UNITED STATES PATENT OFFICE.

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EXPLOSIVE CHARGE.

1,033,285. Specification of Letters Patent. Patented July 23, 1912.

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To all whom it may concern:

Be it known that I, ERNST SOKOLOWSKI, a subject of the Emperor of Germany, residing at Hamburg, Germany, have invented a new and useful Improvement in Explosive Charges, of which the following is a full, clear, and exact description.

For numerous blasting operations in the field, such as the blowing up of bridges and of bridge pillars, the throwing over of walls, the blasting of ice, and of rocks, wrecks and posts below the surface of water, etc., it has heretofore been customary to use containers with charges of brisant explosives in a fused or strongly pressed state. Similar conditions are encountered in the blowing up of underground mines, submarine mines, and the charging of torpedo heads. A charge of this type possesses a relatively high density, which renders it possible to place considerably larger quantities of the explosive nearer the place to be blown up than is possible with the use of the explosive in a crystalline state, as, for instance, crystalline trinitrotoluene.

The use of pressed or fused explosive bodies can be carried out only if they are placed relatively close to one another. In case this is not carried out carefully, the propagation of the detonation from body to body is not satisfactory, and it frequently occurs that the detonation is not propagated and that the detonation is imperfect. Further, pressed and fused bodies must be prepared in certain forms and the preparation of same is expensive. Further, the shapes available do not always correspond to the given dimensions of the places to be blown up. It is for this reason of advantage to improve the strength of explosion of the inexpensive crystalline explosive product, which readily comes into close contact with the walls of any container into which the same is filled. To effect this object, I take trinitrotoluene, which by fusing has been converted into a granular state, and intimately mix it with a crystalline trinitrotoluene.

Any known process of rendering the nitrotoluene granular may be employed, as, for example, the blowing of compressed air and steam into a jet of fused trinitrotoluene, which is formed into a spray whose particles drop into cold water, hardening into the shape of small globules about the size of large shot and the single grains of which possess an especially high density, *i. e.*, 1.62.

Any known process of obtaining crystalline trinitrotoluene may be employed, as, for example, recrystallizing the crude trinitrotoluene from solvents, such as ethyl-alcohol. The crystals have nearly or quite the same absolute density as the fused granules (say 1.45–1.6 according to pressure), but owing to their fine state of subdivision, that may be compared to a coarse meal, a given volume of the crystalline trinitrotoluene is substantially lighter than an equal volume of the granular trinitrotoluene.

Plastic trinitrotoluene (so-called) may be used as an equivalent for the crystalline meal. So-called plastic trinitrotoluene is a mixture of trinitrotoluene, dinitrotoluene and nitrocotton, in about the ratio 80:19.5:0.5. As is known, the dinitrotoluene is melted in a mixing machine and gelatinized with the nitrocotton. Then the trinitrotoluene is added and the whole cooled and kneaded for some time. The density of this plastic mass is about 1.25 and its sensitiveness to the shock of exploding fulminates is greater than that of fused trinitrotoluene.

The mixture above described may be used in a loose state; or, if desired, may be rammed, or pressed weakly.

Owing to the fact that a large portion of the mixture consists of fused trinitrotoluene, the density of the mixture, as compared with that of the loose crystalline trinitrotoluene, is very considerably increased. In the same explosion chamber considerably more gas is developed than in the case of crystalline trinitrotoluene alone, and the efficiency is correspondingly increased. During the detonation, the crystalline trinitrotoluene or so called plastic trinitrotoluene, which is distributed throughout the mixture, serves to immediately bring about with certainty the propagation of the detonation throughout the entire explosive mixture.

It is known that the fused trinitrotoluene does not detonate as readily as the crystalline material. If granular trinitrotoluene alone were used, the propagation of the detonation would quickly fail, while with a mixture of both, even in large quantities the

propagation of the detonation is absolutely insured. The mixture as described above is therefore especially suitable for the purpose cited, particularly so since its cost of production is not high and it may be applied without difficulty.

Plastic trinitrotoluene may be used to advantage instead of crystalline trinitrotoluene for primers, *i. e.*, intermediate changes designed to propagate the explosion to the main change of the projectile.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. An explosive consisting of a mixture of granular trinitrotoluene and crystalline trinitrotoluene, said crystalline trinitrotoluene having a smaller density than said granular trinitrotoluene.

2. An explosive consisting of a mixture of granular trinitrotoluene of high specific gravity and crystalline trinitrotoluene, said crystalline trinitrotoluene having a smaller density than said granular trinitrotoluene.

3. An explosive consisting of a mixture of fused granular trinitrotoluene and crystalline trinitrotoluene, said crystalline trinitrotoluene having a smaller density than said granular trinitrotoluene.

4. An explosive consisting of a mixture of granular trinitrotoluene and crystalline trinitrotoluene, said crystalline trinitrotoluene having a smaller density than said granular trinitrotoluene, said explosive being pressed lightly.

In testimony of which invention, I have hereunto set my hand, at Hamburg, on this 22′ day of Aug., 1911.

ERNST SOKOLOWSKI.

Witnesses:
ERNEST H. L. MUMMENHOFF,
ANDREW W. PENTLAND.