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# UNITED STATES PATENT OFFICE.

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## TRACER MIXTURE.

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(GRANTED UNDER THE ACT OF MARCH 3, 1883; 22 STAT. L. 625.)

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment to me of any royalty thereon, in accordance with the act of March 3, 1883.

The subject of my invention is a tracer mixture.

The primary object of this invention is the provision of a mixture which will burn with a brilliant color so as to clearly mark the path of the projectile which contains it.

With the foregoing and other objects in view, my invention resides in the novel arrangement and combination of ingredients hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

A mixture such as forms the subject of my invention will consist essentially of a salt of an alkali earth metal having a characteristic color of burning, a second salt acting as an oxidizing agent but which also preferably though not necessarily will have the same characteristic color of burning, a suitable fuel and a binder. To these ingredients, if it is desired to increase the brilliancy of the flame, may be added suitable oxidizing compounds.

A mixture which has proven successful in practice is one such as prepared according to the following formula:

| | Parts. |
|---|---|
| Strontium nitrate | 50 |
| Strontium carbonate | 2 |
| Magnesium | 25 |
| Gum arabic | 23 |

This mixture will burn with the characteristic red flame of strontium. A green burning mixture may be obtained by substituting for the strontium components suitable barium compounds as in the following mixture:

| | Parts. |
|---|---|
| Barium nitrate | 60 |
| Barium carbonate | 2 |
| Magnesium | 25 |
| Gum arabic | 23 |

The proportions of the ingredients cited in either of the formulæ given above may be altered by the addition of a suitable oxidizing agent where it is desirable to augment the brilliancy of the characteristic flame. So, if desired, a suitable amount of potassium nitrate or other oxidizing material may be added directly to either of the above mixtures as in the composition:

| | Parts. |
|---|---|
| Strontium nitrate | 50 |
| Strontium carbonate | 2 |
| Magnesium | 25 |
| Gum arabic | 23 |
| Potassium nitrate | 5 |

The green burning composition may likewise be altered by the addition of five or any other suitable number of parts of potassium nitrate.

While under certain conditions the use of gum arabic as a binder is preferable, any other suitable binder material may be employed, but preferably calcium resinate since the same will not only act as a suitable binder but will lend brilliance to the colored flame, as in the composition:

| | Parts. |
|---|---|
| Strontium nitrate | 50 |
| Strontium carbonate | 2 |
| Magnesium | 25 |
| Calcium resinate | 15 |
| Potassium nitrate | 5 |

The calcium resinate may be employed also with the green burning composition as in the formula:

| | Parts. |
|---|---|
| Barium nitrate | 60 |
| Barium carbonate | 2 |

| | Parts. |
|---|---|
| Magnesium | 25 |
| Calcium resinate | 15 |
| Potassium nitrate | 5 |

Potassium nitrate is a powerful, quick burning oxidizing agent. It is sometimes preferable to use a slower burning oxidizer. For this purpose, red lead or any equivalent compound may be employed. A composition which has proved successful in practice and which is somewhat less powerful and slower burning than those given above is as follows:

| | Parts. |
|---|---|
| Barium nitrate | 60 |
| Barium carbonate | 2 |
| Magnesium | 25 |
| Calcium resinate | 15 |
| Potassium nitrate | 4 |
| Red lead | 7 |

Those compositions containing strontium will give characteristic red flame of that metal; those mixtures containing barium will burn with the characteristic green flame of that element. If it is desired to have compositions having other characteristic colors of burning, for the barium or strontium ingredients given in the above formulæ, sodium salts, or other compounds having distinct color characteristics may be substituted in the proper proportions.

The ingredients used and the proportions employed may be varied, moreover, within wide limits as will be clear to those skilled in the art. It has been found that aluminum powder or any other suitable fuel may be substituted for the magnesium and give satisfactory results. For gum arabic any other suitable binder may be employed and in those mixtures in which calcium resinate is used, other resinates or other compositions having similar properties, may be substituted. Very good results have been obtained with the use of lead resinate and barium resinate. The amount of resinate used in these mixtures will depend entirely upon the purity of the substituted resinate.

Tracer mixtures made according to any one of the formulæ given above are especially satisfactory for use with .30 and .50 caliber projectiles. My invention, however, is by no means limited to this use, nor, indeed, is it confined to use with tracers since any one of these mixtures may be employed in the manufacture of other pyrotechnic compositions whether military or industrial.

I claim:

1. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, magnesium, potassium nitrate, red lead and calcium resinate.

2. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, magnesium, potassium nitrate, red lead and a resinate.

3. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, potassium nitrate, red lead and a resinate.

4. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, magnesium, potassium nitrate and a resinate.

5. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, potassium nitrate and a resinate.

6. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, an oxidizing agent other than the nitrate or carbonate and a resinate.

7. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, magnesium, potassium nitrate, red lead and a binder.

8. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, potassium nitrate, red lead and a binder.

9. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, magnesium, potassium nitrate and a binder.

10. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, potassium nitrate and a binder.

11. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel, an oxidizing salt of an alkali metal and a binder.

12. A tracer composition including a nitrate of an alkali earth metal with a carbonate of the same metal, a suitable fuel, an oxidizing agent other than the nitrate or carbonate and a binder.

13. A tracer composition including a nitrate of an alkali earth metal, a carbonate of an alkali earth metal, a suitable fuel, an oxidizing agent other than the nitrate or carbonate and a binder.

14. A tracer composition including an inorganic oxidizing salt that will give a colored flame upon ignition, a second inorganic oxidizing salt, an oxidizing agent other than the salts named, a suitable fuel and a binder.

15. A tracer composition including an inorganic oxidizing salt that will give a colored flame upon ignition, a second inorganic oxidizing salt that will also give a colored flame upon ignition, an oxidizing agent other than the salts named, a suitable fuel and a binder.

16. A tracer composition including one salt of an alkali earth metal adapted to

burn with a characteristic color, another salt of the same alkali earth metal adapted to burn with a characteristic color, a suitable fuel, an oxidizing agent and a binder.

17. A tracer composition including one salt of an alkali earth metal adapted to burn with a characteristic color, another salt of an alkali earth metal, a suitable fuel, an oxidizing agent and a binder.

18. A tracer composition including a nitrate of an alkali earth metal, a carbonate of the same metal, a suitable fuel and a binder.

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