ABSTRACT: A noncorrosive priming mixture for use with 7.62 mm. solid caseless cartridges, said mixture consisting of 30–40 percent lead styphnate, 10–15 percent tetracene, 20–25 percent barium nitrate, 7–10 percent lead dioxide, 5–10 percent antimony sulfide, 7–10 percent zirconium, and 3–5 percent pentaerythritol tetranitrate.
PRIMING MIXTURE FOR AMMUNITION

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

This invention relates to priming mixtures, and more particularly relates to priming mixtures for solid caseless cartridges.

With the advent of the 7.62 mm. solid caseless cartridge, the development of a combustible percussion primer to satisfactorily ignite this type ammunition became necessary. Primers previously used in standard 7.62 mm. cartridges have proven unsatisfactory for the caseless cartridge. The design of a new primer created several problems. The primer required sensitivity specifications of a no-fire height of $H = 2 \sigma = 3$ inches, and an all-fire height of $H + 5 \sigma = 15$ inches where $H$ represents mean critical height, or that height at which 50 percent of the primers fired during drop test studies; and $\sigma$ represents the standard deviation of $H$ (See Manual of Test Methods for Small Arms Ammunition, ORD—M 608 —PM, Vol. III Frankford Arsenal, Jan. 1945 ). These limits of sensitivity are necessary in order that the primer be safe to handle, yet sensitive enough to function when exposed to standard firing pin energies in present 7.62 mm. weapons.

A further requirement for the new priming mixture was that after combustion of the caseless cartridge, the primer residue had to be extremely small so that the weapons using combustible ammunition could function satisfactorily in repetitive fire. Unless the primer residue is completely combustible, it might add large quantities of residue to the firing chamber. It was also essential that the products of combustion be nontoxic. Certain ingredients in the priming mixtures, such as antimony sulfide and calcium silicide, are known to produce abrasive products upon combustion. Therefore, all such ingredients which are not essential to the sensitivity and the output of the primer must be removed to prevent, or at least minimize, the erosion of the firing chamber.

It is therefore the overall object of the present invention to provide a percussion priming mixture which will satisfactorily ignite a solid caseless cartridge.

Other objects, features, and advantages will become apparent from the following description when taken in conjunction with the single drawing which illustrates a sectional view of a combustible cartridge with primer attached thereto.

In the cartridge construction of FIG. 1, the cartridge, shown generally at 11, has a caseless molded propellant charge 15 having its forward end open to receive a bullet 16. The rear portion of the cartridge is provided with a primer container 14 enclosing the priming mixture 13 of the invention and a magnesium or propellant disc 12 which covers and protects the priming mixture, as shown.

Standard noncorrosive priming mixtures when charged into the primer container 14 of caseless cartridges are not sufficiently impact sensitive to ignite when subjected to normal 7.62 mm. firing pin energies. However, it has been discovered that by employing a lead stannate priming mixture containing about 10-15 percent tetracene, a primer is obtained which can be ignited with these impact energies. The priming mixture of this invention consists essentially, by weight, of 30-40 percent lead stannate, 10-15 percent tetracene, 20-25 percent barium nitrate, 7-10 percent lead dioxide, 5-10 percent antimony sulfide, 7-10 percent zirconium, and 3-5 percent pentaerythritol tetranitrate (commonly referred to as PETN).

A preferred composition within the ranges defined above consist essentially, by weight, of 36 percent lead stannate, 12 percent tetracene, 22 percent barium nitrate, 9 percent lead dioxide, 7 percent antimony sulfide, 9 percent zirconium, and 5 percent PETN. This preferred composition exhibited the proper sensitivity required by the 7.62 caseless cartridge.

The priming mixture was prepared by initially weighing out the desired quantities of zirconium and the primary explosives, i.e., lead stannate and tetracene, all in a wet condition having a moisture content of 15 percent by weight, and placing the above materials in a rubber bowl. Immediately thereafter, the antimony sulfide and a preblend mix of barium nitrate and lead peroxide and the secondary explosive, PETN, were intermixed with the primary explosives. It should be noted that the mixing should be started without hesitation to prevent evaporation of the water which would tend to dry the explosives and create additional hazards. Subsequently, the priming mixture is filtered in a Buchner funnel to remove any excess water remaining in the mix.

The values of the means critical height, $H$, and the standard deviation of $H$, $\sigma$, were evaluated to determine the sensitivity of the new mixture. The values were obtained through the use of a rundown drop test described in Manual of Test Methods for Small Arms Ammunition aforementioned. A 4-oz. ball and a standard drop test pin were used in the studies for the primers assembled for the 7.62 mm. ammunition. Inert primer containers such as indicated by numeral 14 of the drawing, were manufactured for drop tests and used in lieu of the standard molded propellant charges so that hazardous operations when charging the priming mixture and drop testing the primed units would be minimized. The inert containers were composed of a cellulose acetate in a binder of 7 percent solution of cellulose acetate in a 50/50 mixture of acetone/alcohol. The primer containers usually employed in the caseless cartridges consist generally of extruded propellants.

The inert containers for the drop test were assembled by charging approximately 0.9 grains of the priming mixture into the primer container and then compressing the mixture to 9700 p.s.i. A 0.005 inch thick magnesium disc was cemented to the mixture, using a nitrocresol base cement, and allowed to air dry. The magnesium disc prevents damage to the priming mixture due to rough handling.

The results obtained on drop tests of the primer mixture were $H=4.0$ inches; $\sigma=1.17$ inches. These values were all within the present primer specifications. The relative impact sensitivity of the primers obtained can be adjusted by a change in the pin contour.

Preliminary rifle tests were also performed using a Frankford Arsenal modified 1903 Springfield rifle. In these tests a caseless cartridge propellant and ball bullet were assembled in combination with the primer of the instant invention as shown in the drawing. Examination of the weapon showed after firing that very little residue remained in the chamber of the rifle following the tests. The quantity of residue produced was not considered serious enough to affect the functioning of the weapon during repetitive fire. The improved primer assembly exhibited good impact sensitivity and a high degree of combustibility.

I wish to be understood that I do not desire to be limited to the exact details described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. A priming mixture for solid caseless cartridge ammunition which consists of, by weight, 30-40 percent lead stannate, 10-15 percent tetracene, 20-25 percent barium nitrate, 7-10 percent lead dioxide, 5-10 percent antimony sulfide, 7-10 percent zirconium, and 3-5 percent pentaerythritol tetranitrate.

2. A priming mixture as described in claim 1 which consists of, by weight, 36 percent lead stannate, 12 percent tetracene, 22 percent barium nitrate, 9 percent lead dioxide, 7 percent antimony sulfide, 9 percent zirconium, and 5 percent pentaerythritol tetranitrate.