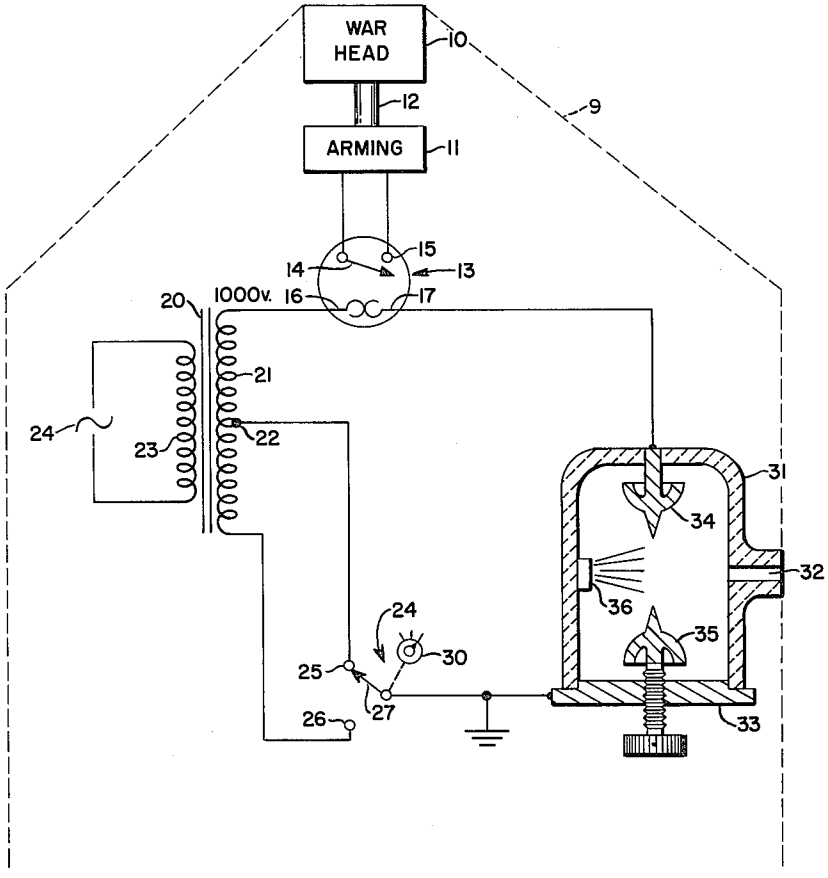
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ARMING CIRCUIT WITH PRESSURE RESPONSIVE DISCHARGE SWITCH

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ARMING CIRCUIT WITH PRESSURE RESPONSIVE DISCHARGE SWITCH

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This invention relates to the field of electrical control and more specifically to pressure responsive control means for use in high altitude vehicles. It has for its object to provide a high altitude switch of improved design which is physically compact, highly reliable, and completely insensitive to vibration and acceleration, and to embody that switch in an improved control system.

Various other objects, advantages, and features of novelty not individually enumerated above which comprise my invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However for a better understanding of the invention, its advantages, and objects attained by its use, reference should be had to the subjoined drawing, which forms a further part hereof, and to the accompanying descriptive matter, in which I have illustrated and described a preferred embodiment of my invention.

The single figure of the drawing schematically shows an improved switch according to the invention, embodied in a control system exemplary of applications in which the switch is useful.

In the drawing reference numeral 10 represents the warhead of an air-borne vehicle such as a ballistic missile 9, which is normally disabled, to protect its firing crew and others in the friendly territory from which it is launched, until after energization of an arming circuit 11 connected to the warhead by suitable connecting means 12. Arming circuit 11 is energized by operation of an explosive relay 13 which is a circuit component well known in ordnance applications to give reliable, chatterless circuit closing, and is shown schematically to comprise a pair of contacts 14 and 15 which are explosively closed upon the flow of significant current between a pair of contacts 16 and 17.

The apparatus also includes a transformer 20 having a secondary winding 21 tapped at 22, and a primary winding 23 energized from a source 24 of alternating voltage which may be provided by an inverter for example. There is also included a single pole double throw switch 24 having a pair of fixed contacts 25 and 26 connected respectively to tap 22 and one terminal of secondary winding 21, and a movable contact 27 actuated by a setting knob 30. The other secondary winding terminal is connected to contact 16 of relay 13.

The apparatus is completed by gaseous-conduction switching device of the avalanche discharge type. It is shown to comprise a ceramic chamber or housing 31, open to the ambient atmosphere through a connection 32 and having a closure 33. A first point electrode 34 passes through the closed end of chamber 31 and is connected to relay contact 17. A second point electrode 35 passes through closure 33 and is connected to movable contact 27. Contact 35 is adjustably received in closure 33 to make it possible to vary the spacing between the electrodes. Ionization of the gas ambient to the electrodes is insured by providing a source 36 of low energy β particles.

The secondary voltage of transformer is so chosen relative to the spacing of electrodes 34 and 35 that when the vehicle carrying the apparatus is at ground level the pressure in chamber 31 is relatively large and no significant discharge takes place between the electrodes. In one embodiment of the invention the transformer secondary output was 1,000 volts. As the altitude of the vehicle increases, the ambient pressure decreases and air passes out of chamber 31 through opening 32. A negligible current may pass between the electrodes under these conditions. However, further increase in altitude and consequent reduction of pressure in the chamber leads to a situation in which a randomly disturbed particle may experience a free path long enough to gain sufficient velocity so that upon collision with an uncharged particle it can release more than one particle pair. When the pressure is sufficiently reduced enough ion pairs are produced to free from the electrodes by bombardment sufficient electrons to sustain a discharge between the electrodes. This regenerative avalanche discharge conduction is a surge of current which is limited only by the external impedance, and is supplied to cause sufficient current to flow between relay contacts 16 and 17 to actuate the relay, thus completing the arming circuit and readying the warhead for firing.

The provision of switch 24 makes it possible to operate the apparatus at different predetermined high altitudes, depending upon the selection of the transformer secondary voltage and the location of tap 22.

Numerous objects and advantages of my invention have been set forth in the foregoing description, together with details of the structure and function of the invention, and the novel features thereof are pointed out in the appended claims. The disclosure, however, is illustrative only, and I may make changes in detail, especially in matters of shape, size, and arrangement of parts, within the principle of the invention, to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

I claim as my invention:

1. In combination: a ballistic missile including a warhead; and an arming circuit connected to said warhead including an avalanche discharge arming switch.

2. In combination, a vehicle capable of movement from a point of higher atmospheric pressure to a point of lower atmospheric pressure, electrically energizable apparatus carried by said vehicle, a source of electrical energy connected to said apparatus, a chamber open to the ambient atmosphere, a plurality of mutually insulated, spaced electrodes in said chamber, and means including said electrodes providing an energizing circuit between said apparatus and said source, the spacing of said electrodes and the voltage of said source being selected so that no significant discharge takes place between said electrodes at an initial higher ambient pressure, while avalanche discharge conduction may take place between said electrodes at a subsequent lower ambient pressure.

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