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DEVICE FOR ACCELERATING THE IGNITION OF THE PROPELLANT FOR A PROJECTILE

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FIG. 1

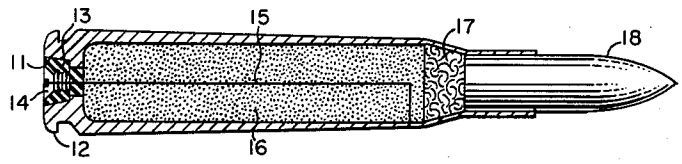


FIG. 2

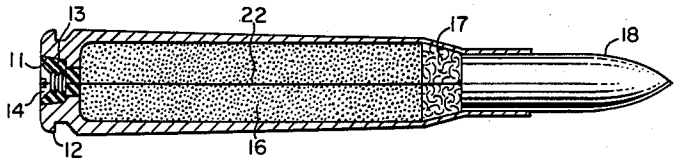


FIG. 3

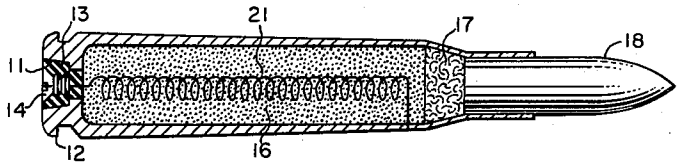
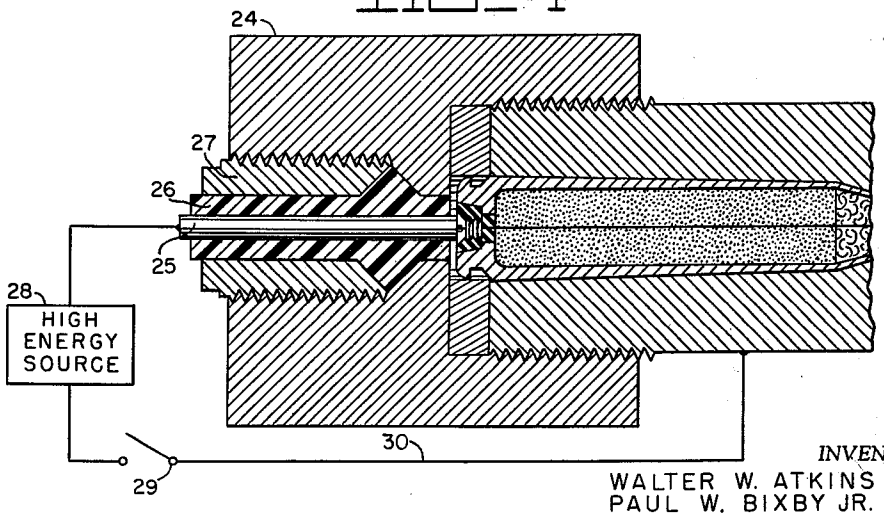


FIG. 4



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DEVICE FOR ACCELERATING THE IGNITION OF THE PROPELLANT FOR A PROJECTILE

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1 Claim. (Cl. 89—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.

The present invention relates to a new device and method for accelerating the ignition of a solid, liquid or gaseous material and more particularly to accelerating the ignition of the propellant for a projectile without the use of a primer.

In firing projectiles, the propellants used are generally in the solid state and function by rapid transformation into gaseous products with the simultaneous evolution of heat, this change of state developing the necessary pressure to produce movement of the projectile. The necessary pressure is developed by the propellant converting into gas which builds up within the cartridge casing to force the projectile from the casing. The propellant is not easily ignited by direct ignition therefore, prior art devices use an easily ignited primer which burns rapidly building up sufficient heat and pressure to ignite the main propellant. The primer contains a small quantity of very sensitive igniting material which initiates burning of the propellant and it is extremely essential that a primer fire under certain conditions so care must be exercised in the design of the components to insure proper functioning thereof. Cartridge primers are usually situated in or near the head of the casing and when the cartridge is fired the primer initiates an explosive train from the head toward the projectile. As the propellant burns, pressure builds up until the projectile is expended from the casing and then the propellant continues to burn until the projectile leaves the gun barrel. In these devices it is necessary that the primer operate satisfactorily in igniting the main propellant in order to obtain maximum results from the main propellant.

Since the propellant burns from the head longitudinally of the propellant toward the projectile, pressure builds up accordingly and is greatest at the head due to the pressure build-up during burning away from the head. In order to provide constant pressure and burning over the full length of the propellant for more efficient results, it is necessary for the propellant to burn radially from the center thereof along the whole length. Radial burning provides even, instant burning which produces greater efficiency, increased energy and increased velocity for the projectile.

It is an object of the present invention to provide a new device for igniting the propelling charge of a cartridge.

Another object is to provide a new and improved device for firing projectiles at increased velocities.

A further object is to provide radial burning along the entire length of a cylindrical propellant.

Still another object is to provide means for igniting the propelling charge of a cartridge without the use of a primer.

Yet another object is to provide a new device for ignition of a solid, liquid, or gaseous material.

The exact nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following detailed description relating to the annexed drawings in which:

Fig. 1 illustrates a cross sectional view of a preferred embodiment of a cartridge made according to the invention;

Figs. 2 and 3 illustrate modified forms of the cartridge of Fig. 1; and

Fig. 4 is a sectional view of a cartridge positioned in a gun chamber and illustrates the relationship between the cartridge and the electrical firing means.

In accordance with the teachings of the present invention a device is provided for ignition of a solid, liquid or gaseous material applied to accelerate projectiles. The device makes use of a standard metal casing modified to have an electrical contact insulated from the head of the casing and a low resistance ignition wire attached thereto which passes centrally along the length of the propellent chamber and is grounded to the casing. The wire produces an ignition channel throughout the length of the propellant such that the surface area of combustion will be constantly increasing perpendicular to the entire length of the channel. A source of high electrical energy is passed through the wire which instantaneously explodes the wire causing a rapid, even ignition of the propellant to expel the projectile. The arrangement of the exploding wire in the casing provides combustion of the propellant without the use of a primer, and provides greater efficiency and increased energy of the propellant as well as increased velocity for the projectile.

Referring now to the drawings wherein like reference characters represent like parts throughout, the cartridge, as illustrated in Fig. 1, comprises a standard casing **10** of the desired calibre such as 60, 50, 30, etc. The primer pocket **11** of the head **12** has been modified to provide space in which an insulator **13** such as Bakelite has been pressed. The insulator has a threaded hole through the center thereof for reception of a metallic screw **14** which secures one end of a low resistance electrical conductor **15**, such as a wire, to the head end. The wire extends centrally along the longitudinal axis of the cartridge casing through the length of the propellant **16** and then is attached to the side of the casing near the mouth. The cartridge is shown with a cotton wad **17** between the propellant **16** and the projectile **18**.

Figs. 2 and 3 are modifications of Fig. 1 which illustrates respectively a straight wire **22** which is brought out near the mouth of the casing and makes contact with the projectile and a spiral wire which is attached to the casing as in Fig. 1.

Fig. 4 illustrates a cartridge positioned in firing position in a gun chamber **23** and backed by a specially designed breech **24** to prevent back pressure leaks. Electrical contact for the wire in the cartridge is provided through the breech and includes a suitable lead-in wire **25** insulated from the breech by a Bakelite insulator **26** which is held in the breech by a screw threaded insert **27**. A suitable high energy electrical source **28** with one side connected to the lead-in wire **25** and the other side grounded to the gun chamber through lead **30** and a suitable switch means **29** supplies current through the wire within the cartridge. The current supply may be a bank of charged condensers, pulse power sources such as used for radar transmitters, modulators or any electrical device which will supply a large current through the wire for a short interval. A preferred source will deliver a pulse of energy at a potential of 50,000 volts.

Carttridges are easily made (see Fig. 1) by drilling a hole in the side thereof near the mouth end, leaving out the usual primer, then milling the head to provide space for the insulator insert **13**. The insert is pressed into

the head and then a screw **14** having a hole centrally along the longitudinal axis thereof is screwed into the insulator. The ignition wire is bent to form a 90° angle near one end and then the ends are pressed respectively through the hole in the screw and the hole in the side of the casing. The wire is held in position along the longitudinal axis of the casing and soldered to the screw and the casing, then the excess wire is cut off and the ends are smoothed down to the respective surfaces. After the wire is secured in place, a fine grain propellant is poured into the casing which surrounds the wire, a cotton wad **17** is inserted into the casing to hold the propellant into place and then the projectile is inserted into the mouth behind the cotton wad to complete a high velocity cartridge. In the embodiment of Fig. 2 it is not necessary to bore a hole in the casing and the cotton wad will hold the wire centrally along the casing and in contact with the projectile.

In operation of the device, a loaded cartridge such as shown in Figs. 1, 2 or 3 is positioned in the gun chamber with the wire through the carttridge making electrical contact with the lead-in wire **25**, and the casing of the cartridge making electrical contact with the gun chamber. The high energy electrical source is made operative and switch **29** is closed to complete the circuit to the ignition wire. On completion of the circuit, the high electrical energy passes through the wire within the cartridge causing the wire to disintegrate or explode to provide an ignition channel in the form of a high energy heat throughout the length of the propellant such that the surface area of combustion will be constantly increasing. The high energy heat produces immediate burning of the propellant radially from the exploded wire which produces greater pressures, higher temperature and greater energy release per unit of time than that of cartridges fired by a primer. The device of this invention provides burning of the propellant radially through the longitudinal length thereof whereas the propellants of the primer fired devices burn from the primer end to the projectile end. The difference in burning of the propellant produces a sizeable difference in the pressure and energy released by the propellant.

The electrical energy applied to the ignition wire must be of sufficient current to "explode" or instantly evaporate the wire to completion. This energy must be greater than that required to raise the wire to its melting point, this excess in current is known as the explosion factor (E) which must be 10^2 to 10^{10} times as great as the energy required to melt the wire. The energy depending on the type of ignition wire used.

The spiral wire type of ignitor shown in Fig. 3 provides more heating surface throughout the propellant thereby providing instantaneous burning to more surface area of the propellant. Such an arrangement also produces greater pressure, high temperatures, and greater energy release per unit time than the present known primer fired cartridges.

The modification of Fig. 2 is electrically the same as that of Fig. 1 except the wire extends entirely through the propellant and contacts the projectile which provides a ground through the casing to the gun chamber and simplifies loading the cartridge. The chemical reaction is substantially the same as for the cartridge of Fig. 1.

Cartridges fired according to this invention provide increased projectile velocities up to about 25% above that of projectiles fired according to present day primer systems and with the same amount of propellant. The preferred ignition wire is of low resistance such as tin-copper wire #20, magnesium or aluminum ribbon but it can be any appropriate electrical conducting material and only requires sufficient high current to instantly explode the wire.

The device is not limited to a solid propellant such as double base progressive burning but can be a gas such as helium and hydrogen-oxygen mixture.

It should be understood, of course, that the foregoing disclosure relates to only preferred embodiments of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claim.

What is claimed is:

A primerless electrically fired cartridge combination comprising a casing, said casing having a mouth and an inseparable head, a projectile adapted to be frictionally secured within said mouth, an electrical contact centrally disposed in the head of said casing and electrically insulated therefrom, a propellant adapted to be placed within said casing between the head end and said projectile, an axially disposed electrically explodable conductor connected at one one end to said electrical contact and extending axially through said propellant, another end of said electrically explodable conductor being secured to provide a ground connection with said casing, means for passing electrical energy through the conductor at about 10^2 to about 10^{10} times the energy required to melt the conductor, said conductor on exploding providing ignition of said propellant and producing radial burning of said propellant simultaneously throughout the length of said conductor, said ignition of said propellant providing propellant force within said casing for expending said projectile.

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