Nov. 24, 1964 R. H. SEMENOFF ETAL 3,158,060

WAFER SWITCH HAVING QUICK RELEASE CONNECTOR

Filed Nov. 2, 1961

FIG.1.

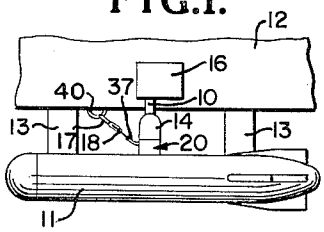


FIG.2.

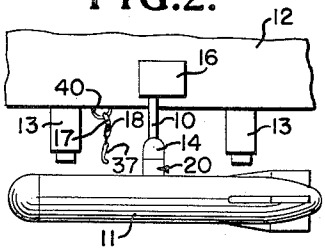


FIG.3.

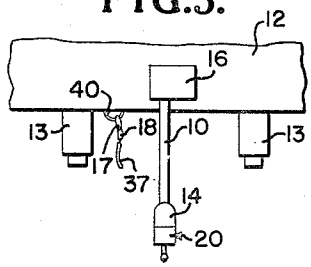
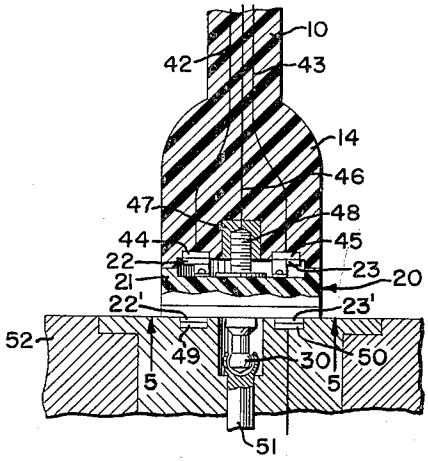


FIG.4.



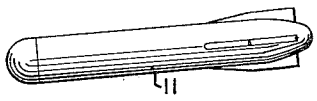


FIG.6.

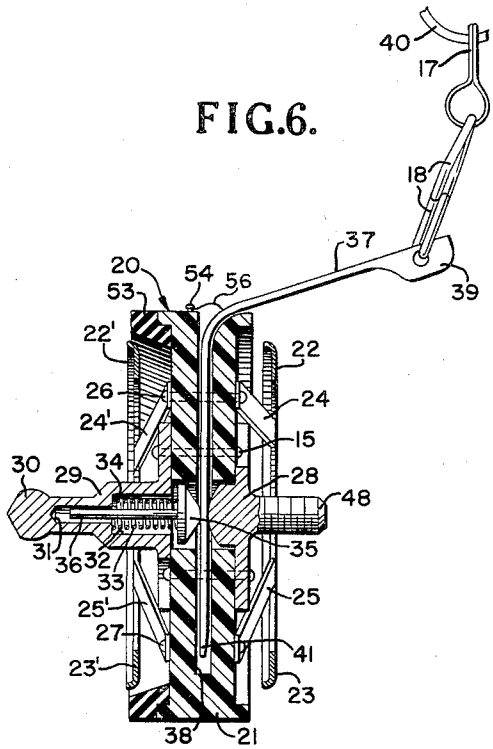
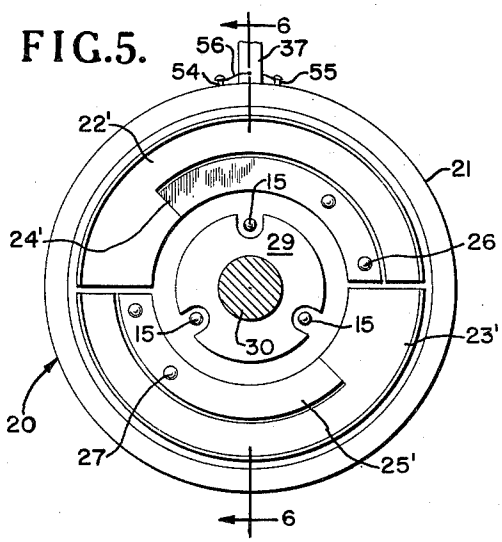


FIG.5.



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WAFER SWITCH HAVING QUICK RELEASE CONNECTOR

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(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.

The subject invention generally relates to electric switches and more particularly, to an electrical switch which serves the dual purposes of functioning both as a switch and as a quick release connector. The subject switch is further characterized in that it includes two spaced apart electrical contact members having a removable non-electrically conductive member positioned therebetween. In addition, one of the above recited contact members is formed as a plug-in type jack and contains within it a spring biased member which is adapted to electrically engage the other contact when the electrically non-conductive member is withdrawn from between the contacts.

In addition to performing the functions of a switch as well as those of a disconnector, the instant switch can be fabricated at extremely low cost due to the few number of parts which can be easily assembled and retained in position by several bolts or rivets or other well known securing means.

FIG. 1 is a simplified side elevational view of the switch in combination with a weapon release system wherein the weapon is shown as being in its secured position and the switch is in its inactive state;

FIG. 2 is a simplified side elevational view showing the weapon in its semi-released position and the switch in its active state;

FIG. 3 is a simplified side elevational view showing the weapon in its fully released position and the switch in its disconnected state;

FIG. 4 is an enlarged side elevational view of the switch assembly showing the adaptor plug and a portion of the weapon in cross-section;

FIG. 5 is a greatly enlarged end view of the switch, partly in cross-section, taken along line 5—5 of FIG. 4; and

FIG. 6 is a cross-sectional side view of the switch taken along line 6—6 of FIG. 5.

FIGS. 1 through 3 show the switch in one possible application wherein it serves to electrically connect an umbilical cord 10 to weapon 11 which is to be launched from an aircraft release rack 12 having conventional release arms 13.

As shown in FIG. 1, the weapon 11, which may be a bomb or torpedo or other piece or ordnance to be dropped from an aircraft, is structurally secured to the rack 12 by means of releasing arms 13 and is electrically connected to an arming system (not shown) through switch 20, plug 14 and umbilical cord 10 which has a minor exposed portion visible in FIG. 1. The major portion of umbilical cord 10 is housed within cord housing 16 wherein it may be in a folded position or secured to a reel from which it unwinds upon the physical release of the weapon 11 by arms 13. For obvious reasons, it is not desirable to have weapon 11 in electrical contact with umbilical cord 10 when the weapon is in its secured position as shown in FIG. 1. Therefore, switch 20 is designed such that it forms a positive obstruction in the

circuit between cord 10 and the weapon 11 until such time as the weapon is released by arms 13 as shown in FIG. 2. In this position switch 20 functions as an electrical connector between cord 10 and weapon 11 so that the latter becomes armed only after it is physically separated from the aircraft. Thereafter, as shown in FIG. 3, switch 20 further functions as a disconnector whereby the weapon becomes electrically as well as physically separated from the launching aircraft. It should thus be noted that switch 20 remains with the aircraft for reuse with the next weapon load and that the launched weapon is unobstructed by any switch or contact means which might disrupt its passage through the air or through the water in the case of a torpedo or depth charge. The physical construction of switch 20 will now be described in detail by reference to FIG. 5 which is an enlarged cross-sectional view of the switch per se.

FIG. 5 illustrates a preferred embodiment of the subject invention wherein numeral 21 designates a substantially disc-shaped housing member which may be preferably composed of a light weight, electrically non-conductive plastic material such as an acetal resin, as for example, that known as "Delrin." As further shown in FIG. 5, a plurality of contacts 22, 22', 23 and 23' are secured to housing 21 by means of integral leaf springs 24, 24', 25, and 25'. Each of leaf springs 24, 24' and 25, 25' is rigidly secured to housing member 21 and electrically connected to each of the other springs by means of rivets 26 and 27 respectively. Of course, it is to be understood that other securing means such as bolts, pins, or clamps may be used equally well in lieu of the rivets illustrated. The above recited contacts with their respective lead springs and securing rivets obviously form a plurality of electrical paths or channels which are permanently connected and which therefore remain electrically conductive at all times. Such electrical path or channels may, for example, comprise high voltage and low voltage current paths having a common ground path afforded by centrally disposed contact members 28 and 29 which are secured to disc 21 by means of rivets 15. Contact member 29 is further shown to be comprised of a plug-in type jack 30 having a central bore 31 which opens into an enlarged portion 32 containing an electrically conductive spring 33 one end of which bears against annular surface 34 and the other end of which bears against head portion 35 of piston contact member 36. It will therefore be apparent that an electrical path is provided by jack 30, spring 33 and head 35, the latter of which is urged toward engagement with corresponding contact member 28 but which is prevented from making electrical contact therewith by the inter-position of insulator tape 37 which may be of any thickness which is sufficient to prevent electrical breakdown between head 35 and contact 28. In a preferred embodiment of the invention, insulator tape 37 may be composed of a high density polyethylene known commercially as "Marlex-5003" which is a good insulator material and which is also semi-flexible such that it allows removal of the tape from slot 38 in housing 21 when a tensional force is applied to end 39 thereof. In practice it has been found that removal of tape 37 is greatly facilitated by providing a rounded portion 40 on the upper surface of slot 38 since a right angle flexure of the tape is thereby avoided. It has also been found desirable to provide means for insuring against accidental removal of the tape, or more importantly, partial removal of the tape to the extent that end portion 41 of tape 37 would remain within slot 38 but be positioned to the left of contacts 35, 28 so that electrical connection would result without the knowledge thereof. For this reason, pins 54, 55 may be inserted into housing 21 on either side of slot 38 and a thin wire or thread 56 may be passed through

a suitable bore in tape **37**. In this manner, any partial withdrawal of the tape will be immediately evident and the tape may be properly re-positioned before the insertion of the switch into the weapon system as illustrated in FIG. 1. Furthermore, if desired, a quantity of sealing material suitable for the purpose such, for example as silicone rubber paste may be applied to the tape **37** sufficient to effect a water tight seal between the tape and the switch **20**.

From the foregoing description of FIG. 5, it will be apparent that when weapon **11** is released by arms **13**, the slack provided by links **17** and **18** is taken up whereby tape **37** is withdrawn from slot **38** and thereafter remains suspended from and secured to rack **12** by means of a ring **40** secured to link **17**. Thus, in the position as illustrated in FIG. 2, tape **37** has been withdrawn from slot **38** allowing spring biased head **35** to engage contact **28** thereby providing a ground path for both the high and low voltage channels previously described. Once the appropriate fuze elements (not illustrated) within weapon **11** have been activated by the signals provided through the aforesaid channels, weapon **11** has elongated umbilical cord **10** to its full extent and, thereafter, switch **20** is automatically removed from weapon **11** containing a suitable socket **51** for the reception of jack **30**. In this manner, weapon **11** is first released, then armed, and then disconnected from the arming circuit located within the aircraft. Since switch **20** remains connected to plug **14** and cord **10**, the weapon may then proceed without any obstruction on the surface thereof nor with any unnecessary weight as in the case of a switch provided within weapon **11**.

One manner of connection between switch **20** and plug **14** is shown in FIG. 4 wherein high voltage lead **42** and low voltage lead **43** are shown to terminate in contact plates **44** and **45** respectively. Similarly, ground lead **46** is shown to terminate in threaded socket **47** which is adapted for engagement by threaded portion **48** of contact member **28**. In this manner, electrical as well as physical connection is conveniently provided between switch **20** and plug **14**.

As further schematically shown in FIG. 4, contacts **22'** and **23'** are engaged by contact plates **49**, **50** and jack **30** is received in female member **51** all of which may be conveniently molded within weapon casing **52**. In addition, rubber seal ring **53** may be cemented to disc housing **21** to thereby provide a dust and moisture free enclosure for contacts **22'**, **49** and **23'**, **50**.

The foregoing disclosure has been directed to an embodiment of the invention wherein it is desired to connect a plurality of electrical channels between umbilical cord **10** and weapon **11**, however, it is to be understood that the subject invention relates equally well to an environment wherein a single channel is to be established. In such an environment it is only necessary to replace contacts **22**, **23**, with a single annular contact and similarly to replace contacts **22'**, **23'** by a second annular contact ring. In this form, it would obviously be desirable to reverse the polarity of the contacts, that is, to connect contact **28** and head portion **35** to the high voltage side of the circuit thereby utilizing the annular contact rings as the ground side of the circuit. In this manner the switch is positioned immediately adjacent the weapon and thus there is no possibility of stray inductance effects, as for example those which might be produced by radar or other communication systems in the vicinity of the aircraft, from inducing a current flow through the high voltage line of the connector thereby accidentally arming weapon **11** prior to release by arms **13**. From the foregoing disclosure it will be apparent that an extremely compact and fail safe switch has been provided wherein the switch performs the dual functions of a quick release connector and an electrical safety switch and which is so positioned with respect to the weapon as to prevent premature arming of the weapon by stray inductance effects.

While it is to be understood that the foregoing description has been made with reference to a preferred embodiment of the invention which gives satisfactory results, numerous modifications and/or alterations may obviously be made therein without departing from the spirit and scope of the invention and it is intended, therefore, in the appended claims to cover all such modifications and alterations.

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

1. A weapon release and arming system comprising; means carried by an aircraft for supporting and releasing said weapon while the aircraft is in flight, electrical means for connecting said weapon to an arming system, said electrical means including an umbilical cord and a switch disposed between said cord and said weapon, said switch including removeable insulator means permanently connected to the aircraft whereby, upon release of said weapon by said releasing means, said insulator means is automatically withdrawn from said switch thereby activating said weapon.

2. A system according to claim 1 including means for detachably securing said switch to the weapon.

3. A system according to claim 2 including means securing said umbilical cord to the switch and to the aircraft in such manner that the switch is detached from the weapon in predetermined time delayed relation after the weapon has been activated.

4. A combination switch and electrical connector comprising; a base member, a first fixed contact means and second fixed contact means mutually spaced and secured to said base member, engagement means movably connected to said first contact means for providing engagement with said second contact means, flexible insulator means removably disposed between said engagement means and said second contact means, and third and fourth spring bias contact means rigidly secured to said base member and permanently disposed in current conducting relationship to each other.

5. A combination switch and electrical connector comprising; a disc-shaped base member having substantially a pair of planar surface portions disposed on opposite sides thereof, a first contact and second contact being mutually spaced and secured to said planar portions respectively of said base member, one of said contact means being formed in the shape of a plug-in type jack, engagement means moveably connected to said first contact means for providing engagement with said second contact means, removable insulator means disposed between said engagement means and said second contact means, and third and fourth spring bias contact means rigidly secured to said base member and permanently disposed in current conducting relationship to each other.

6. A combination switch and electrical connector comprising; a base member having a pair of substantially planar surface portions disposed on opposite sides thereof, a first contact means and a second contact means mutually spaced and secured to said planar portions respectively, of said base member, removable insulator means disposed between said first and second contact means, engagement means connected to said first contact means including a movable portion which engages said second contact means upon the removal to said insulator means, one of said contact means being formed in the shape of a plug-in type jack, and third and fourth spring bias contact means rigidly secured to said base member and permanently disposed in current conducting relationship to each other.

7. A combination switch and electrical connector comprising; a base member having a pair of substantially planar surface portions disposed on opposite sides thereof, a first contact means and a second contact means mutually spaced and secured to said planar portions respectively of said base member, removable insulator means composed of a semi-flexible tape disposed between

said first and second contact means, engagement means connected to said first contact means and including a movable portion which engages said second contact means upon the removal of said insulator means, one of said contact means being formed in the shape of a plug-in type jack, and third and fourth spring bias contact means rigidly secured to said base member and permanently disposed in current conducting relationship to each other.

8. A weapon release and arming system comprising; means carried by an aircraft for supporting and releasing said weapon while the aircraft is in flight, electrical means for connecting said weapon to an arming system, said electrical means including an umbilical cord and a switch disposed between said cord and said weapon, said switch including a base member, a first fixed contact means and a second fixed contact means mutually spaced and secured to said base member, engagement means movably connected to said first contact means for providing engagement with said second contact means, flexible insulator means removably disposed between said engagement means and said second contact means, and third and fourth spring biased contact means rigidly secured to base member and permanently disposed in current conducting relationship to each other, said flexible insulator means being permanently connected to the aircraft whereby, upon release of said weapon by said releasing means, said flexible insulator means is automatically withdrawn from said switch thereby activating said weapon.

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