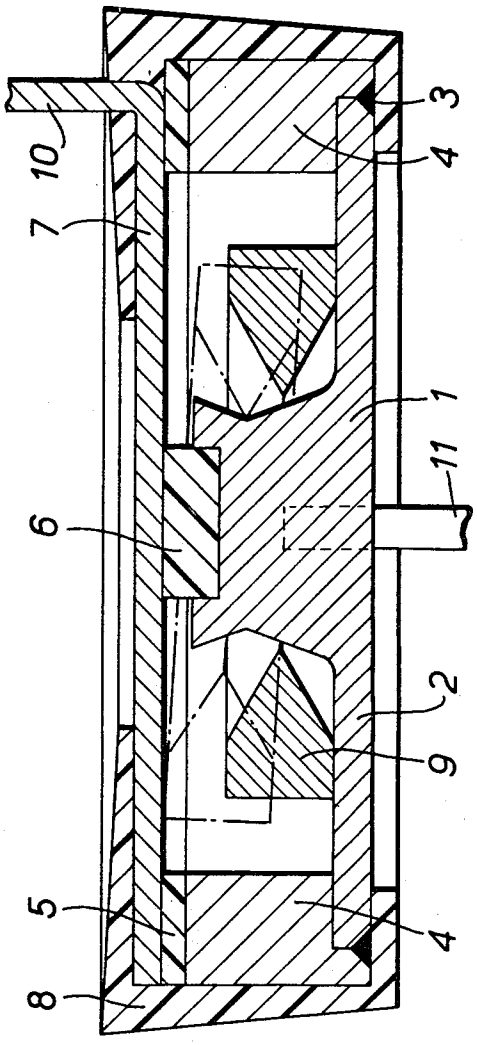
July 28, 1970 W. W. H. CLARKE 3,522,395

GYROSCOPICALLY ACTUATED ELECTRIC SWITCHES

Filed Dec. 9, 1968

Fig.1.



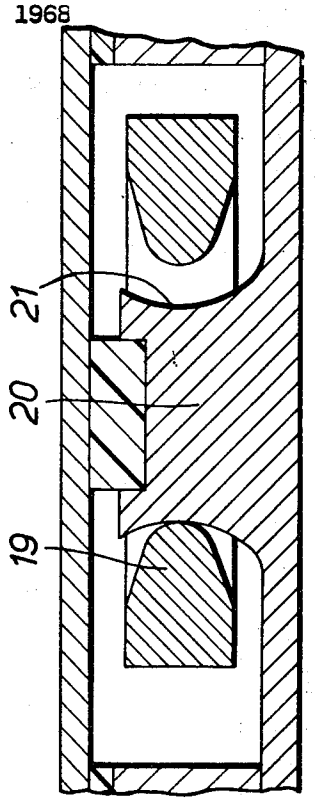


Fig.2.

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GYROSCOPICALLY ACTUATED ELECTRIC SWITCHES

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U.S. Cl. 200—61.45 4 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to gyroscopically actuated electric switches and in particular to such switches which are intended to provide a switching action in a projectile having a high speed of rotation when the projectile changes its velocity and/or orientation suddenly, as upon impact.

The present invention relates to gyroscopically actuated electric switches and in particular to such switches which are intended to provide a switching action in a projectile having a high speed of rotation when the projectile changes its velocity and/or orientation suddenly, as upon impact.

Switches are known which are actuated upon changes in motion of a projectile. Thus one known type of switch employs a magnetically retained element and another known type employs a spring retained mass. Both these known types are expensive although each has certain inherent advantages. The present invention seeks to provide a switch which retains the best features of the above two known switches and which is less expensive to manufacture.

According to the present invention there is provided a gyroscopically actuated electric switch characterised by a double frusto-conical member, one portion thereof being inverted with respect to the other portion thereof, an annular member freely mounted upon the double frusto-conical member to sit in the reduced diameter portion of the double frusto-conical member at the junction of the two portions thereof upon rotation of the switch as a whole, the double frusto-conical member forming one contact of the switch, a second contact being located spaced from and adjacent one end of the double frusto-conical member and electrically insulated therefrom, the second contact being so dimensioned that upon a precession of the annular member about the frusto-conical member upon a change in torque applied to the switch the annular member bridges the two contacts to thereby close the switch.

Preferably the inner face of the annular member is formed as a knife edge which sits in the reduced diameter portion of the double frusto-conical member at the junction of the two portions thereof. In order to establish a good electrical contact the annular member, the double frusto-conical member and the second contact may be gold plated. The second contact may be in the form of a plane disc arranged at one end of the switch at right angles to the longitudinal axis of the double frusto-conical member. The double frusto-conical member itself may be formed with an integral base of diameter substantially equal to the diameter of the second contact or alternatively the double frusto-conical member may be fixedly mounted upon such a base. The second contact and the base are spaced apart and electrically isolated one from the other by an annular spacer. The switch so formed may be encapsulated within a resin, plastics or like material.

The invention will be described further, by way of

example, with reference to the accompanying drawings in which:

FIG. 1 is a cross-section through one embodiment of a gyroscopically actuated electric switch; and

FIG. 2 is a cross section through a part of a second embodiment of such a switch.

A double frusto-conical member **1** is formed integral with a rear plate **2**. The plate **2** is secured, as by soldering at **3** to an outer ring **4**. Insulation members **5** and **6** space the member **1** and the ring from a front plate **7**. The whole is maintained by an encapsulation **8** of resin, plastics or like material.

An annular ring **9** is freely mounted upon the double frusto-conical member **1**, the inner face of the ring being formed as a knife edge. The member **1**, the plate **2**, the plate **7** and the ring **9** may be gold plated to provide good electrical contact. Electric connections **10** and **11** are made to the plate **7** and the plate **2** respectively.

The normal position of the annular ring is shown in full outline and the connections **10** and **11** are insulated one from the other.

In use, with the switch mounted within a projectile for example, the knife edge will tend to position itself at the junction of the two frusto-conical members when the projectile is spinning, since the ring **9** will take up the spin of the remainder of the switch. The double frusto-conical member around which the ring **9** gyrates forms one side of the switch, the other side of the switch being formed by the plate **7** which is isolated from the member **1** by the insulators **5** and **6**.

During the spin of the switch about an axis coincident with or parallel to its own longitudinal axis the ring **9** will remain substantially normal to the axis of spin. However, upon a deceleration a couple will be applied to the ring **9** through its point of contact with the double frusto-conical member **1**, which will result in the ring twisting about an axis across its diameter and through its point of contact with the double frusto-conical member **1**.

When this occurs the ring **9** takes up the position represented by dotted outline in the drawing. Connection is now made between the member **1** and the plate **7**, and thus between the connections **10** and **11** to complete an electric circuit.

Alternatively, if the deceleration is negligible. but there occurs a change in the orientation of the spin, then the ring **9** will tend to remain spinning about its original direction of travel and will therefore again close the switch.

FIG. 2 shows an alternative construction in which an annular ring **19** is freely mounted about a support member **20** having a concave surface **21**. In this embodiment the inner face of the ring **19** is rounded. Otherwise, the construction and operation of the switch shown in FIG. 2 is the same as that described with reference to FIG. 1.

I claim:

1. A gyroscopically actuated electric switch characterised by a support member having a tapered waist portion, an annular member freely mounted about the support member to sit in the tapered waist portion upon rotation of the switch, a first switch contact formed by the support member, a second switch contact being located spaced from and adjacent one end of the support member and electrically insulated therefrom, the second contact being so dimensioned that upon a precession of the annular member about the support member upon a change in torque applied to the switch, the annular member bridges the two contacts to thereby close the switch.

2. A gyroscopically actuated electric switch characterised by a double frusto-conical member, one portion thereof being inverted with respect to the other portion there-

of, an annular member freely mounted upon the double frusto-conical member to sit in the reduced diameter portion at the junction of the said two portions of the double frusto-conical member upon rotation thereof, a first switch contact formed by the double frusto-conical member, a second switch contact being located spaced from and adjacent one end of the double frusto-conical member and electrically insulated therefrom, the second contact being so dimensioned that upon a precession of the annular member about the double frusto-conical member upon a change in torque applied to the switch, the annular member bridges the two contacts to thereby close the switch.

3. A gyroscopically actuated electric switch according to claim **2** in which a knife edge is formed around the inner face of the annular member.

4. A gyroscopically actuated electric switch according to claim **2** in which the second contact comprises a plane

disc arranged at right angles to the longitudinal axis of the double frusto-conical member.

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