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CONNECTING SWITCH

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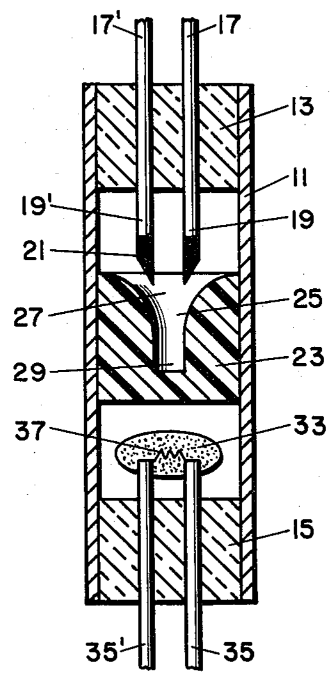

FIG. I

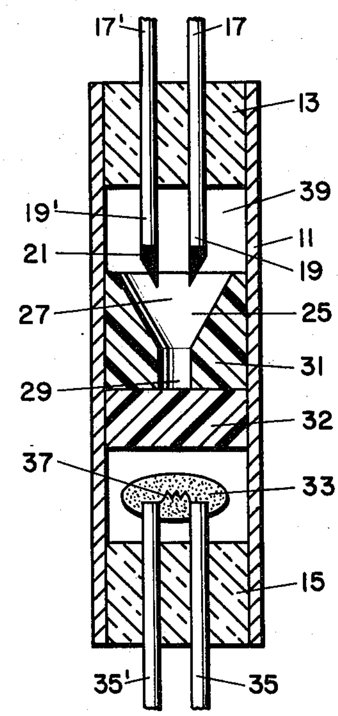

FIG. 2

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CONNECTING SWITCH

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The present invention relates to an improved electrical switch and more particularly to an electrical switch which connects electrical contacts. The switches of the present invention are especially suited to be actuated by an explosive charge.

Some types of projectiles and missiles require reliable, compact electrical switches which are stable to large multidirectional forces and which are operable while exposed to such forces, for example, when the projectile or missile containing the switches are in a state of violent tumbling or rolling.

The present invention provides an electrical switch that operates in a positive manner to make an electrical connection by connecting electrical contacts one with another and is independent of the position of the switch or forces acting upon the switch.

In general, the switches of the present invention comprise a slide member moveable along a line and a pair of spaced electrical contact members. The spaced contact members are generally positioned parallel to the line along which the slide member moves. At least one of the contact members has a free end extending toward the slide member arranged to contact the other contact member upon lateral pressure near the free end. The slide member is provided with a surface oblique to the direction of travel of the slide member. This surface is so oriented with the contact members that upon motion of the slide member toward and against one of the contact members having a free end, one contact member is pushed into contact with the other contact member. Preferably at least one of the electrical contact members is of a metal deformable into a permanent set. A driving means may also be provided to drive the slide member toward the contact members with sufficient force to deform the deformable contact members into a position wherein there is physical contact between the contact members.

If desired, the contacting surface on the slide member may be provided by a cavity in the slide member which is aligned with the electrical contact members. The wall surface of the cavity is obliquely positioned toward the contact members. Preferably, the slide member cavity is of a size that will freely admit the contact members and narrows within the piston to a size such that the contact members are tightly squeezed together upon insertion therein.

Preferably, the terminal end of at least one of the contact members has a layer of solder thereon positioned so that the action of the slide member forcing the electrical contact members together provides a soldered electrical connection between the contact members.

Although the driving means may comprise a compressed spring released by either a mechanical or electrically actuated release mechanism, it preferably comprises an explosive charge fired by electrical energy. A particularly suitable driving means is an electrically actuated squib.

In order to protect the electrical connection and insure that it is maintained after the slide member has forced the electrical contact members together, it is sometimes desirable to maintain tight contact between the connected electrical contact members and the contacting portion of the slide member. However, if the electrical contact

members are positioned in an enclosed space, the gas surrounding the electrical contact members undergoes compression by the movement of the slide member and a backpressure is formed which tends to dislodge the slide member from contact with the electrical contact members. Therefore, in a preferred embodiment of the invention the slide member is comprised of separable sections, with the section closest to the contact members equipped with a perforation extending therethrough. The perforation allows equalization of pressure on either side of the perforated slide member section and safeguards against backpressure dislodging the slide member once it engages the contact members. Suitably the slide member cavity which provides a contact surface may also be adapted to provide a means of pressure equalization by extending the cavity through at least one of the slide member sections but not through all of the sections. The perforation allows the backpressure to bypass the portion of the slide member contacting the contact members and act upon a section of the slide member having no cavity therethrough. If the solid portion of the slide member is displaced, the displacement has no effect upon the portion in contact with the electrical contact members.

The invention will be better understood from the following description when considered in connection with the accompanying drawings.

FIGURE 1 is a longitudinal cross-sectional view of a switch in accord with the present invention.

FIGURE 2 is a longitudinal cross-sectional view of a modification of the switch shown in FIGURE 1 wherein the piston member comprises two sections.

In each of the views like components bear like numbers and for the most part, the switch in FIGURE 1 and the modification in FIGURE 2 may be discussed together.

A generally cylindrical metallic outer shell member **11** is sealed on one end by a plug of non-conducting material **13** and on the other end by a second plug of non-conducting material **15**. The plug members may suitably be fabricated of such non-conducting material, as plastic, asphalt, rubber or glass. Preferably the plug members are fabricated of a ceramic material. A pair of spaced electrical contact members **17** and **17'** enter shell **11** through plug **13** and terminate within the shell. The electrical contact members **17** and **17'** preferably are of a metal deformable into a permanent set, for example, copper or brass. The free ends **19** and **19'** of contacts **17** and **17'** are coated with a thin layer of a solder **21**, of metal or metallic alloy such as gold, lead, tin, silver amalgam, lead-tin or indium alloys. A slide member **23** having a cavity **25** is positioned in shell **11** in spaced relation to electrical contact members **17** and **17'**. Cavity **25** is aligned with contact members **17** and **17'**. Cavity **25** is of sufficient size to freely receive contact members **17** and **17'**. Wall **27** of cavity **25** tapers to a narrowed opening **29**. Narrowed opening **29** is of a size such that free ends **19** and **19'** are tightly squeezed together upon insertion therein. Slide member **23** is preferably fabricated of a non-conducting material, for example, resin, hard rubber, compacted fiber board, or ceramic materials.

In FIGURE 2, a modification of the piston arrangement is shown wherein the piston has a first piston section **31** and a second piston section **32**. The first piston section **31** is similar to piston member **23** shown in FIGURE 1 except cavity **25** extends completely therethrough to provide a means of equalizing pressure on either side of piston section **31**. The second piston section **32** has no perforation therein and represents a solid obstruction across shell **11**. Although the second or solid slide member section **32** is preferably fabricated of a non-conducting resin, it may be suitably fabricated of metal or other conductive material suitable to prevent the communication from one end of shell 11 to the other.

The switches shown in the drawings both utilize a gas-forming explosive charge **33**, suitably composed of lead mononitroresorcinate, positioned in proximity to the slide member. A firing means comprising leg wires **35** and **35'** enters shell **11** through plug **15** and is electrically connected to a high resistance bridge wire **37** embedded in charge **33**.

In operation, the gas-forming explosive charge is fired by applying sufficient electrical energy to the bridge wire **37** via leg wires **35** and **35'** to fire charge **33**. The gases from charge **33** forceably move the slide member toward contact members **17** and **17'**. The tapered wall surface **27** of the slide member causes contact members **17** and **17'** to be bent inward and into physical contact by lateral pressure on said contact members. The free ends **19** and **19'** of the electrical contact members are coated with a thin layer of solder **21** and when forceably joined form a soldered connection. The free ends **19** and **19'** of electrical contact members may be angularly cut to present a meeting face with tapered wall **27** of the slide member.

Although after firing the connection of electrical contact members **17** and **17'** is completed, it is often desirable to protect the connection by maintaining wall **27** of the slide member in tight contact with the connected electrical contact members. The modification in FIGURE 2 shows a means of providing such contact. The gas in area **39** around electrical contact members **17** and **17'** is compressed by movement of the slide member toward contact members **17** and **17'**. This movement forms a backpressure in area **39** tending to force wall **27** of the slide member out of contact with the connected contact members. The modification shown in FIGURE 2 prevents this action by extending cavity **25** completely through the first section of slide member **31** to form a gas passage. The backpressure thereby bypasses the first section of slide member **31** by passing through extended cavity **25** and acts to force the second section of the slide member **32** toward plug **15** which does not affect the contact between wall **27** and connected electrical contact members **17** and **17'**.

It is obvious that modifications and alterations of the present invention will occur to one skilled in the art, and it is understood that changes can be made within the scope of the appended claims.

What is claimed is:

1. A switch for making an electrical connection comprising

a sealed outer shell containing,

a pair of spaced electrical contact members having free ends extending generally in the same direction and made of a metal deformable into a permanent set,

a slide member having a contacting surface and moveable in said shell toward said free ends in a direction generally opposite to that in which said contact members extend,

said contacting surface providing a means so oriented with respect to said electrical contact members that on movement of said slide member toward and against said free ends, said free ends are deformed by lateral pressure into contact with one another, and

a squib means in said casing to drive said slide member toward said contact members with sufficient force to deform said deformable metal into a position wherein there is physical contact between said contact members,

said slide member comprising separate parts separately slidable in said shell, one adjacent to the squib means, being an imperforate piston member and another, comprising the said contacting surface, providing a gas passage between said piston and the locus of said electrical contacts.

2. A switch in accordance with claim **1** in which said contacting surface is obliquely inclined toward said electrical contact members.

3. A switch in accordance with claim **2** in which said surface comprises a side wall of a cavity in said slide member, the space between opposite surfaces of said cavity narrowing within said slide member from a size sufficient freely to admit said spaced contact members to a size such that said free ends of such contact members are tightly squeezed together upon insertion therein.

4. A switch in accordance with claim **3** in which at least one free end of said pair of contact members is provided with a layer of solder.

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