

[54] **BASE EJECTING ORDNANCE PROJECTILE**

[72] Inventors: **Spencer I. Radnich**, Webster, N.Y.;
Samuel Davelman, Succasuna, N.J.; **Paul S. Symonds**, Wharton, N.J.; **Willis H. Taylor**, Clifton, N.J.

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

[22] Filed: **Nov. 23, 1970**

[21] Appl. No.: **91,897**

[52] U.S. Cl.102/1 R, 102/2, 102/56,
102/92.6

[51] Int. Cl.**F42b 9/00**

[58] Field of Search.....102/1, 2-6, 56-58,
102/92.15

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Primary Examiner—Robert F. Stahl

Attorney—Harry M. Saragovitz, Edward J. Kelly and Herbert Berl

[57]

ABSTRACT

This disclosure is directed to a safety lifting plug for a base ejecting projectile which includes a cavity-defining body and at least one opening in the body for receiving the plug. The safety lifting plug is disclosed as including a top, a base means depending from the top which is receivable and rigidly engageable within the one opening, a lifting bar secured to the top, passage means formed in the plug through the top and the base means, and sealing means disposed in the passage means, which sealing means is manufactured from a material the melting point of which is less than the "expelling charge reaction temperature" of expelling charge material to be carried by the projectile. Thus, where a projectile is provided with a safety lifting plug according to the invention, the experience of high environmental temperatures thereby, which temperatures are in excess of the "expelling charge reaction temperature" thereby creating a possibility of a catastrophic event, causes the sealing material of the safety plug to melt thereby communicating the interior of the projectile with the atmosphere so as to allow the expelling charge gases to escape thereby to preclude the generation of undesired pressures within the projectile.

11 Claims, 5 Drawing Figures

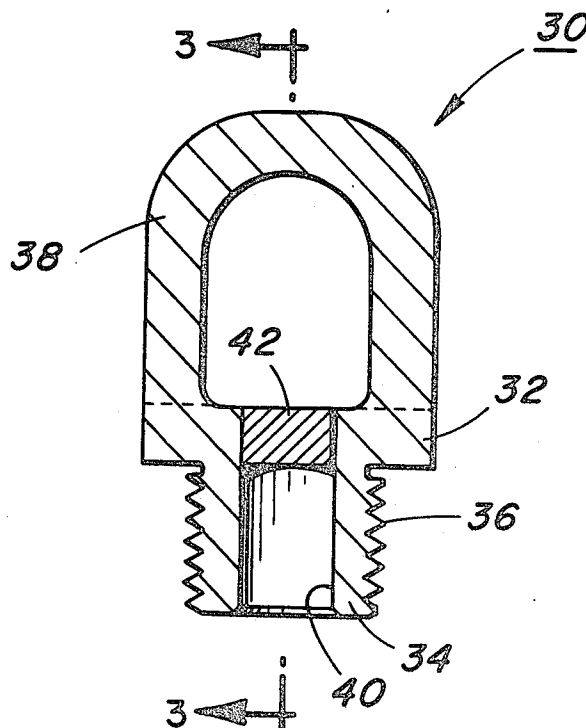


FIG. 1

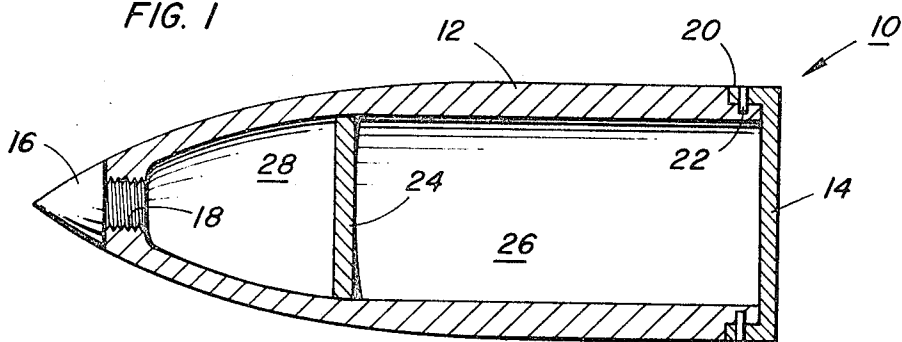


FIG. 2

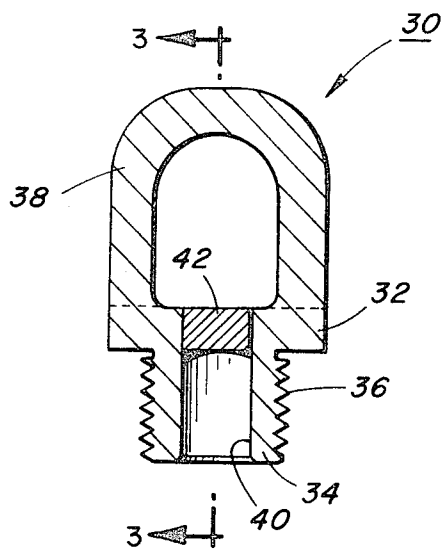


FIG. 4

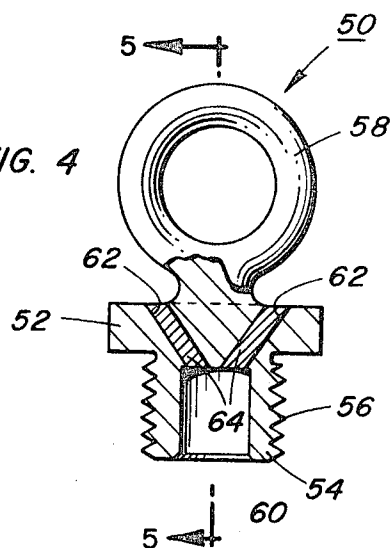
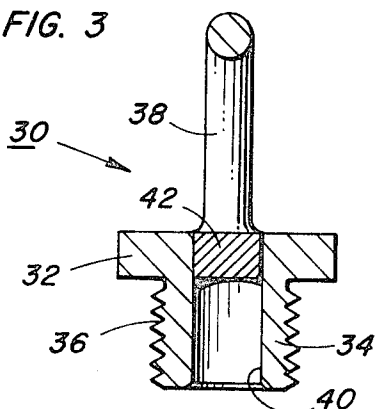
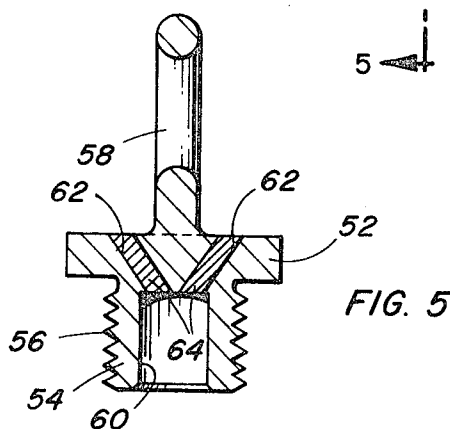


FIG. 3



INVENTORS

SAMUEL DAVELMAN
WILLIS H. TAYLOR
PAUL S. SYMONDS
SPENCER I. RADNICH

Harry M. Saragovitz,
Edward J. Kelly &
Herbert Berl

ATTORNEYS

BASE EJECTING ORDNANCE PROJECTILE

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BACKGROUND OF THE INVENTION

This invention relates broadly to the field of safety devices. More specifically, this invention relates to safety devices for pressure containers e.g. ordnance projectiles, which are utilized to transport heat responsive cargo, the overheating of which cargo can cause catastrophic events in the absence of relief means.

One of the more difficult problems facing those concerned with the ordnance arts is the problem resulting from the possibility that an ordnance projectile carrying a heat responsive cargo may be subjected to relatively high degrees of heat during transportation or storage. In such situations, where the applied heat is sufficient to exceed the reaction temperature of the cargo, a catastrophic event such as destruction of the container, cargo damage or other occurrence may result. Often such a catastrophic event occurs when the temperature to which the projectile is subjected is sufficiently high to cause the explosive cargo to generate gases such as by "cooking" or detonation.

Typical of the projectiles which are subject to these dangers is the base ejecting projectile. In such projectiles, a cargo cavity is closed at the base of the projectile casing by a releasable base plate. The head end of the cargo cavity is bounded by a slidable pusher plate within the projectile casing, on the other side of which pusher plate is positioned an ejection charge which may be of mortar propellant or the like. A fuse is ordinarily provided in the nose of the projectile casing. When such a base ejecting projectile is fired, the fusing mechanism will, at some selected point in the trajectory, initiate the expelling charge thereby generating gas under pressure. The expansion of the pressurized gas pushes the pusher plate against the cargo, thus causing separation of the base plate from the projectile casing and ejection of the cargo through the opening in the casing formed by the separation of the base plate.

When projectiles such as the base ejecting projectile described above are stored, the fuse is ordinarily removed and replaced with a lifting plug, i.e. a plug which is securable in the fuse well, which plug is provided with a bar or eye fitting to which material handling apparatus such as a lifting device can be attached. The known plugs are pressure tight and thus, notwithstanding the removal of the fusing mechanism and substitution of the plug therefor, it has been found that when the projectiles have been subjected to relatively high temperatures, e.g. during a fire in an ammunition storage area where the projectile is being stored, the ignition temperature of the expelling charge has been exceeded thus causing the expelling charge to ignite and "cook-off" thus expelling the cargo. One of the problems presented by cargo expulsion under these circumstances is the necessity for cleaning the area to remove the expelled cargo. The more serious problem, however, is that the cargo may be explosive in nature thus creating the possibility that personnel in the area may be injured or killed. Unfortunately, injuries and fatalities resulting from cargo ejection under these circumstances have been experienced.

It is the principal object of the invention, therefore, to provide a safety lifting plug which is suitable to maintain the integrity of a cargo container e.g. a base ejecting projectile, during ordinary conditions, but which plug prevents the buildup of potentially damaging pressures within the container upon the occurrence of environmental temperatures in excess of the expelling charge reaction temperature.

SUMMARY OF THE INVENTION

This principal object and others are not enumerated and are achieved by the safety lifting plug of the present invention, one embodiment of which may include a top, a lifting means secured to the top, a base depending from the top which base is securably receivable within an opening in a container having

a cargo receiving cavity, a passage formed in the plug through both the top and the base, and sealing means disposed in the passage, the sealing means being selected from a material the melting point of which is lower than the expelling charge reaction temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present invention and the manner in which it can be made and used may be had from the following detailed description, particularly when read in the light of the accompanying drawing wherein:

FIG. 1 is a schematic, cross-sectional view of a base ejecting ordnance projectile with respect to which the safety lifting plug of the invention may be used;

FIG. 2 is an elevational view, partly in cross-section of one embodiment of safety lifting plug according to the invention;

FIG. 3 is a cross-sectional view through the plane 3—3 of FIG. 2;

FIG. 4 is an elevational view, partly in cross-section of a second embodiment of the safety lifting plug according to the invention; and

FIG. 5 is a cross-sectional view through the plane 5—5 of FIG. 4.

DETAILED DESCRIPTION

Referring therefore to FIG. 1, a base ejecting ordnance projectile with respect to which the safety lifting plug of the invention may be utilized is shown and designated generally by the reference numeral 10.

Base ejecting projectile 10 is shown schematically to include a projectile casing 12 which is closed at one end by a base plate 14 and at the other by a fuse 16 which is threadedly received within a fuse well 18. Base plate 14 is a shallow cup shaped member which is provided with an annular lip 20 having suitably spaced radial bores for receiving therethrough a plurality of shear pins 22 for releasably connecting the base plate 14 with the projectile casing 12. Slidably disposed within the cavity defined by projectile casing 12 is a pusher plate 24. Thus, the interior of projectile casing 12, base plate 14 and pusher plate 24 cooperate to define a payload chamber 26 in which is carried the payload of the projectile, whatever it may be. Similarly, pusher plate 24 cooperates with the remaining inner cavity of projectile casing 12 and the inner end of fuse 16 to define an expelling charge chamber 28 in which is suitably positioned an expelling charge which, as noted above, may be mortar propellant or the like.

As will be recognized by those having skill in this art, fuse 16 is placed within fuse well 18 only shortly prior to the time when it is desired to fire the projectile. At other times, particularly during storing and handling of projectile 10, the fuse 16 is replaced by a lifting plug. Known lifting plugs ordinarily comprise U-bar or eye plugs which have threaded bases corresponding to the threaded base of the fuse and thus are rigidly threadedly receivable within fuse well 18.

With respect to ordnance projectiles, the present invention defines such a lifting plug but embodies in the lifting plug safety structure which, as is discussed in detail below precludes the generation of potentially damaging pressures within projectile 10 in the event that the projectile is exposed to temperatures which are in excess of the expelling charge reaction temperature.

One embodiment of safety lifting plug according to the invention which may be utilized as a lifting plug for projectile 10 is shown in FIGS. 2 and 3 and designated generally by the reference numeral 30.

Safety lifting plug 30 comprises a top 32 having a base 34 depending therefrom. Top 32 may be of circular configuration or may be polygonal to accommodate the receipt of a wrench thereover for tightening and loosening the plug from fuse well 18. In this regard, the peripheral surface of base 34 is provided with threads 36 to enable the threaded engagement of safety plug 30 in fuse well 18 of projectile 10.

Integral with top 32 and extending upwardly from the upper surface thereof is a U-shaped bar 38 which defines a lifting means to which a material handling apparatus may be attached. Thus, the hook of a chain lift, ammunition hoist or other article handling apparatus may be positioned through U-bar 38 and thereby be operably secured to the projectile in which plug 30 may be engaged.

Extending longitudinally axially through base 34 and top 32 is a bore 40 at the top adjacent end of which is positioned a sealing plug 42. Sealing plug 42 may be of any material the melting point of which is less than the expelling charge reaction temperature. Because most expelling charges have a melting point in excess of 215° F., it has been found that the most satisfactory material for forming plug 42 are ternary eutectic compositions of bismuth, lead and either cadmium or tin in such proportions as to obtain a melting point in the range of 185° to 215° F. One such composition is an alloy comprising 52.5 percent bismuth, 32 percent lead and 15.5 percent tin. This alloy is particularly desirable because it can be sealed against humidity and has a melting point of approximately 203° F.

Safety lifting plug 30, which has been satisfactorily made from steel and aluminum, can be manufactured by casting or forging the base device, i.e. the top, base and U-bar, machining to provide the threads 36 and bore 40, cleaning to remove dirt and grease, covering the end of bore 40 adjacent top 32 so as to preclude the flow of material therefrom coating the surface of bore 40 with an anaerobic sealant, and thereafter pouring a desired amount of sealing material in the molten state into the bore to form plug 42. After the sealing material has been poured into bore 40, it is permitted to cool and set whereafter the bore closing means is removed, desired finishes may be applied, and plug 30 is ready for use.

It has been found that where high humidity conditions are to be experienced, difficulties occur in getting a sufficiently satisfactory sealing between the sealing material 42 and the inner surface of bore 40, and across the material of plug 42 per se, to establish a hermetic sealing condition. Under such circumstances, a suitable filler means can be utilized to perfect the seal. More specifically, it has been found that a small amount of anaerobic sealant, can be deposited on the surface of sealing material 42 and allowed to settle into any voids which may exist in either the sealing material or at the interface of the sealing material and bore 40 and that such filler material provides a fluid tight bond without a requirement for a pressure or impregnation process.

Considering the operation of lifting plug 30 with respect to projectile 10, it will be assumed that fuse 16 is replaced by safety lifting plug 30 for purposes of both safety and projectile handling. The plug 30 is threadedly inserted within fuse well 18 and suitably secured in the known manner. With the safety plug so secured, the projectile 10 may be handled by projectile handling apparatus while at the same time maintaining the environmental integrity of the interior of projectile casing 12. In the event that the projectile 10 having safety plug 30 installed is subjected to high environmental temperatures, e.g. in the event of a fire in an ammunition storage area, and in the event that the environmental temperatures exceed 203° F., the material of sealing means 42 will melt thereby opening bore 40 to allow communication of the expelling charge chamber 28 with the atmosphere. Such communication precludes the buildup of potentially damaging pressures within the chamber and precludes, therefore, the possibility that the expelling charge will ignite and the payload will be ejected from the casing into the ammunition storage area.

A second embodiment of safety lifting plug according to the invention is shown in FIGS. 4 and 5 and designated generally by the reference numeral 50. Lifting plug 50, similarly to safety lifting plug 30, comprises a top 52, a base 54 having threads 56 formed thereon. An eye bar 58, secured to and disposed centrally of top 52, is adapted for connecting safety plug 50 to article handling apparatus such as crane hook, lifting apparatus or the like.

Formed in the inner end of base 54 is a longitudinally axially extending counter-bore 60 which is in communication with a plurality of angularly oriented bores 62 which extend through top 52 from a point adjacent the base of eye bar 58 into counter-bore 60. Bores 62 are filled with sealing material 64, which is a fusible material with a low melting point such as the alloy described above with respect to sealing material 42 in the first embodiment of safety plug 30.

Thus, where it is desirable to have an eye type lifting plug such as plug 50 rather than a U-bar type lifting plug such as plug 30, eye type lifting plug 50 will be utilized. The materials, manufacture and operation of plug 50 are substantially the same as described above with respect to plug 30.

Although plugs 30 and 50 have been disclosed with respect to the use of aluminum or steel as the material for the basic plug structure and the bismuth, lead, tin alloy as the meltable sealing material, it will be recognized that other materials can be utilized. Thus, the basic plug structure can be manufactured from suitable metal alloys as desired. Similarly, the sealing material may be other alloys or even plastics so long as they exhibit the capability to seal the plug bores during normal operation and to melt in the event that environmental temperatures approaching the expelling charge reaction temperature are experienced.

In view of the foregoing detailed description, it can be seen that the safety plug of the invention comprises a multi-purpose plug which is useful for closing a container, defining a lifting apparatus for handling a container, and providing a safety structure for precluding the generation of potentially damaging pressures within the container as a result of heating. The device can be manufactured relatively cheaply because the entire basic structure can be a monolithic pour thus requiring minimum of machining and other manufacturing procedures.

Although the detailed description of the invention has been with respect to two embodiments thereof, it is considered to be manifest that many modifications and variations to the inventions may be accomplished without departing from the spirit and scope thereof.

We claim:

1. A base-ejecting ordnance projectile comprising:

a casing;

a cavity defined by said casing, said cavity including a payload chamber and an expelling charge chamber separated by a payload pusher plate;

an opening in said casing for communicating said expelling charge chamber with the exterior of said casing; and

a safety lifting plug disposed in said opening in said casing, said safety lifting plug comprising a top, a base means depending from said top, said base means being receivable within said opening for rigid engagement with said casing, lifting means secured to said top for attaching said plug to an article handling apparatus, passage means formed in said plug through said top and said base means, and sealing means disposed in said passage means, said sealing means being manufactured of a material the melting point of which is a lower temperature than the cargo reaction temperature of cargo material to be received in said container.

2. A base-ejecting projectile according to claim 1 wherein said top and said securing member of said safety lifting plug are a monolithic structure.

3. A base-ejecting projectile according to claim 1 and further including a counter-bore in said securing member of said safety lifting plug, said counter-bore being in communication with said passage means.

4. A base-ejecting projectile according to claim 1 wherein said lifting means of said safety lifting plug comprises a generally U-shaped bar rigidly secured to said top.

5. A base-ejecting projectile according to claim 4 wherein said base means, said top and said U-shaped bar of said safety lifting plug are a monolithic structure.

6. A base-ejecting projectile according to claim 1 wherein said lifting means of said safety lifting plug comprises an eye bar rigidly secured to said top.

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7. A base-ejecting projectile according to claim 6 wherein said base means, said top and said eye bar of said safety lifting plug are a monolithic structure.

8. A base-ejecting ordnance projectile according to claim 1 and further including filler means disposed over said sealing means of said safety lifting plug, said filler means for filling any interstices in said passage in and around said sealing means.

9. A base-ejecting ordnance projectile according to claim 6 wherein said passage means of said safety lifting plug comprises a plurality of bores extending from said top adjacent the base of said eye bar through said top and said base means.

10. A base-ejecting ordnance projectile according to claim 1 wherein said sealing means of said safety lifting plug is a metal alloy consisting of 52.5 percent bismuth, 32 percent lead and 15.5 percent tin.

11. A base-ejecting ordnance projectile according to claim 1 wherein said sealing means of said safety lifting plug comprises ternary eutectic compositions of bismuth, lead and either cadmium or tin in such proportions as to obtain a melting point in the range of 185° to 215° F.

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