March 28, 1967 E. F. FOHRMANN ETAL 3,311,058

RF SHIELDED SWITCH FOR SAFETY-ARMING DEVICES

Filed March 22, 1965

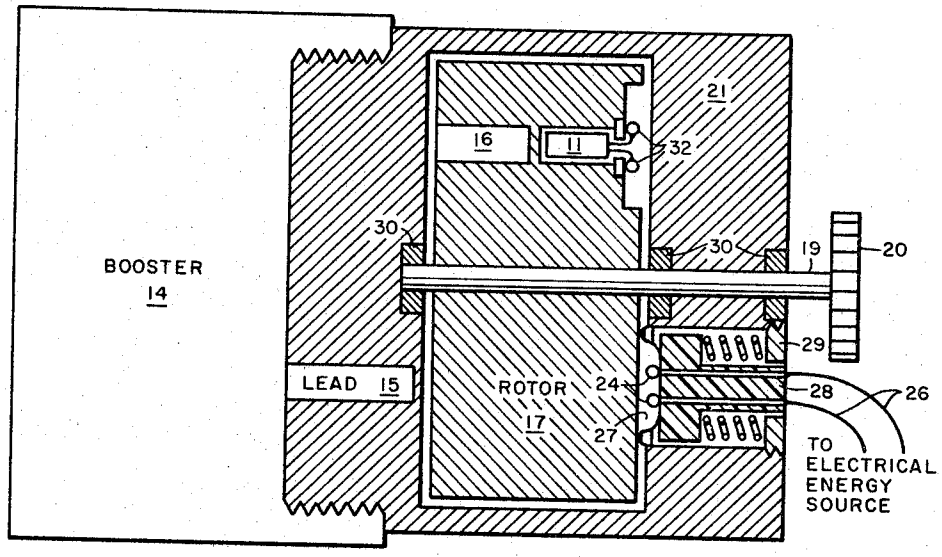


FIG. 1

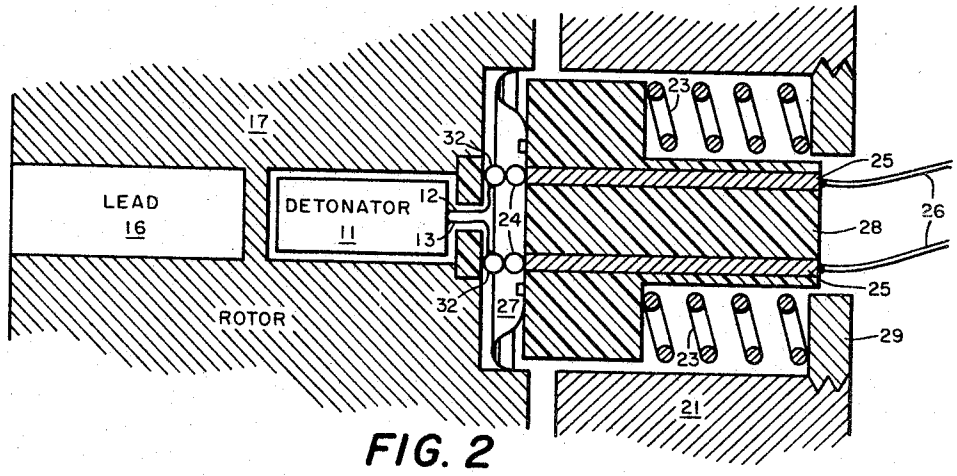


FIG. 2

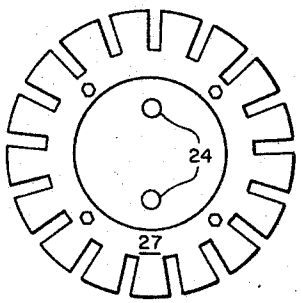


FIG. 3

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United States Patent Office 3,311,058 Patented Mar. 28, 1967

3,311,058
RF SHIELDED SWITCH FOR SAFETY-ARMING DEVICES

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Filed Mar. 22, 1965, Ser. No. 441,939
3 Claims. (Cl. 102—70.2)

The invention herein described 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 present invention relates to electrical detonator switches and more particularly to an RF shielded switch for safety-arming devices.

The general purpose of this invention is to provide a Faraday shield for the detonator component of an explosive train of a warhead weapon system and to eliminate direct electrical lead connections when the safety and arming device is in the safe position. The shield prevents the absorption of electrical energy at any frequency by the wire bridge of the detonator. Furthermore, since there are no direct connections to the detonator in the safe position, electrical energy induced in the electrical leads cannot be transferred either directly or indirectly to the detonator until the safety-arming device has completed its arming cycle. By the time the arming cycle is completed, the electrical energy transmitted by high powered radar transmitters and the like aboard ships, or on land or aircraft is at an acceptable level which if absorbed by the detonator and the associated circuitry do not cause any deleterious effects.

It is an object of the invention to provide an RF shielded switch for safety-arming devices.

Another object of the invention is to provide a Faraday shield for the detonator components of an explosive train to prevent deleterious effects due to powerful electromagnetic radiation sources in the vicinity.

A further object of the invention is to provide a means to prevent absorption of RF electrical energy in components of an electrical initiator of an explosive train.

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

FIG. 1 is a sectional view of an embodiment of the invention showing an RF shielded switch in safe position.

FIG. 2 shows the switch of FIG. 1 in armed position.

FIG. 3 shows in detail a typical RF conductive circular spring as used in the embodiment of FIG. 1.

Referring now to the drawings like numerals refer to like parts in each of the figures.

In the present safety-arming device, detonator **11** has permanently attached leads **12** and **13** of desired lengths. Even though these leads **12** and **13** are disconnected from the electrical energy source when the S–A device is in the safe position, FIG. 1 (i.e., circuit is only completed at end of arming cycle FIG. 2) sufficient electrical energy could, in prior devices, be coupled into these leads by other internal wiring (which are directly connected to the missile external to the safety-arming device) when the weapon system is in the vicinity of powerful electromagnetic radiation sources. In addition, in prior devices, the detonators themselves are not embedded in a complete metal enclosure, and thus bridgewire itself in the detonator could be exposed to high frequency radiation emitted from energy sources both internal in the safety-arming device and external to the safety-arming device.

Referring to FIG. 1 which is a sectional view of a booster **14** and the RF shielded switch containing the explosive components i.e. detonator **11** and relay leads **15** and **16** and electrical contacts, it is seen that the relay lead **16** and detonator **11** are embedded in a metal rotor **17** which can be rotated by shaft **19** and gear **20** shown, for example, and which in turn can be actuated by any external suitable mechanism. FIG. 1 shows the RF shielded switch in the out-of-line or safe position where it is completely RF shielded by metal components. The stationary housing member **21** which ordinarily is attached to an outer housing contains spring **23** loaded switch contacts **24** at the ends of conductor pins **25** which through flexible leads **26** are connected to an external power source not shown. A circular RF shielding spring disc **27** as shown in FIG. 3 is attached to the spring loaded contact assembly **28** (retained in member **21** by ring **29**) is in intimate contact with rotor **17** and housing member **21**. The explosive components **11** and **16**, when the switch is in the safe position (FIG. 1), are thus completely contained in a metal enclosure providing a Faraday shield. In safe position this shield consists of the housing **21**, the pinion shaft assembly **19**, bearings **30** attached to the housing providing a metal to metal contact, and the circular RF shielding spring **27**. As can be seen in the safe position shown in FIG. 1, spring **27** contacts housing **21** as well as rotor **17** thereby completing the RF shield, i.e., any RF energy that might be conducted through leads **26** or around assembly **28** will be shielded from reading detonator **11**. When the safety-arming device has completed its arming cycle, the spring loaded contacts **24** are in line with contacts **32** of detonator **11** which can be actuated by an electrical energy pulse via the electrical leads **12** and **13**, and **25** and **26**. In this in-line position the Faraday shield is substantial though only a partial one. However, at this point the levels of external RF radiation have been reduced to such an extent that the explosive elements can no longer be actuated by it. The mechanical construction of providing a Faraday shield for the explosive elements can be accomplished in a variety of ways.

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 is:

1. A rotary switch to provide complete RF shielding for the electrical initiator components of an explosive train in a warhead system for preventing deleterious effects due to electromagnetic radiation sources in the vicinity thereof; comprising:

(a) a metal housing member having a cylindrical cavity therein,

(b) a metal rotor assembly adapted to fit within said housing cavity and rotatably mounted therein,

(c) a metal shaft and drive means for rotating said rotor,

(d) said housing, rotor and shaft means all being in metal to metal contact with each other so as to be completely RF conductive,

(e) a plurality of explosive train components mounted in said housing and rotor,

(f) an electrical initiator having two electrical contacts connected thereto mounted in an off-center cavity in said rotor,

(g) a spring loaded electrical contact assembly which is connected to an external source of electrical energy mounted adjacent to said rotor in a passage in said housing,

(h) an RF shielding conductive spring means mounted at the end of said spring loaded contact assembly adjacent to said rotor and being in intimate contact therewith,

(i) said explosive train components, electrical initiator and spring loaded electrical contact assembly being out-of-line when said rotor is in safe position and being in-line when said rotor is rotated to armed position, when in said out-of-line safe position said RF conductive spring means being in contact with both said rotor and said housing thereby preventing any RF energy from reaching the electrical initiator in said rotor,

(j) said electrical initiator being completely RF shielded by metal components when in safe position and substantially shielded when in armed position.

2. A device as in claim 1 wherein the electrical contacts of said spring loaded electrical contact assembly make positive contact with said electrical contacts connected to said electrical initiator when said rotor has been rotated to armed position.

3. A device as in claim 1 wherein said electrical initiator is a detonator.

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