

# UNITED STATES PATENT OFFICE.

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## PROCESS OF MAKING EXPLOSIVE COMPOUNDS.

SPECIFICATION forming part of Letters Patent No. 333,345, dated December 29, 1885.

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*To all whom it may concern:*

Be it known that I, JOHN C. SCHRADER, of McCainsville, in the county of Morris and State of New Jersey, have invented a new and useful Process of Manufacturing Explosive Compounds; and I do hereby declare that the following specification is a clear, true, and complete description of my invention.

My object is to produce what I believe to be a novelty in the art—viz., a dry-grained free-running high-explosive powder, containing, as may be required, from ten to forty per cent. of a liquid explosive.

Nitro-glycerine powders containing, say, more than eight or ten per cent. of the liquid explosive have heretofore contained solid matters in such a form or of such a character as to render said powders of a more or less clingy, doughy, or pasty character.

The first step in my novel process involves the production of a novel "dope" or artificially-formed grains or granules of a novel character in that each grain is a cellular structure capable of resisting the softening effects of the liquid explosive, and they are of such bulk that they are capable by capillary attraction of taking up and completely housing and retaining within them effective quantities of nitro-glycerine; and the second and final step in my process involves the charging of said grains with the liquid explosive within their capacity for receiving, housing, and internally-retaining the same by capillary attraction, so that the resultant powder possesses substantially the same dry grained free-running characteristics of the uncharged grains. The said first step may be considerably varied in its details without departure from my invention, inasmuch as the constituents of my novel grains may be somewhat varied, and substantially equivalent means resorted to for developing said grains.

One variety of grain or granule artificially produced by me in accordance with my invention is composed of sulphur and vegetable fiber, the latter being in the form of wood pulp or granulated wood, or cotton, or lint, or cellulose, or any other comminuted or fibrous vegetable matter. Of these vegetable bodies wood pulp is deemed most desirable, having

reference to its effective value in the powder, and also to its cost as compared with other suitable fibrous matter.

With wood pulp I proceed as follows: To a given quantity of pulp in a dried state and well separated I add from twenty to fifty per cent. of ground sulphur, mix it well together, and apply heat thereto until the sulphur is melted or thoroughly softened into an adhesive condition, and then develop the mass into grains or granules more or less uniform in bulk. These grains should not be finer than, say, such as would pass through a twelve-mesh sieve or coarser than such as would pass through a four-mesh sieve, according to particular requirements. The graining operation is effected preferably by stirring the compounded mass while soft until it cools, although good results will accrue if the mass, while still soft, is lightly compressed between plates, and then when cold and hard granulated by toothed rolls, as in the manufacture of ordinary black powder. For obtaining the best results each grain or granule should also contain a nitrate, and for producing such grain I compound with the sulphur and woody or vegetable matter nitrate of soda in various proportions, but always with sufficient sulphur to enable the latter to constitute the supporting or rigid portion of each grain, and avoiding such excess thereof as would render the grains inaccessible to the entrance of the nitro-glycerine.

For obtaining a desirable and efficient grain of this variety, I compound substantially as follows: twelve (12) parts vegetable or woody matter; twenty (20) parts sulphur; sixty-eight (68) parts nitrate of soda. The nitrate in a finely-ground condition is mixed with the sulphur and fibrous matter, and heated, as before described, and grained. In these grains the woody or vegetable matter serves as a natural absorbent, which in itself takes up the liquid explosive. The finely-divided nitrate housed within the cellular mass or structure formed by the melted sulphur in each grain also takes up between its fine particles more or less of the liquid explosive, and so, also, is more or less of the latter taken into and retained internally by the more or less open pores or



cells of each grain, so that in charging such grains during the second step in my process they are enabled to take up by capillary attraction and to effectually retain or house 5 within them from ten per cent. to as high as forty per cent. of the liquid explosive, and yet to substantially maintain their normal dry-grained free-running characteristics.

While the use of wood pulp or other fibrous 10 matter in the production of my novel grains or granules enables the latter to take up large quantities of the liquid explosive, as for producing powders of the highest grades, such grains can also be more lightly charged for 15 producing powders of lower grades; but it is desirable for low-grade powders that matter of a less absorbent capacity be employed in the production of grains which can only be charged with from, say, ten to twenty per cent. 20 of the liquid explosive, and in such lower grades of powder it is also deemed desirable to employ grains of greater specific gravity than those which embody wood pulp or equivalent vegetable matter, and therefore in the produc- 25 tion of a cheaper grade of powder, I employ a compound substantially as follows: twelve (12) parts of bituminous coal; sixteen (16) parts sulphur, and seventy-two (72) parts ni- 30 trate of soda; but the proportions named may be varied, if, as before stated, the sulphur be present in sufficient quantity to adhesively control the mass and form the cellular grains, and not enough to render the grains too dense, 35 and therefore inaccessible to the entrance of the liquid explosive by capillary attraction. The grains produced from this last-named com- 40 pound can be relied upon to take up and retain internally from ten to twenty per cent. of the liquid explosive, and to maintain substan- 45 tially their dry-grained free-running characteristics.

The charging of the grains or granules with nitro-glycerine in accordance with the second 45 step in my process is best effected by mixing the two in a warm room, the percentage of the liquid explosive being always within the quantity which can be taken up or housed and retained by capillary attraction within the 50 grains, so as to leave the mass a dry-grained explosive.

It is to be understood that I am aware that it is not new to prepare artificial grains for use in the manufacture of nitro-glycerine powder; but I believe it is to be broadly new 55 to prepare artificial grains capable of taking up and effectually housing sufficiently large quantities of liquid explosive to form a dry-grained high-grade explosive, as distinguished from certain well-known low-grade high ex- 60 plosives, of which there are at least two general types, viz: First, that low-grade nitro glycerine powder which contains grains capable of being mixed with not more than from three

to five per cent. of nitro-glycerine, because of the intentional incapacity of said grains to 65 take up or house the liquid explosive within them, and which are merely superficially coated therewith, and are therefore more or less adhesive, and cannot constitute a dry-grained powder; and, secondly, that low-grade nitro- 70 glycerine powder embodying a compound of solid matter in a finely-comminuted condition, which is combined with, say, from three to six per cent. of the liquid explosive, and which can receive no greater quantity without be- 75 coming a clingy mass or pasty. In the manufacture of this powder last referred to, sulphur, coal, and nitrate are employed, and those ingredients are mixed and heated; but instead of using sulphur in sufficient proportion as 80 used by me to form a rigid cellular support or housing for the other ingredients in each grain such a small proportion of sulphur is employed as to not materially change the mass as to its original comminuted condition, and 85 therefore not sufficient to operate as a cellular grain-building medium, and whereas under my process cellular grains are developed which are distinctive in their character, the solid mat- 90 ter in said last-named low-grade powder is so little coarser than the original solid constitu- 95 ents that such powder is not dry-grained and free-running, both because of the fineness of the solid matter and because of the incapacity of each particle to completely house the liquid 100 explosive. In this connection I will also refer to the well-known prior practice of com- 105 pounding nitro-glycerine with common black powder in artificially-constructed grains, and which embodies coal, nitrate, and sulphur; 110 but said prior practice has been followed without the intent of, or producing a dry-grained free-running powder, which is the prime object of my invention.

Having thus described my invention, I claim 105 as new and desire to secure by Letters Patent—

The process of manufacturing nitro-glyc- 110 erine powder, substantially as hereinbefore described, which consists in mixing with suitable combustible ingredients a quantity of powdered sulphur capable when melted of 115 adhesively controlling the mass, heating said mass and melting the sulphur, cooling said mass and forming it into porous grains, each containing a cellular mass of sulphur, and then 120 charging said grains with the liquid explosive in quantity not greater than their capacity for receiving and retaining the same by capillary attraction, and thereby producing a dry-grained free-running nitro-glycerine powder.

JOHN C. SCHRADER.

Witnesses:

JAS. H. NEIGHBOUR,  
FRANK F. HUMMEL.