

UNITED STATES PATENT OFFICE.

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EXPLOSIVE POWDER.

SPECIFICATION forming part of Letters Patent No. 260,786, dated July 11, 1882.

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To all whom it may concern:

Be it known that I, WILLIAM R. QUINAN, a citizen of the United States, residing at the city of San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Explosive Powders, of which the following is a full, clear, and exact description, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of detonating explosives which more or less resemble gunpowder in their strength and mode of action, and are known as "low powders," in contradistinction to the stronger grades of detonating explosives.

The object of my invention is to make a low powder which can be readily exploded by the ordinary blasting-cap by using a small portion of nitro-glycerine in combination with other ingredients which form the essential elements of gunpowder.

It is a well established principle that a very small percentage of nitro-glycerine will detonate or cause the sudden conversion into gas of gunpowder and analogous mixtures when the nitro-glycerine itself is detonated by the fulminate cap. The difficulty to be overcome in making a low powder on this principle is to retain such small percentage of nitro-glycerine in such a state that though distributed in the mixture it can be readily detonated. When a small proportion of nitro-glycerine is mixed with the pulverized ingredients of gunpowder or analogous gas-producing mixtures it is so taken up and held that the ordinary blasting-cap will not detonate it.

The substances ordinarily used in forming with nitro-glycerine the stronger or high explosive powders may be classed as porous substances or absorbents proper and non-porous substances, or those which hold the nitro-glycerine by surface attraction. The power of this surface attraction for nitro-glycerine varies with different non-porous or non-absorbent substances. Some possess it slightly, and certain oily substances exercise a feeble repulsion. Whatever power of surface attraction a non-porous substance may possess it is plain that the amount of nitro-glycerine which will be taken up and held by a given weight of any such substance depends on the extent of sur-

face exposed. A solid lump will hold only the amount which adheres to its surface. If, however, the lump be broken into fragments new surfaces are formed, giving with every division an increasing surface of attraction. Owing to this attraction the particles of nitro-glycerine are separated more and more by being made to cover more surface, until if the process of division be carried far enough the nitro-glycerine ceases to give any indication of its presence as a liquid and loses the property of detonation by the ordinary cap. The greater the specific attraction of the substance for nitro-glycerine the more rapidly and readily will the extension of the surface bring about this condition of attenuation. The nitrates of soda and potash and the various other explosive salts used as oxydizing agents in nitro-glycerine powders belong to this class of non-porous or non-absorbent substances which hold the nitro-glycerine by surface attraction. Their specific attraction for nitro-glycerine is comparatively strong. Heretofore in forming high explosive powders with nitro-glycerine these nitrates or other explosive salts have been pulverized or reduced to fine particles. Owing to their great extent of surface in a given weight, these particles will take up and render practically inexplosive the small proportions of nitro-glycerine desirable to use in low powders. This result, being in all essential respects the same as that given by the employment of veritable absorbents or porous substances, has probably caused the value in the problem of making low powders of the distinction between the action of veritable porous absorbents and such non-porous or surface-attracting substances to be hitherto overlooked. Thus another inventor has found a means of counteracting this so-called "absorption" of the nitro-glycerine by coating or varnishing the pulverized salts used with some substance having less attraction than such salts for the nitro-glycerine. I am the first to discover the cause of the failure to produce a low powder from the mixture of such explosive salts and small proportions of nitro-glycerine—viz., the great extent of surface attraction exercised by the salts in the pulverized condition in which they have been hitherto employed—and the remedy for this so-called "absorption" without changing the character of the surface—viz., to lessen

its extent by employing the salts in the form of larger masses or grains.

The carbonaceous ingredient or ingredients or the element which in the explosion furnishes the carbon or hydrogen or both to unite with the oxygen of the nitrate or other explosive salt may be one or several of a great variety of substances. For the purposes of my invention it should be essentially non-porous. To diminish as much as possible the surface, I generally employ a granular form and by preference a spherical grain as giving less surface than any other. As the nitrate or other explosive salt properly forms more than two-thirds of the mixture, its condition is of greater importance than that of any other element. If its condition is such as to leave the nitro-glycerine free when the two are mixed, it is easy to find a carbonaceous element sufficiently non-absorbent to be added in properly small proportion to the mixture without destroying the susceptibility of the nitro-glycerine to detonation by the cap. Almost any hard or dense form of carbon or hydrocarbon will fulfill this condition.

Sulphur is an element which is non-porous or non-absorbent, and has a comparatively feeble attraction for nitro-glycerine. As a regularly-granulated form of sulphur is not easily obtainable, I prefer to use a form of carbon which, with the nitrate or other explosive salt, will leave the nitro-glycerine so free that the sulphur may be added pulverized.

The following is a typical example of my invention: Unground nitrate of soda or cubic niter is taken in the crystallized commercial form and run through a sieve having twelve meshes to the linear inch. Of the crystals or grains which pass through this sieve I mix sixty-seven parts, by weight, with fifteen and a half parts rape-seed, twelve and a half parts pulverized sulphur, and five parts nitro-glycerine. If the nitrate of soda has absorbed moisture, it should be dried before using. The order in which the ingredients are mixed is immaterial, though it is more convenient to add the nitro-glycerine last. After all the materials are in, thorough mixing can be obtained by running them through a coarse sieve.

For the nitrate of soda any other explosive salt that can be used as an oxidizing agent—such as the nitrate of potash, of baryta, of lead, &c.—may be substituted. The nitrate of soda is to be preferred on account of its cheapness and the greater regularity of its granulation in the crystal form. If any part of it should be pulverized by accidental attrition or otherwise, the dust should be sifted out before it is passed through the sieve.

For the rape-seed any other form or forms of non-porous carbon or hydrocarbon may be substituted, such as coal-screenings freed from dust and run through a sieve like the nitrate of soda, mustard-seed, granulated resin, or asphaltum, &c. The purer forms of carbon or hydrocarbon are best; but the presence of small

amounts of oxygen, as in resin, will not seriously impede the explosive reaction.

The proportions of nitrate or other explosive salt and the carbonaceous element should be adjusted by the chemical composition of the latter. There should be enough oxygen furnished by the nitrate or explosive salt to oxidize the carbon to carbonic acid and the hydrogen to water.

To make powders of various degrees of quickness and strength, the percentage of nitro-glycerine may vary from one to ten. In making the powders it should be borne in mind that the nitro-glycerine should be so well distributed and securely held that there is no danger of leakage, and at the same time it should remain free enough to be readily detonated—that is, the powders should not be wet, neither should they be too dry. The meshes of the sieve through which the nitrate of soda or explosive salt is passed may vary in size from that given above as greater or less proportions of nitro-glycerine are designed to be employed. The finer the grains of nitrate of soda or explosive salt the more nitro-glycerine they will take up. For larger proportions of nitro-glycerine the finer sieves may therefore be used for the nitrate; or the carbonaceous ingredient may be wholly or partly pulverized. For smaller proportions of nitro-glycerine coarser sieves may be used for the nitrate or explosive salt; or the sulphur may be reduced in quantity, or the whole or part of it may be used in the granular form. The proper combinations of these alternatives will enable the powder-maker to produce a variety of low powders, each having its special application in blasting, and all of which are safe against leakage of the nitro-glycerine and susceptible to the action of the cap.

In making this powder the unground crystallized nitrate may be used efficiently without passing it through the sieve. Regularity of granulation, though desirable, is not essential.

For the purposes of this invention the granulation of the nitrate or other explosive salt used, and of the sulphur, and even of certain forms of carbon, may be effected by fusing each separately and running it through a sieve, or by other means. For convenience the crystallized form of the nitrate is to be preferred. If the sulphur is to be grained, it can be done by breaking up roll-sulphur.

The essence of my invention consists in utilizing the principle of surface attraction. Without changing the character of the surface of the substances holding the nitro-glycerine, I lessen its extent by using the nitrate or explosive salt in masses large enough to leave the nitro-glycerine free to be readily detonated.

Among the advantages of my invention is this: The nitrate being in the form of grains is less liable to injury by deliquescence. Moreover, the nitro-glycerine, having less surface to cover, acts more efficiently as a coating im-

pervious to moisture. Its other advantages are its sensitiveness to the cap, cheapness, and the small amount of labor required in making it.

I claim and desire to secure by Letters Patent of the United States as my invention—

5 1. A low explosive composition consisting of an untriturated nitrate—such as nitrate of soda—in the form of small masses, grains, or crystals of determinate size, sulphur, pulver-
10 ized or grained, carbonaceous material, either pulverized or in the form of non-porous small masses or grains of determinate size, the unpulverized ingredients remaining as separate
15 grains in the mixture, and a small proportion of nitro-glycerine, which forms a coating in immediate contact with said small masses or grains, whereby the surfaces of the ingredients are so limited in extent as to retain the small

proportion of nitro-glycerine susceptible to detonation by the ordinary blasting-cap, substantially as described.

2. The process of making a low explosive composition, which consists in mixing crystals of nitrate of soda or its equivalent and carbonaceous material, as specified, either pulverized 25 or in small non-porous masses or coarse grains of definite regulated size, the unpulverized ingredients remaining as separate grains in the mixture, mixing therewith sulphur in powder or grains, and adding a small proportion of ni- 30 tro-glycerine, substantially as described.

Dated at San Francisco October 6, 1881.

WILLIAM RUSSELL QUINAN.

Witnesses:

JOHN A. WRIGHT,
CHAS. D. WHEAT.