UNITED STATES PATENT OFFICE.

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EXPLOSIVE COMPOSITION.

1,420,364. Specification of Letters Patent. **Patented June 20, 1922.**

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To all whom it may concern:

Be it known that I, LEON O. BRYAN, a citizen of the United States, and a resident of Wilmington, in the county of New Castle and State of Delaware, have invented a certain new and useful Explosive Composition, of which the following is a specification.

This invention relates to high explosives containing a relatively high percentage of nitrocellulose such as ground smokeless powder and a relatively low percentage of a liquid explosive, as for example nitroglycerine, nitrated polymerized glycerine, or glycol dinitrate.

In times past, nitrocellulose has been used with nitroglycerine in the manufacture of high explosives for the purpose of gelatinizing nitroglycerine, and when so used it can be employed only in small proportions,—for example, blasting gelatin is ordinarily composed of 92.0% nitroglycerine and 8.0% nitrocellulose. Even lower ratios of nitrocellulose are used in making so-called gelatin dynamites and gelingnites; thus, an explosive containing 62.0% of nitroglycerine is often manufactured with only 2.0% of nitrocellulose. Explosives of this type are of a gelatinous, plastic nature and are entirely unlike the explosives which I desire to protect by patent.

Nitrocellulose in a finely divided condition, such as is obtained, for example, by the disintegration of smokeless powder, may be employed in the manufacture of blasting explosives or high explosives without the use of any liquid explosives, but such explosives are extremely bulky, very dusty, and consequently, dangerous to manufacture and to handle, and of comparatively low strength and velocity of detonation. In attempting to use a liquid explosive in conjunction with a greater proportion of nitrocellulose than is ordinarily used in making a gelatin dynamite or a blasting gelatin, it was found that the nitrocellulose gelatinizes with practically all known liquid explosives, and forms a product which, if the percentage of liquid explosive be high enough, resembles a gelatin dynamite, even though said percentage is less than that of the nitroglycerine in a typical gelatin dynamite. However, when somewhat lower percentages of liquid explosive are used, the product soon becomes a sticky mass which hardens with age and eventually becomes entirely insensitive to detonation. Thus for example an explosive consisting of 50.0% ground smokeless powder, 20.0% nitroglycerine and 30.0% sodium nitrate, while it can be satisfactorily mixed and cartridged, becomes extremely hard within 24 hours and will fail to detonate. This phenomenon is due to the gelatinization which takes place between the nitrocellulose and the nitroglycerine.

I have now discovered that if the percentage of liquid explosive, for example nitroglycerine, is made sufficiently low and if certain precautions are observed in the manufacture of the explosive, I can produce explosives which are entirely satisfactory from the standpoint of strength, density, velocity of detonation, and freedom from dust; and, what is of most importance, these explosives retain a soft, granular structure indefinitely, and can be completely detonated with an ordinary commercial blasting cap.

The percentage of nitroglycerine which I prefer to use may vary from 1.0–10.0% based upon the weight of the complete explosive mixture. A typical example of the composition of my explosive would be—nitroglycerine 5.0%, ground smokeless powder 57.0%, sodium nitrate 37.0%, and chalk 1.0%. These proportions might be varied so as to contain from 1.0–10.0% nitroglycerine, from 30.0–90.0% ground smokeless powder, and from 0.0–60.0% sodium nitrate. In addition, other materials might be added, as for example, combustible material such as wood pulp, corn meal, flour, etc., which materials are ordinarily used in the manufacture of dynamite. In place of sodium nitrate, I may use another alkali-forming metal nitrate such as potassium nitrate or barium nitrate.

In the manufacture of this explosive, I have found that it is essential to mix the materials thoroughly and for a sufficient length of time to insure that the gelatinization of the nitrocellulose and the nitroglycerine or glycol dinitrate is complete before the mixing operation is finished. The length of time which this gelatinization takes will depend upon the method of mixing and other factors, such as temperature, moisture content of ingredients, and size of charge. With

a mixer of the type ordinarily used in the manufacture of dynamite in this country, a mixing charge of from 600 to 1100 lbs., a temperature of the various ingredients from 45 to 80° F., and a moisture content between 0 and 2% for the several ingredients, the mixing period should not be less than 10 minutes. I have found that if the materials are mixed for a relatively short period of time, as for example, 2 or 3 minutes, the cartridges will become hard and insensitive. I have also found that when using more than 10.0% of nitroglycerine, it is impossible to prevent the hardening of the cartridges even by prolonging the mixing time beyond a point where it would be feasible or economical to continue it. I believe that by using a low percentage of nitroglycerine with a relatively high percentage of nitrocellulose and mixing for a sufficient length of time, the nitroglycerine is completely gelatinized, and that no further gelatinization takes place after the mixing operation is complete, and that this explains the good results which I have obtained.

The nitrocellulose used in my new explosive compositions should preferably be a finely ground smokeless powder having a nitrogen content above 12.4%. To increase the sensitiveness of the explosive composition I may incorporate a small percentage of powdered aluminum, for example from 0.3 to 5%.

I claim:—

1. An explosive composition comprising more than 25% of ground smokeless powder and from about 1 to 10% of a liquid explosive.

2. An explosive composition comprising from about 30 to 90% of ground smokeless powder and from about 1 to 10% of a liquid explosive which is a nitrate of a polyhydric alcohol.

3. An explosive composition comprising from about 30 to 90% of ground smokeless powder and from about 1 to 10% of nitroglycerine.

4. An explosive composition comprising an alkali-forming metal nitrate, more than 25% of ground smokeless powder, and from about 1 to 10% of a liquid explosive.

5. An explosive composition comprising a substantial proportion, but less than 60%, of an alkali-forming metal nitrate, from about 30 to 90% of ground smokeless powder, and from about 1 to 10% of a liquid explosive which is a nitrate of a polyhydric alcohol, said liquid explosive being present in a completely gelatinized condition.

6. An explosive composition comprising a substantial proportion, but less than 60%, of an alkali-forming metal nitrate, from about 30 to 90% of ground smokeless powder, and from about 1 to 10% of nitroglycerine.

7. An explosive composition comprising from about 30 to 50% of an alkali metal nitrate, from about 40 to 65% of ground smokeless powder, and from about 1 to 10% of nitroglycerine, the latter being present in a completely gelatinized condition.

8. An explosive composition comprising more than 25% of nitrocellulose, from about 1 to 10% of a liquid explosive, and from about 0.3 to 5% of powdered aluminum.

9. An explosive composition comprising from about 40 to 65% of nitrocellulose, more than 30% of sodium nitrate, from about 1 to 10% of nitroglycerine, about 1% of chalk, and about 1% of powdered aluminum.

In testimony whereof I affix my signature.

LEON O. BRYAN.