

UNITED STATES PATENT OFFICE

2,275,569

LOADING PASTY SOLIDS

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Serial No. 391,213

6 Claims. (Cl. 86—20)

This invention relates to loading of pasty solids and has for its principal object the provision of a method of so loading such material as to increase its loaded density. A specific object of the invention is to charge 80—20 amatol into a shell or bomb to a density as great as is possible with a 50—50 amatol which may be poured or cast into the shell cavity.

Amatol is the general name for an explosive consisting of ammonium nitrate and trinitrotoluene in various percentages, frequently in equal parts, this explosive then being known as 50—50 amatol. Since an amatol containing as little as one-fifth of trinitrotoluene can be detonated with full effectiveness it would be highly desirable to substitute such 80—20 amatol for the more common 50—50 amatol except for the appreciable differences in gravity.

When amatol is formed of equal parts of the two ingredients it can be poured into a shell in just the same way that the straight TNT can be loaded and therefore can have a high density whereas amatol containing a greater proportion of ammonium nitrate must always be extruded, tamped or packed into the cavity as a hot pasty solid rather than as a flowing liquid because it does not become a liquid at temperatures 10° or 20° above the melting point of TNT at 80.2° C. and therefore must be loaded into the shell cavity at approximately its own density.

Another disadvantage of amatols containing a major portion of ammonium nitrate is that the total weight of the explosive that can be loaded is appreciably less than is possible with an amatol which is fluid at the melting point of TNT. This is due to the fact that the density of amatol of equal parts of ammonium nitrate and trinitrotoluene runs as high as 1.55 whereas the amatol having four parts of ammonium nitrate to one of TNT can be given a loading density of 1.40 only with difficulty. This of course means that the total weight of the 80—20 explosive that can be loaded into a shell is almost a tenth less than is possible with the 50—50 amatol. The bulk or loading density of 80—20 amatol is lower because the ammonium nitrate crystals do not melt at this temperature range, and there is not enough fluid TNT to flow into the porous spaces and fill them. When the density of the solid crystals is considered, that of ammonium nitrate (1.72) is slightly more favorable than that of TNT (1.65), hence the basic soundness of the idea of highly compressing the material into pellets.

My method contemplates treating any material

such as will be a pasty solid at loading temperatures and is based on the discovery that by using a portion of the untreated material as a matrix and charging this matrix with as large a percentage as possible of highly compressed particles of the same material it will be possible to increase materially the density of the charge. The particles may be of any size or shape best suited to the particular cavity to be filled. I have found it very convenient to form the particles or grains into small round spheres or pellets particularly since these pellets can readily be made in available pellet presses, using a pressure of say two tons per square inch. By using pellets of relatively small size the charge can more readily be loaded and the transfer of heat from the pellets which may be at room temperature or may be chilled to any desired degree will not take up all the heat of the hotter matrix material until loaded in place.

In the form of my invention in which I am most interested the material to be loaded is an amatol in which the major portion of the mixture is ammonium nitrate. When four parts of ammonium nitrate to one part of trinitrotoluene are heated together at a temperature about equal to the boiling point of water or somewhat less, an amatol is formed having an apparent density or apparent specific gravity of 1.15. The amatol thus made is divided into a chosen proportion, using a major portion as a matrix without further treatment and treating the minor portion which may be as little as one-fourth but is preferably from one-third to one-half of the total mix, so as to increase its density to 1.50 or higher, preferably by pelleting the amatol in a pellet press, using a pressure which may conveniently vary as desired from as little as 5,000 pounds per square inch to as much as 30,000 pounds per square inch, these figures giving pellets having a density which may vary from 1.50 to 1.65 or even slightly higher. The compressed pieces may be of other shapes, such as cubes, lozenges, etc., but I prefer the ball shape.

When the shells are ready to be loaded the major portion of the amatol running half to two-thirds of the total mix is warmed to a point at which the trinitrotoluene will melt and the mixture becomes a pasty solid. The compressed blocks or pellets are now mixed with a hot 80—20 amatol in its pasty condition, providing a charging mixture in which the high density pellets are each surrounded by a matrix of the untreated but hot 80—20 amatol which has a density of about 1.40. The shells may be loaded in any

desired manner with the mixture or by alternate layers of matrix and compressed lozenges separately tamped in place. Densities running from 1.45 to 1.50 may be obtained with care, and a shell may be loaded to a density of 1.55 or even higher under specially favorable conditions.

As an example of effectiveness of this manner of loading, the normal load which can be charged into a hundred pound demolition bomb is 50 pounds of 50—50 amatol; with untreated 80—20 amatol the best loading is about four pounds short of this weight because of the difference in density, while with the present invention a charge of nearly if not fully 50 pounds of 80—20 amatol may be loaded.

Up to the date of the present invention it was never known to be possible to load 80—20 amatol to any density equal to or even substantially equal to the density of the poured 50—50 amatol. By the use of this invention one can load 80—20 amatol not only to a higher density than was possible before my invention, but it is possible to materially facilitate the loading operation as the time of loading is reduced by the use of compressed blocks or pellets of high density amatol in the matrix of 80—20 amatol of ordinary density. In general the admixture of the pellets not only tends to increase the density of the mass of amatol, but by the sharing of the heat present in the freshly-made 80—20 amatol with the earlier made pellets of highly compressed 80—20 amatol, the cooling of the bomb charge is facilitated, and the length of time that the bomb must remain on the loading floor in process of being loaded is considerably shortened. The length of time can still further be shortened by chilling the pellets before mixing with the hot amatol or by increasing the size of the pellets or both.

What I claim is:

1. The method of increasing the density of a charge of amatol in which the percentage of the TNT is less than required to make the amatol a flowing liquid at a temperature within ten or twenty degrees above the melting point of the TNT; which comprises compressing a minor por-

tion of the amatol into pieces of a density in excess of 1.50 at a pressure from five to thirty thousand pounds per square inch, mixing such pieces with a major portion of the uncompressed amatol at a temperature well above 80.2° C., and charging the mixture while still hot into the cavity to be filled.

2. The method of charging a shell with amatol in which the percentage of the ammonium nitrate is appreciably greater than that of the TNT; which comprises compressing from about one-fourth to about two-thirds of the charge to pieces of a density of at least 1.50, heating the uncompressed portion of the charge to a pasty condition to form a matrix, mixing the compressed pieces with the hot matrix and charging the shell with the mixture, whereby to obtain a charge of greater density than if the amatol were loaded into the shell entirely as a pasty solid.

3. The process of claim 2 in which the amatol is 80—20, the compressed portion is from one-third to one-half the charge and is in pellets with a density of at least 1.50 and the final density of the filled charge is above 1.45.

4. The method of filling a cavity with a material which is pasty at ordinary filling temperatures, which comprises compressing a portion of the charge into pieces of solid form with a density above 1.42, warming a portion of the untreated material to form a matrix, mixing the solid compressed material with the pasty matrix, and loading the cavity with the mixture while the matrix is still pasty.

5. The method of claim 4 in which the pieces are pellets compressed at a pressure greater than two tons per square inch and comprising at least one-fourth of the filling charge, and the cooling of the charge is facilitated by the transfer of heat from the hot matrix to the relatively cool pellets.

6. An amatol charge comprising a body of amatol, with a density below 1.45 having embedded therein a proportion, exceeding one-fourth, of particles of amatol compressed to a density above 1.45.

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