United States Patent

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[73] Assignee The United States of America as represented by the Secretary of the Army

[54] PERCUSSION-ELECTRIC PRIMER AND RADIATION SHIELD
6 Claims, 5 Drawing Figs.

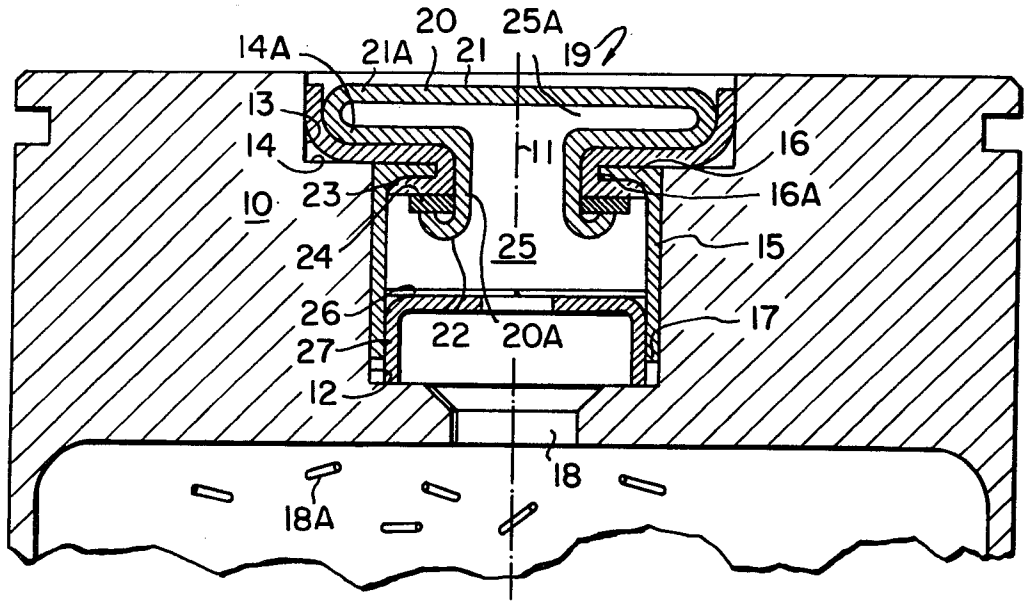
[52] U.S. Cl. 102/46
[51] Int. Cl. F42b 9/08
[50] Field of Search 102/28, 45, 46, 70.2, 86.5

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ABSTRACT: A combined percussion-electric primer having an electrically insulated rimfire cap is centrally positioned at the rearward end of a cartridge, and an electromagnetic radiation shield having a weakened central portion adapted to yield upon firing pin impact is positioned rearwardly of the primer.



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2 Sheets-Sheet 1

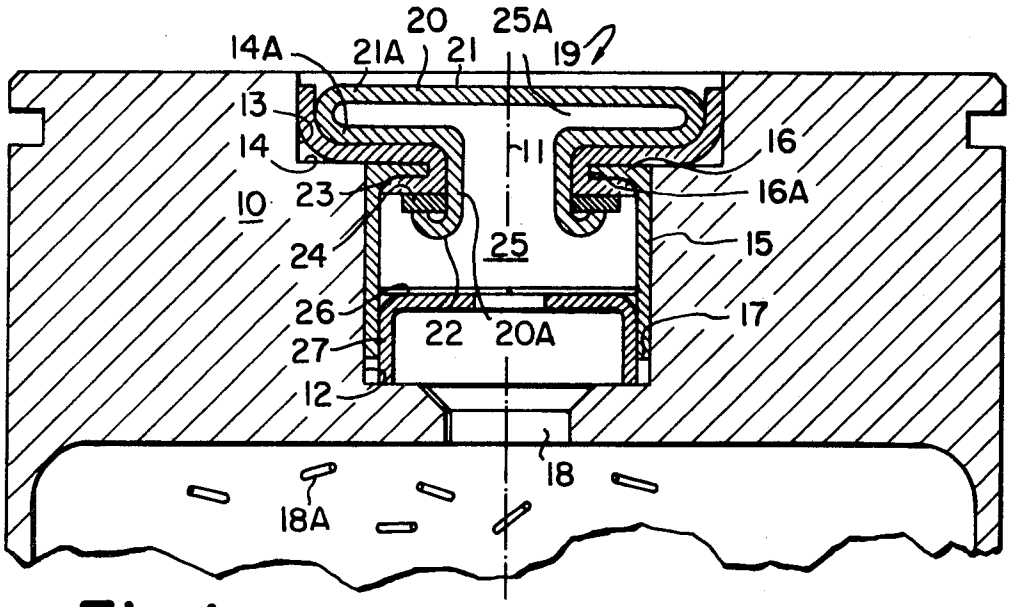


Fig. 1

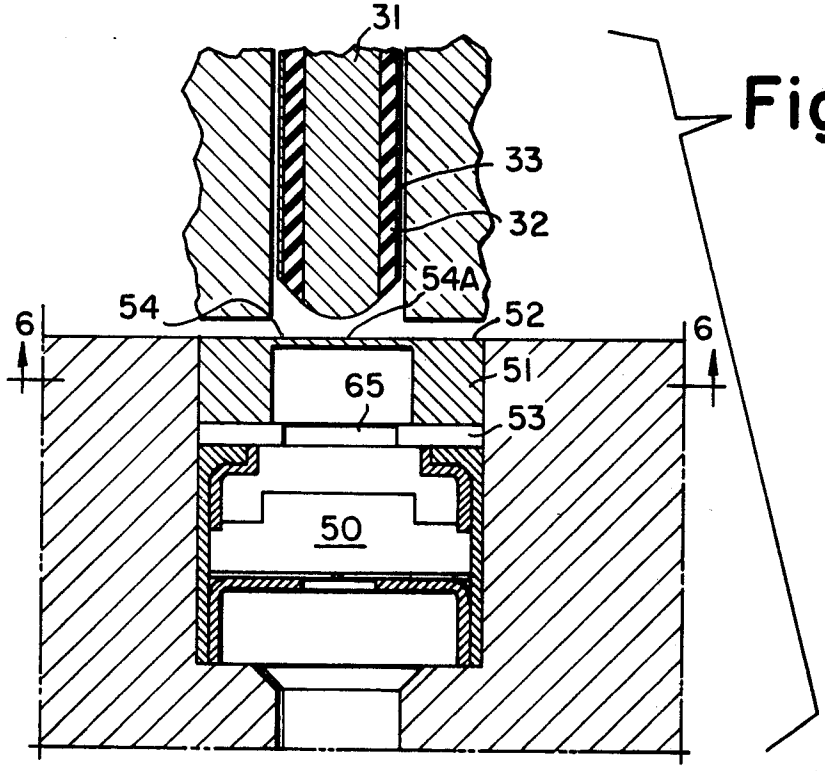


Fig. 4

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Fig.2

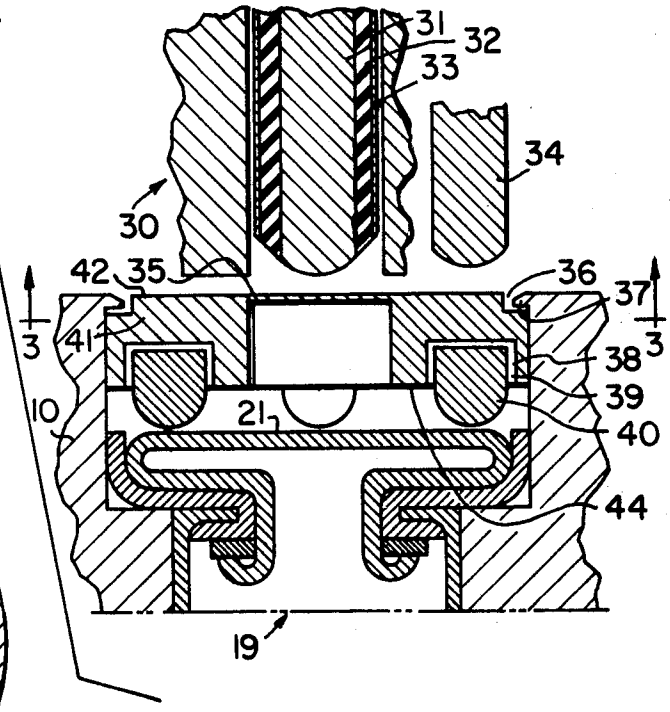
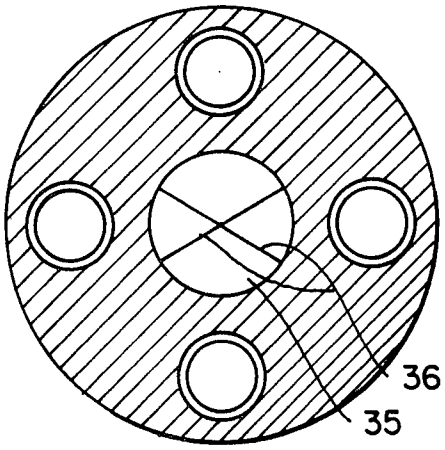


Fig.3



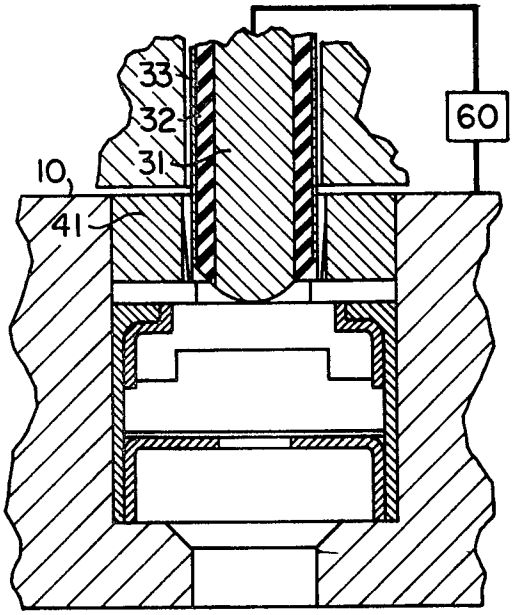


Fig.5

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PERCUSSION-ELECTRIC PRIMER AND RADIATION SHIELD

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

Modern warfare has generated an ever increasing interest in the interchangeability of multiservice ordnance in order to achieve greater flexibility in logistics. Some naval and air weapons systems, for example, utilize electrically fired ammunition while their counterparts among land forces use percussively initiated cartridges. Therefore, the effective interchangeability of these types of ordnance requires that a cartridge having both percussively and electrically initiated primers be developed.

The combination of electric and percussion primers in a single cartridge is not new, as may be seen in U.S. Pat. No. 753,035, issued T. D. Bennett et al., which discloses a percussion-electric primer. Primers of this type, as well as modified forms thereof, have not been entirely satisfactory. As illustrated in the aforementioned patent, a complex structure is required to prevent the rearward escape of gases through the primer, and attempts to achieve better gas obturation with fewer and more easily manufactured components have been unsuccessful.

In addition to the aforementioned problems associated with percussion-electric primers, there also exists a need for protecting the electrically initiated portion of the primer from stray electric currents induced by electromagnetic radiation. In some instances, it is possible to remove the radiation hazard by simply keeping the ammunition at a safe distance from the radiation source; however, this expedient is frequently obviated by spatial limitations that exist on aircraft carriers where radar and radio transmitting equipment is in continual operation.

It is, therefore, an object of this invention to provide an improved primer which may be fired either electrically or percussively, and which is able to withstand combustion gas pressures acting rearwardly thereon.

It is another object of this invention to provide an electromagnetic radiation shield for cartridges having electrically initiated primers.

In a preferred form of the invention, a cartridge base is provided with a rearwardly counterbored central recess which receives a percussion-electric primer. The primer comprises essentially three components: a cup portion which receives a primer mixture; a rimfire cup having an outwardly extending hollow peripheral flange with an integral shank positioned within a central aperture in the cup, and an insulator between the cap, the cup and the cartridge base. The cap flange, insulated from the cartridge base, has a portion of its forward peripheral surface supported by an annular wall which is located transversely to the cartridge longitudinal axis and which is formed at the transition in diameters between the recess and the recess counterbore. The annular wall provides an anvil for the cap flange which absorbs some firing pin impact energy to thereby reduce primer component distortion and consequently increase gas obturation and cartridge performance.

A cuplike shield having a weakened central portion is positioned aft of the primer and is maintained in electrical contact with the cartridge base for the conduction thereto of electromagnetically induced currents. The shield central portion is weakened to permit an insulated firing pin to pierce it and to impinge upon the primer. The conduction of stray electrical currents to the base thereby prevents inadvertent initiation of the primer by high intensity electromagnetic radiation.

Other objects, features and advantages will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmentary, longitudinal cross-sectional view of a cartridge having a percussion-electric primer which embodies features of the invention.

FIG. 2 is a fragmentary, longitudinal cross-sectional view of a cartridge and firing mechanism having an electromagnetic radiation shield positioned in the cartridge between the firing mechanism and the cartridge primer.

FIG. 3 is a cross-sectional view of the electromagnetic radiation shield of FIG. 2 taken along line 3–3.

FIG. 4 is a fragmentary, longitudinal cross-sectional view of a modified cartridge having an electrically initiated primer with an electromagnetic radiation shield positioned between the primer and an electrically insulated firing pin.

FIG. 5 shows the operative relationship between the firing pin, radiation shield and primer of FIG. 4.

A conventional cartridge case, having a base **10** (FIG. 1) and a central longitudinal axis **11**, has a central bore **12** with a rearward counterbore **13**. An annular surface **14** is formed therein at the transition between bore **12** and counterbore **13**, and a primer assembly, shown generally at **19**, is inserted in the cartridge base recess which is defined by the bores.

Primer assembly **19** has a cup **15**, and a cap **21**, and an electrical insulator **23**. Cup **15** has cylindrical sidewalls having a forward terminus **17** defining an opening in registry with a flash hole **18** in the cartridge base leading to a main propellant charge **18A**. The sidewalls are also formed into a integral rear wall **16** that has a central aperture **16A** therein. Cap **21** is of the rimfire type and has a rear wall **20** shaped into a peripheral flange **21** which has an annular cavity containing a percussively sensitive primer mixture **25A**. A hollow shank **20A**, formed integral with flange **21**, and in open communication with the flange cavity, extends forwardly and is centrally secured in fixed spaced relationship within aperture **16A**. An electrically sensitive primer mixture **25** is charged within the hollow shank and cup **15**, with a foiling disc **26**, held in position by apertured retainer **27**, containing and providing a moisture seal for the contained mixture. Washer **24** is slid onto shank **20A** during assembly and is peened at **22**. When the shank is peened, insulator **23** will assume the configuration as shown in FIG. **1** where it will be noted that cap flange **21A** is electrically insulated circumferentially around its forward and lateral peripheral surface **14A** from cup **15** and cartridge base **10**.

Percussive initiation of the primer occurs when a firing pin strikes flange **21** and compresses or pinches the percussively sensitive mixture. Surface **14** promotes positive flange deformation by providing an anvil against which the firing pin striking force is directed. With surface **14** absorbing much of the firing pin impact energy, the other primer components will not be damaged or distorted. As a consequence, the combustion gases will be retained within the primer structure to increase both cartridge performance and safety.

Electrical primer initiation occurs when a conventional electrical firing pin contacts rear wall **20** of primer cap **21**. After contact is made an electrical impulse is applied to the primer mixture to cause a current to flow from wall **20** through mixture **25** to base **10**.

FIG. 2 illustrates an electromagnetic radiation shield **41** in cooperation with the percussion-electric primer **19** of FIG. **1**. In this arrangement, cartridge base **10** has a deeper counterbored portion, so that when shield **41** is slidably positioned rearwardly or aft of primer assembly **19**, shield rearward surface **42** will be substantially flush with the rear of the cartridge base and will completely overlie cap **21**. A rearwardly facing circumferential surface **36** is formed in shield **41** and engages cartridge base surface **37**. Surface **37**, formed after shield **41** has been inserted in the counterbore, maintains the shield within the cartridge base recess.

Forward peripheral surface **44** of shield **41** has a plurality of circumferentially spaced receptacles defined by walls **38** for receiving forwardly projecting pins **40** which are positioned within the receptacles and are insulated therefrom by electrical insulation material **39**. If desired, a forwardly projecting annular member could be substituted for the plurality of spaced pins **40** to facilitate cartridge manufacture without sacrificing cartridge performance. When a cartridge having this primer and shield arrangement is inserted within a weapon

which has a percussion firing pin **34**, operative impact of pin **34** on shield **41** causes shield **41** and pins **40** to move forwardly into contact with primer flange **21** to initiate the primer and fire the cartridge.

The initiation of a cartridge embodying the primer and shield arrangement of FIG. **2**, in a weapon having an electrical firing pin shown generally at **30**, requires that the electrically energized firing pin contact primer stud **65**. This contact is facilitated in the present invention by providing shield **41** with a weakened central portion **35** which is adapted to yield upon impact by firing pin **31** and thereby permitting the firing pin to contact the stud. Although there are many ways in which shield central portion **35** may be weakened, the preferred embodiment of this invention utilizes a plurality of diametrically extending notches to weaken it. The thickness of weakened portion **35**, as well as the depth of notches **36** (FIG. **3**), may be varied to suit particular design requirements in light of available firing pin impact energies. In order to prevent short circuiting of the electric firing impulse after firing pin **31** has pierced the weakened portion **35**, firing pin **31** has a metal shield **33** with electrical insulation material **32** positioned intermediate the shield and the pin, it being contemplated that the electric impulse is to be applied to pin **31** after insulation **32** has reached an effective position. As may be seen in FIG. **5**, shield **33** and insulating material **32** prevent electrical firing pin current from flowing through shield **41** to cartridge base **10**. The current must then flow through the primer mixture to the cartridge base to thereby initiate the primer and fire the cartridge propellant.

Depicted in FIG. **4** is a modified form of one aspect of the invention. A conventional electric primer **50**, of the type illustrated in U.S. Pat. No. 3,286,631, issued to H. Gawlick et al., is secured within a recess in a cartridge base. Positioned within the cartridge base recess rearwardly of primer **50** is electromagnetic radiation shield **51** which is spaced from primer **50** by an annularly shaped electrical insulator **53**. Similarly to shield **41** of FIG. **2**, shield **51** has a weakened central portion **54** which is adapted to yield upon impact by a firing pin. As is FIG. **2**, portion **54** is weakened by a plurality of diametrically extending notches **54A** with half the length of one diametrical notch being less than the maximum thickness of shield **51** measured in the direction of the cartridge longitudinal axis. This dimension is critical, since the petals formed after the weakened portion has yielded upon firing pin impact must not contact the primer cap, for if they do, the electric firing impulse will be short circuited to the cartridge base without initiating the primer mixture. The importance of this feature may be better understood by reference to FIG. **5** which illustrates how the petals, formed by the shield-piercing firing pin, are deflected to permit the firing pin to contact primer **50**. An electrical impulse from power supply **60**, applied when the firing pin contacts primer stud **65**, will cause the impulse to travel through the primer and to the cartridge base. In this embodiment it is not necessary that the shield **51** be slidably positioned within the cartridge base recess as in the embodiment of FIG. **2**, but it is preferable for shield **51** to be pressed into position in the cartridge recess after the annular electrical insulator **53** is positioned therein rearwardly of primer **50**. By pressing shield **51** into the cartridge base recess, good electrical communication is established between the shield and the cartridge base which will ensure efficient performance of the electromagnetic radiation shield.

While the foregoing illustrations are exemplary of the various aspects of the invention, various changes, alterations, or modifications thereof may be resorted to without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. In a cartridge having a base with a central longitudinal recess and a counterbore coaxial therewith defining a rearwardly facing annular surface therebetween, said cartridge having a percussion-electric primer comprising:

a cup containing an electrically sensitive primer mixture, said cup having imperforate sidewalls formed into an integral wall at a rear end thereof, said sidewalls having a forward terminus defining an opening for communicating gases generated by said mixture with a cartridge contained propellant, said integral rear wall having a central aperture therein,

a rimfire cap having a hollow shank and a peripheral flange with an annular cavity therein in communication with said hollow shank, said flange having a forward peripheral surface aligned with said cartridge base annular surface for substantially restraining forward relative movement therebetween upon impact by a firing pin on said flange, said hollow shank being secured within said cup rear wall aperture in fixed spaced relationship therewith,

a percussively sensitive primer mixture positioned within said flange annular cavity, said electrically sensitive primer mixture positioned within said cap hollow shank in contact with said percussively sensitive mixture, and

an electrical insulator positioned within said counterbore circumferentially around said rimfire cap, said insulator extending between said flange forward peripheral surface and said cartridge base annular surface with a portion thereof positioned intermediate said cap shank and said cup rear wall aperture, said insulator being arranged to insulate said cap from said cup and base so that a voltage applied between said cap and said base will initiate said electrically sensitive primer mixture and ignite said cartridge propellant.

2. The cartridge of claim **1** further including a disc-shaped electrically conductive shield having a weakened central portion arranged to yield upon impact by an insulated electric firing pin, said shield being slidably positioned in said cartridge base counterbore rearwardly of said cap and being in electrical contact with said base, said shield also having forwardly projecting means secured thereto and insulated therefrom aligned with said cap flange for contacting said flange upon a predetermined amount of pin forward movement, said shield adapted to conduct any stray electrical currents induced therein to said cartridge base, and means for limiting rearward movement of said shield.

3. The cartridge as recited in claim **2** wherein said shield completely overlies and is parallel to said cap flange, and said shield has integral forwardly extending peripheral wall means in slidable engagement with said cartridge base counterbore.

4. The cartridge of claim **3** wherein said shield forwardly projecting means includes a plurality of forwardly protruding pins positioned within and insulated from circumferentially spaced cavities located in said forwardly extending peripheral wall means.

5. In a cartridge having a base with an electrically initiated primer positioned within a recess therein, an electrically conductive electromagnetic radiation shield positioned within said recess rearwardly of said primer an insulated spaced distance therefrom, said shield completely overlying said primer and being in electrical contact with said cartridge base, said shield having an integral forwardly extending peripheral wall and a weakened central portion adapted to yield upon firing pin impact, and an annular electrical insulator positioned within said insulated spaced distance, said shield being arranged to protect said primer from electromagnetic radiation by conducting any stray electrical currents induced therein to said cartridge base.

6. The shield as defined in claim **5** wherein said shield weakened central portion has a plurality of diametral centrally intersecting notches, half of each notch length being less than the length of said forwardly extending peripheral wall measured longitudinally of said cartridge, said notches being arranged so that upon firing pin impact, the forwardmost notch defined weakened portions will yield and be deformed to positions spaced a predetermined distance from said primer for preventing short-circuiting of a primer electrical firing pulse applied to said pin.