Sept. 23, 1952 P. P. ALEXANDER 2,611,316

AMMUNITION

Filed June 14, 1949

Fig. 1.

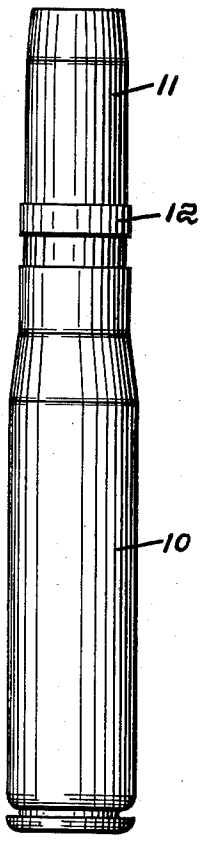
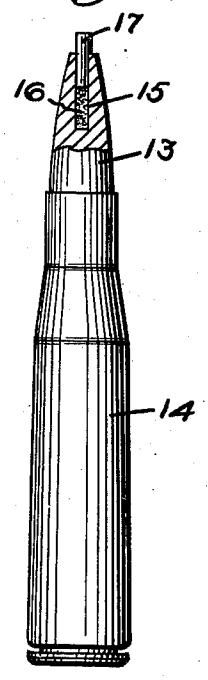


Fig. 2.



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AMMUNITION

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1 Claim. (Cl. 102—38)

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This invention relates to bullets or projectiles for ammunition for use in rifles, guns, etc. Such bullets or projectiles usually are fitted in a cartridge case containing an explosive charge which, when detonated, propels the projectile from the gun at a predetermined velocity. The cartridge case contains means for detonating the explosive charge, which commonly is a detonator cap fitted in the base of the cartridge case, adapted to be detonated by the impact of the gun hammer. In some cases, a ring of a soft metal, such as copper, is fitted in an annular groove in the projectile for a purpose well known to those skilled in ordnance.

Prior to the present invention it had been known that sparks are produced when a hard metal, such as iron, was subjected to the violent abrasive action of an abrasive wheel rotating at high speed. When brittle iron is subjected to impact sufficient to break it into small pieces no sparks are produced. The action of an abrasive wheel upon iron generates considerable heat which raises the temperature of the small particles removed sufficiently high to cause them to glow.

It also was known that certain alloys, such as alloys containing about 70 per cent cerium and 30 per cent iron, produce sparks when subjected to mild abrasion, such as by rotating a small knurled wheel a partial revolution while contacting the alloy under very slight pressure. The mild abrasion does not generate any substantial amount of heat. The production of sparks by these alloys has been explained by those skilled in the art as being caused by the removal of a multiplicity of small particles which immediately become ignited in air. Such alloys are referred to as pyrophoric alloys. They contain a large percentage of a very soft metal, namely, cerium.

Another pyrophoric alloy is described in the copending application of Robert J. Anicetti, Serial No. 746,329, filed May 6, 1947, now Patent No. 2,490,570. This pyrophoric alloy consists essentially of zirconium and lead in the proportions of 20 to 75 per cent of lead and 25 to 80 per cent of zirconium by weight. Like the cerium-iron alloy, the zirconium-lead alloy produces sparks when subjected to mild abrasion by rotating a small knurled wheel a partial revolution while contacting the alloy under very slight pressure. It too contains a very soft metal component, namely, lead.

In spite of the similarity in appearance and the above mentioned properties of the cerium-iron alloy and the lead-zirconium alloy, they

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differ radically in at least one property. Thus, I have made the surprising discovery that when a piece of the lead-zirconium alloy is subjected to a sudden heavy impact, instead of being broken into fragments, it is crushed to a fine powder and the whole mass set afire. The present invention is based upon this discovery and the conception of utilizing this peculiar property of the lead-zirconium alloy by embodying the alloy in projectiles for ammunition. I have discovered that alloys which are essentially lead and zirconium in the proportions of 10 to 70 per cent of lead and 30 to 90 per cent of zirconium by weight possess this property and are suitable for use in the practice of the invention. If the projectile is composed wholly of this alloy, I prefer to employ an alloy containing between about 50 to 60 per cent by weight of lead because of its better ballistic characteristics. It was surprising to discover that an alloy of zirconium and lead containing a high percentage of lead possesses this peculiar property since it was well known that bullets made of lead or lead alloys theretofore tended to flatten upon striking a target.

The alloy may contain substantial amounts of diluting metals, such as titanium, manganese, tin, antimony, etc., without detrimentally affecting its basic characteristics. The combined amounts of lead and zirconium should not be less than about 60 per cent by weight of the alloy. I prefer, however, that the alloy contain not more than minor amounts of diluents.

In accordance with the present invention, ammunition for rifles, guns, etc., is provided in which the bullets or projectile is formed either wholly or in part of the pyrophoric alloy of lead and zirconium. In accordance with one aspect of the invention, a small piece of the pyrophoric alloy may be secured in the tip of the bullet such as the hole in the open point bullet, to provide ammunition particularly suitable for target practice either in daylight or in darkness. When such a bullet strikes a hard target, the alloy is set afire and informs the marksman, either military or civilian, as to the location of the hit. If desired a small amount of a smoke producing compound, such as black powder, magnesium metal, etc., may be placed in the bullet so that it is ignited by the pyrophoric alloy when the bullet strikes the target, thus supplementing the flame produced by the pyrophoric alloy and producing smoke which can be seen by the marksman. If desired, any known incendiary composition may be placed in the bullet or projectile so that it

will be ignited by the pyrophoric alloy when the bullet strikes a target. The ammunition of the invention may be used to replace tracer bullets and, for this purpose, possesses the advantage of giving no visible evidence to the enemy of the location of the miiltary group using it.

The zirconium-lead alloy portion of the bullet or projectile, preferably, is employed as a solid block of the alloy. However, ingots of the alloy may be crushed under oil or in a neutral protective atmosphere, such as argon, to form coarse particles which may be mixed with a binder such as glyptol, and shaped to desired form by molding, extruding, etc. While a fine powder of about 325 mesh still is crystalline, it cannot be crushed further and is not desirable for use in the practice of the invention. The particle size should be such that the particle will split or crush at the predetermined velocity for which the article of ammunition is designed to propel the projectile against the target. Where the predetermined velocity is about 1000 feet per second, the particle size should be of the order of 100 mesh.

The invention, therefore, in its broad aspect contemplates ammunition in which at least a portion of the bullet or projectile is formed of a pyrophoric alloy. In one embodiment, a piece of pyrophoric alloy is secured in a hole in the tip of the bullet so as to project forward therefrom. The action of the pyrophoric alloy may be supplemented by an additional smoke and flame producing compound adapted to be ignited by the sparks or flame produced by the pyrophoric alloy when the bullet impacts a hard target. When the entire bullet or projectile is a pyrophoric alloy of zirconium-lead, the lead component should be relatively high so that the density of the alloy is not less than about 6.5 because of its better ballistic characteristics.

The invention is illustrated further in the accompanying drawing, in which:

Fig. 1 is an elevational view of a piece of ammunition embodying the invention; and

Fig. 2 is an elevational view, partly in section, of an open point bullet embodying the invention.

The embodiment illustrated in Fig. 1 comprises a cartridge case 10 of brass into the open end of

which a bullet or projectile 11 is fitted in the usual manner. The projectile 11 is formed of an alloy which is essentially zirconium and lead. A ring 12 of copper may be fitted into an annular groove formed in the body of the projectile near its rear end.

Fig. 2 illustrates a piece of ammunition for small arms having an open point expanding bullet 13 fitted in the open end of a brass cartridge case 14. The bullet 13 may be formed of lead or other metal commonly employed and is provided with a hole 15 in its tip. As illustrated, a smoke producing compound 16, such as black powder, is placed in the bottom of the hole 15 and a piece 17 of the pyrophoric alloy is fitted in the hole so as to project forwardly a short distance from the tip of the bullet.

This application is a continuation-in-part of my copending application, Serial No. 18,642, filed April 2, 1948, now abandoned.

I claim:

In an article of ammunition having a cartridge case and a projectile fitted therein and in which a portion of the projectile is ignitible upon impact with a target, the improvement wherein said ignitible portion is a pyrophoric alloy consisting essentially of zirconium and between about 50 to 60 per cent of lead by weight and projects forwardly from the tip of the projectile and is thereby adapted to come in direct contact with a hard target whereby the force of impact therewith causes said alloy to be crushed to a finely divided condition and thus be set afire.

PETER P. ALEXANDER.

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