Dec. 6, 1960 C. G. MISHLER 2,963,562

MAGNETIC G LOAD ACTUATED SWITCH

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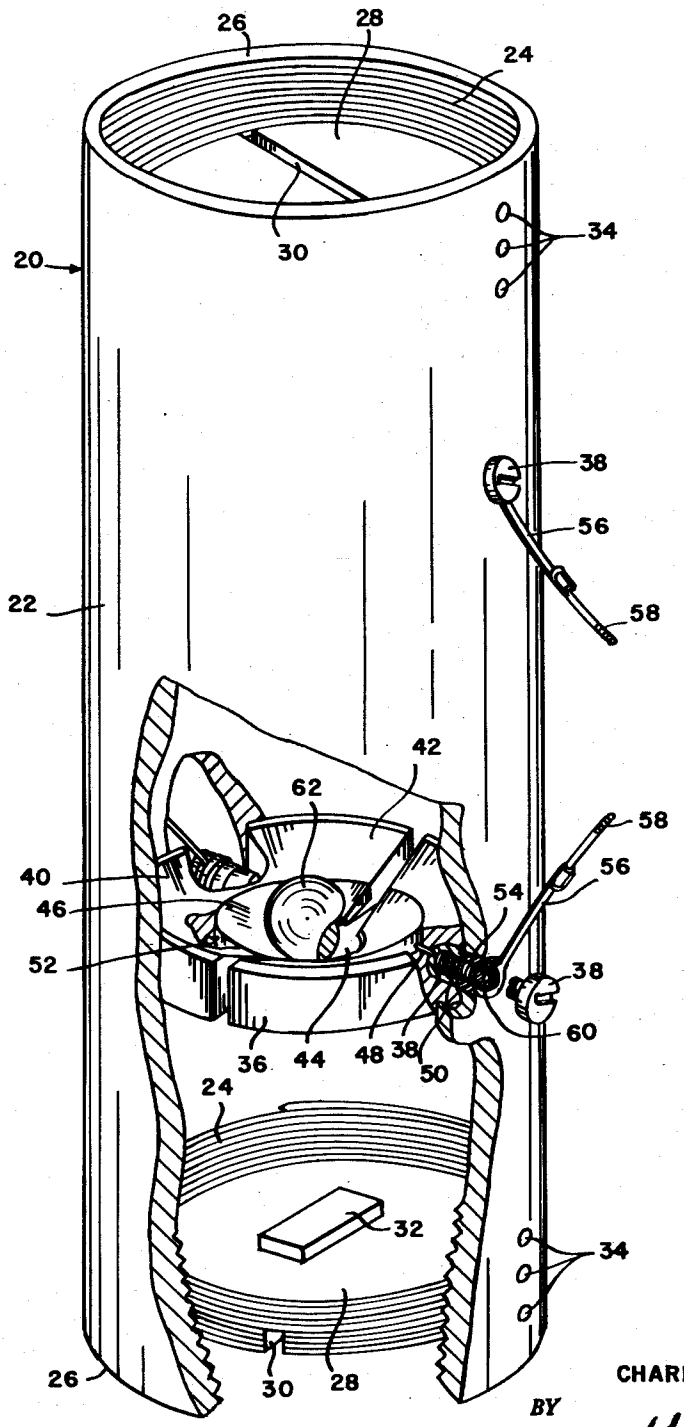


Fig-1

INVENTOR.
CHARLES G. MISHLER

BY

ATTORNEYS

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MAGNETIC G LOAD ACTUATED SWITCH

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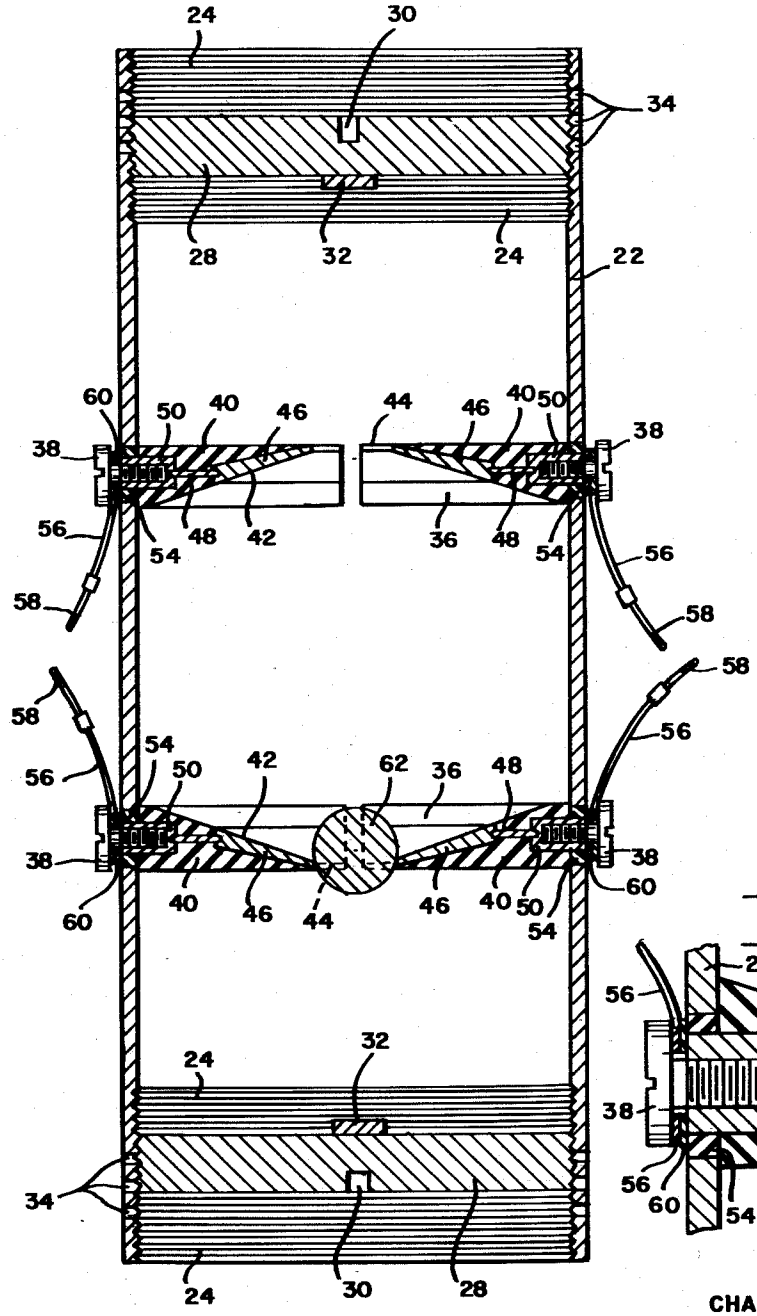


Fig-2

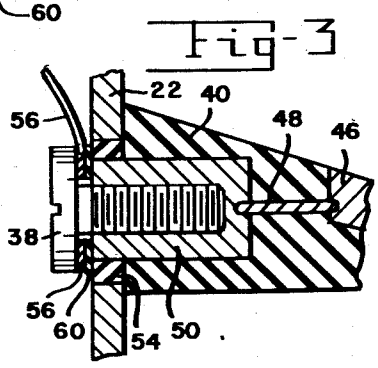


Fig-3

INVENTOR.
CHARLES G. MISHLER

BY

ATTORNEYS

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MAGNETIC G LOAD ACTUATED SWITCH

Charles G. Mishler, 116 N. Madison St., Rome, N.Y.

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6 Claims. (Cl. 200—61.45)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to electrical switches and more particularly to an adjustable magnetic switch which is actuated by gravitational or G loads acting thereon.

An object of the present invention is to provide an electrical switch or circuit breaker which may be adjusted to react to variable intensity G loadings of both a positive and negative nature.

A further object of the present invention is to provide a simple positively acting electrical switch adapted to activate or control various valves, relays and ignition systems during the take-off, flight and re-entry phases of missile firings. The magnetic G load actuated switch of the present invention is also adapted for use as an automatic power disconnect to disconnect aircraft bus systems to reduce fire hazards during crash landings.

The novel magnetic switch of the present invention comprises a metallic cylindrical casement having internal threads on each open end thereof. A threaded slotted plug having a magnet on the inner side thereof is adjustably disposed within each open end of said cylinder. A pair of split cone electrical contacts are oppositely positioned intermediate said plugs and are provided with means for connecting said contacts with separate electrical circuits external of said cylinder. A metal ball, freely movable between said pair of split cone contacts, is adapted to close either of said electrical circuits and maintain that circuit in a closed condition under the influence of one of said magnets.

These and other objects and features of the present invention will be readily apparent when the following detailed description is viewed in connection with the accompanying drawing in which:

Fig. 1 is a partially broken-away perspectus view of the magnetic switch of the present invention;

Fig. 2 is a sectional view taken along a vertical plane through the center of the magnetic switch of the present invention; and

Fig. 3 is a blown-up sectional view of the electrical connecting and contact mounting apparatus of the present invention.

Referring now in detail to the drawing wherein like reference numerals designate like parts and more particularly to Fig. 1, there is shown the magnetic G load actuated switch of the present invention generally designated **20**. The switch **20** comprises a cylindrical, nonmagnetic metallic casement **22** having internal threads **24** at each open end **26** thereof. A plug **28** having a slot **30** on one side and a magnet **32** on the other side is adapted to be threadedly inserted into each open end **26** of the casement **22** in a manner permitting the slot **30** to be exposed at each end of the casement **22**. The slot **30** is adapted to receive a screwdriver or other suitable tool to permit the adjustment of the plug **28** to any desired depth within the limits of the internal threads **24**. A series of ports or

openings **34** extending through the casement wall are located in vertical alignment adjacent the open ends **26** of the casement to permit inspection of the depth to which the plug **28** is seated within the casement **22**.

A pair of oppositely disposed split cone contacts, generally designated **36**, are positioned approximately equidistant from their respective open ends **26** of the casement **22** and each other. The split cone contacts **36** are mounted within the casement **22** by means of screw fasteners **38** which further serve as part of the electrical circuitry, later to be described. The split cone contacts **36** comprise a main two-part disk-like portion **40** of a nonconductive plastic or ceramic material having a conical recess **42** therein and a central opening **44** therethrough. The main disk-like portion **40** has molded therein semicircular metallic contacts **46**, a metal connector **48** and a threaded metallic insert **50**. The metallic insert **50** is adapted to threadedly receive the screw fasteners **36**.

The semicircular metal contacts **46** are lockingly fixed to the main portion **40** by anchor fasteners **52** which are an integral part of the contacts **46** and are molded within the main portion **40**.

The metallic insert **50** is held within and separated from the casement **22** by a nonconductive insulating sleeve **54**. A lug **56** connecting the switch **20** to a lead wire **58** of an external circuit is secured to the switch **20** by means of a screw fastener **38** but spaced from the metallic casement **22** by a nonconductive plastic washer **60**.

The magnetic switch of the present invention is opened and closed through the action of a freely movable metal ball **62**, said metal ball **62** being free to move within a cylinder formed by the walls of the casement **22** and closed at the top and bottom by the oppositely disposed split cone contacts **36**.

In operation the magnetic G load actuated switch of the present invention will normally be in a vertical position with the ball **62** at rest on the metallic contacts **46** and partially disposed through the opening **44** of the lower split cone contact **36**. An adjustable magnetic force maintains the metal ball **62** in contacting relationship with the metal contacts **46** thus maintaining the lower of the two circuits in a closed condition. With only one circuit closing metal ball within the switch the other or upper of the two circuits must necessarily be open when the lower circuit is closed and vice versa. When a negative G force is imparted to the metal ball **62** of sufficient magnitude to overcome the attraction of the lower magnet **32** the ball will be removed from the lower metal contacts **46** thus opening the lower circuit. If the G force is of sufficient magnitude and duration to permit the ball to travel vertically upward until it becomes attracted by the upper magnet **32** the upper circuit will then be closed and remain closed until a positive G force opens the upper circuit by removing the metal ball **62** from the upper set of metal contacts **46**.

It will also be evident that the lower circuit could be intermittently opened and closed if the force acting on the ball **62** when in contact with the lower metal contacts **46** was one of sufficient intensity but short in duration such as that encountered in shock and bounce testing. In the latter case the ball would not rise vertically to an extent sufficient to allow it to come under the influence of the upper magnet **32** and consequently would return to the lower set of metal contacts thus again closing the lower circuit.

The intensity of the G load required to open either of the circuits is inversely proportional to the distance between the magnet **32** and the adjacent split cone contact **36** and is adjustably controlled by the depth to which the plug **28** is threadedly inserted into the casement **22**.

The present invention has been described in detail

above for the purpose of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims.

I claim:

1. A magnetic switch adapted to activate a pair of separate external circuits comprising a cylindrical, nonmagnetic metallic outer casement having internal threads in the open ends thereof, a threaded plug having a magnet on the inner side thereof adjustably disposed within each open end of said casement, a tool receiving slot in the outer side of said plug, a series of openings in said casement to permit depth inspection of said plug, a pair of oppositely disposed split cone contacts intermediate said plugs, said split cone contacts comprising a two-part disk-like, nonconductive main portion having a conical recess therein and a central opening therethrough, a pair of semicircular oppositely disposed metallic contacts in said conical recess, screw fasteners adapted to maintain said parts of said disks in a fixed position within said casement and electrically connect said switch with said external circuits, electrical conducting means connecting said screw fasteners with said metallic contacts, and a metallic ball freely movable between said oppositely disposed split cone contacts for alternately opening and closing said pair of external circuits.

2. A magnetic switch adapted to activate a pair of separate external circuits comprising a cylindrical, nonmagnetic metallic outer casement having internal threads in the open ends thereof, a threaded plug having a magnet on the inner side thereof adjustably disposed within each open end of said casement, a tool receiving slot in the outer side of said plug, a pair of oppositely disposed split cone contacts intermediate said plugs, said split cone contacts comprising a two-part disk-like, nonconductive main portion having a conical recess therein and a central opening therethrough, a pair of semicircular oppositely disposed metallic contacts in said conical recess, screw fasteners adapted to maintain said parts of said disks in a fixed position within said casement and electrically connect said switch with said external circuits, electrical conducting means connecting said screw fasteners with said metallic contacts, and a metallic ball freely movable between said oppositely disposed split cone contacts adapted to maintain one of said external circuits in a closed condition while under the influence of the magnet adjacent the split cone contacts of said circuit.

3. A magnetic switch adapted to activate a pair of separate external circuits comprising a hollow cylindrical, outer casement having internal threads in the open ends thereof, a threaded plug having a magnet on the inner side thereof is adjustably disposed within each open end of said casement, a pair of oppositely disposed split cone contacts intermediate said plugs, said split cone contacts comprising a two-part disk-like, nonconductive main portion having a conical recess therein and a central opening therethrough, a pair of semicircular oppositely disposed metallic contacts in said conical recess, screw fasteners adapted to maintain said parts of said disks in a fixed position within said casement and electrically connect said switch with said external circuits, electrical conducting means connecting said screw fasteners with said metallic contacts, and a metallic ball freely movable between said oppositely disposed split cone contacts adapted to engage either of said pair of split cone contacts whereby said related external circuit will be closed and maintained in a closed condition under the influence of the adjacent magnet until a G force of sufficient magnitude removes said ball from said contacts opening said related circuit.

4. A magnetic switch adapted to activate a pair of separate external circuits comprising a hollow cylindrical casement having internal threads in the open ends thereof, a threaded plug having a magnet on the inner side thereof is adjustably disposed within each open end of said casement, a tool receiving slot in the outer side of said plug to facilitate the axial movement of said plug within said casement, a pair of oppositely disposed split cone contacts intermediate said plugs, said split cone contacts comprising a two-part disk-like, nonconductive main portion having a conical recess therein and a central opening therethrough, a pair of semicircular oppositely disposed metallic contacts in said conical recess, screw fasteners adapted to maintain said parts of said disks in a fixed position within said casement and electrically connect said switch with said external circuits, electrical conducting means connecting said screw fasteners with said metallic contacts, and means within said casement for alternately opening and closing said pair of external circuits.

5. A magnetic G load actuated switch of the type described, comprising a hollow cylindrical outer casement having a pair of axially movable plugs closing the open ends thereof, a magnet on the inner side of each of said plugs, a pair of oppositely disposed split cone contacts intermediate said plugs, dual purpose means mounting said split cone contacts within said casement and connecting said contacts with electrical circuits external of said casement, a metallic ball freely movable between said pair of split cone contacts adapted to electrically connect one of said pair of contacts whereby one of said external circuits will be closed and maintained in a closed condition until a force of greater magnitude than that of the adjacent magnet removes said ball from said contacts opening said closed circuit.

6. A magnetic G load actuated switch of the type described for actuating a pair of external circuits, comprising a hollow cylindrical outer casement having a pair of axially movable plugs closing the open ends thereof, a magnet on the inner side of each of said plugs, a pair of oppositely disposed split cone contacts intermediate said plugs, dual purpose means mounting said slit cone contacts within said casement and connecting said contacts with said electrical circuits external of said casement, a metallic ball freely movable between said pair of split cone contacts adapted to electrically connect one of said pair of contacts whereby one of said external circuits will be closed and maintained in a closed condition until a force of greater magnitude than that of the adjacent magnet removes said ball from said contacts opening said closed circuit and subsequently closing the other of said pair of external circuits.

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