Nov. 5, 1963 R. H. F. STRESAU 3,109,372

BRIDGELESS ELECTRIC DETONATOR

Filed May 22, 1959

FIG.1.

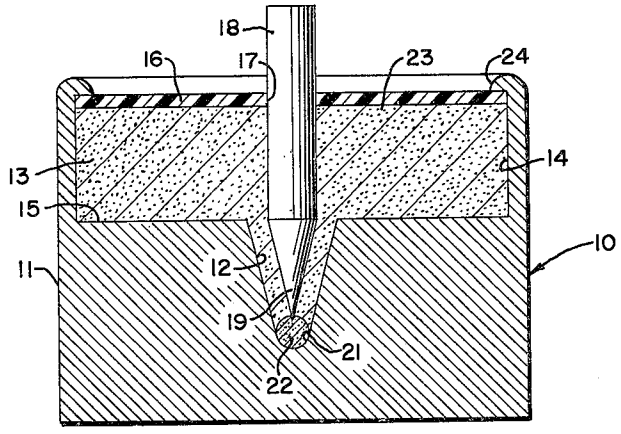


FIG.2.

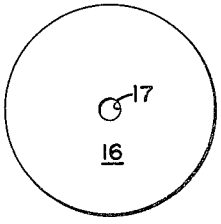
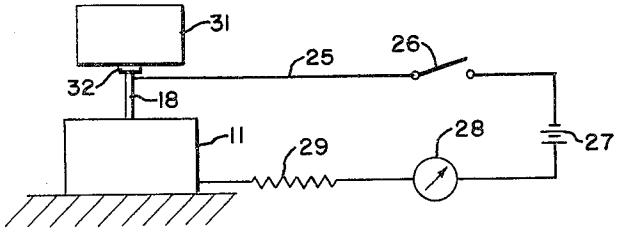


FIG.3.



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3,109,372

Patented Nov. 5, 1963

3,109,372

BRIDGELESS ELECTRIC DETONATOR

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Filed May 22, 1959, Ser. No. 815,233

9 Claims. (Cl. 102—28)

(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 electrical detonators and more particularly to electrical detonators of the low energy bridgeless type of small size particularly well suited for use with modern military weapons in which automatic fuzes are employed therein. In devices of this type heretofore devised it has been the usual practice to employ a bridge wire of small diameter for igniting a combustible mixture in contact therewith. Such devices have been found to be not altogether satisfactory when employed with a low energy firing circuit for the reason that an exceedingly fine wire when used for this purpose is subject to breakage and deterioration during storage of the detonators prior to use. Other devices employ a graphite film for the bridge element in lieu of a wire and these detonators have been found to possess the disadvantages inherent in the detonators employing an ultra fine bridge wire.

Still other devices contain a primary explosive which is set off by means of an exploding wire when a firing current is applied thereto. Detonators which contain primary explosives must be isolated from the larger components of the explosive systems until the weapon has been launched. Mechanisms for aligning the explosive systems are expensive, complex and adversely affect the reliability of the weapon.

The device of the present invention possesses all of the advantages of the prior art devices and none of the foregoing disadvantages. In accordance with the present invention this desirable result is achieved by employing a conical or tapered bore within a metallic member or block and having a spherical pellet of electroconductive explosive mixture disposed within a semispherical cavity at the apex portion of the bore and held in place by a quantity of tightly packed non-conductive high explosive mixture through which a pointed electrode is thrust in such manner that the tip of the electrode makes contact with the pellet. The pellet, due to the conductive nature thereof, thus establishes an electroconductive path between the electrode and the semispherical surface of the cavity in the metallic member. The pellet is detonated in response to a firing current applied thereto thereby firing the high explosive as the detonation wave travels outwardly through the cone shaped aperture within the block, as will more clearly appear as the description proceeds.

One of the objects of the present invention is to provide a low energy electrical detonator for a high explosive charge in which new and improved means are employed for initiating the operation of the detonator and transmitting the detonating shock to the explosive.

Another of the objects is to provide a new and improved process for fabricating a low energy electrical detonator and testing the operation thereof during such fabrication.

Still another object is to provide a low energy bridgeless electrical detonator having new and improved means for controlling the shape of the shock wave set up by the detonating material upon ignition thereof to a main high explosive charge.

A further object is to provide an electrical bridgeless

low energy detonator which is economical to fabricate, reliable in operation and which possesses the desirable qualities of durability without substantial depreciation during long periods of stowage prior to use and which is impervious to severe shock during fabrication, transportation and use.

Various other objects and advantages of this invention will be apparent from a consideration of the following detailed description of a preferred embodiment thereof taken in connection with the accompanying drawing of which:

FIG. 1 is a greatly enlarged view in section of the detonator device of the instant invention in accordance with a preferred embodiment thereof;

FIG. 2 is a view somewhat reduced of the sealing and electrode retaining member of FIG. 1; and

FIG. 3 is a diagrammatic view of the device during a fabricating and testing operation thereof.

Referring now to the drawing on which like numerals of reference are employed to designate like parts throughout the several views and more particularly to FIG. 1 thereof, there is shown thereon in sectional view and greatly enlarged the low energy electrical detonator of the present invention indicated generally by the numeral 10 and comprising a casing 11 preferably of a cylindrical configuration and composed of metal suitable for the purpose, such for example, as brass, aluminum or the like. The casing is provided with a frusto conical or tapered bore 12 coincident with the axis thereof and in communication at its larger end with a chamber 13 formed by a cylindrical wall 14 and base portion 15, the chamber being sealed by a sealing disc 16 composed preferably of plastic material suitable for the purpose and having an aperture 17 centrally disposed therein within which is slideably disposed a pin 18 pointed as at 19 to form a firing electrode. The aperture 17 is of just sufficient size to allow the pin 18 to be forced therethrough to a desired position or setting and to retain the pin in the set position.

As shown in FIG. 1, frusto-conical bore 12 terminates in a semi-spherical cavity 21 which is adapted to receive and retain a spherical pellet 22 composed of an explosive mix such, for example, as RDX, TETN, TNT, tetryl or other high explosive suitable for the purpose having a small proportion of electroconductive material such as carbon black, metal powder, graphite or the like thoroughly intermixed therewith and compressed under high pressure into a spherical pellet prior to placing the pellet within hemispherical cavity 21 of the conical bore 12. A pellet having a diameter of .015 inch in diameter has been found to be satisfactory for the purpose when employed with a hemispherical cavity 21 of like diameter. It will be understood that, although a pellet of .015 inch has been found to be satisfactory, other small pellets of different diameters may be employed, if desired, it being merely necessary to configure the hemispherical cavity 21 to the proper diameter to engage and retain the pellet therein.

A quantity of high explosive 23, such, for example, as RDX, PETN, tetryl, PBX or the like, is disposed within chamber 13 and within the conical bore 12 after the pellet 22 has been placed within the hemispherical cavity 21. When this has been done the sealing disc is placed on top of the high explosive and pressure applied thereto sufficient to obtain a high degree of compaction of the explosive within chamber 13 and the conical bore 12. The cylindrical wall 14 is spun over as at 24 to retain the sealing disc in the position shown in FIG. 1 thereby to maintain the high explosive 23 tightly compressed within the chamber 13 and conical bore 12.

The tip of the pin or electrode 18 is now forced through

aperture 17 of the sealing disc and connected as by conductor 25 to switch 26, FIG. 3 and thence to a low voltage battery 27, the circuit being continued by way of meter 28 and high resistance 29 to casing 11. Switch 26 is now closed and pressure applied to the pin 18 by press 31, the press ram preferably being insulated as at 32 to prevent an electrical connection between the press and pin 18. The press is now operated in a manner to force the pin or electrode 18 through aperture 17 and the high explosive 23 until the point of the electrode moves into engagement with the electrically conductive pellet 22.

When this occurs a test circuit is closed causing a flow of current through the pellet from electrode 18 to the casing 11, this condition being made manifest by meter 28. This current flow is limited by high resistance 29 to a value insufficient to detonate the pellet 22 but of sufficient strength to give a visual indication on meter 28. When a signal indication has been received by meter 28, further movement of press 31 is arrested. The detonator is now removed from the press, disconnected from the test circuit and is now in readiness for use. Whereas the device of FIG. 1 has been described with reference to a quantity of high explosive 23 within chamber 13 and conical bore 12 and thereafter compacted by pressure applied thereto, it is not so limited as, if desired, the conical cavity 12 may first be filled with high explosive and compacted therein. The remaining explosive 23 may, if desired, be prepelleted and thereafter be consolidated in place within chamber 13.

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

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

1. The method of making a low energy bridgeless electric detonator comprising the steps of; forming a substantially closed casing of an electrically conductive material having one aperture therethrough, forming an elongated bore in one wall of said casing opening to the interior thereof, partially filling said bore with a small quantity of explosive electroconductive mix, filling the remaining portion of said bore and said casing with an explosive non-electro-conductive mix, forming a closure member over said aperture, forcing an electrode through said closure member and into said non-electroconductive mix, connecting a current indicating circuit to said casing and said electrode, and further forcing said electrode through said non-electroconductive mix until engagement of the electrode with said electroconductive mix as indicated by said indicating circuit.

2. The method of making a low energy bridgeless electric detonator as claimed in claim 1 further including the step of compacting said electroconductive explosive mix into pellet form before inserting into said bore.

3. The method of making a low energy bridgeless electric detonator as claimed in claim 2 further including the step of compacting said non-electroconductive mix before forming said enclosure member.

4. The method of making a low energy bridgeless electric detonator comprising the steps of; forming a substantially enclosed casing of an electrically conductive material having one aperture therethrough, forming an elongated bore in one wall of said casing opening into the interior thereof, partially filling said bore with a small quantity of high explosive electroconductive mix, filling the remaining portion of said bore and said casing with a high explosive non-electroconductive mix, forming a closure member over said aperture, forcing an electrode through said closure member and said non-electroconductive mix until said electrode engages said electroconductive mix.

5. A low energy electrically actuated detonator comprising; an enclosure member composed of a first electrically conductive portion and a second non-electrically conductive portion, a blind bore formed in said electrically conductive portion and opening to the interior of said enclosure member, a quantity of electroconductive explosive material located at the blind end of said bore, a quantity of non-electroconductive explosive material filling the remaining portion of said bore and said enclosure, and an electrode extending through said non-conductive enclosure portion and said non-electroconductive explosive material into electrical contact with said electroconductive explosive material.

6. The low energy electrically actuated detonator claimed in claim 5 wherein said electrode contacts said electroconductive explosive material at the surface of contact of said non-electroconductive explosive material with said electroconductive explosive material.

7. The low energy electrically actuated detonator claimed in claim 5 wherein said bore is substantially conical whereby, upon detonation of said electroconductive explosive material, all thermal and mechanical shock waves are propagated in the same direction along the axis of said conical bore thereby amplifying and accelerating said waves.

8. The low energy electrically actuated detonator claimed in claim 5 wherein said electroconductive explosive material is in pellet form.

9. The low energy electrically actuated detonator claimed in claim 5 in combination with a current detecting circuit connected between said electrode and said enclosure member for determining the precise position at which said electrode contacts said electroconductive explosive material.

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