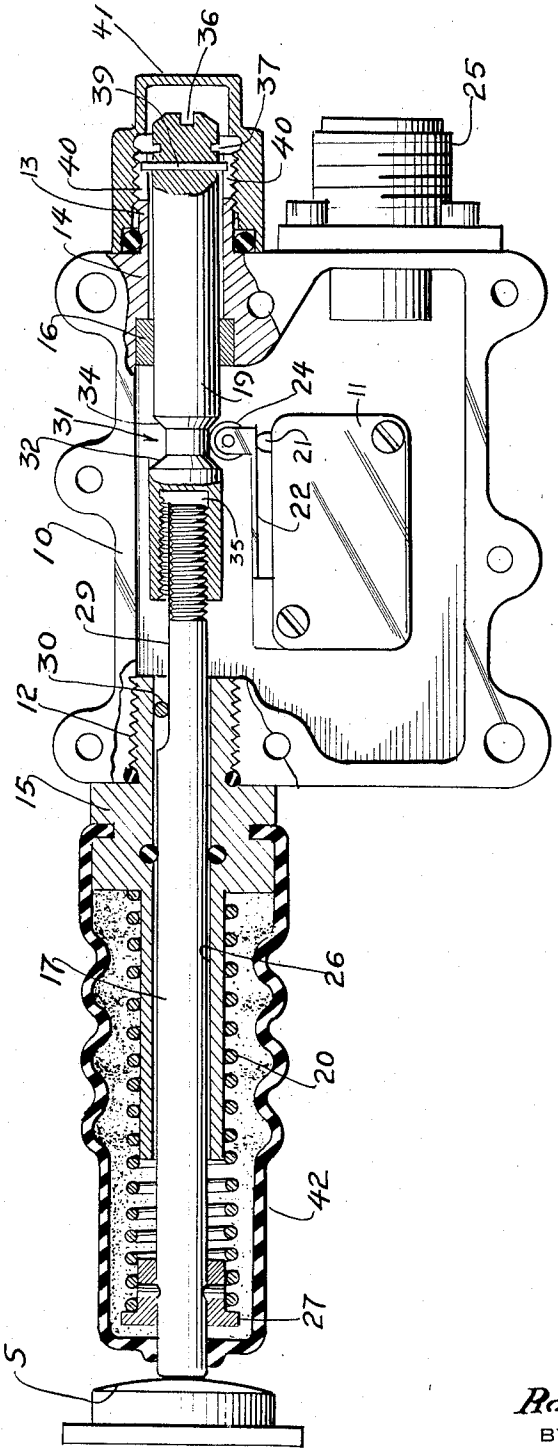
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REACTION SWITCH

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REACTION SWITCH

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This invention relates to electrical circuit makers, and, more particularly to switches which are operable by excessive movement of a mounted structure.

Heretofore, it has been proposed to provide aircraft with systems which are automatically operable in the event of a crash to prevent explosions or the breaking out of fire. In such systems, it is necessary that initiating means be able to sense a crash as distinguished from other less violent occurrences such as storms and the like, normal relative movement of parts within predetermined limits, such as is occasioned by vibrations, for example, as well as from malfunction of components in the system itself. Such systems may therefore be operated by the actuation of a plurality of switches simultaneously, each of which responds to a different condition which has been found to occur during a crash.

Careful study of crashes revealed that explosion or fire often result when, due to the force of the impact, an engine is torn loose from its mount severing fuel and oil lines and permitting the contents thereof to spill and contact hot engine parts such as the cylinder block, exhaust manifold and the like.

Accordingly, it is an object of the present invention to provide a switch mechanism which is adapted to control an electrical circuit in the event that an engine, for example, is caused to move with respect to the aircraft frame in excess of the movement due to normal vibration and torque.

It is another object to provide such apparatus including an initiating member abutting the engine structure capable of reacting to excessive movement thereof such as might occur in the event of a crash.

It is another object to provide such apparatus wherein excessive movement of the engine structure in any direction will effect actuation of the circuit controlling means.

It is a further object to provide such apparatus which is reliable and efficient in operation, is easily installed, cannot get out of adjustment, is light in weight, requires little maintenance, is free from damage due to moisture or dust and has a long shelf life.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects are generally accomplished by providing, in combination with craft having structure arranged for movement within predetermined limits, a rod having a surface abutting the structure and being movable from its normal position in either of its longitudinal directions, spring means for urging the rod towards the structure, actuating means and an element movable with the rod for effecting operation of the actuating means upon movement of the structure beyond the limits.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and

is shown in the accompaning drawing, forming a part of the specification, wherein the single figure is a side elevational view, partly in section, of apparatus in accordance with the present invention.

Referring to the drawing in detail, there is shown a frame or casing **10** supporting a conventional switch **11** and formed with a pair of opposite apertures **12** and **14** in the ends thereof and with a sleeve portion **13** surrounding the aperture **14** and extending outwardly thereof. Slide bearings **15** and **16** are mounted in the respective apertures **12** and **14**, a rod **17** is slidably mounted in the bearing **15** and has an inner end within the casing and an outer end projecting outwardly therefrom, an elongate element **19** connected to the inner end of the rod **17** for movement therewith is slidably mounted in the other bearing **16**, and a helical compression spring **20** is arranged for urging the outer end of the rod **17** outwardly of the bearing **15**.

The switch **11** is provided with an actuating plunger **21** and an operating arm **22** formed preferably of spring steel, secured at one end to the switch body and positioned over the plunger at its other end. A roller **24** is mounted at the free end of the arm and is normally urged by the spring action thereof in a direction away from the plunger **21**. The terminals of the switch are connected to an electrical connector **25** in the casing in the usual manner.

The bearing **15** is formed with an elongate sleeve portion **26** through which the rod **17** extends, and a flanged collar **27** is secured to the rod adjacent its outer end for movement therewith. The spring **20** fits over the sleeve **26** and bears against the flanged collar **27** at one end and against the bearing **15** at the other end to urge the rod **17** to the left, as viewed. The inner end of the rod, disposed within the casing, is screw threaded and is formed with a flat zone **29** extending longitudinally to a point within the bearing **15**. A pin **30** mounted in the bearing **15** extends through the bearing opening and abuts the flat zone **29** of the rod for a purpose to be described hereinafter.

The element **19**, slidably mounted in the bearing **16**, is generally cylindrical in contour and is formed with a section **31** of reduced diameter having frusto-conical cam faces **32** and **34** at the respective ends for actuating the switch as described hereinafter. The inner end of the element **19** is provided with an internally threaded longitudinal bore **35** for securing the inner end of the rod **17** for movement therewith. The element **19** is provided with a diametric slot **36** at its free end and with a circumferential groove **37** adjacent that end. A pin **39** is mounted in the element **19** and extends radially outwardly therefrom at each end thereof, and is disposed within a pair of diametrically opposite slots **40** in the end of the sleeve portion **13**.

To mount the device for actuating the switch **11** upon movement of an aircraft engine, for example, in excess of the normal movement due to vibration and torque, the casing **10** may be secured to the aircraft frame structure in such a manner that the longitudinal axis of the rod is parallel to the longitudinal axis of the engine and that the free end of the rod **17** abuts a surface S on or attached to the engine for that purpose. The dimensions of such a surface will depend upon the maximum allowable torque reaction of the particular engine involved. For example, if the maximum torque reaction of an engine is 4° clockwise and 1° counterclockwise, this vertical surface is so dimensioned that movement in excess of maximum torque reaction will move the surface out of abutment with the end of the rod **17**.

The position of the section **31** of reduced diameter of the element **19** with respect to the roller **24** is adjusted by manually urging the rod **17** in a direction against the action of the spring **20** until the pin **39** in the element

19 is moved out of the slots 40. The element 19 is then rotated by the action of a suitable tool in the slot 36 until, upon release of the rod 17, the pin 39 moves back into the slots 40 and the groove 37 lines up with the end of the sleeve portion 13. Aligning the groove and the sleeve portion automatically locates the center of the section 31 in abutting relation with the roller 24, thus permitting adjustment without the necessity of opening the casing.

After the mechanism has been properly adjusted, the pin 30 bearing against the flat zone 29 and the pin 39 extending into the slots 40 prevent rotation of the rod 17 and the element 19, respectively, so that the mechanism cannot get out of adjustment as a result of vibration, for example, and also prevent excessive longitudinal movement of the rod and the element.

The dimensions of the section 31 of reduced diameter including the cam faces 32 and 34 will be determined by the alowable maximum longitudinal vibrational excursion of the particular engine involved. For example, one quarter of an inch may be the maximum longitudinal vibrational excursion allowed for the aforementioned engine, wherefore, when used in connection with that engine, the section 31 is dimensioned to effect actuation of the switch upon longitudinal movement of the engine through a distance greater than one eighth of an inch from its normal position.

In operation, normal vibration or torque reaction of the engine will not cause or permit sufficient movement of the rod 17 to allow either of the cam faces 32 or 34 to abut the roller 24 to depress the arm 22 and effect actuation of the switch through the plunger 21. However, in the event of excessive movement of the engine with respect to the aircraft frame, due to collision or crash, for example, the rod 17 will be moved in one of its longitudinal directions, either by the engine or the spring depending upon the direction of movement of the engine, until one of the cam faces 32 or 34 abuts and depresses the roller 24 sufficiently to effect actuation of the switch 11.

In order to seal the apparatus against moisture and dust, a cap 41, formed to permit movement of the element 19, may be screw threaded to the sleeve portion 13 and conventional O-rings may be disposed between the sleeve portion and the cap and between the bearing 15 and the rod 17. Likewise, the outer end of the rod 17 and the spring may be enclosed by a flexible housing 42 to prevent corrosion or contamination of the spring.

From the foregoing description, it will be seen that the present invention provides a switch mechanism adapted to control an electrical circuit in the event that an engine, for example is caused to move with respect to its frame in excess of the movement due to normal vibration and torque, which mechanism is reliable and efficient in operation, is easily installed, cannot get out of adjustment, is light in weight, requires little maintenance, is free from damage due to moisture or dust and has a long shelf life.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interrupted as illustrative and not in any limiting sense.

I claim:

1. A control mechanism of the class described comprising a frame having aligned apertures in opposite sides thereof, a slide bearing in each of said apertures, switch means supported by said frame having a member adapted to be actuated, a rod slidably mounted in one of said bearings and extending through said frame formed with a flat zone extending longitudinally from the inner end thereof to a point within said rod-mounting bearing, a spring retainer at the outer end of said rod, an element adjustably connected to the inner end of said rod and slidably mounted in the other of said bearings, said element having an intermediate section of reduced diameter formed with oppositely facing frusto-conical cam faces at its respective ends for actuating said switch means member, a cylindrical helical spring surrounding said rod and extending between said retainer and said frame for urging said rod outwardly of its bearing, a slot formed in the free end of said element adapted to be engaged by a tool for adjusting the position of said element with respect to said rod and said switch means, a pin projecting radially from said element adjacent the free end thereof, a stop in said element-mounting bearing constructed and arranged to receive said pin to limit the movement of said element, and pin means supported in said rod-mounting bearing etxending transversely of said rod and abutting said flat zone thereof to prevent rotation of said rod.

2. A control mechanism of the class described comprising a frame having aligned apertures in opposite sides thereof, a slide bearing in each of said apertures, switch means supported by said frame having a member adapted to be actuated, a rod slidably mounted in one of said bearings and extending through said frame, a spring retainer at the outer end of said rod, an element adjustably connected to the inner end of said rod and slidably mounted in the other of said bearings, said element having an intermediate section of reduced diameter formed with oppositely facing frusto-conical cam faces at its respective ends for actuating said switch means member, a cylindrical helical spring surrounding said rod and extending between said retainer and said frame for urging said rod outwardly of its bearing, a cap secured to said element-mounting bearing for sealing one of said apertures, and a flexible sleeve mounted at one end of said rod-mounting bearing and attached at its other end to the outer end of said rod to seal the other of said apertures.

3. A control mechanism of the class described comprising a frame having aligned apertures in opposite sides thereof, a slide bearing in each of said apertures, switch means supported by said frame having a member adapted to be actuated, a rod slidably mounted in one of said bearings and extending through said frame, a spring retainer at the outer end of said rod, an element adjustably connected to the inner end of said rod and slidably mounted in the other of said bearings, said element having an intermediate section formed with cam faces for actuating said switch means member, a cylindrical helical spring surrounding said rod and extending between said retainer and said frame for urging said rod outwardly of its bearing, means formed in the free end of said element adapted to be engaged for adjusting the position of said element with respect to said rod and said switch means, stop means on said element and said element-mounting bearing constructed and arranged to limit the movement of said element, and means on said rod-mounting bearing and said rod serving to prevent rotation of said rod.

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