United States Patent

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[72] Inventor **Baltzar Leo De Mare**
Aberdeen, Md.

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[73] Assignee **The United States of America as represented by the Secretary of the Army**

[54] **APPARATUS AND METHOD FOR ENCAPSULATING FRAGILE COMPONENTS**
3 Claims, 3 Drawing Figs.

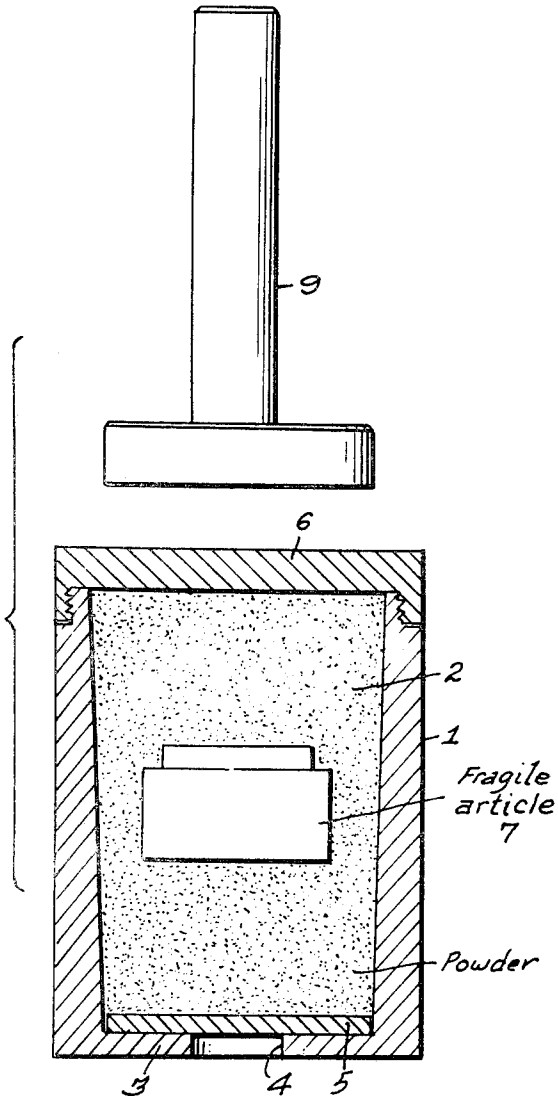
[52] **U.S. Cl.** **102/92.6,** 174/52.6, 206/46
[51] **Int. Cl.** **B65d 85/42**
[50] **Field of Search** ..... 206/46, 46 FR, 46 FC; 174/52.6; 102/92.1, 1, 34, 49.34

[56] **References Cited**
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Primary Examiner—Robert F. Stahl
Attorneys—Harry M. Saragovitz, Edward J. Kelly, Herbert Berl and Robert P. Gibson

ABSTRACT: A fragile article, such as an electronic component being used in a rocket or military projectile vehicle, is embedded in a powder to minimize vibrations, shock and heat effects and to render the packaged article easy of removal for inspection or replacement.



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Fig. 1.

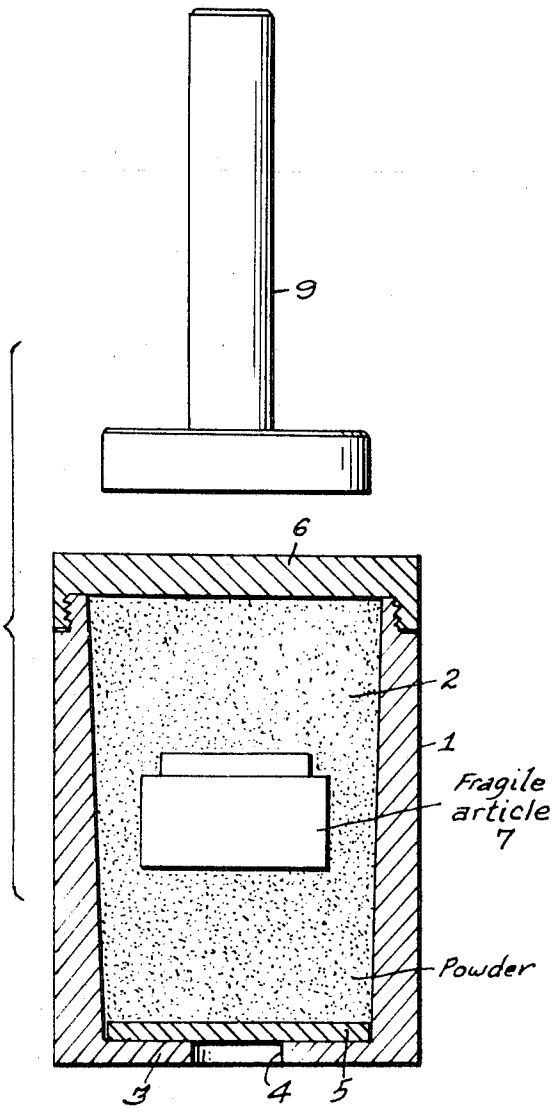


Fig. 2.

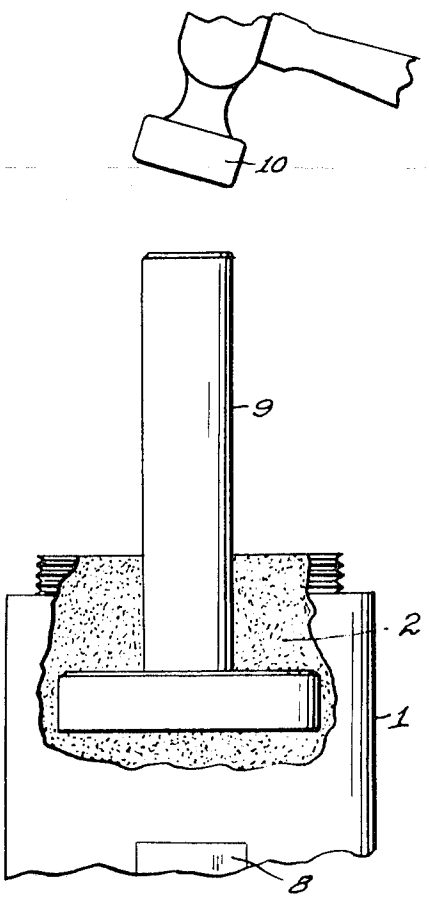
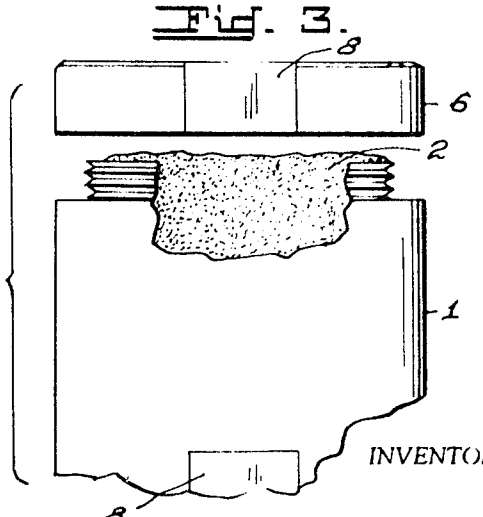


Fig. 3.



INVENTOR,

Baltzar Leo De Maré

BY: Harry M. Saragovitz, Edward J. Kelly, Herbert Berl & Robert P. Gibson

ATTORNEYS.

APPARATUS AND METHOD FOR ENCAPSULATING FRAGILE COMPONENTS

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

BRIEF SUMMARY OF THE INVENTION

An idea as to usefulness of the present invention may be gathered from the following example. Fragile components, such as a package of telemetering equipment, is assembled into a projectile and fired from a gun into the upper atmosphere. Because of the very high acceleration, or deceleration upon return or upon impact with the earth, the telemetering equipment must be intimately supported to prevent tearing loose of wiring an subassemblies as well as insulated from excessive heat.

Commonly, such a fragile component is embedded in a thermoplastic compound which is poured into place while hot and allowed to cool and set. However, the heated compound may soften or otherwise damage materials inside of the fragile component. Also, in order to recover the component for inspection it may be soaked in a solvent for a number of hours, or reheated, and removed as a sticky mass. The solvent, or reheating, could cause damage to the component and this operation is time consuming.

The present invention overcomes many of the problems of other methods of encapsulating.

In the drawing:

FIG. 1 is a view of the invention in partial cross section;

FIG. 2 is a sectional view, illustrating the filling and compacting step;

FIG. 3 is a view of the container in a filled condition and the cap ready to be affixed.

Container 1 may have cylindrical walls, or the walls may be slightly tapered in a truncated conical shape. The conical walls cause the material 2 being inserted to be "wedged" and compressed inwardly circumferentially as the material is tamped or pressed downwardly. The tapered walls also facilitate removal of the powder 2 therefrom. The bottom end closure 3 preferably has an opening 4 therein covered by a plate 5. Top end closure 6 is secured to the container 1 by screw threads, clamps, or other known apparatus. A fragile article is illustrated at 7. Flats 8, knurling, or such, on container 1 and closure 6 render easier the task of assembling or disassembling the apparatus. Tamping tool 9 and hammer 10 may be used to compact powder 2.

In use, a powder (e.g. soapstone) is spooned into the container to partially fill it and the container is then vibrated for initial compaction. Then tamping tools 9, 10 may be used for further compaction. The fragile article is placed inside, additional powder is spooned in therearound and thereover, the container is vibrated, and tools 9, 10 may again be used for compaction. The container is slightly overfilled as illustrated in FIG. 3. The lid is then screwed or clamped into place thereby placing the already compacted powder under further compression to assure lack of voids and to assure firm holding of the fragile article. The downward tamping, and pressure from the lid, together with tapered walls 1, "wedge" the powder firmly around the fragile article.

In operation, the container is immovably mounted in an accessible portion of the vehicle with the sensory equipment embedded in the powdered material. After launch and recovery, the container with the fragile cargo is removed from the vehicle. Accessibility to this equipment is achieved by unscrewing the cover and tapping plate 5 by use of the shank of tool 9 or other tool. The powder and fragile article slide out within a few seconds and with no sticky mess of plastic material as is experienced on the more common method of encapsulating with thermoplastic potting compound. This action is enhanced by the outwardly tapering walls which facilitate the powder removal.

I claim:

1. Apparatus for encapsulating fragile equipment comprising a container having a first end, sidewalls, and a second end, an aperture in said first end, a first closure member covering said aperture, said closure member loosely fitting inside of the sidewalls, a particulate finely divided material filling said container and surrounding the fragile equipment therein, and a second closure member for said second end of said container.

2. The improvement according to claim 1 in which the container sidewalls are tapered outwardly from said first end toward said second end to aid in compressing the material during filling and to aid in removing the material during emptying of the container.

3. The improvement according to claim 1 in which the housing contains means to connect said second closure member to said container and exert pressure against said particulate finely divided material to eliminate or minimize voids therein and to hold the fragile article under gentle substantially uniform pressure.