July 9, 1940. N. K. TURNBULL ET AL 2,206,927

DETECTING THE EMERGENCE OF A PROJECTILE FROM THE MUZZLE OF A GUN BARREL

Filed Jan. 12, 1938

Fig-1-

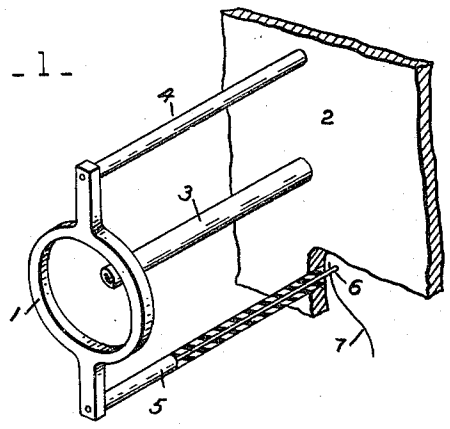


Fig-2-

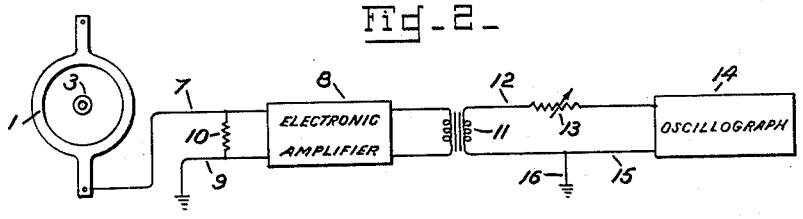


Fig-3-

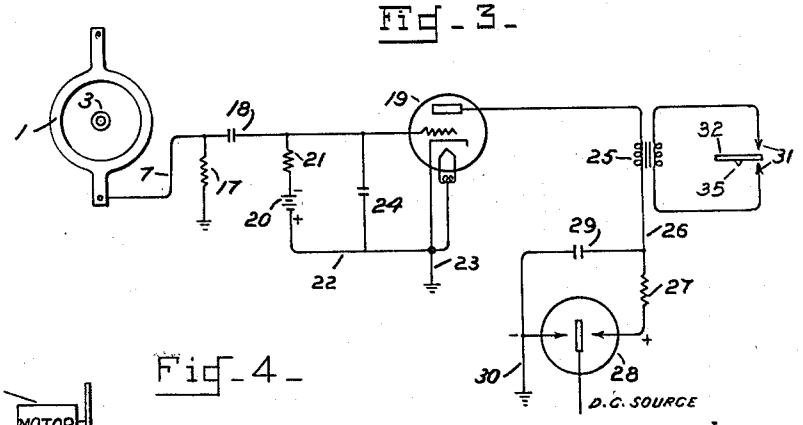
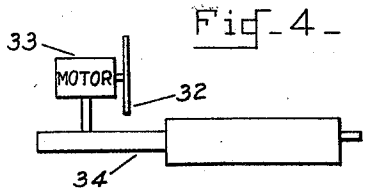


Fig-4-



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DETECTING THE EMERGENCE OF A PROJECTILE FROM THE MUZZLE OF A GUN BARREL

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5 Claims. (Cl. 234—36.5)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to detecting the emergence of a projectile from the muzzle of a gun barrel.

The main object of the invention is the utilization of the electric charge found to be present in the gases escaping from the muzzle of a gun, and of the electric charge found on the barrel or other metallic parts of a gun upon the emergence of the powder gases therefrom, for operating various ballistic apparatus as hereinafter described.

With this and such other objects in view as may hereinafter more fully appear, the invention resides in the use of the electric charge found in the powder gases and on the metallic parts of guns for changing the electrical potential of devices therein or connected thereto, and securing desired indicia therefrom.

Practical embodiments of the construction utilized are disclosed by way of illustration in the accompanying drawing, wherein:

Fig. 1 is a view of a collector mounted near the muzzle of a gun.

Fig. 2 is a schematic view illustrating the use of an oscillograph for indicating the presence of an electrical charge in the powder gases upon their emergence from the muzzle of a gun.

Fig. 3 is a schematic view of a circuit for detecting hangfires.

Fig. 4 is a diagrammatic view of a hangfire machine adapted for use with the present invention.

Referring to the drawing by numerals of reference:

There is provided a collector herein shown consisting of a ring 1 of conducting material of a suitable diameter secured to the baffle plate 2, through which the gun muzzle 3 protrudes, by a rod 4 of insulating material and by tubular rod 5, in which is inserted a rod 6 of conducting material, rod 6 being secured to the collector 1 the opposite end of said rod having connected thereto a lead wire 7. The collector is placed the necessary distance in front of the muzzle and centered thereon.

While there is shown and described a specific form of collector it is to be understood that the form used is immaterial as long as the collector is of conducting material, is insulated from ground and gun and is in position to be contacted by the gases as soon as they emerge from the muzzle of the gun.

Although the electric charge found on the metallic parts of a gun upon the emergence of the projectile from the muzzle may be used to operate any of the apparatus hereinafter described, it is necessary to insulate the gun from the ground. As this is usually inconvenient, the input of such apparatus as may be used is commonly connected to a collector rather than to the gun.

While in most instances the electric charge on the collector is sufficient for the operation of devices that may be used therewith, the lead wire 7 may be connected to the grid terminal of an electronic amplifier 8, the other terminal of which is connected through lead wire 9 to ground. A resistance 10 of from .50 to 10 megohms is connected across the wires 7 and 9. The output of the electronic amplifier contains the primary of an output transformer 11, the secondary of which has one terminal connected through lead wire 12, and adjustable resistance 13 to a terminal of an oscillograph 14, the other terminal of the transformer being connected through lead wire 15 to the other terminal of the oscillograph. A wire 16 connected to the lead 15 is grounded as shown.

With the arrangement just described it is possible to indicate the instant of emergence of the projectile from the gun muzzle or in conjunction with a firing pin and striker assembly which has been insulated from its bolt, to determine the elapsed time between the striking of the primer and the emergence of the projectile from the muzzle of the gun.

The electric charge may be utilized, in conjunction with any of the commonly used velocity screens, for operating any well known chronograph the construction and operation of which are well known to those skilled in this art and are fully described in books on ordnance, for example, "Elements of Ordnance" by T. J. Hayes.

The circuit for indicating hangfires illustrated in Fig. 3 consists of the collector 1, lead wire 7, collector leakage resistor 17 and coupling condenser 18, one terminal of which is connected to the grid of gaseous triode 19. The biasing battery 20 has its negative terminal connected through grid resistor 21 to the grid of the gaseous triode, the positive terminal of said battery being connected through lead 22 to the cathode, the cathode being grounded through lead 23. Connected between the grid and cathode is grid protection condenser 24. The plate of the triode is connected through the primary of spark coil 25

to one terminal of charging resistor 27 by means of lead 26, the other terminal of said resistor being connected to the positive terminal of a full wave rectifier 28. A condenser 29 has one terminal connected to the negative side of the rectifier and the other terminal to lead wire 26. The negative side of the rectifier is grounded through lead 30. The secondary of spark coil 25 is connected to spark gap 31.

From the foregoing it will be seen that condenser 29 is charged through resistor 27 from a source of direct current. Upon the emergence of the projectile from the muzzle of the gun, an electrical charge is picked up by the collector 1 from the ionized gases, this charge causing a change in the electrical potential of the grid of the gaseous triode 19, causing ionization of the triode. Condenser 29 being connected between the plate and cathode of the triode discharges through the triode and the primary of the spark coil 25. This discharge induces a high potential across the secondary of the spark coil to which is connected spark gap 31, the spark across said gap being of sufficient intensity to record on a tape, drum or disc of suitable material.

By rotating a small disc 32, with its periphery between the terminals of the spark gap, in synchronism with the same motor 33 as is used to control operation of the firing mechanism of an automatic gun 34, the sparks will record by perforating the disc in much the same manner as the bullets record by perforating the large discs used on the usual type of hangfire machines. The spark group may be measured in degrees from a preestablished zero point 35, any sparks falling outside of the permissible number of degrees being considered hangfires.

Because of the discharge of condenser 29 the plate potential of the triode is reduced to a point at which deionization takes place, the condenser again becoming charged after which the triode is ready to record the next round.

Through the use of this device, a small disc that may be easily filed for future reference may be used in place of the large discs commonly used.

By the use of a circuit similar to the one described for detecting hangfires, a light source may be initiated having sufficient intensity to photograph a projectile upon its emergence from the muzzle of a gun.

We claim:

1. The method of detecting the passage of a projectile from the muzzle of a gun, which consists in collecting an electrical charge from the charge carried by the powder gases, then utilizing the effect of the same to produce desired indicia.

2. The method of securing data concerning the passage of a projectile from the muzzle of a gun, which consists in collecting an electrical charge from the charge carried by the powder gases, then utilizing the effect of the same to produce desired indicia.

3. The method of detecting the passage of a projectile from the muzzle of a gun which consists in collecting an electrical charge from the charge present in the powder gases propelling the projectile and utilizing the collected charge to alter the electric current of associated mechanism.

4. The method of detecting the arrival of a powder gas at a given point which consists in collecting at said point an electrical charge from the charge present in powder gases, and then utilizing the effect of the same to produce desired indicia.

5. The method of detecting the arrival of a gas at a given point which consists in collecting at said point an electrical charge from the charge present in powder gases, and then utilizing the collected charge to alter the electric current of associated mechanism.

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