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ACCURATE TRIGGERING DEVICE FOR HIGH VELOCITY PROJECTILES

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FIG.3.

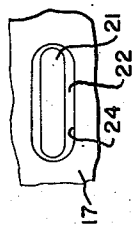


FIG.4.

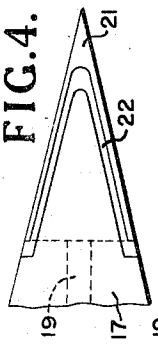


FIG.5

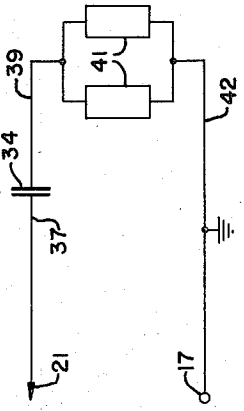
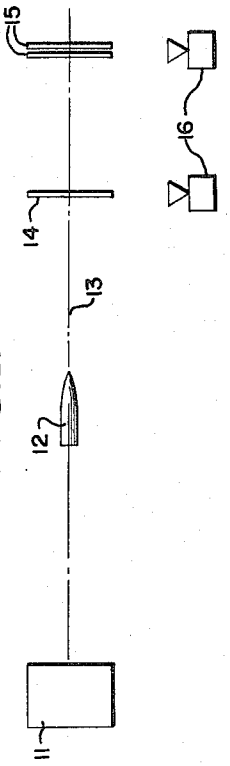


FIG.2.

FIG.1.



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ACCURATE TRIGGERING DEVICE FOR HIGH VELOCITY PROJECTILES

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2 Claims. (Cl. 102—70.2)

(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 method of triggering action in a projectile or missile in flight, and more particularly to an electrical triggering device developed to meet the needs of experimental field tests concerned with a projectile development program which called for a device to initiate instantaneous action in a projectile travelling at extremely high velocity without disturbing the flight characteristics thereof. Accurate positioning of the triggering point was required so that high speed cameras might be set up to photograph the projectile action and a short initiation time and negligible delay in the triggering device were needed to obtain accurately located triggering.

Mechanical time delay fuzing was first considered but was rejected because of the possibility of variations in delay time or projectile velocity, either of which might effect the accurate location of the triggering action.

Instead, electrical fuzing was selected and included a firing circuit which discharged a charged condenser or capacitance means through two electric detonators or primers in parallel when the circuit was completed. The triggering device of the instant invention comprises a pair of external contacts built as an integral part of the nose of a projectile or missile which contacts serve two purposes; they can be used to charge the firing condenser, provided the charging current is limited to a safe value for charging through the electric primers or detonators, and by firing the projectile through a wire mesh screen located at the point where triggering action is desired, the firing circuit can be completed as the contacts engage the wire screen upon piercing of the screen and passage therethrough by the projectile or missile. The outstanding attributes of this arrangement are its simplicity and its rapid and accurate triggering action.

It is therefore an object of the present invention to provide a system for triggering action in a high velocity projectile or missile in flight after passage into a predetermined zone of the trajectory thereof.

Another object is to provide a method of triggering an electrical detonator for discharge of a smokepuff or the like for photographic purposes after a predetermined travel distance of a high velocity projectile or missile.

A further object of the invention is the provision of a pair of external contacts formed as part of the nose of the projectile and comprising elements of a firing circuit in the projectile.

Still another object is the provision of a thin barrier of electroconducting material in the path of flight of the projectile, for the purpose of shorting the contacts of the projectile when the same has pierced the barrier, in order that the firing circuit may be closed.

The exact nature of this invention, as well as other objects and advantages thereof, will be readily apparent from consideration of the following description taken in connection with the annexed drawings in which:

Fig. 1 shows schematically the triggering system of this invention;

Fig. 2 is a fragmentary view, in section, of a projectile incorporating the triggering device of this invention;

Fig. 3 is a fragmentary view of the front end of the projectile and illustrating the relation between the contacts;

Fig. 4 is a fragmentary plan view of the front end of the projectile further illustrating the relationship between the contacts; and

Fig. 5 is a schematic illustration of the firing circuit.

Referring now to the drawing, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 a schematic arrangement of the triggering system of this invention which comprises means **11** for firing or otherwise launching a projectile or missile **12** along a trajectory or path of flight **13**. A wire mesh screen **14**, or the like, is set up substantially normal to said trajectory, the screen being adapted to be pierced by the projectile or missile in flight and close or complete a circuit in the projectile by shorting across a pair of external contacts on the nose of the projectile. In the event that the device should fail to be triggered by screen **14**, other screens **15** may be set up further along the path of flight. High-speed cameras **16** are located at suitable points to record the results. These cameras are operated in any conventional manner in synchronous time relation with the piercing of the screens.

Referring now to Fig. 2, shown therein, in section, is the front portion of the projectile which comprises a nose **17** of metallic electroconductive material that forms one of the aforesaid external contacts and constitutes a ground. Another or central contact, designated generally by numeral **18**, is formed with a rod portion **19**, centrally located in the nose, and an arrowhead-like contact portion **21** having external surfaces which conform to the curvature of the projectile nose.

Insulating material **22**, suitably formed, is disposed about said rod portion and between the arrowhead-like portion and the ground contact so as to insulate the contacts from each other. The nose **17** of the projectile is formed with an axial bore **23**, which receives the insulated rod portion **19**, and is provided with a slot **24** at its front end to receive the insulated arrowhead-like portion **21** of the central contact **18**.

The inner or free end of the rod portion is threaded as at **25**, and terminates in a bead or ball portion **26**. The threaded end **25** of the rod portion is disposed in an enlarged bore **27** in the rear end of said nose and receives a nut **28** which bears against an insulating washer **29** disposed between the nut and the bottom wall of the enlarged bore **27**, said nut, when tightened, serving to hold the central contact in place.

The rear end of the nose is reduced in size and is threaded as at **31** into a head portion **32** of the projectile, which head portion is provided with a central bore **33**. Bore **33** receives a condenser or capacitance means **34** imbedded in a condenser block **35**, the block being made of any suitable potting material, such as one of the commercial thermo-setting plastic resins. Extending from the condenser block **35** is a metallic clip **36** adapted to spring about and receive the bead or ball portion **26**.

From the clip extend leads **37** which are connected to the capacitance means imbedded in the condenser block, the block being secured to the rear end of the nose by screws **38**, or the like. Suitable leads **39**, connected to the condenser or capacitance means, in the block, extend from the block and connect to electric primers or detonators **41** located in the body of the projectile (not shown) which are adapted to set off a smokepuff mixture or other indicating action, the connection from the primers to ground being by way of a lead **42** connected to the nose by a screw **43**.

In operation, the trigger device and other components of the projectile or missile are assembled and the assembly is placed in the launching means. The condenser or capacitance means is now charged by connecting the pair of contacts to a charging circuit containing a current limiting resistor of sufficient resistance, for example, 10 megohms, which allows safe charging of the condenser or capacitance means through the electric primers or detonators. After disconnection of the charging circuit, the projectile or missile is launched along the desired path of flight. Piercing of the metallic wire mesh screen by the projectile or missile serves to cause the wires of the screen to wipingly contact the ground contact and the external surface of the central contact so as to bridge the insulating material therebetween and short the contacts to close or complete the firing circuit of the projectile or missile, thereby discharging the condenser or capacitance means through the electric primers or detonators and igniting the smokepuff mixture or initiating other indicating action. The coextensive lengths of the ground contact and the arrowhead-like portion of the central contact and the velocity of the projectile determine the time during which the firing circuit is closed for discharging the condenser or capacitance means. The high-speed cameras **16** photograph and record the projectile action.

While the projectile or missile has been shown and described as being provided with a firing condenser or capacitance means charged from an external source of power, it will be appreciated the projectile could be provided with a different self-contained source of energy such, for example, as a battery for firing the primers or detonator when the firing circuit is completed, without materially affecting the triggering arrangement of this invention.

It will also be appreciated that a different form of thin barrier of electroconductive material could be employed in place of the wire mesh screen and that the condenser discharge time may be increased by providing a plurality of screens or barriers spaced apart so that after the pair of contacts move past the first screen or barrier beyond shorting contact, the next screen or barrier would be pierced and be in such contact, and so on; thereby extending the time the pair of contacts are bridged or shorted.

There has thus been provided a triggering system for use in field testing projectiles or missiles in flight that is reliable and accurately locates the triggering action so that data of the performance of projectiles or missiles in actual flight may be obtained.

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 and desired to be secured by Letters Patent of the United States is:

1. In a triggering system of the class described, a projectile containing detonator means and capacitance means, said projectile having a nose of electroconductive material constituting a ground contact, said nose having a slot in the front end thereof, an arrowhead-like contact received in said slot and insulated from said ground contact, said last-named contact having external surfaces coextensive with corresponding portions of the nose, means electrically connecting said last-named contact to one terminal of the capacitance means, and means electrically connecting the other terminal of the capacitance means to the ground contact through the detonator means; said contacts being adapted to be shorted by a thin metallic barrier disposed within the trajectory of the projectile and pierced thereby.

2. A projectile comprising a head portion having a central bore therein, a pointed nose of electroconductive material including a reduced portion received in one end of said bore, said nose having an axial bore therethrough of relatively smaller diameter than the central bore in said head portion, the rear end of the nose being formed with a bore between said axial and central bores and of intermediate size relative thereto, said nose having a slot at the front end thereof extending across and communicating with the axial bore through the nose, an arrow-like electroconductive member including a rod portion and an arrowhead-like contact portion, said contact portion being disposed in said slot and having external surfaces coextensive with external surfaces of the nose at the front end thereof, said rod portion extending through said axial bore and terminating in said bore of intermediate size, insulation means insulating said arrow-like member from said nose, means on the end of the rod portion in said last-named bore for retaining said member in said nose, circuit means in said projectile, one end of said circuit means being connected to said last-named end of the rod portion, the other end of the circuit means being connected to said nose, said external surfaces of the nose and contact portion being adapted to be shorted for completing the circuit means.

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