is constructed as a plunger slidably received within a bore **70** in a link **71** which is pivotally connected to the switch arm **22** at **72.** A spiral spring **73** surrounds the shank of the contact **16** and is secured at one end to the head of the contact **16** and at its other end to the end of the link **71.** The shank is electrically insulated from the link **71** by a sleeve **74** and can be connected into an electric circuit for a distress signal transmitter by means of a wire **75.** The contact **14** is similarly mounted by a spring **76** in a bore in a fixed projection **77** on the arm **20** except that the contact shank is in electrical contact with the projection **77.** The arm **20** may be connected into the electrical circuit, as indicated by the ground symbol. To ensure that the contacts **14** and **16** align properly in the closed position of the switch **10** a link **78** is pivotally connected at one end at **79** to the link **71** and at its other end to the foot portion **25** at **80.**

The switch **10** operates in the following manner. The stationary switch arm **20** is appropriately secured to the airplane by any suitable means (not shown). The inertia element **18** and the connecting rod **44** are moved rightwardly so that the toggle linkage system **24** also moves rightwardly. This movement continues until the forward face **52** of the stop member **50** contacts the toggle link **31.** The springs **58** and **60** hold the parts in this position, as shown in FIG. **1.**

If there is a crash of the aircraft, the inertia force of the inertia element **18** is transmitted by the rod **44** to the toggle system and causes both pairs of toggle links to pass over-center against the force of the springs **58, 60** to their FIG. **2** position in which the stop surface **54** engages the arm **22.** Simultaneously the arm **22** moves first away from and then toward the arm **20** to effect engagement of the contact **16** with the contact **14.** The springs **73** and **76** permit the contacts to adjust within their bores so that the contacts are not damaged.

It will be understood that various changes may be made in the form, details, arrangement and proportion of the parts without departing from the scope of the invention. For example, the switch **10** can be disposed so that the toggle system **24** operates in the reverse direction from that shown, and the contacts **14** and **16** can be arranged to cooperate in various ways with the arms **20** and **22.**

What is claimed as novel and unobvious and desired to be protected by Letters Patent is set forth in the appended claims.

What is claimed is:

1. An inertia actuated switch assembly for use in connection with an electrical circuit that is to be selectively operated thereby comprising: two longitudinally extending arms; pivot means at one end of at least one of the arms mounted said one arm for swinging movement toward and away from the other arm in the plane of the arms; a toggle linkage pivotally connected between said arms so as to be pivoted between first and second positions on opposite sides of dead center; inertia means carried by said toggle linkage for moving said linkage from its first position to its second position in response to a predetermined deceleration force whereupon said one arm swings away from the other arm from a first position and then swings toward the other arm to a second position; bias means biasing said one arm and said toggle linkage in one of their positions, said bias means including two tension springs each having one end attached to one of said arms and means interconnected to the other ends of the springs for adjusting the tension of the springs; switch means operated by movement of said arms and toggle linkage between their positions for engaging or disengaging a pair of electrical contacts during such movement, and stop means for stopping the movement of said arms and toggle linkage in their second positions.

2. An inertia actuated switch assembly for use in connection with an electrical circuit that is to be selectively operated thereby comprising: two longitudinally extending arms; pivot means at end of at least one of the arms mounting said one arm for swinging movement toward and away from the other arm in the plane of the arms; a toggle linkage pivotally connected between said arms so as to be pivotal between first and second positions on opposite sides of dead center; inertia means carried by said toggle linkage for moving siad linkage from its first position to its second position in response to a predetermined deceleration force whereupon said one arm swings away from the other arm from a first position and then swings toward the other arm to a second position; bias means biasing said one arm and said toggle linkage in one of their positions; switch means operated by movement of said arms and toggle linkage between their positions for engaging or disengaging a pair of electrical contacts during such movement; and stop means for stopping the movement of said arms and toggle linkage in their first and second positions, said stop means including an arcuate member carried by said toggle linkage for alternate engagement with said toggle linkage and one of said arms.

3. An inertia actuated switch assembly for use in connection with an electrical circuit that is to be selectively operated thereby comprising: two generally parallel arms; pivot means at one end of at least one of the arms mounting said one arm for swinging movement toward and away from the other arm in the plane of the arms; a toggle linkage pivotally connected between said arms so as to be pivotal between first and second positions on opposite sides of dead center; inertia means carried by said toggle linkage for moving said linkage from its first position to its second position in response to predetermined deceleration force whereupon said one arm swings away from the other arm from a first position and then swings toward the other arm to a second position; bias means restraining said one arm and said toggle linkage against movement away from whichever position these elements occupy; switch means operated

by movement of said arms and toggle linkage between their positions for engaging or disengaging a pair of electrical contacts during such movement; and stop means carried by said toggle linkage for stopping the movement of said arms and toggle linkage in their first and second positions.

4. An inertia actuated switch comprising: an arm and toggle assembly including first and second arms pivoted together at their inner ends so that one arm may swing toward and away from the other arm in the plane of the arms and further including two toggle linkages disposed between the arms and pivotally connected to the arms at longitudinally spaced apart locations on the arm so as to be pivotal between first and second positions on opposite sides of dead center; inertia means for moving said linkage from one position to the other in response to a predetermined deceleration force, said inertia means including a rod connected to both toggle linkages and having a free end adjacent the outer ends of the arms and a weight carried on said free end; bias means biasing said arms and toggle linkages in one of their positions; and two switch elements carried by said arm and toggle assembly in positions such that they are in engagement in one position of the arms and toggle linkages and are out of engagement in the other position of the arms and toggle linkages.

5. An inertia actuated switch assembly for use in connection with an electrical circuit that is to be selectively operated thereby comprising: two longitudinally extending arms; pivot means at one end of at least one of the arms mounting said one arm for swinging movement toward and away from the other arm in the plane of the arms; a toggle linkage pivotally connected between said arms so as to be pivotal between first and second positions on opposite sides of dead center; inertia means carried by said toggle linkage for moving said linkage from its first position to its second position in response to a predetermined deceleration force whereupon said one arm swings away from the other arm from a first position and then swings toward the other arm to a second position; bias means biasing said one arm and said toggle linkage in one of their positions; an electrical contact carried by said of said arms and arranged such that they engage each other when said arms are in one of their positions and are out of engagement when said arms are in their other position.

* * * * *