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C. O. HESSON
MECHANICAL SWITCH AND HERMETICALLY SEALING
MEANS FOR AN ELECTRIC TIME FUZE

2,974,597

2 Sheets-Sheet 1

FIG. 1.

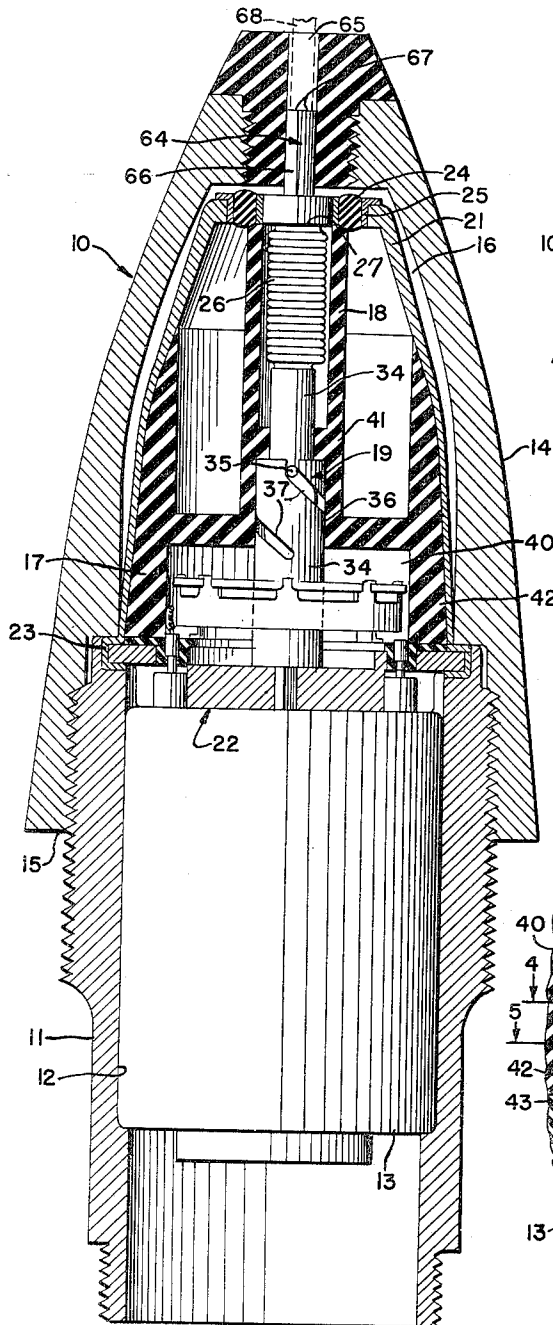
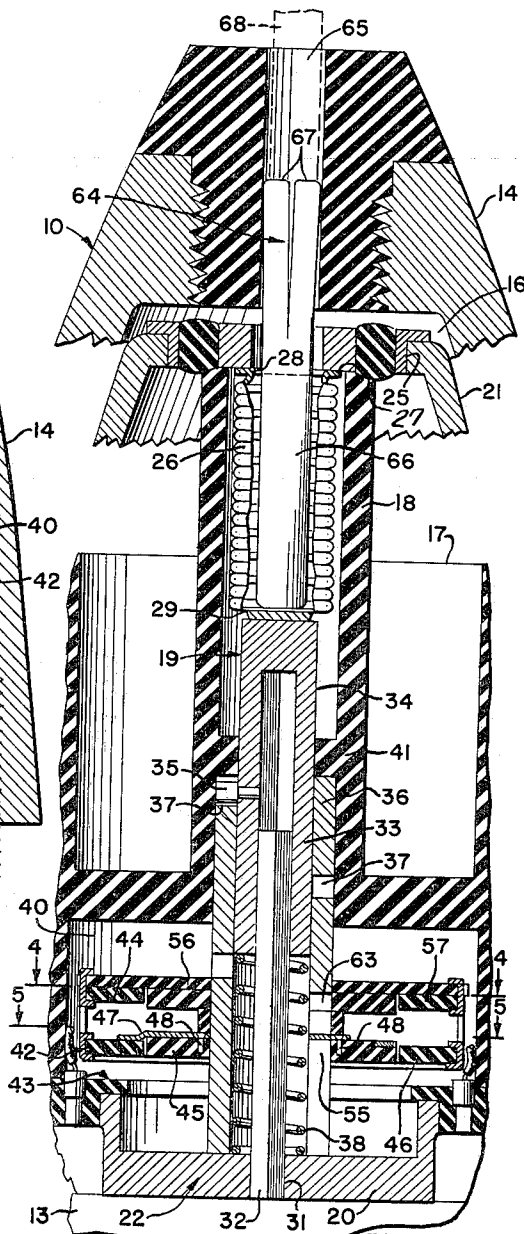


FIG. 2.



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FIG. 3.

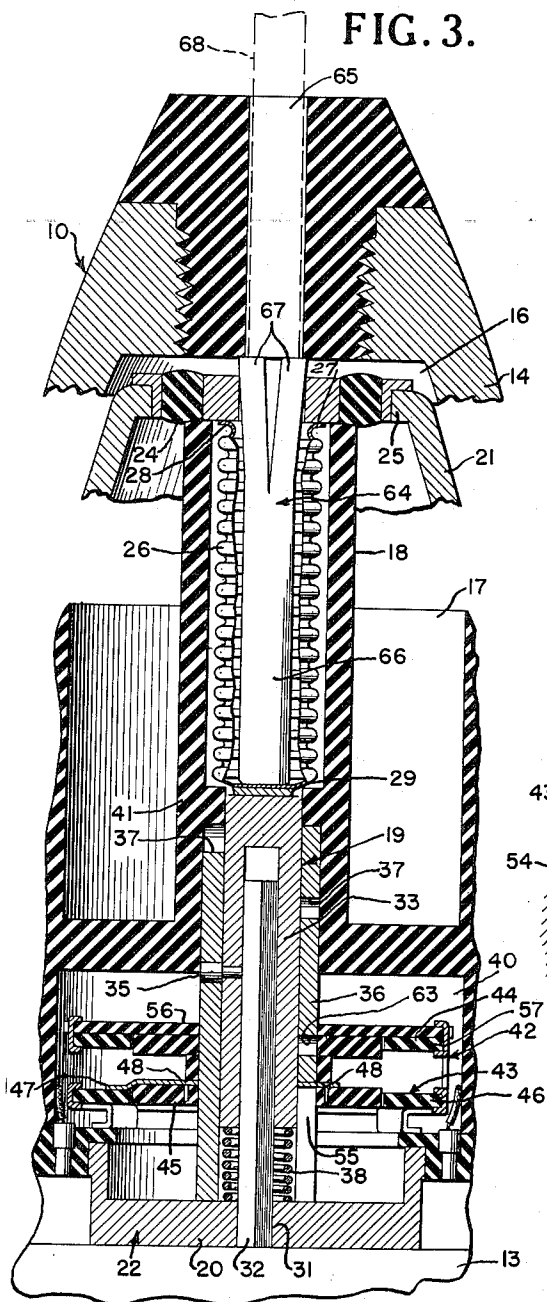


FIG. 4.

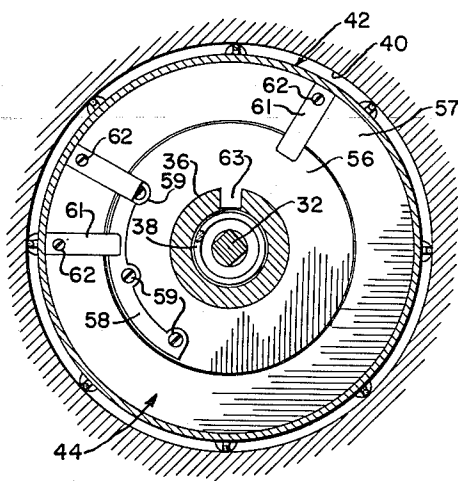
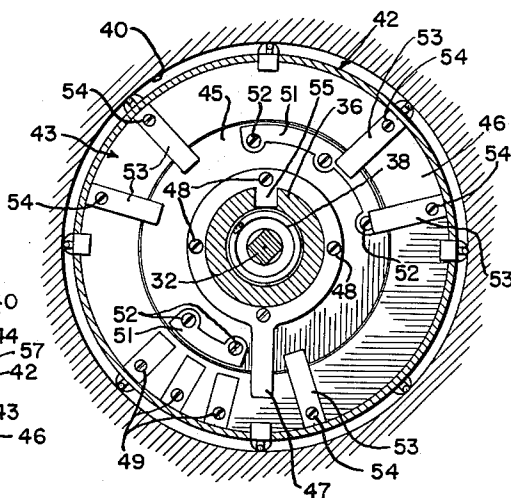


FIG. 5.



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MECHANICAL SWITCH AND HERMETICALLY SEALING MEANS FOR AN ELECTRIC TIME FUZE

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3 Claims. (Cl. 102—70.2)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to a switch and more particularly to a mechanically actuated switch mechanism and charging arrangement for use in an electrically controlled time delay fuzed projectile.

The invention further provides a switch mechanism for an electrically controlled fuzed projectile wherein the electrical contact means thereof are adapted to complete a plurality of electrical circuits in successive order as the switch is actuated thereby to charge a plurality of condensers respectively connected thereto and included in the R-C circuits of the fuze while the projectile is disposed within the arming rack thereby to arm the fuze prior to loading the projectile into the breech of the gun. Furthermore, the present invention provides a hermetic seal for the fuze which includes an expansible bellows and a movable element associated therewith adapted to actuate the switch to operative position as the bellows is moved a predetermined amount in response to a predetermined force applied thereto by a rod or bar inserted in the nose of the projectile. Thus by this arrangement the movable element may be actuated repeatedly and reciprocally as desired from a force applied externally thereto during testing operations whereupon various test potentials may be applied to the switch contacts as desired to test the R-C fuze circuits after complete assembly and sealing of the fuze without breaking or otherwise injuring the hermetic seal thereof.

In accordance within the present invention a new and improved switch device for a time delay fuze has been devised which overcomes the objectional characteristics heretofore encountered in prior art fuzes for the reason that in the present invention means are provided for testing the R-C circuits thereof after complete assembly and sealing of the fuze casing without breaking or injuring the hermetic seal and thus by such test the duds would be detected and discarded. In prior art fuzes, particularly after complete assembly and sealing of the fuze casing, no test could be made on the R-C circuits and as a result of this numerous duds would be issued to our armed forces.

An object of the invention is to provide a new and improved switch mechanism for an electric time fuze wherein means responsive to an external force applied thereto actuates the switch to a plurality of charging positions in successive order.

Another object is the provision of a switch mechanism wherein means are provided for charging a plurality of condensers in successive order to different potentials as the actuating means therefor is inserted in the nose of the fuze and predetermined potential and pressure applied thereto.

Another object is the provision of a mechanical switch mechanism for an electric time fuze wherein means are employed for providing a hermetic seal for the fuze

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whereby a movable element thereof may be actuated repeatedly and reciprocally as desired during testing operations while the fuze is in a sealed condition.

Still another object is the provision of a switch device wherein means are employed for locking the mechanism thereof in the actuated position as the locking means therefor is moved a predetermined amount in response to a predetermined pressure applied thereto.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the case becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a central longitudinal sectional view of an electric time fuze suitable for use with the device of the present invention, the device being illustrated in the normal position and in elevation;

Fig. 2 is an enlarged longitudinal sectional view of the device of the present invention illustrating the mechanism thereof in a normal position;

Fig. 3 is a view similar to Fig. 2 illustrating the mechanism in an operated position;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 2; and

Fig. 5 is a view similar to Fig. 4 taken on the line 5—5 of Fig. 2.

Referring now to the drawings and more particularly to Fig. 1 thereof a conventional electric time delay fuze is illustrated and indicated generally by the reference character 10. The fuze comprises a casing 11 having a recess or bore 12 formed therein. Disposed within the bore 12 is a sealed container 13 which encloses the usual control circuits and component parts thereof such, for example, as condensers, diodes and the like.

A nose portion 14 is secured to the casing 11 in any conventional manner, preferably by threading the parts together as indicated by the numeral 15, the nose being provided with a well or cavity 16 in communication with the recess 12.

As shown more clearly on Figs. 2 and 3 a support 17 composed of suitable insulating material is disposed within the cavity 16 and having a centrally disposed tubular member 18 formed thereon in which the switch mechanism generally indicated by the reference character 19 is arranged. The support 17 is enclosed by a shield 21 having one end thereof secured to the base plate 22 as at 23, the other end thereof being sealed by a sealing gasket 24 secured to the shield as at 25 and an expansible bellows 26 secured to the sealing gasket as at 27. As more clearly shown on Figs. 2 and 3 one end of the bellows 26 is open as at 28, the other end thereof being closed by a wall 29.

Secured to the member 20 of the base plate 22 as at 31 is a guide member 32, the configuration of which is substantially square in cross section and disposed within a socket 33 of the same general configuration and formed in a shaft 34, the shaft having formed thereon and extending outwardly therefrom an actuating pin 35.

Rotatably supported on the shaft 34 and having a portion thereof disposed within the sleeve 18 is an actuating member or sleeve 36, the sleeve having a helical slot or track 37 formed therein in which the pin 35 rides and thus by this arrangement rotative movement is transmitted to the sleeve 36 as the member 34 is moved longitudinally along the axis of the guide shaft 32 in response to a predetermined pressure applied thereto.

A spring 38 is disposed within the sleeve 36 and having one end in engagement with the member 20 forming a part of the base plate 31, the other end thereof being in engagement with one end portion of the shaft 34. By this arrangement the shaft 34 is maintained in abutting engagement with the end wall 29 of the bellows and

thus upon longitudinal or endwise movement of the bellows rotative movement is transmitted to the sleeve 36 by reason of the aforesaid pin and spiral slot connection therebetween.

As more clearly shown in Fig. 2 one end of the sleeve 36 is in engagement with the member 20, the other end thereof being rotatably supported on the shaft 34 and in engagement with an annular rib 41 formed on the tubular member 18 and thus by this arrangement longitudinal movement of the sleeve is prevented, however, rotative movement thereof is permitted.

A switch device generally indicated by the reference character 42 is disposed within a recess 40 formed in the member 17 and comprises a pair of mutually spaced wafers 43 and 44.

The wafer 43 comprises a rotatable disc 45 and a fixed annular member 46. A wiper element 47 is secured to the disc 45 as at 48 and adapted to successively engage a plurality of contact elements 49 carried by the fixed member 46. The disc 45 is provided with a pair of bridging contact elements 51 secured thereto as at 52 and adapted to engage and bridge a plurality of spring contacts 53 secured to the fixed member 46 as at 54 successively as the disc 45 is rotated thereabout. The disc 45 and wiper 47 are keyed to the sleeve 36 as at 55 and thus in response to rotation of the sleeve rotative movement is imparted to the disc. The wafer 44 comprises a rotatable disc 56 and a fixed annular member 57. The disc 56 is provided with a bridging contact element 58 secured thereto as at 59 and adapted to engage and bridge a plurality of spring contacts 61 secured to the fixed member 57 as at 62 successively as the disc 56 is rotated thereabout. The disc 56 is keyed to the sleeve 36 as at 63 and thus in response to rotation of the sleeve rotative movement is imparted to the disc.

As more clearly shown in Fig. 2 a charging lock generally indicated by the reference character 64 is disposed within a central bore 65 formed in the end portion of the nose 14. The lock comprises an elongated shaft 66 disposed within the bellows 26 and having one end portion in engagement with the end wall 29 thereof, the other end being arranged within the bore 65 and locked therein by a plurality of spring fingers 67 formed thereon and in frictional engagement with the walls defining the bore 65. By this arrangement it will be understood that the switch device 42 may be actuated as the lock 64 is moved longitudinally within the bore 65 by a suitable rod shown in dashed lines, Fig. 2, as at 68. Furthermore, longitudinal movement of the member 64 by the rod 68 causes expansion of the bellows 26 which exerts an inward thrust on shaft 34 and moves the shaft longitudinally a predetermined amount and thus during such movement of the shaft the pin 35 thereon rides in the spiral groove 37 formed in the sleeve 36 thereby imparting rotative movement to the sleeve. Movement of the sleeve 36 is sufficient to cause the switch wiper 47 to engage the contact elements 49 and the bridging elements to engage the spring contacts 53 successively as the disc 45 is rotated by the sleeve. Furthermore, movement of the sleeve causes the bridging elements 58 to engage and bridge the spring contacts 61 successively as the disc 56 is rotated by the sleeve. By this arrangement it will be understood that means are provided for charging a plurality of condensers to different potentials, the condensers being included in the various electrical circuits of the time fuze arrangement and operatively connected to their respective switch contact, a predetermined high potential being applied thereto by the aforesaid rod 68 operatively connected to a suitable source of electrical energy as the projectile is placed in a conventional arming rack and the rod moves into engagement with the bellows 26.

It will be understood, however, that when the rod 68 has reached the end of its inward travel into the nose of the fuze by way of bore 65 during the charging cycle,

the lock is moved sufficiently to cause the spring fingers 67 thereof to expand and lock the switch in the actuated position thereof (Fig. 3).

By arrangement of the switch contact elements arcuately in a plane normal to the direction of movement of the shaft, the aforesaid switch contacts are widely separated from one another thereby decreasing the leakage current therebetween. Furthermore, by employing a bellows in the manner disclosed, a hermetic seal is provided for the fuze and a movable element thereof may be actuated repeatedly and reciprocally as desired during testing operations while the fuze is in a sealed condition and after complete assembly thereof. It will be understood, however, that after complete assembly of the fuze and during such testing operations with the charging switch lock removed a premarked rod may be employed to repeatedly actuate the switch to any desired position and thus various test potentials may be applied thereto as desired to test the R-C circuits after assembly thereof within the fuze without breaking the hermetic seal.

In view of the foregoing, it will be understood that a new and improved switch mechanism has been devised for use in an electrical time delay fuze and having means for converting translational movement of a rod into rotary movement of a switch member about an axis parallel to the direction of movement of the rod without breaking or otherwise injuring a hermetic seal enclosing the chamber within which the switch and condenser elements are arranged. Furthermore, the present invention provides a switch device wherein the contact means are employed for completing a plurality of electrical circuits in successive order as the wiper elements thereof are rotated a predetermined amount in response to longitudinal movement of expansible bellows.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent in the United States is:

1. In a switch device for completing a plurality of electric fuze circuits in successive order, a casing having a centrally disposed bore therein, a rotatable sleeve arranged within said casing and having a spiral groove formed therein, a plurality of mutually spaced fixed contact elements arranged within said casing, a plurality of mutually spaced contact members secured to said sleeve and moved into engagement with said fixed contact elements in successive order as the sleeve is rotated a predetermined amount thereby to successively complete said fuze circuits, a support, a plunger slideably arranged on said support and moved longitudinally thereon in response to a predetermined pressure applied thereto, an expansible bellows in engagement with said plunger and expanded in response to a predetermined force applied thereto for moving said plunger longitudinally on said support, a pin means secured to said plunger and disposed within said spiral groove for rotating the sleeve said predetermined amount in response to said longitudinal movement of the plunger, a rod disposed within said bore in engagement with said bellows for applying said force to said bellows, and a pair of spring fingers on said rod for locking said sleeve against further rotation when said rod is moved an amount sufficiently to cause said fingers to move out of said bore and into locking engagement with said casing.

2. In a switch device for completing a plurality of electric fuze circuits in successive order, a casing, a rotatable sleeve having a spiral groove formed therein, a pair of discs secured to said sleeve and rotated thereby, a pair of annular members surrounding said discs respectively, a plurality of mutually spaced contact members secured to one of said discs and a single contact mem-

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ber secured to the other disc and moved into engagement with said mutually spaced contact members in successive order as the discs are rotated by said sleeve thereby to successively complete said fuze circuits, a plunger disposed within said sleeve and moved longitudinally in response to a predetermined pressure applied thereto, an expansible bellows in engagement with said plunger and expanded in response to a predetermined force applied thereto for moving said plunger longitudinally, a pin secured to said plunger and disposed within said spiral groove for rotating the sleeve as the plunger is moved longitudinally, a rod in engagement with said bellows and movable longitudinally for applying said force to said bellows, and a pair of spring fingers on said rod for locking said sleeve against further rotation when said rod is moved an amount sufficiently to cause interlocking relation between the fingers and said casing.

3. In a switch mechanism for completing a plurality of electric fuze circuits in successive order, the combination of a fuze casing, a sleeve rotatably supported within said casing and having a spiral groove formed therein, a plurality of mutually spaced fixed contact elements disposed within and secured to said casing, a plurality of mutually spaced contact members secured to said sleeve and moved into engagement with said fixed contact elements successively as the sleeve is moved a predetermined amount thereby to complete said circuits in successive order, an element disposed within said sleeve and movable longitudinally in response to a predetermined

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pressure applied thereto, an expansible bellows in engagement with said movable element and expanded in response to a predetermined force applied thereto for moving the element, a pin carried by said element and disposed within said spiral groove for rotating the sleeve as the element is moved longitudinally a predetermined amount, actuating means in engagement with said bellows for applying said force to the bellows, a pair of initially retracted spring fingers on said actuating means for locking said sleeve against further rotation when the actuating means is moved an amount sufficient to cause release and movement of the fingers into locking engagement with said switch device, and a sealing gasket including said bellows for hermetically sealing said casing whereby the sleeve may be moved repeatedly by said bellows without breaking said seal.

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