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COMBINATION GRAZE AND IMPACT SWITCH

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Fig. 3.

Fig. 1.

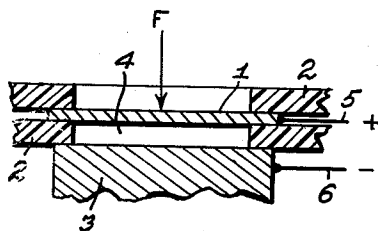
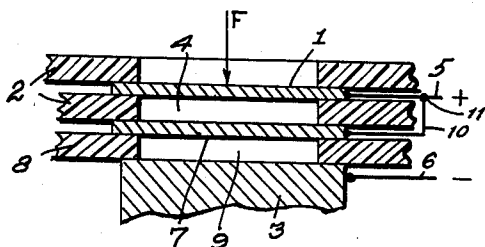
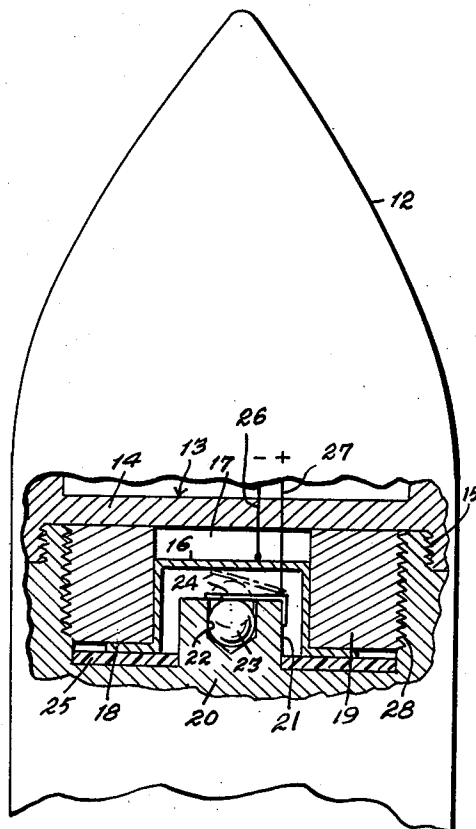


Fig. 2.



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1

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COMBINATION GRAZE AND IMPACT SWITCH
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2 Claims. (Cl. 200-61.08)

This invention relates to a combination graze and impact switch and more particularly to a laminated direct impact sensor consisting of electrical conductors of varying thicknesses and materials which are separated by dielectric elements, and in inertially operated spring-mass graze sensor.

An object of this invention is to provide a switch to close an electrical firing circuit in a rocket or projectile fuze when actuated by direct or graze impact of the projectile; direct impact being defined as good contact of the projectile with a target and with good perpendicular relationship therewith, and graze impact meaning a glancing contact of the projectile with a target at angles of less than one degree.

Another object of this invention is to provide a switch of laminated construction that will resist accidental closing thereof.

A further object of this invention is to provide a graze and impact switch that will reset itself in event of an impact of insufficient force to close it.

A still further object is to provide a laminated graze and impact switch having predetermined operating levels which can be varied separately for graze and impact forces over a wide range of magnitudes.

A final object is to provide a graze and impact switch of simple construction and having great reliability of operation.

The specific nature of the invention as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

FIG. 1 is a fragmentary section view showing a simple form of the switch of the invention;

FIG. 2 is a fragmentary view showing a switch provided with additional components, and

FIG. 3 is a side elevation of the nose portion of a projectile with parts broken away and showing one application of the switch of this invention therein.

Referring now to the drawing in which (see FIG. 1) there is illustrated a simple form of the switch of the invention, in axial section, and in this view, only the essential elements operating on direct projectile target impact are shown. A disc shaped conductor 1, of spring-like metal is supported between supports 2 of dielectric material. A second conductor 3 is spaced from conductor 1 by the dielectric supports 2 to form an air gap 4 therebetween.

Electrical leads 5 and 6 are connected to conductors 1 and 3 respectively and connect the conductors 1 and 3 to a firing circuit in a projectile, not shown.

Upon a direct target impact of a projectile (no projectile being shown in this view), force F, caused by crushing of the projectile's nose or an impact operated member in the projectile's nose will deform conductor 1 through air gap 4 to contact conductor 3, thus closing the firing circuit (not shown) through leads 5 and 6.

As shown in FIG. 2, the switch of FIG. 1 has been provided with additional components to further increase safety and versatility thereof.

A third conductor 7 is added and is spaced between conductors 1 and 3 by a dielectric support 8 to form a second air space 9.

An additional lead 10 connects the conductors 1 and 7 to a lead 5 and a common terminal 11.

2

Upon a direct hit of the projectile, conductor 1, being of spring-like material will deform to contact second conductor 7 and deform that conductor to contact conductor 3 to close the switch.

Conductor 7 may be formed of ductile material, if desired, to effect permanent closure of the switch. In any case, the final contact must be made between conductors 7 and 3 to effect closure of the switch.

The polarity shown in FIGS. 1, 2 and 3 is arbitrary and can be changed without affecting the closing of the switch; the size of all air gaps 4 and 9, and the thicknesses of dielectric supports 2 and 8 can be varied and also the dielectric supports may be made of various dielectric materials to accommodate the varied magnitudes of impact forces.

Obviously, many combinations are possible.

In FIG. 3, there is illustrated a portion of a projectile 12 with its skin broken away to reveal one form of a switch, constructed according to the invention, completely assembled therein. The switch assembly is indicated generally by 13 and is composed of a relatively heavy cup 14 which is secured in projectile 1 by threads 15.

A second cup 16 of relatively thinner metal than cup 14 is spaced from cup 14 to provide an air gap 17. Cup 16 is provided with a flange 18 and a spacer nut 19, threadably mounted in projectile 1 by threads 28, and abuts flange 18 to secure cup 16 in the assembly.

A graze mechanism is provided in switch 13 and consists of a ball support 20 positioned in projectile 1 and is provided with a central boss 21 having an axial bore 22 which normally houses a steel ball 23. Ball 23 is normally retained by a leaf spring 24 in bore 22. A washer 25 of dielectric material between flange 18 and ball support 20 electrically insulates support 20 from cup 16. Cup 16 forms one electrical conductor, while ball support 20 forms a second conductor.

Leads 26 and 27 connect cups 14 and 16 respectively, to the firing circuit (not shown) in the projectile 1 for the initiation of the explosion thereof.

Cup 14 further acts as a protection against accidental closing of the switch 13, such as might occur in dropping of the projectile or rough handling thereof.

The operation of the switch 13 is simple. When projectile 12 hits a target directly, the impact force will crush the nose, or whatever other element is employed, to crush cup 14 to deform, in turn, cup 16 against ball support 20 and close the switch 13 whereby the firing circuit of the projectile 1 (not shown) will be closed to initiate firing of the projectile.

If a glancing impact of projectile 1 occurs, steel ball 23 moves out of bore 22 to force spring 24 against cup 16 and close the switch 13.

Predetermined operating levels, for the switches shown in FIGS. 1-3, can be selected by varying the strength and spacing of the conducting elements and the air gaps to meet the varied impact force magnitudes.

The operation levels for the graze impact forces can be controlled also by the design of the spring element 24.

While the switch of the invention has been shown and described in the foregoing specification as being applied to a projectile, other uses for the switch may be found where its use is applicable.

Variations and modifications may be effected without departing from the scope of the novel concept of the present invention as set forth in the appended claims.

What is claimed is:

1. A combination graze and impact switch for closing a projectile electric firing circuit and including a laminated assembly secured in said projectile, said assembly comprising a crushable member; a first electrical

3

conducting member, a spacing element disposed between said crushable member and said first conducting member whereby said crushable member is spaced from said first conducting member to form an air gap therebetween; a second electrical conducting member; a nonconducting member between said first conducting member and said second conducting member whereby said second conducting member is spaced from said first conducting member, whereby upon a direct target impact of said projectile, said crushable member is crushed against said first conducting member to cause said first conducting member to deform and contact said second conducting member to close said switch; and a graze actuated means carried by said second conducting member comprising a steel ball housed in said second conducting member and a leaf spring connected at one of its ends to said

4

second conducting member and normally retaining said steel ball against movement out of said second conducting member, said steel ball, upon projectile graze, moving out of said second conducting member against the bias of said spring to contact said first conducting member and close said switch.

2. A switch as set forth in claim 1 wherein said crushable element is relatively thicker than said first conducting member.

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