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FUZE POWDER COMPOSITION

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The invention herein described and claimed, if patented, may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon.

The present invention relates to new and substantially non-gaseous powder composition intended for use in powder trains of ammunition to provide a definite burning time interval. Particularly, the invention resides in the use of dichromated zirconium-nickel alloy powders and titanium-nickel alloy powders, together with potassium perchlorate and barium chromate to produce the fuze powders hereinafter described and claimed.

The primary object of the invention is to provide a non-gaseous fuze powder composition which, upon ignition, will burn for a definite interval without failure to burn through at temperatures between -65° F. and +170° F. A further object is to provide new fuze powder compositions which are easily ignited even when compressed to high density and which will not change substantially, in burning time, after storage at normal and elevated temperatures up to 170° F. over long periods of time.

Practically all non-gaseous fuze powders presently employed, increase in burning time when stored at normal and elevated temperatures up to 170° F. This is generally due to the slow-oxidation of the metal or alloys employed. In 1947, alloys of zirconium-nickel and titanium-nickel in powdered form first became available commercially. I have discovered that the employment of dichromated zirconium-nickel and titanium-nickel alloy powders, together with potassium perchlorate and barium chromate, each in a very finely divided state, produces a fuze powder composition which meets each and all of the requirements indicated above.

As examples, the following compositions have been particularly successful in producing easily ignitable, uniform burning, non-gaseous fuze powders of definite burning time intervals, which will burn through at temperatures between -65° F. and +170° F. and which will not change appreciably in burning time after storage at +170° F. over long periods of time.

No.	Dichromated Zirconium-Nickel (Percent)	Dichromated Titanium-Nickel (Percent)	Potassium Perchlorate (Percent)	Barium Chromate (Percent)	Binder (Percent)	Burning Rate Column, 11" long x 0.2" diam. (sec./in.)
1	17 (50/50)		5	78		14
2	28 (30/70)		15	57		20
3	23 (30/70)		14	60		25
4	3 (70/30)					
5	30 (30/70)		19	51		17
6	21 (30/70)		14	60		12
7	5 (70/30)					
8	20 (50/50)		5	75		10
9		15 (70/30)	5	80		15
10	22 (70/30)		5	70	3 Ethyl Cellulose	2
11	22 (70/30)		5	70		4
12	17 (50/50)		8	72	3 Ethyl Cellulose	6
13		20 (70/30)	5	75		5
14		15 (70/30)	10	75		11
15	33 (30/70)		8	59		9
16	13 (50/50)		5	82		19
17	17 (50/50)		3	83		13

It is not intended that this invention be limited to the specific examples set forth above, as it is known that by varying the proportions of the combining ingredients,

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viz, dichromated zirconium-nickel alloy, dichromated titanium-nickel alloy, potassium perchlorate and barium chromate, the burning rates of the desired compositions may be varied over a wide range. The burning rates may also be varied widely by varying the proportions of zirconium to nickel or titanium to nickel in the alloys. In compositions prepared according to the present invention containing dichromated zirconium-nickel alloys, the dichromated zirconium-nickel alloy may vary, for example, from 10 to 35 percent, the potassium perchlorate from 2 to 20 percent and the barium chromate from 50 to 85 percent. The zirconium in the zirconium-nickel alloys may vary, for example, from 30 to 70 percent. More or less similar wide variations may be made in the proportions of the ingredients of the compositions containing dichromated titanium-nickel alloys, the proportion of each ingredient and the composition of the alloy being chosen according to the burning rate desired.

These new fuze powder compositions are very readily prepared, but careful control of the particle size of the ingredients is essential. It is desirable that all of the ingredients be finely divided so as to pass through a 250 mesh screen. The powdered zirconium-nickel alloy and the powdered titanium-nickel alloy is dichromated by immersing it in an aqueous solution of 1 to 20 percent sodium dichromate containing less than one percent of an alkali acid sulfate, boiling for 1/2 hour, filtering and drying at 100° C. Dry incorporation of the fuze powder ingredients may be used, but it is preferable to wet mix the compositions using water or alcohol. After thorough incorporation, the fuze powders are granulated in commercially available mechanical granulators or by passing through screens. Although binding agents have not been found necessary to assist in granulating and pelleting these powders, one may be used if special cases require it.

Having thus described the invention, what is claimed as new is:

1. A fuze powder composed of a mixture containing 10 to 35 percent finely divided dichromated zirconium-nickel alloys, 2 to 20 percent potassium perchlorate and 50 to 85 percent barium chromate.

2. A fuze powder composed of a mixture of about 10 to 35 percent dichromated zirconium-nickel alloys sufficiently finely divided to pass through a 250 mesh screen, 2 to 20 percent potassium perchlorate and 50 to 85 percent barium chromate, each sufficiently finely divided to pass through a 250 mesh screen.

3. A fuze powder composed of a mixture containing dichromated titanium-nickel alloy powder, potassium perchlorate and barium chromate, each sufficiently finely divided to pass through a 250 mesh screen.

4. The fuze powder of claim 2 in which the alloy of zirconium-nickel contains from 30 to 70% zirconium.

5. The fuze powder of claim 2 containing additionally about 3% of an organic binder.

6. The fuze powder of claim 5 in which the organic binder is ethyl cellulose.

7. A fuze powder containing from 10 to 35% of a

member of the group consisting of dichromated zirconium-nickel and titanium-nickel alloys, the remainder of said powder consisting substantially of inorganic oxidizing agents.

8. The fuze powder of claim 7 in which the alloy of zirconium-nickel contains from 30 to 70% zirconium.

9. The fuze powder of claim 7 in which the alloy of titanium-nickel contains from 30 to 70% titanium.

10. The fuze powder of claim 7 in which the inorganic oxidizing agents are chosen from the class consisting of potassium perchlorate and barium chromate.

11. A stable non-gaseous fuze powder composition comprising a major proportion of an inorganic oxidizing agent and a minor proportion of a component selected from the group consisting of dichromated zirconium-nickel alloy powder, dichromated titanium-nickel alloy powder, and mixtures of dichromated zirconium-nickel alloy powder and dichromated titanium-nickel alloy powder.

12. A stable, non-gaseous fuze powder composition comprising a major proportion of an inorganic oxidizing agent and a minor proportion of a component consisting of dichromated zirconium-nickel alloy powder.

13. A stable, non-gaseous fuze powder composition comprising a major proportion of an inorganic oxidizing agent and a minor proportion of a component consisting of dichromated titanium-nickel alloy powder.

14. A stable, non-gaseous fuze powder composition comprising a major proportion of an inorganic oxidizing agent and a minor proportion of a component consisting of a mixture of dichromated zirconium-nickel alloy powder and titanium-nickel alloy powder.

15. A stable non-gaseous fuze powder composition comprising a major proportion of a mixture of potassium perchlorate and barium chromate, and a minor proportion of a component selected from the group consisting of dichromated zirconium-nickel alloy powder, dichromated titanium-nickel alloy powder, and mixtures of dichromated zirconium-nickel alloy powder, and dichromated titanium-nickel alloy powder.

16. The method of preparing a stable non-gaseous fuze powder composition which comprises treating an alloy powder selected from the group consisting of zirconium-nickel alloy powder, titanium-nickel alloy powder, with an aqueous solution of sodium dichromate, whereby a dichromated alloy powder is produced, and incorporating with said dichromated alloy powder, a major proportion of an inorganic oxidizing agent.

17. The method of preparing a stable non-gaseous fuze powder composition which comprises immersing an alloy powder selected from the group consisting of zirconium-nickel alloy powder, and titanium-nickel alloy powder, in an aqueous solution containing 1 to 20 per cent sodium dichromate, boiling said solution while said alloy powder is immersed therein, whereby a dichromated alloy powder is produced, and incorporating with said dichromated alloy powder, a major proportion of an inorganic oxidizing agent.

18. The method according to claim 16 wherein said aqueous solution of sodium dichromate contains 1 to 20 per cent sodium dichromate and less than 1 per cent of an alkali acid sulfate.

19. The method according to claim 16 wherein the incorporation of said dichromated alloy powder with said inorganic oxidizing agent is effected in the presence of a wetting material selected from the group consisting of alcohol and water.

20. The method according to claim 16 wherein after the incorporation with said dichromated alloy powder of an inorganic oxidizing agent the resulting mixture is subjected to a granulation operation.

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