

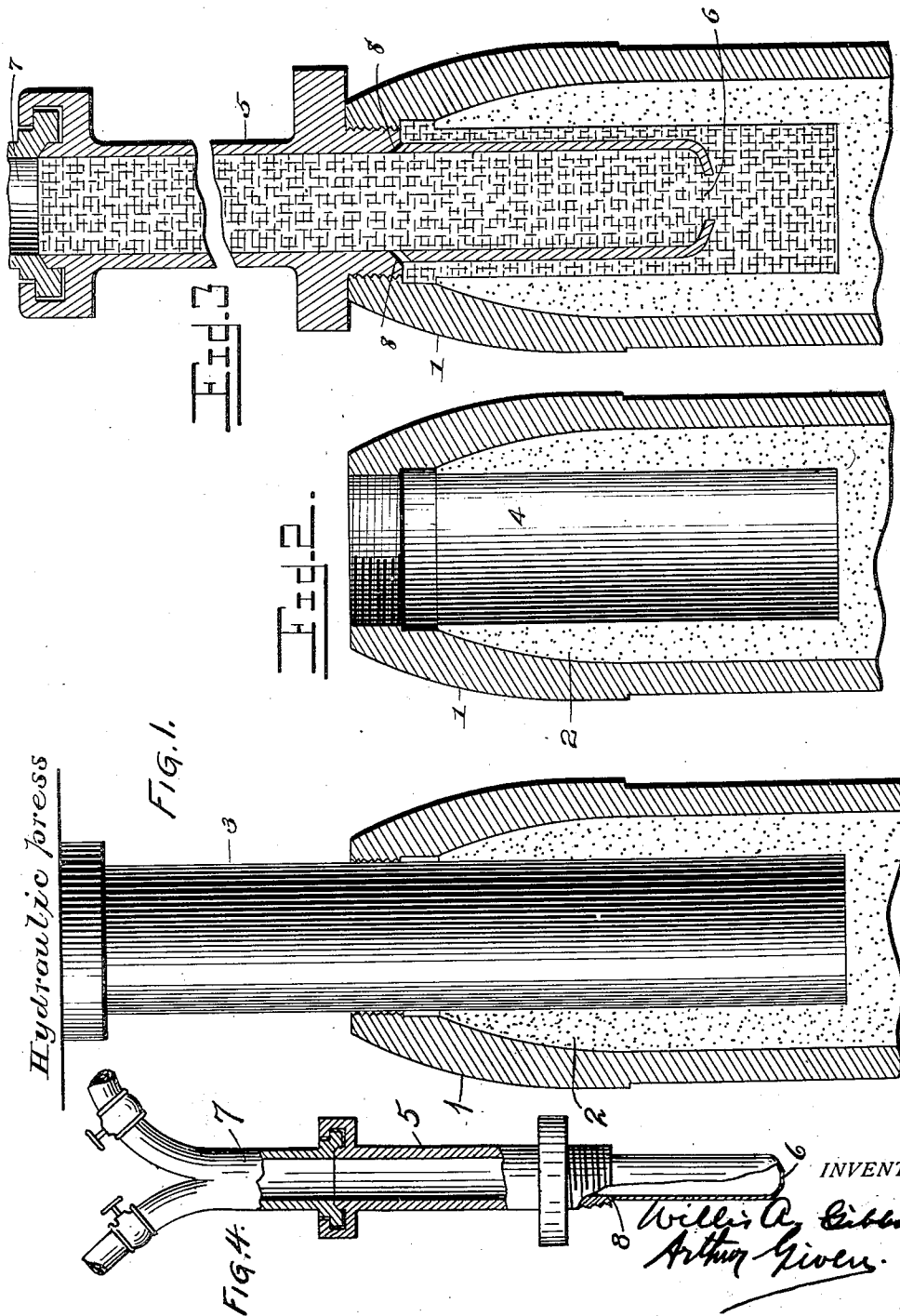
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METHOD OF LOADING HIGH EXPLOSIVE SHELLS

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METHOD OF LOADING HIGH-EXPLOSIVE SHELLS.

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To all whom it may concern:

Be it known that we, WILLIS A. GIBBONS and ARTHUR B. GIVEN, citizens of the United States, respectively residing at New York city, borough of Manhattan and State of New York, and Newark, county of Essex and State of New Jersey, have invented a new and useful Improvement in Methods of Loading High-Explosive Shells, of which the following is a specification.

This invention relates to method of loading high explosive shells.

The main object of the invention is the provision of a method for loading shells which will render the loading thereof safer and will permit a partially loaded shell to be stored away as a non-explosive, the loading thereof to be easily completed when the shell is to be used.

The invention also contemplates the provision of a method of loading high explosive shells with a mixture of explosives or of materials ordinarily non-explosive but which when mixed together or with a high explosive become explosive.

This method, briefly, consists in loading the shell with a component, preferably in solid form at normal temperature and at temperatures slightly above normal, and adding to the solid component a liquid component or components, preferably liquefied by raising the temperature thereof.

The specific form of apparatus is not material in this connection but for purposes of illustration one manner of carrying out this method is shown in the accompanying drawings in which similar numerals indicate corresponding parts.

Fig. 1 is a central longitudinal sectional view of the forward end of a shell showing the first step of the improved method.

Fig. 2 is a similar view showing the shell ready for the following step in the loading method or in condition for storing.

Fig. 3 is a similar view showing parts of one form of apparatus used when performing the final step of the loading operation; and

Fig. 4 is a fragmentary view showing the connection of the filling device used in the last operation of filling the shell.

Referring, to the drawings by numerals 1 indicates the shell, in which the explosive is packed and while the invention is not limited to any explosive materials here men-

tioned, one material that might be extensively used would be a mixture of T. N. T. and ammonium nitrate.

The ammonium nitrate 2 in powdered or ground form and in a dry state, is packed in the shell to a density of say 1.0 to 1.2. Any preferred means of accomplishing this packing or tamping may be used such as a hydraulic press the plunger of which is shown at 3, or by forcing the ammonium nitrate into the shell by means of the well known horizontal shell loading or extrusion machine (not shown).

The choice of loading by any method without being limited to a few, suitable only for handling high explosives, is a distinct advantage. For example an ordinary tamping machine could be used for charging the shell with ammonium nitrate so far as the element of safety is concerned.

As indicated above the shell is provided with a charge of ammonium nitrate at the density desired and can be stored for any length of time, in said partially loaded condition.

In this manner shells may be filled at leisure with from 60 to 80% of their total charge and completed in time of emergency. This will permit said partly charged shells to be stored in any place without having them regarded as explosive.

Shells loaded by this method could be more conveniently finished if left with a core opening or hole in the ammonium nitrate as seen at 4, Fig. 2.

To complete the loading process, melted trinitrotoluene commonly called T. N. T. is poured into the shell in quantities amounting to from 20% to 30% of the total charge to give the desired density of from 1.35 to 1.50 which will not exceed the amount capable of withstanding the shock of discharge from the gun and yet give satisfactory detonation. The percentage of components used in the loading process is not of importance in this connection and will be controlled by conditions.

In practice it may be found desirable to have the shell and ammonium nitrate preheated slightly, which may be done in any preferred manner. The T. N. T. can be conveniently run into the shell through a former 5 inserted in the nose of the shell, said former being the shape of the desired booster cavity in the finished shell, but pro-

vided with a hole 6 in the bottom through which the T. N. T. can pass into the core or cavity 4 in the ammonium nitrate and percolate from thence out into the spaces 5 between the particles of the ammonium nitrate.

The absorption of T. N. T. by the ammonium nitrate may be considerably facilitated by the exhaustion of air from the ammonium nitrate through connection 7 preferably before the introduction of the molten T. N. T., or said vacuum may be applied intermittently, the rapidity of absorption being determined by the duration of application and completeness of the vacuum. For this purpose connection 7 is conveniently the terminal of a branched pipe, Fig. 4, one branch of which leads to an air pump and the other branch to a container for the liquid. Suitable stop cocks are provided in these branches so that the branches may be alternately cut off and on.

The former 5 is provided with passages 8 through its walls at the upper part of the shell to permit the passage of any gases trapped between the former and the walls of the cavity being filled.

The former will preferably have a volume approximating that of the space between the ammonium nitrate particles which is to be filled or 20% to 30% of the volume of the shell, plus the volume of the core from the center of the shell exclusive of the booster cavity.

The former 5 may be secured in the shell in any preferred manner and is shown in the drawings as threaded into the nose of the shell in the seat provided for the fuse.

After the T. N. T. is introduced the shell is set aside with the former in place, and is allowed to cool. When thoroughly cold the former is removed leaving the shell loaded with a mixture of ammonium nitrate and T. N. T. in the desired proportions and in addition a core of T. N. T. having a cavity of the proper size to receive the booster of the shell. This core of T. N. T. to hold the booster is similar to the present design, but by present methods must be made in a separate operation and is commonly called the T. N. T. surround and seal.

One of the many advantages gained by this method is that to load a shell, containing 10 pounds of explosive for example, will require the handling and carrying through factory process, of only two to four pounds of actual high explosive, as the ammonium nitrate is not a high explosive during its introduction into the shell. This will greatly reduce the danger, since the weight of explosive handled is only about 20 to 30% of that handled in the ordinary process, and furthermore will permit of the

loading of a much larger number of shells for the same number of T. N. T. kettles and other equipment required in the handling of T. N. T. The advantages in permitting of the loading with ammonium nitrate at a time and place quite different from that of loading the T. N. T. are obvious.

The foregoing is a specific example of the application of this method of loading high explosive shells with T. N. T. and ammonium nitrate. Other solid materials than ammonium nitrate, whether explosive or not, may be used, and other melted or meltable explosives, or melted or meltable non-explosive material, may be used in place of T. N. T. Furthermore, the process may obviously be used for materials other than high explosives, where it is desired to obtain a compact and homogeneous mixture of two materials, one of which is infusible or else does not melt at temperatures at which the other is liquid. It might, for example, be used conveniently in filling a mold of any material in order to produce a pattern, or other object conforming to the shape of the mold, or where it is desired for any reason to secure more intimate contact between two materials, one fusible, the other not fusible, at the temperatures at which the first is liquid.

Having described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. The method of loading high explosive shells, using an explosive mixture including a fusible material, consisting in partly filling the shell with solid material, packing to a predetermined density and then adding to the shell thus partially charged the fused material in the desired proportion.

2. The method of loading high explosive shells, using an explosive mixture including a fusible substance, consisting in partly filling the shell with solid material leaving a cavity therein, introducing the fusible material in a liquefied state to percolate through the solid material and partly fill the cavity and allowing the fusible material to solidify.

3. The method of loading high explosive shells using an explosive mixture including a fusible material, consisting in partly filling the shell with a solid material leaving a cavity therein, placing a former in the cavity, introducing the fusible material in a liquid state through the former to percolate through the solid material and fill the cavity and former, allowing the fusible material to solidify and withdrawing the former and material contained therein.

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