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METHOD OF LOADING HIGH EXPLOSIVE SHELLS

No Drawing. Original application filed January 19, 1928, Serial No. 248,013. Divided and this application filed January 2, 1929. Serial No. 329,962.

My invention relates to an improved charge for high explosive shells and method of loading and, more particularly, relates to a charge which will be efficient in operation and may be readily and efficiently loaded into a shell.

Heretofore high explosive shells have been charged with a composition known as amatol and comprising a mixture of ammonium nitrate and trinitrotoluol, usually in the proportion of 80% NH_4NO_3 to 20% T. N. T.

Amatol as a charge for high explosive shells has proved highly efficient from the standpoint of explosive strength, but in loading it is essential that the amatol completely fill the load cavity of the shell in order to avoid so-called "set-back" which leads to premature explosion of the shell in the gun on firing.

The complete filling of the load cavity with amatol presents a difficult problem, since the amatol mixture is solid and effective loading of shells has only heretofore been accomplished through the use of hydraulic rammers, which act to pack the solid amatol into the cavity. Hence, the loading of shells according to present known methods and with the desirable explosive amatol involves substantial difficulty and thus requires expensive and substantially fixed machinery and is attended by substantial risk.

Now, in accordance with my invention I provide an explosive composition for shells which will have the effectiveness of amatol and, at the same time, lend itself to effective charging, i. e. complete filling of the shell cavity, in a simple manner and without the necessity for any complicated apparatus.

In accordance with my invention, I provide an explosive composition which, because of its composition, may be readily brought to a fluid condition through the application of heat, enabling it to be run into the cavity of a shell and therein resolidified, with insurance that the cavity will be completely filled without the necessity for any tamping or ramming.

The composition in accordance with my invention includes in admixture the ingredients of amatol, ammonium nitrate and trinitrotoluol, which in admixture alone cannot be rendered fluid by the application of heat because of the danger incident to the high temperature necessary to fuse the ammonium nitrate, to which is added more or less hydrated magnesium nitrate, the presence of which I have discovered will, through the presence of water of crystallization released on the application of heat at a relatively low temperature, so reduce the fusing temperature of the ammonium nitrate as to enable the mixture to be rendered fluid at a temperature well within the limits of safety.

The amount of hydrated magnesium nitrate included in the composition may be varied within relatively wide limits depending upon the fusing point desired for the composition and without material effect upon the explosive power of the composition as compared with amatol, it being only necessary where any large amount of hydrated magnesium nitrate is used, resulting in the presence of effective quantities of water of crystallization, to increase the proportion of trinitrotoluol over that usually found in amatol.

As illustrative of various specific compositions of hydrated magnesium nitrate and ammonium nitrate with the fusing temperatures thereof, reference is made to the following table:

$\%Mg.(NO_3)_2.6H_2O$	$\%NH_4NO_3$	Fusing Temp. ° C.
10	90	127
15	85	118.5
20	80	111
25	75	104
30	70	97
35	65	91
40	60	85.5

As an example of a specific composition in accordance with my invention, 80% of a mixture comprising 10% hydrated magnesium nitrate and 90% ammonium nitrate is mixed with 20% trinitrotoluol, in any convenient manner. The resultant composition will fuse at about 127° C., since the trinitrotoluol has a melting point of 75° C.–80° C. depending on its purity and the magnesium nitrate-ammonium nitrate mixture will fuse at 127° C., as indicated in the above table. In the making up of compositions in accordance with my invention, it will be understood that the proportions of hydrated magnesium ni-

trate and ammonium nitrate may be widely varied and that the trinitrotoluol content of the composition may be increased to compensate for any loss of explosive strength resultant from the presence of the water of crystallization of the hydrated magnesium nitrate.

In the loading of a shell in accordance with my invention the explosive composition, for example, one comprising 20% T. N. T. and 80% of a mixture of 10% $Mg.(NO_3)_2.6H_2O$ and 90% NH_4NO_3 is heated to a temperature of about 127° C. The heating will cause the mixture of $Mg.(NO_3)_2.6H_2O$ and NH_4NO_3 to fuse or melt due to the release of the water of crystallization from the hydrated magnesium nitrate in which the magnesium nitrate and the ammonium nitrate will dissolve. The trinitrotoluol will be melted or fused at a temperature of 127° C. since its melting point is 75 C.–80 C.

When the composition has been fused or melted, it is run into the shell and will completely fill the cavity thereof without the necessity for ramming. When the shell cavity is filled the fused composition therein is allowed to cool and will solidify due to the return of the water of crystallization to the magnesium nitrate with recrystallization thereof and of the ammonium nitrate and solidification of the trinitrotoluol at a temperature below 75° C.–80° C.

It will now be observed that by virtue of my invention an explosive composition for shells is provided having the efficiency of amatol and, at the same time, the efficient loading of shells may be accomplished with great simplicity and without the necessity for any particular apparatus, thus enabling the loading operation to be readily carried out at almost any point on short notice.

It will be understood that my invention is not limited to the use of hydrated magnesium nitrate, since other hydrated salts, such as calcium nitrate, zinc nitrate, or any hydrated salt which will not decompose nitrate of ammonium and T. N. T., or equivalents therefor, when mixed may be substituted therefor, and that likewise other explosive salts, as ammonium perchlorate, and the like may be substituted for ammonium nitrate and ammonium picrate, or the like may be substituted for trinitrotoluol. Further, it will be understood that I do not intend that my invention shall be limited to compositions having the ingredients in any particular proportions as variation of the proportions will be obvious to one skilled in the art.

No claim is made in this application for the charge for high explosive shells herein disclosed, as such forms the subject matter of an application for patent filed by me January 19, 1928, Serial No. 248,013, of which this application is a division.

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

1. The method of loading high explosive shells which includes fusing a high explosive mixture containing a hydrated salt through release of water of crystallization from the hydrated salt, running the fused composition within the cavity of a shell and effecting solidification of the explosive composition within the shell cavity by cooling.

2. The method of loading high explosive shells which includes adding magnesium nitrate to an explosive composition containing ammonium nitrate and trinitrotoluol, heating the resultant composition to melt the trinitrotoluol, and release the water of crystallization from the hydrated magnesium nitrate to dissolve the ammonium nitrate, running the resulting fluid composition within the cavity of a shell and effecting solidification of the fluid composition within the shell cavity by cooling.

3. The method of loading high explosive shells which includes heating an explosive composition containing about 20% trinitrotoluol and about 80% of a mixture comprising about 10% hydrated magnesium nitrate and about 90% ammonium nitrate to melt the trinitrotoluol and to release the water of crystallization from the hydrated magnesium nitrate to dissolve the ammonium nitrate, running the resulting fluid composition within the cavity of a shell and effecting solidification of the fluid composition within the shell cavity by cooling.

4. The method of loading high explosive shells which includes adding a hydrated salt to an explosive composition containing an explosive salt and trinitrotoluol, heating the resultant composition to melt the high explosive and release the water of crystallization from the hydrated salt to dissolve the explosive salt, running the resulting fluid composition within the cavity of a shell and effecting solidification of the explosive composition within the shell cavity by cooling.

In testimony of which invention, I have hereunto set my hand, at Kenvil, N. J., on this 27th day of December, 1928.

NEWTON C. BOYD.