

UNITED STATES PATENT OFFICE

2,095,302

AMMUNITION

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No Drawing. Application December 4, 1934, Serial No. 755,910

9 Claims. (Cl. 52—2)

This invention relates to metallic alloys of unusual properties and to particular uses of such alloys. The characteristic property of said alloys is stability at ordinary temperatures and capacity for rapid oxidation at elevated temperatures, and use is made of this property in compositions designed for the ignition of propellant powders and detonators.

Priming compositions for ammunition ordinarily include a percussion sensitive combustion initiator, an oxidizer, and a fuel. Reaction between the oxidizer and fuel is initiated by the decomposition of the percussion sensitive ingredient and results in a flame of sufficient duration and heat to properly ignite propellant powder. In the detonation of disruptive charges a detonating material such as lead azide is used, this material being sometimes ignited by an igniter composition comprising an oxidizer and a fuel.

For the purpose of this application, both ammunition priming charges and detonator igniters will be identified as "igniter compositions", and the term "alloys" will be used as defining broadly any mixture of different metals in any proportions.

The fuels of the igniter compositions hitherto used have been chiefly such oxygen deficient substances as antimony sulphide, lead sulphocyanate, and calcium silicide. The present invention comprises the discovery that numerous alloys have properties which adapt them to use as igniter fuels and that many such alloys are much superior to fuels previously used. It is necessary that the alloy, while susceptible to very rapid oxidation under the stimulus of a combustion initiator, be stable under moist storage, both alone and in intimate mixture with the oxidizer and/or the combustion initiator. Many different alloys have been found to be suitable. Generally stated, the metals forming such alloys are iron, antimony, arsenic, aluminum, bismuth, cerium, cobalt, copper, manganese, nickel, phosphorus, silicon, tin and zinc. Prominent among this group is antimony. Binary alloys of antimony with varying proportions of iron, aluminum, arsenic, bismuth, cobalt, copper and nickel, form excellent fuels. Antimony, however, is not an essential or necessarily characteristic ingredient. Alloys of iron with manganese, phosphorus and silicon, are suitable; likewise, alloys of silicon and manganese, copper and bismuth, and aluminum and manganese.

The foregoing examples are typical binary alloys usable as igniter composition fuels. The invention, however, is not limited to binary al-

loys. Desirable variations in the properties of binary alloys, as well as alloys possessing distinctive and desirable properties, are formed by admixtures of three or more of the above-mentioned metals. Thus, cerium, manganese, silicon, phosphorus, nickel, tin and zinc, in varying amounts, may be introduced into an alloy of antimony and iron. The proportions of the metals may vary widely, and if iron is present its carbon content may vary.

Among the alloys suitable for use in igniter compositions are the following:

Binary alloys:

	Percent		Percent
Antimony	50	Iron	50
Antimony	70	Iron	30
Iron	80	Manganese	20
Copper	20	Bismuth	80
Nickel	50	Antimony	50
Aluminum	80	Antimony	20
Copper	50	Antimony	50
Iron	80	Phosphorus	20
Silicon	50	Manganese	50
Cobalt	50	Antimony	50

Ternary alloys:

	Percent		Percent		Percent
Iron	40	Manganese	20	Antimony	40
Manganese	35	Silicon	10	Antimony	55
Iron	33	Nickel	33	Antimony	33
Iron	50	Antimony	45	Aluminum	5
Iron	50	Tin	25	Antimony	25

The foregoing examples are merely typical of the very numerous alloys which have been found to possess desirable fuel properties. The proportions given are merely illustrative, and are not to be taken as limiting the scope of the invention. In general, alloys containing iron are hardened by the presence of silicon. In certain ammunition primers hardness is a desirable property, since it enables the elimination of an inert abrasive, such as powdered glass. The abrasiveness of the alloys is controlled not only by their hardness but by their granulation, the finer granulations, say over 200 mesh, being less abrasive but more sensitive to percussion, while granulations from 100 to 200 mesh are more abrasive. Glass, however, may be retained where the alloy does not possess sufficient abrasiveness but is otherwise desirable.

The use of such alloys in igniter compositions and particularly in ammunition priming mixtures has been found to be beneficial in several different ways. In many mixtures the amount of explosive ingredient can be very materially reduced without any reduction in sensitiveness or priming capacity. Substantial reductions in maximum pressures have been secured with no detriment to muzzle velocity or barrel time. Due to the high gravimetric density of the alloys as

compared with other fuels, primary charges can, when necessary or desirable, be substantially increased. There is frequently a definite increase in sensitiveness over ordinary priming, particularly with non-fulminate combustion initiators. Wet loading is preferred, due to the fact that the finely ground alloys do not pack readily when dry; however, dry loading has been found entirely practicable. A further and most extraordinary result has been secured in that a single mixture functions satisfactorily in both rimfire and centerfire cartridges. This feat is believed to be without precedent. An example of such a mixture is the following:

	Per cent
Guanylnitrosaminoguanilyltetrazene (tetra- zene) -----	3
Lead styphnate -----	27
Lead nitrate -----	40
Alloy:	
Iron 30% } -----	30
Antimony 70% }	

Other typical priming compositions utilizing a metallic alloy fuel comprise 10% to about 60% of a combustion initiator, such as lead styphnate with a small admixture of tetrazene; 25% to 50% of an oxidizer, such as lead nitrate or a mixture of barium nitrate and lead peroxide; and 5% to 50% of such an alloy as iron-antimony, nickel-antimony, copper-bismuth, iron-tin-antimony, iron-nickel-antimony. An abrasive, such as glass, is sometimes desirable. These compositions, however, are mentioned by way of illustration only. Tetrazene and/or lead styphnate may be replaced wholly or in part by any other known sensitizer and/or initial explosive. Among such sensitizers and initial explosives may be mentioned mercury fulminate, basic lead styphnate, diazodinitrophenol, lead dinitrophenyl azide, mono-basic and di-basic lead picrate, normal and basic lead azide, lead methylene di-isonitroamine, the salts of tetrazene, the derivatives of tetrazole and their salts, such as lead azo tetrazole and the lead and copper ammonium salts of diazo-amino-tetrazole, lead hypophosphite, the lead salts of dinitro salicylic acid, the lead salts of di- and tri-nitro benzol, lead dinitro-ortho-cresylates, and lead nitro-phthalates. The oxidizing ingredient may comprise one or more of the usual oxides and peroxides, normal or basic nitrates, chlorates or permanganates; and other conventional fuels, such as antimony sulphide and calcium silicide, may be optionally used with any desired alloy.

The present applicants being the first to discover the utility of metallic alloys as igniter com-

position fuels, the appended claims are to be broadly construed.

What is claimed is:

1. An igniter composition comprising an alloy of iron with a metal selected from the group consisting of antimony, aluminum, manganese, phosphorus, tin and zinc.
2. An igniter composition comprising an alloy of antimony with a metal selected from the group consisting of aluminum, arsenic, bismuth, cobalt, copper, iron and nickel.
3. An igniter composition comprising an alloy of antimony and iron.
4. An igniter composition comprising an alloy of antimony and iron in the proportions of 25 to 50% antimony and 75% to 50% iron.
5. An ammunition priming composition comprising a combustion initiator, an oxidizer, and a fuel including an alloy of antimony and iron.
6. An ammunition priming composition comprising guanylnitrosaminoguanilyltetrazene, lead styphnate, an oxidizer, and a metallic alloy selected from the group of alloys consisting of antimony-iron, antimony-aluminum, antimony-arsenic, antimony-bismuth, antimony-cobalt, antimony-copper, antimony-nickel, iron-manganese, iron-phosphorus, silicon-manganese, copper-bismuth, aluminum-manganese, antimony-manganese-iron, antimony-manganese-silicon, antimony-iron-nickel, antimony-iron-aluminum, antimony-iron-tin, antimony-iron-cerium, antimony-iron-silicon, antimony-iron-phosphorus, and antimony-iron-zinc.
7. An ammunition priming composition comprising guanylnitrosaminoguanilyltetrazene, lead styphnate, an oxidizer, and an alloy of antimony and iron.
8. An ammunition priming composition comprising guanylnitrosaminoguanilyltetrazene, lead styphnate, an oxidizing nitrate, and an alloy of antimony and iron.
9. An igniter composition comprising an alloy selected from the group of alloys consisting of antimony-iron, antimony-aluminum, antimony-arsenic, antimony-bismuth, antimony-cobalt, antimony-copper, antimony-nickel, iron-manganese, iron-phosphorus, silicon-manganese, copper-bismuth, aluminum-manganese, antimony-manganese-iron, antimony-manganese-silicon, antimony-iron-nickel, antimony-iron-aluminum, antimony-iron-tin, antimony-iron-cerium, antimony-iron-silicon, antimony-iron-phosphorus, and antimony-iron-zinc.

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