Jan. 5, 1960 C. J. CARDONA ET AL 2,919,627

PROJECTILE IGNITION DEVICE

Filed May 5, 1953

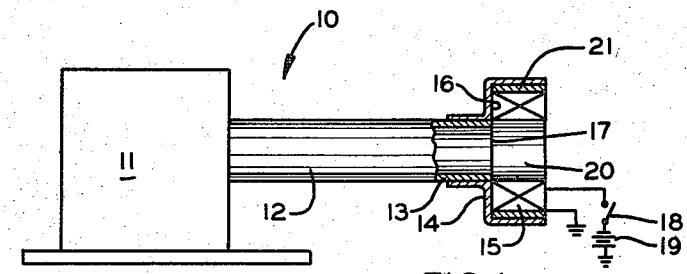


FIG. 1

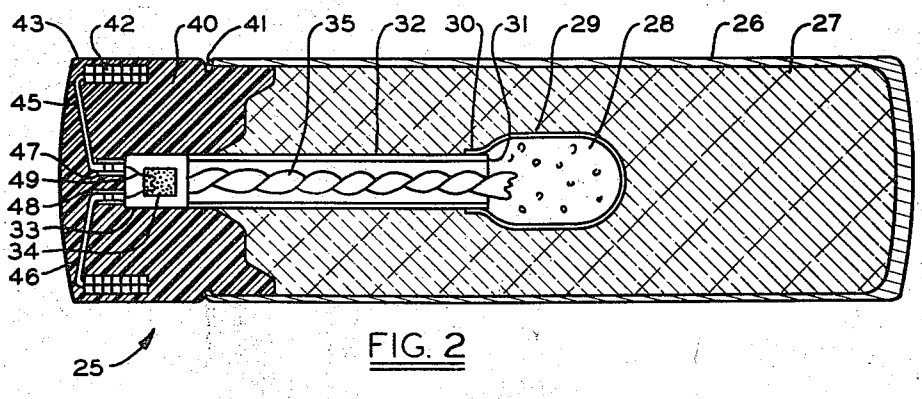


FIG. 2

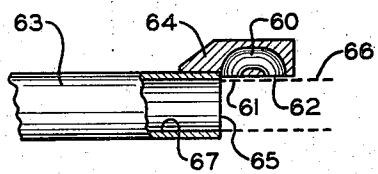


FIG. 3

CARLOS J. CARDONA
AND NORMAN H. MILDE
INVENTORS

BY William W Haefliger

United States Patent Office 2,919,627 Patented Jan. 5, 1960

2,919,627

PROJECTILE IGNITION DEVICE

Carlos J. Cardona, North Hollywood, and Norman H. Milde, Palos Verdes Estates, Calif., assignors to McCulloch Motors Corporation, Los Angeles, Calif., a corporation of Wisconsin

Application May 5, 1953, Serial No. 353,032

1 Claim. (Cl. 89—1)

The invention relates to means for firing explosives and relates in particular to a means for igniting or setting off a powder charge after it has been ejected from a launching device or gun.

It is an object of the invention to provide a simple system and means for firing a charge in a projectile at a desired time after it has been ejected from a propelling or launching device, wherein a time-delay fuse is ignited by electrically actuated means utilizing electric current induced in a coil carried by the projectile.

A further object of the invention is to provide a simple yet dependable ignition means for igniting and dispersing a quantity of flare powder. However, the term "powder" is herein employed in its broad sense to mean explosives in general regardless of whether they are the slow burning or detonating types, or whether they are prepared in small granules or larger bodies.

These and other objects and advantages of the invention may be brought out in the following part of the specification wherein forms of the invention have been explained in detail for the purpose of completeness of disclosure, and not for limiting the scope of the invention which is defined in the appended claim.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a partly schematic and partly cut-away view of a projectile launching device incorporating electromagnetic field inducing means at the launching end thereof;

Fig. 2 is a cross-sectional view of a projectile incorporating the present invention therein; and

Fig. 3 is a partly cut away view of a projectile launching device incorporating magnetic field inducing means at the launching end thereof.

Referring now to Fig. 1, there is schematically illustrated therein a propelling or launching device **10** which includes a launching mechanism **11** such as a pneumatic or compressed air type of launcher, and a barrel or guide tube **12** projecting rightwardly from the launching mechanism. Mounted on the rightward end **13** of the barrel **12** is a retaining member **14** which is adapted to position an annular induction coil **15** or other means for establishing magnetic flux in close proximity to the end of the barrel. As illustrated in Fig. 1, the coil is positioned co-axially with the barrel **12** so that its major axis extends in the launching direction. Also, the leftward extremity or face **16** of the coil is positioned closely adjacent the plane **17** formed by the end face of the barrel **12**. A switch **18** and a source of potential such as battery **19** are connected in series with the coil so that when switch **18** is closed, electric current will flow through the coil windings causing an electromagnetic field to build up around the coil. The flux density of the electromagnetic field will be greatest within the aperture or space **20** surrounded by the coil body **15** and adjacent the end face **17** of the barrel **12**. One reason for positioning the coil **15** rightwardly of the end face **17** of the barrel is to minimize interference with the establishment of the magnetic field within aperture **20**, which is caused by the metallic barrel **12**. An annular flux concentrating member **21** is positioned around coil **15** in order to increase the electromagnetic field strength or flux density within aperture **20**. Member **21** may comprise any ferromagnetic material, such as iron.

The projectile **25** illustrated in Fig. 2 is adapted to be launched by being propelled through the barrel **12** and through the aperture **20** surrounded by the coil **15**. Projectiles to which the present invention may be adapted may be of various types; however, the particular projectile illustrated is adapted to be exploded after a known time interval after launching to form an intensely luminous body or flare. Projectile **25** includes a metal case **26** filled with a flash mixture such as magnesium powder, which becomes brilliantly luminous on ignition and combustion. The ignition charge **28** is packed within a container **29** having a neck portion **30** which surrounds the open end **31** of a fuse guard tube **32**. The opposite end of the tube is fastened to a container **33** within which an electrically ignitable element or squib **34** is positioned. A typical element of this type contains a combustible consisting of a few grains of black powder, and is adapted to ignite when an electric current is passed through it.

A time delay fuse **35** is connected between the squib **34** and the detonating charge **28** and it extends through the tube **32**. The fuse illustrated comprises a fuse rope type of powder train. The container **33** is positioned within solid cylindrical member **40** to which the projectile case **26** is fastened, the member **40** projecting leftwardly or rearwardly from the end of the case **41**. Member **40** consists of a solid insulator such as a plastic material, for example, a phenolic resin. A second coil **42** is molded or embedded in the portion **43** of member **40** which projects rearwardly from the end **41** of the projectile case. Coil **42** is electrically connected in series with squib **34** by means of leads **45** and **46** which are pressed into terminals **47** and **48** to which the ends of a wire **49** are soldered. Wire **49** passes through the body of the electrically ignitable element **34**.

Coil **42** is positioned in the rearward portion of the projectile with its major axis extending in the launching diretcion, which is the direction of the longitudinal axis of the guide tube **12**. Coil **42** is essentially an induction element in which a voltage is generated by the passage of the coil through a magnetic or electromagnetic field. The coil turns are positioned with respect to the launching direction so that a maximum voltage is induced in the coil when the projectile is launched. The electrical current induced in the coil **42** passes through the squib wire **49** and ignites the black powder, which in turn ignites the time delay fuse rope **35**. The fuse rope burns toward the ignition charge which will ignite after the known time delay interval. The ignition charge will in turn ignite the flash material **27** and fragment the case **26**.

The magnetic field at the end of the barrel may alternatively be established by magnetic means such as horseshoe magnet **60** illustrated in Fig. 3. Magnet **60** has pole faces **61** and **62** disposed longitudinally in the general direction of the axis of the barrel **63**. A non magnetic retainer **64** is mounted at the end of the barrel to position pole faces **61** and **62** near the end **65** of the barrel **63** and adjacent an imaginary extension **66** of the cylindrical bore **67** of the barrel. So-called lines of magnetic flux extend between the pole faces and necessarily pass through a portion of the imaginary cylinder **66**. When a projectile such as flare projectile **25** is launched from barrel **63**, it will pass through the imaginary cylinder **66** and the induction coil **42** carried by the projectile **25** will cut through the portion of the flux

passing through imaginary cylinder 66. An igniting voltage will thus be induced in coil 42.

We claim:

In apparatus of the character described, a combination of a launching mechanism including a barrel having a discharge end; an annular induction coil mounted on said barrel coaxially therewith and at the discharge end thereof; and a projectile arranged to be discharged from said barrel and comprising a case open at the rear end and having a powder charge therein; a time-delay fuse extending longitudinally in said case having at one end thereof an ignition charge arranged to effect ignition of said powder charge; a longitudinal guard tube arranged to cover said fuse; a body of insulating material closing the open end of said case and projecting outwardly therefrom, said body having an inwardly faced cavity communicating with said guard tube; an electrically sensitive ignition element disposed in said cavity and at the other end of said time-delay fuse, said ignition element comprising a combustible, which upon becoming ignited, will ignite the contiguous end of said fuse, and a wire for conducting an electric current in proximity to said combustible; and an induction coil supported by the outwardly projecting portion of said body of insulating material and at the rear thereof so that when the projectile passes through said magnetic flux field, a current will be

induced in said coil to initiate a sequence consisting of the ignition of said combustible, the burning of said time-delay fuse, the ignition thereby of said ignition charge and finally the ignition of said powder charge at a time after said projectile has been discharged from said propelling means.

References Cited in the file of this patent

UNITED STATES PATENTS

29,573	Cranston et al.	Aug. 14, 1860
1,280,579	Stone et al.	Oct. 1, 1918
1,704,302	Ruhlemann	Mar. 5, 1929
1,739,921	Schuler et al.	Dec. 17, 1929
1,776,796	Ruhlemann	Sept. 30, 1930
2,459,854	Swift	Jan. 25, 1949
2,465,351	Busignies et al.	Mar. 29, 1949
2,514,359	Allison	July 11, 1950
2,520,949	Meister	Sept. 5, 1950
2,555,384	Watt	June 5, 1951
2,557,949	Deloraine	June 26, 1951
2,581,096	Gould	Jan. 1, 1952
2,640,417	Bjork et al.	June 2, 1953

FOREIGN PATENTS

578,153	Great Britain	June 18, 1946