Feb. 10, 1948. C. F. SCHNEIDER 2,435,610

FUNNEL FOR CASTING EXPLOSIVE CHARGES

Filed April 30, 1941

Fig-1-

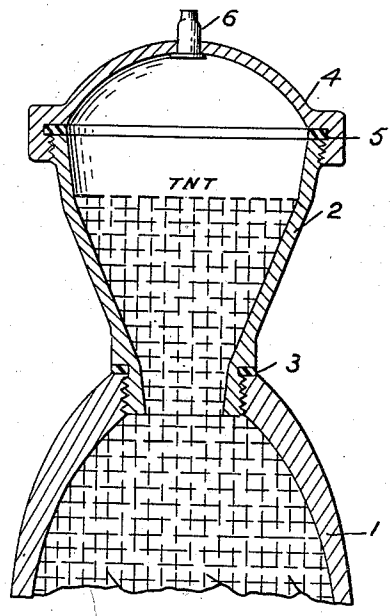


Fig-2-

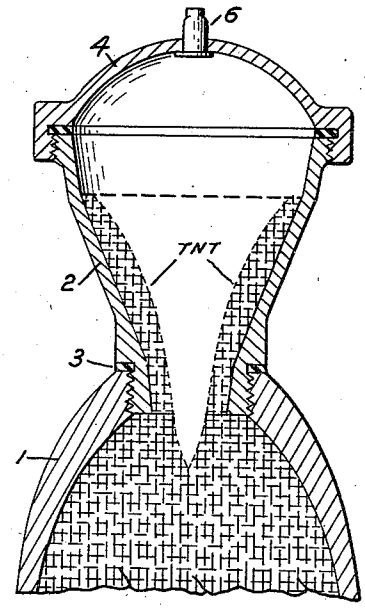


Fig-3-

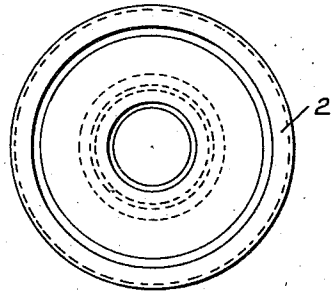
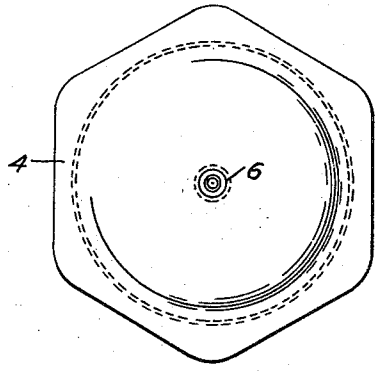


Fig-4-



INVENTOR
Charles F. Schneider
BY G. J. Kenesnick & J. H. Church
ATTORNEYS

Patented Feb. 10, 1948

2,435,610

UNITED STATES PATENT OFFICE

2,435,610

FUNNEL FOR CASTING EXPLOSIVE CHARGES

Charles F. Schneider, San Antonio, Tex.

Application April 30, 1941, Serial No. 391,120

7 Claims. (Cl. 86—31)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

My invention relates to a method for filling a high explosive shell and apparatus therefor.

In the past shells have been filled with T. N. T. by pouring molten T. N. T. in the shell and then performing a manual "breaking down" or "puddling" operation. It was found that each individual particle of the T. N. T. would not cool at the same rate, i. e., the particles adjacent to the metal envelope of the shell and the particles forming the upper surface of the T. N. T. would solidify first and form a crust-like structure around the internal molten liquid. This condition is found to be readily attributed to the fact that the metal envelope of the shell and the air above the surface of the shell conducts heat away from the adjacent T. N. T. particles at a greater rate than supplied by the internal particles and to the fact that the density of solid T. N. T. is greater than the density of liquid T. N. T. If the T. N. T. were allowed to cool as indicated, minute voids would appear within the body of the T. N. T. and as a result the maximum amount of explosive per cubic inch of shell is not realized; also the effectiveness of the detonation of the T. N. T. would not be fully realized and in some cases the T. N. T. would not be detonated by the booster charge.

To guard against the presence of these undesirable voids in the body of the T. N. T. in the past, small amounts of T. N. T. were progressively poured in the shell and allowed to cool and during the cooling period external manually operated means were employed to break up the "crust" formation. This process of course was time consuming and required the continued vigilance of the operating personnel.

According to the present invention the voids are greatly reduced or eliminated as seen from the fact that the density of the T. N. T. loaded according to my invention has been found to be 1.65 as compared to a density of 1.55 which was obtained according to the prior art practise. Also the shell is, according to my invention, filled in a shorter period of time with less operating personal.

An object of my invention is to provide a method for filling a shell with T. N. T. or other material having a higher density when in the solid state than when in the liquid state, so that a dense packing of the T. N. T. or other material within the shell results.

2

In its broader aspects my invention relates to a method and apparatus for filling a container with a material which shrinks in size when it passes from the liquid to the solid state; an object of my invention is to produce a dense packing of such a material in the container.

Another object of my invention is to produce a densely packed shell with the use of compressed gas.

With the foregoing and other objects in view, my invention resides in the method and novel arrangement and combination of elements necessary to produce a dense loading of a container in a manner and of the type hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

Referring to the drawings,

Fig. 1 discloses the disposition of the liquid T. N. T. in the shell and funnel after the T. N. T. has been poured and the cap has been screwed on the funnel.

Fig. 2 discloses the disposition of the T. N. T. in the shell after it has solidified under gas pressure.

Fig. 3 discloses a plan view of the filling funnel with the cap removed.

Fig. 4 discloses a plan view of the filling funnel with the cap in place.

The numeral 1 designates the metal shell. The funnel 2 is made of heat insulating material and has screw threads so that it might be screwed in the opening of the shell. The gasket 3 is made of rubber and serves to make the connection between the funnel 2 and the shell 1 gastight. The upper portion of the funnel has screw threads which are adapted to be engaged by the screw threads on the hexagon headed cap 4. The rubber gasket 5 serves to make the joint between the funnel and funnel cap gastight. The cap 4 may be made of metal or of a heat-insulating material and is preferably made of heat insulating material in order to prevent a too rapid cooling of the T. N. T. in the funnel.

Provisions are made to introduce air above the T. N. T. through a conventional bicycle tube valve stem 6. The air pressure above the T. N. T. is maintained at approximately 90 lbs. per square inch during the cooling operation.

T. N. T. is molten at temperatures above 176° F., approximately. Molten T. N. T. is poured in the funnel until the level of the T. N. T. almost reaches the top of the funnel as indicated in Fig.

1. The cap 4 is then screwed on the funnel and air or any other suitable gas at a pressure of 90 lbs. per square inch is introduced above the surface of the T. N. T. Due to the fact that the molten T. N. T. is less dense than the solid T. N. T., the gas space above the T. N. T. is increased in volume during the cooling operation. This increase in volume would cause a reduction in gas pressure according to Boyle's law. The pressure above the T. N. T. is not critical for effective operation of this method so that by making the gas space above the T. N. T. large in comparison to the increase in volume due to the solidification of the T. N. T., further application of gas pressure during the solidification process would not be necessary. Otherwise, it might be necessary to maintain a high pressure by permanently or periodically connecting the valve 6 to a source of constant pressure. The use of the funnel and cap of a material of high heat insulating value insures that the T. N. T. contained in the funnel will remain molten during the solidification of the charge in the shell case and will thus be available to replenish shrinkage in the shell as it occurs.

Enough molten T. N. T. is poured in the funnel so that after the solidification process the T. N. T. is disposed as indicated in Fig. 2. It is then necessary to remove some of the T. N. T. in the shell to make room for the booster charge. After the solidification process the funnel is removed and sufficient T. N. T. is then cut out of the shell so that the booster may be accommodated.

I claim:

1. An apparatus for filling a container with a molten explosive charge which solidifies upon cooling and has a greater density in the solid state than in the molten state, comprising, a funnel of heat insulating material for the container, means for making airtight connection between the funnel and the container, a cap of heat insulating material for the funnel, means for making an airtight joint between the cap and funnel, and means for introducing pressure to the interior of the funnel.

2. The invention claimed in claim 1, characterized in that the cap is provided centrally with an opening and has a valve in said opening for controlling the flow of pressure to the interior of the funnel.

3. An apparatus for filling a shell with a molten explosive charge which solidifies upon cooling and has a greater density in the solid state than in the molten state, comprising a funnel of heat insulating material for said shell, means for making an airtight connection between the funnel and the shell, a cap for said funnel also of heat insulating material, means for making an airtight connection between the cap and funnel, an opening in said cap and a valve in the opening for controlling the flow of pressure to the interior of the funnel and its escape therefrom.

4. The process of filling a container with a molten explosive charge which solidifies upon cooling and has a higher density in the solidified state than in the molten state, which comprises heating the solid to a temperature to bring it to a molten state, filling the container with the substance in a molten state, and keeping a substantial fraction of the molten substance in contact with the substance in the container by the application of a constant pressure thereto during filling, and maintaining said fraction at a higher temperature than the substance in the container by insulating said fraction from the surrounding atmosphere.

5. The process described in claim 4, wherein the supply of molten substance is maintained under fluid pressure in excess of that of the surrounding atmosphere.

6. The method of filling a shell with a molten explosive charge which solidifies upon cooling and which has a greater density in the solid state than in the molten state, comprising the steps of securing a heat insulating funnel to the shell in airtight relation, melting the explosive material, pouring the molten material into said funnel to fill the shell and at least partially fill said funnel, sealing the top of the funnel with a heat insulating cover, continuously applying fluid pressure to the surface of the molten explosive in said funnel during filling, and allowing the charge to solidify in said shell whereby room is made for a portion of the molten explosive forced from the heat insulating funnel to fill shrinkage cavities in the shell as the charge therein solidifies.

7. The method of filling a shell with a molten explosive charge which solidifies upon cooling and which has a greater density in the solid state than in the molten state, comprising the steps of securing a heat insulating funnel to the shell in airtight relation, melting the explosive material, pouring the molten material into said funnel to fill the shell, and also the funnel in excess of the amount necessary to fill the shell after solidification of the charge therein, sealing the top of the funnel with a heat insulating cover, applying fluid pressure continuously during filling to the surface of the molten explosive in said funnel, and allowing the charge to solidify in said shell whereby room is made for a portion of the molten explosive forced from the heat insulating funnel to fill shrinkage cavities in the shell as the charge therein solidifies.

CHARLES F. SCHNEIDER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
925,419	Bichel	June 15, 1909
927,867	Maxim	July 13, 1909
1,011,511	Sokolowski et al.	Dec. 12, 1911
1,074,263	Issler	Sept. 30, 1913
1,329,565	Woodbury	Feb. 3, 1920
1,477,040	Davidson	Dec. 11, 1923

FOREIGN PATENTS

Number	Country	Date
675,453	France	Nov. 7, 1929

OTHER REFERENCES

Handbook on High Explosives and Shell Loading. Ordnance Dept. H. B. #1723; Apr. 8, 1918; rev. Nov. 1, 1918—Washington, G. P. O., 1918.