

1

2,887,370

NON-CORROSIVE PERCUSSION PRIMER
MATERIAL

Reed E. Donnard, Philadelphia, Pa., assignor to the
United States of America as represented by the Sec-
retary of the Army

No Drawing. Application February 12, 1957
Serial No. 639,831

2 Claims. (Cl. 52—4)

(Granted under Title 35, U.S. Code (1952), sec. 266)

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

This invention relates to a percussion type primer material and has for an object to provide such a material which is satisfactory in cold climates for firing either a single or a double base propellant composition. Another object is to provide such a primer composition capable of more nearly effecting uniformity in results than has been possible previously and therefore obtaining greater accuracy in firing.

Previously no satisfactory small arms primer composition has been known which is reliable for firing in all climates for both the single base type propellant, such as nitrocellulose, and a double base propellant such as a blend of nitroglycerine and nitrocellulose. That is, a primer mixture yielding a sufficient heat transfer to ignite double base propellants is too violent (due to gas pressure) in its ignition of single base propellants, causing, as discussed below, a break up of the propellant, resulting in highly variable rates of propellant burning. The composition of this invention has been discovered to be the first primer filling the long need for one suitable for both types of propellant.

An age old goal for a primer composition has been to find one which is uniform in results giving uniformity in projectile velocity and accuracy of fire. The primer does more than merely ignite the propellant. The pressure blast for example from the customary primer has heretofore been found to be too high with the result the propellant has been broken exposing more surface area to burning more rapidly at some times than at others with the resulting differences in pressure generated. This effect is aggravated at very cold temperatures, resulting in occasional cartridge pressure being dangerously high. The present primer composition gives a pressure blast that is about 60% lower than what has heretofore been common with lead styphnate type priming mixtures. Duration and length of the primer flame are other factors contributing to a close approach to uniformity in results.

According to this invention it has been discovered that two of the probably most important novel factors contributing to the foregoing new results are the use of a smaller percentage than usual of lead styphnate as a non-corrosive primer material, in combination with zirconium of larger particle size than has heretofore been suggested. A prior patent to Chamberlain, 2,036,119, suggested the use of zirconium as a primer material but in a particle size which was too small to be safe. The present invention uses zirconium with at least a major portion having a particle size between 30 and 62 microns.

More specifically the present invention has been tried out according to the seven following embodiments. These are as follows:

2

Examples (% by weight)	1, per- cent	2, per- cent	3, per- cent	4, per- cent	5, per- cent	6, per- cent	7, per- cent
Lead Styphnate.....	15	20	25	30	35	37	37
Tetrazene.....	4	3.8	3.5	3.3	3.1	3	3
Barium Nitrate.....	40.5	33.1	35.8	33.4	31.0	30	30
Lead Dioxide.....	13.5	12.9	11.9	11.1	10.3	10	5
P.E.T.N.....	13.5	12.9	11.9	11.1	10.3	10	5
Antimony Sulphide.....	13.5	12.9	11.9	11.1	10.3	10	15
Zirconium.....	13.5	12.9	11.9	11.1	10.3	10	5

Each of these embodiments has been found satisfactory in the sensitivity drop test. Each has also been tested in an electronic device for testing the output characteristics of percussion type primers. Some of these characteristics tested are mentioned hereinafter. The flame temperature was measured by photo multiplier sensitive to the wave length of the emitted light from the primer flame. The explosive force was measured with the aid of a piezo-electric crystal impinged by the primer blast at a measured distance. Primer time, flame duration, and length of flame were measured in ways well known to those skilled in the art. To those skilled in the art, the measurement of the above characteristics of the primer mixture also results in an indication of heat transfer. The particular electronic device for measuring output characteristics of primers is known by that name and is a model XMC-72-1 made by Denver Research Institute. The data obtained from each embodiment is as follows:

30	Primer Time, SEC $\times 10^{-4}$	105	95	95	98	97	96	97
	Flame Duration, SEC $\times 10^{-3}$	1,250	1,600	1,650	1,200	1,400	1,350	1,564
	Flame Temp., Volt Meter Reading.....	1,227	1,258	1,280	1,278	1,360	1,297	1,298
35	Flame Length, Inches.....	4½	4½	4½	4½	4½	4½	4½
	Explosion Force, Volt Meter Reading.....	3.6	4.2	5.8	6.5	6.5	15.7	22.8

The use of particles of metallic zirconium of the sizes specified above, that is when the zirconium is from 10 to 62 microns (but with about 60% of the zirconium within the range of 30 to 62 microns, 0.030 mm. to .062 mm.), is believed to be an important factor of the present invention. With this zirconium of the sizes indicated less lead styphnate has been found necessary.

The heat capacity of zirconium is believed to be a factor which has made it important in the present invention.

Among the advantages of this invention may be mentioned that this primer is believed to be the first non-corrosive primer adapted to give substantial uniformity in results over a wide range of temperature and frequency of firing in regard to both single and double base propellants. This is the first primer found satisfactory and successful with both the single and double base propellants. Not all of the factors contributing to the improved results in the present invention are understood but one such factor is that due to the use of a larger particle size than has been heretofore found desirable for zirconium. The particle sizes mentioned above for zirconium have required less than the usual amount of lead styphnate to be used. Although the primer blast may be brief, it may require only one and a half milliseconds, the time and length of the flame is important ballistically in obtaining the desired approach to uniformity. Too large a particle size for the zirconium requires a longer time for it to be ignited and burned, resulting in breech sparks and flames in automatic gas operated rifles with danger

3

of injury to personnel. Such sparks and flames in military uses possess the danger of revealing troop locations to an enemy. Also too large a particle size increases hang fire, i.e., too large an increase in time between the moment of impact of firing pin on the primer and the moment the projectile leaves the muzzle of the gun. The present invention has selected particle sizes for zirconium in which these disadvantages have been eliminated. Too small a particle size for the zirconium proved to be dangerous by reason of it being too easily ignited. Also, too small a particle size for the zirconium results in too rapid a combustion as to lose the projectile effect of the hot metal particles being driven into the propellant. The zirconium is thought to be a contributing cause of the reduction of the pressure wave front. As compared with the usual primer containing lead styphnate it is believed the blast pressure of the present embodiments of this invention is considerably lower by about 60% as indicated by the voltmeter readings given.

The lead styphnate is a primary explosive which is set off by mechanical shock to the material and shearing of its particles in percussion primers. The optimum range for the lead styphnate is believed to be 35% to 37% by weight and when this percentage is increased above 37% the ballistic results become erratic. The softer blast from this invention is believed to be a contributing factor to the closer approach to uniformity in results. Tetrazene is also a primary explosive assisting the lead styphnate to be ignited. Where large amounts of lead styphnate have been used previously, 38% and more, the presence of zirconium in the particle sizes stated requires less lead styphnate and a less strong primer blast. Barium nitrate is an old oxidizing agent. Lead dioxide is known to be a powerful oxidizing agent. P.E.T.N. (pentaerythrite tetranitrate) is a known satisfactory explosive making the primer flame hotter. Antimony sulphide is a customary fuel constituent of primers. The single base propellant is one such as nitrocellulose whereas the double

4

base propellant includes one such as nitrocellulose and nitroglycerine.

No claim is made herein to the use of zirconium when largely in a particle size of 10 microns and less.

The present primer has been found to be satisfactory for use in both the tropics and regions of extreme cold.

I claim:

1. An improved non-corrosive primer yielding a heat transfer of an intensity to ignite double base propellants without at the same time having a gas pressure which will cause break up and over ignition of single base propellants, consisting essentially of: about 30 to 37% of the total weight of the mixture of lead styphnate, as a primary explosive; about 5 to 10% lead dioxide, as a first oxidizer; about 30 to 35% barium nitrate, as a second oxidizer; 3 to 4% tetrazene, as a sensitizer; 0 to 5% pentaerythrite tetranitrate, as an oxygen rich explosive for raising the gaseous flame temperature; about 10 to 15% antimony sulfide, as a reducing agent; and about 5 to 10% zirconium, having a particle size of from about .030 to .062 mm.

2. An improved non-corrosive primer yielding a heat transfer of an intensity to ignite double base propellants without at the same time having a gas pressure which will cause break up and over ignition of single base propellants, consisting essentially of: about 37% of the total weight of the mixture of lead styphnate; about 5% lead dioxide; about 30% barium nitrate; about 3% tetrazene; about 5% pentaerythrite tetranitrate; about 15% antimony sulfide; and about 5% zirconium having a particle size of .030 to .062 mm.

References Cited in the file of this patent

UNITED STATES PATENTS

2,480,141	Kind	Aug. 30, 1949
2,749,226	Lewis	June 5, 1956
2,775,514	Wainer	Dec. 25, 1956