

UNITED STATES PATENT OFFICE

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BLACK POWDER AND METHOD OF MANUFACTURING THE SAME

No Drawing.

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The object of the present invention is to provide an improved explosive, of the nature of black powder, and method of manufacturing the same. Black blasting powder is one of the most useful of explosives. It finds many important applications; sells at a lower price than, practically, any of the detonating explosives, but it is open to the objection that it has a low strength factor.

bility of strength regulation, and that the high temperature of combustion and the deficiency of oxygen of regular black powder be utilized to assist in increasing the strength factor.

It has, heretofore, been proposed to increase the strength factor of black blasting powder by incorporating with the same, in the usual process of manufacture, one or more of a variety of strengthening agents, such as ammonium perchlorate, potassium perchlorate, ammonium nitrate, nitro-compounds and organic nitrates.

However, most of the methods, heretofore proposed, with which I am familiar, have the disadvantage of an increased hazard which renders them inapplicable to the usual black powder mills, and equipment. Some of them present the difficulty that, when incorporated in intimate contact with the usual sodium nitrate or potassium nitrate of black powder, a greatly increased hygroscopicity factor is introduced and black powder, at its best, is not of great moisture resistance. For instance, ammonium perchlorate alone is not seriously hygroscopic, but when intimately mixed with nitrate of soda, the mixture is more hygroscopic than nitrate of soda by itself. Further, various ingredients, which might be proposed for incorporation with black powder to strengthen it, have other individual disadvantages in one or more of such items as manufacture, handling, shipment, storage and application.

Some of the objects which should, desirably, be attained or approached in making stronger black blasting powder, are: that it be adapted for manufacture in the usual black powder mills; that there be no increase in cost over usual black powder; that normal black powder safety in manufacture, handling, shipment, storage and application be maintained; that the usual methods of handling black powder, in the respects mentioned, will apply; that there be no increase in hygroscopicity; that the product possess the capa-

Increased black powder strength without any, or at least without a proportional increase in cost, represents a distinct direct saving to the consumer in powder purchases. It offers further saving in less drilling because of possible increased spacing of holes and less springing of holes because of the lack of necessity of getting so much powder in the holes, to accomplish the desired work.

The above described requirements of the situation and the present price and availability of the desired ingredients point distinctly to oxygen carrying inorganic salts, such as ammonium nitrate, especially, and various perchlorates as ammonium and potassium, as the means to secure the desired results. The oxygen carrying explosive salts used in carrying out my invention are ammonium nitrate and perchlorates, to which this application is limited. I will use ammonium nitrate in the following description of one way of arriving at the invention.

Ammonium nitrate on thermal decomposition or explosion forms gas entirely and has an explosive strength equal to about 70% of that of nitroglycerine. It exerts a much greater explosive strength than sodium or potassium nitrate which are the normal oxygen carriers of black powder. In black powder manufacture, as is well known, sodium nitrate or potassium nitrate is incorporated under heavy wheels with sulphur and charcoal. The product is pressed into cakes, the cakes grained and the grains usually separated into various sizes by screening. The grains are usually glazed with graphite, dried and packed for shipment in metal kegs.

The present invention differs, radically, from black powder made by incorporating ammonium nitrate, sulphur and charcoal in the wheel mills, or by incorporation under the wheels, of ammonium nitrate, mixed with the usual ingredients. In the latter case, such intimate contact of sodium nitrate or potassium nitrate with ammonium nitrate

would result, that there would be greatly increased hygroscopicity. Also, such a mixture would be less safe in the rather violent operations of wheeling, pressing and grain-

ing. The invention contemplates the preparation of black powder in the usual way, through the final glazing operation, as a rule, though regular unglazed powder is sometimes used and is within the scope of the invention. This regular black powder may be in the form of grains of quite uniform size, or in that of grains of mixed sizes, often called "run of mill" in the industry. There is separately prepared the desired oxygen carrying explosive salt,—as ammonium nitrate. This preparation may merely consist of drying and converting to the proper particle size, the particle size being controlled at will to suit the particular case. For the best conditions usually, the oxygen carrying explosive salt should be in a dry, free-flowing crystalline form. It should be coated or glazed with a material similar to that used in glazing the black powder. In many cases, it should further be given a coating of water-proofing material, such as petrolatum, paraffin or rosin. The salt may be smaller in particle size than some sizes of black powder grains and equal others. It will mix especially well with "run of mill" powder.

Only after both ingredients—the usual black powder and the oxygen carrying explosive salt—have been completely prepared, are they brought together. This simply involves good intermingling of the particles of each, which may be carried out in the usual glazing barrels, or by mixing in the manner described and thereafter packing in the final containers.

Thus, it will be seen that the invention answers, to a large extent, each requirement of the situation as follows:

There is ready adaptability to usual black powder mills because black powder is made as usual and crystals or particles of the oxygen carrying explosive salt may be coated and mingled with the black powder in the usual glaze barrels and the mixture packed for shipment in the usual way.

At present prices for ammonium nitrate, the cost of the mixture would be little more than that of regular black powder. Ammonium perchlorate is somewhat more costly, but its great strength offsets this to a considerable extent.

The hazard, as compared with usual black powder, in manufacture, handling, shipment, storage and application is kept within satisfactory limits, because the oxygen carrying explosive salts are prepared separately and only mingled with the black powder as a last step. Further, the salts proposed—ammonium nitrate, ammonium perchlorate and potassium perchlorate—are of a high degree of

safety in handling. I distinctly eliminate chlorate from consideration. My mixtures would have lower flame lengths and temperatures, an important factor in coal mines.

My mixture would and could be handled by producer and consumer in all respects essentially as regular black powder is handled.

I avoid undue moisture absorption or hygroscopicity by refraining from mingling the salts in intimate contact, a condition usually conducive to increased absorption of moisture. Ammonium perchlorate and potassium perchlorate are of a relatively low degree of hygroscopicity. Ammonium nitrate, when reasonably pure, unmixed with other salts and suitably coated, is not greatly inferior to regular black powder in hygroscopicity. I wish to stress the importance of my procedure of not mingling my oxygen carrying explosive salts in intimate contact with the normal salts of black powder.

Strength regulation of the composition is simple, merely consisting in varying the proportions of black black powder and oxygen carrying explosive salts.

Black powder has a relatively high temperature of combustion, long flame on combustion and a large deficiency of oxygen. The flame and temperature conditions are such that excellent efficiency is derived from the presence of the oxygen carrying salts. Also the oxygen carrying salts with the oxygen deficient black powder cause a better balanced mixture for full blasting efficiency.

Since I use my stronger black powder over a widely varied range of blasting conditions, I do not desire to limit my proportions closely. Dynamites or detonating explosives have been made from 5% to 100% in strength. In the past, black powder has been handicapped by a small strength range in comparison, which has been largely controlled by minor variations in manufacture and a variation in grain sizes. While maintaining essentially its usual characteristics, I make possible a far wider strength range and in an entirely new manner. There is no limitation on my mixtures, therefore, except that reliable results require not less than 40% of regular black powder present. I contemplate employing from 2 to 60% by weight of the oxygen carrying explosive salt and from 98 to 40% by weight of black powder.

While representing somewhat less desirable conditions, especially as regards hygroscopicity, it is understood that any two or all three of my oxygen carrying explosive salts may be used in the same mixture, and I claim this as being within the scope of my invention.

It is emphasized that stronger black powder, in order to find extensive application, should be characterized in manufacture, shipment and application by features which keep its cost to the manufacturer and consumer,

per unit of weight, at or closely approaching that of usual black powder. The quality in all respects should equal or approach that of usual black powder. These objects rendered necessary the adaptation of a number of conditions to the main ends. It has been explained how each adaptation has fitted into the whole and in the simplicity of accomplishment lies to an important extent the value of the invention. I wish to emphasize that the present invention is in the realm of low explosives and differs radically in its nature, action and field of use from detonating or high explosives and the term "low explosives" as used in the accompanying claims, is intended to refer to the explosives of the black powder or non-detonating type. I am aware of the fact that it has heretofore been proposed to use ammonium nitrate in conjunction with detonating explosives to increase their brisance and secure a shattering hammer blow action, in use. The explosive of the present invention is designedly made to avoid the foregoing action characteristic of high explosives, but, upon the other hand, increases the strength of the black powder type of explosives while maintaining the pushing, heaving and relatively widespread action of black powder. The combination of black powder and ammonium nitrate reduces any brisance or shattering action of the ammonium nitrate rather than augments it.

I contemplate compressing the intermingled grains into suitable pellets in a manner common in the use of ordinary blasting black powder.

It is to be understood that the invention includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. A low explosive of the character described consisting of intermingled grains of black powder, and an oxygen carrying explosive salt of the group consisting of ammonium nitrate and perchlorate, the grains of at least one of the said substances being coated with a protecting material.

2. The herein described method of preparing a low explosive of the nature of black powder but of stronger blasting efficiency which consists of separately graining black powder and oxygen carrying salts of the group consisting of ammonium nitrate and perchlorate and wherein the normal salt of the black powder is not exposed at the face of the grains of said powder, and subsequently intermixing these separate grains of black powder and oxygen carrying explosive salts.

3. The herein described method of preparing a low explosive of the nature of black powder but of stronger blasting efficiency which consists of separately graining black powder and oxygen carrying salts of the

group consisting of ammonium nitrate and perchlorate and wherein the normal salt of the black powder is not exposed at the face of the grains of said powder, and subsequently intermixing these separate grains of black powder and oxygen carrying explosive salts in such proportions that there will be 40% to 98% by weight of black powder grains in the resultant mixture.

4. The process as described in claim 3, in which the grains of oxygen carrying explosive salt are coated with a material which will cause them to have the color of black powder, and also further separate them from intimate contact with the alkali metal nitrate of the black powder.

5. The process as described in claim 3, in which the grains of oxygen carrying explosive salt are coated with a moisture and water-proofing material, before intermingling with the black powder, this coating material also serving to prevent intimate contact of the grains with the alkali metal nitrate of the black powder.

6. The process of preparing a low explosive of the nature of black powder, which avoids the hygroscopicity resultant from intimate contact of black powder with an oxygen carrying explosive salt, which consists of graining black powder, graining an oxygen carrying explosive salt of the group consisting of ammonium nitrate and perchlorate, and coating the grains of both of said materials with a material which tends to maintain separation between them.

7. The process of preparing a low explosive of the nature of black powder, which avoids the hygroscopicity resultant from intimate contact of black powder with an oxygen carrying explosive salt, which consists of graining black powder, graining an oxygen carrying explosive salt of the group consisting of ammonium nitrate and perchlorate, coating the grains of each of said materials with a material which will tend to maintain separation between them, and thereafter coating the grains of the oxygen carrying explosive salt with a water-proofing composition.

8. The herein described method of preparing a low explosive blasting medium of the nature of black powder which avoids the hygroscopicity resulting from intimate contact of the normal salt of black powder with oxygen carrying explosive salts of the character described, which consists of incorporating the normal salt of black powder with combustible and coating materials which form a protective coating with respect to said normal salt of black powder, graining the incorporated mass and thereafter intermingling these grains with separate grains of an oxygen carrying explosive of the group consisting of ammonium nitrate and perchlorate.

9. The herein described method of preparing a blasting medium of the nature of black powder, but of stronger blasting efficiency, which consists in separately preparing grains of black powder and grains of an oxygen carrying explosive salt of the group consisting of ammonium nitrate and perchlorate, coating the grains of each of the two materials with a graphite, and thereafter intermingling the grains of the two materials.

10. The process of preparing a blasting medium of the low explosive type, which avoids the hygroscopicity resultant from intimate contact of black powder with ammonium nitrate, which consists of graining black powder, separately graining ammonium nitrate, coating the grains of one of said materials with a substance tending to maintain separation between them, and thereafter intermixing said granules.

11. The process of preparing a blasting medium of the low explosive type, which avoids the hygroscopicity resultant from intimate contact of black powder with an oxygen carrying explosive salt, which consists of graining black powder, separately graining ammonium nitrate, coating the grains of ammonium nitrate with graphite and thereafter intermixing the separate grains of powder and ammonium nitrate.

12. The process of preparing a blasting medium of the low explosive type, which avoids the hygroscopicity resultant from intimate contact of black powder with an oxygen carrying explosive salt, which consists of graining black powder, separately graining ammonium nitrate, coating the grains of ammonium nitrate with graphite, further coating said grains of ammonium nitrate with waterproofing material, and thereafter intermixing the separate grains of powder and ammonium nitrate.

13. A low explosive of the nature of black powder, which consists of intermixed grains of black powder and ammonium nitrate, the grains of the two substances being distinctly separate from each other, and the grains of one of said substances being coated with a material tending to maintain separation between the grains of the two materials.

In testimony whereof I affix my signature.
ROY LINDEN HILL.