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Neuhaus et al.

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[54] **METHOD FOR SHAPED CHARGE BOMBLET PRODUCTION**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 160,072, June 24, 1971, abandoned.

[52] **U.S. Cl.** ..... **264/3 R;** 102/24 HC; 86/1 R

[51] **Int. Cl.²** **C06B 21/00**

[58] **Field of Search** ..... 264/3 C, 3 R; 86/1 R, 20 R, 86/20 A; 102/24 HC

[56] **References Cited**

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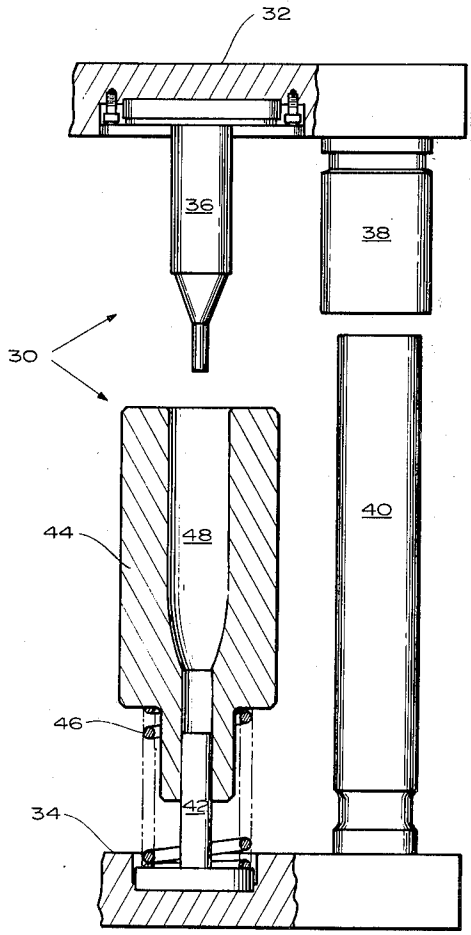
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[57] **ABSTRACT**

A process for producing shaped charge bomblets, apparatus for carrying out the process and the product made thereby. The process includes the steps of preheating an explosive molding powder, inserting the powder into a die, and applying high pressure (40,000 psi) for a timed period (e.g., 3 minutes). The disclosed die is a double action type exerting pressure from both ends of the material.

4 Claims, 2 Drawing Figures



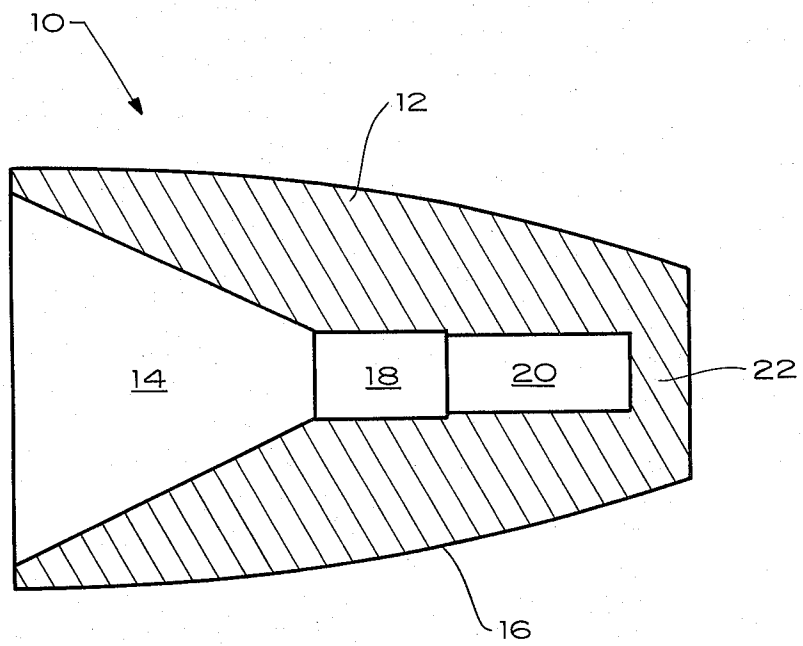


FIG. 1.

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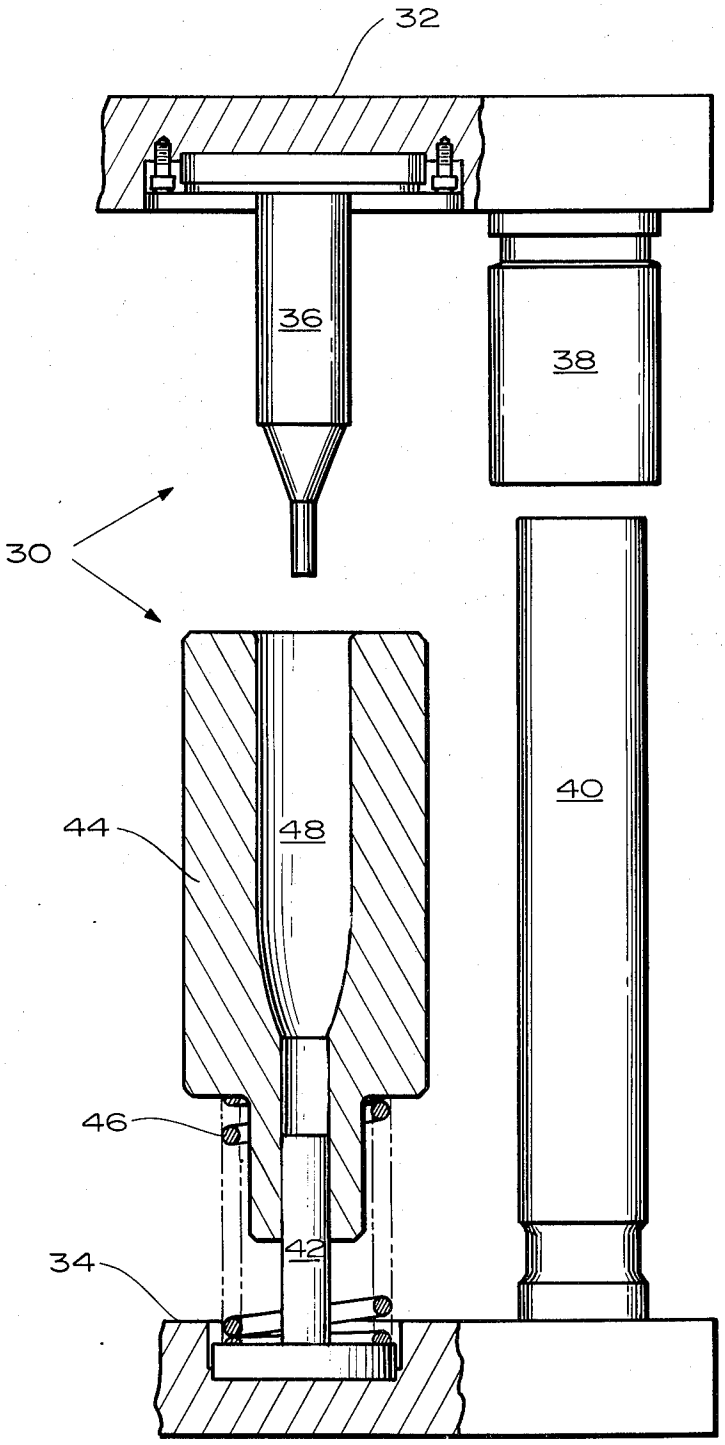


FIG. 2.

METHOD FOR SHAPED CHARGE BOMBLET PRODUCTION

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of applicants' copending application Ser. No. 160,072 filed 24 June 1971 and now abandoned.

BACKGROUND OF THE INVENTION

Loading of small bomblets in the past has been done almost exclusively by pouring a melted explosive mixture into the cavity provided therefor. Under such circumstances, the density of charge was constant for a given volume. One notable exception to the pouring process had been previously investigated at the Naval Weapons Center, China Lake wherein a moldable explosive powder was pressed into a casing as shown in assignees' copending application Ser. No. 78,068, filed 5 Oct. 1970, now abandoned.

SUMMARY OF THE INVENTION

According to the present invention, it has been found that a prepressed insert of explosive material may be fitted into the preshaped casing and may be formed to accept a shaped liner for use in a shaped charge device without appreciably degrading the penetration qualities of the shaped charge device. With the method according to the invention, pressed inserts may be manufactured with a high degree of uniformity and with a consistently high density for the weight and volume.

There are many advantages in utilizing a prepressed insert of explosive material in the manufacture of explosive ordnance. Whereas in the assembly of weapons by pouring in the explosive mix, it was necessary for personnel to do more or less extensive work on the weapons after being loaded, assembly of weapons with prepressed inserts may be more easily accomplished by automatic machinery and the handling of loaded weapons is minimized.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a cross-sectional view taken along the longitudinal axis of symmetry of a typical explosive insert pressed according to the invention; and

FIG. 2 is a fragmentary side elevation partly in section of a press and die arrangement for carrying out the invention.

DESCRIPTION OF THE INVENTION

The prepressed insert **10** shown in FIG. **1** comprises a pressed explosive powder **12** with a conical cavity **14** which is a common feature in shaped charge devices. This particular insert has a curved external surface **16** which conforms to the ogive configuration of a small bomblet. The particular bomblet for which this insert was manufactured also requires a bore **18,** a counterbore **20** and, in some applications the removal of some material to provide a passage through the web portion **22.** The form of the prepressed insert, however, is not considered to be important to the present invention and the shape shown is therefore only illustrative.

A double acting press arrangement according to the invention is shown generally at **30** in FIG. **2** and comprises an upper platen or press head **32** and a lower platen or base plate **34.** Upper platen **32** is movable and carries an upper die member **36** and a female aligning member **38,** the lower platen **34** carries a male aligning member **40** and a lower die member or punch **42.** A die mold **44** is assembled for sliding action on lower die member or punch **42** with the aid of a spring **46.**

As may be seen from the drawing, when the powder is placed in mold **44** it will fill a portion of cavity **48** and, when press head **32** is lowered, the upper die member **36** will enter cavity **48** and begin forming the loose powder. When the lower surface of press head **32** contacts the upper surface of die mold **44,** mold **44** begins to descend upon the lower die member **42** against spring **46** and compression from both ends is applied to the explosive powder in cavity **48** of die mold **44.** As the press head **32** nears its limit of travel, the pressure on the explosive powder is very great and, at this point, a dwell time may be utilized to advantage. It may also be found advantageous in the pressing of some explosive mixes to heat the powder and all die parts before pressing. Good results have been achieved, however, without heating and with only the heating of the powder. Die mold **44,** spring **46** and lower die member may be secured together as a unit and separable from base plate **34** so that the assembly may be inverted to remove the finished product from the mold. Since the cavity **48** and die members **36** and **42** are carefully contoured to shape the powder to the form shown in FIG. **1.,** the pressed charge fits the bomblet casing and liner closely without further alteration.

The results in the following table were recorded from investigation of pellets made according to the invention wherein the explosive mixture was preheated to 248° F.

TABLE 1

Data Derived From Randomly Selected Inserts

Insert number	High explosive	Weight of pressed explosive charge, g	Pressed explosive charge density, g/cc	% of TMD
2	PBXN-2	59.56	1.743	95.19
4	PBXN-2	59.10	1.746	95.35
5	PBXN-2	59.78	1.747	95.41
6	PBXN-2	59.53	1.755	95.84
7	PBXN-2	59.47	1.750	95.57
9	PBXN-2	59.43	1.746	95.53
50	Modified LX-09-0	59.68	1.734	97.69
51	Modified LX-09-0	59.91	1.736	97.80
52	Modified LX-09-0	58.89	1.736	97.80
53	Modified LX-09-0	57.84	1.730	97.46
54	Modified LX-09-0	59.96	1.736	97.80
55	Modified LX-09-0	58.13	1.737	97.85

prior to loading into the dies at room temperature and pressing at 40,000 psi with a 3 minute dwell.

In the above Table, TMD is an abbreviation for theoretical maximum density, PBXN-2 is an abbreviation for a Navy plastic bonded explosive containg 94.5% by weight cyclotetramethylene tetranitramine (HMX) and 5.5% by weight Nylon binder and Modified LX-09-0 is an abbreviation for a plastic bonded explosive containg 93% by weight HMX, 6% by weight poly (2,2-dinitro propylacrylate) binder (DNPA) and 1% by weight bis (2,2-dinitro-2-fluoruethyl) formal plasticizer (FEFO).

PBXN - 2 powder may be prepared by:

1. forming a Nylon-methanol lacquer by refluxing Nylon and methanol together;
2. cooling the lacquer to about room temperature;
3. adding HMX (cyclotetramethylene tetranitramine) particles to the lacquer and stirring; and
4. adding water to the stirred mixture of HMX and lacquer to cause the Nylon to precipitate onto the HMX particles.

After the Nylon has been precipitated onto the HMX particles, the Nylon coated particles are isolated by means of filtration and air dried to remove any residual methanol and water. Naturally, the amounts of Nylon and HMX are chosen to give a final product having 94.5 weight % HMX and 5.5 weight % Nylon. For example, to prepare 100 grams of PBXN-2, a lacquer would be formed from 5.5 grams of Nylon and about 100 to 150 cc of methanol. Then 94.5 grams of HMX would be added. And finally, about 100 cc of water would be used to precipitate the Nylon onto the HMX.

Modified LX-09-0 powder may be prepared by:

1. dissolving poly (2,2-dinitropropylacrylate) and bis (2,2-dinitro-2-fluoroethyl) formal in either ethyl acetate or acetone;
2. adding HMX to the solution while stirring; and
3. precipitating the poly (2,2-dinitropropylacrylate) and bis (2,2-dinitro-2-fluoroethyl) formal onto the HMX by adding either water or aliphatic hydrocarbons.

As in the case of PBXN-2, modified LX-09-0 can then be filtered and dried. And, as in the case of PBXN-2, the weights of the various ingredients are chosen in a manner which will give the desired final product. In a suitable form for molding the particles of powder should pass a No. 5 screen and the majority of particles should pass a No. 4 screen.

It should be realized the PBXN-2 and modified LX-09-0 are not the only moldable powders suitable for use in this invention. They and methods for their preparation are described only to aid in the practice of the invention and it is not intended to limit the invention to practice only on them or only on explosive mixes. Inert ingredients have been pressed according to the invention, for example, for weapon testing purposes.

What is claimed is:

1. The method of manufacturing molded preformed explosive charges for placement within a shaped chamber in an explosive device comprising the steps of

forming an explosive powder mixture;

pouring a measured quantity of said explosive powder into a mold that has a central contoured cavity whose internal surface area defines the external shape of said charge;

applying pressure against said powder by means of a first punch having an external surface shape that defines the shape of the internal chamber of said charge;

supplying an opposing force against said powder by means of a second punch movable within said mold that has an external end surface that defines the external surface area of the closed end of said charge;

releasing the pressure against said charge; and

disassemblying said first and second punches from said mold to remove said charge from said mold cavity.

2. The method according to claim **1** wherein said mold, said first punch and said second punch are heated before said powder is poured into the mold.

3. The method according to claim **1** wherein the powder is heated before it is poured into the mold.

4. The method according to claim **3** wherein said powder is heated to and is pressed at 40,000 psi with a 3 minute dwell.

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