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McGhee

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[54] **INSTALLATION OF INCENDIARY LINERS IN BOMBS THROUGH USE OF PRELINED TUBULAR STEEL STOCK**

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[52] **U.S. Cl.** **29/1.21**; 29/447; 86/17; 29/DIG. 35

[51] **Int. Cl.** **B21k 21/06**

[58] **Field of Search** ..... 29/447, DIG. 35, 1.21; 86/17

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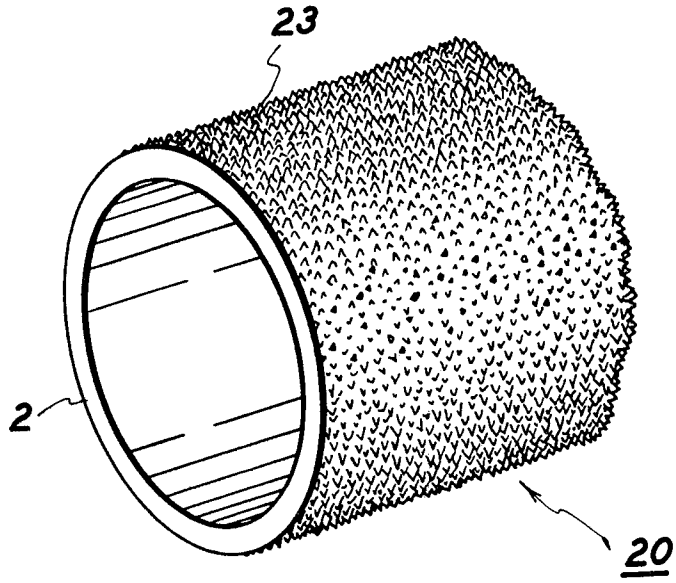
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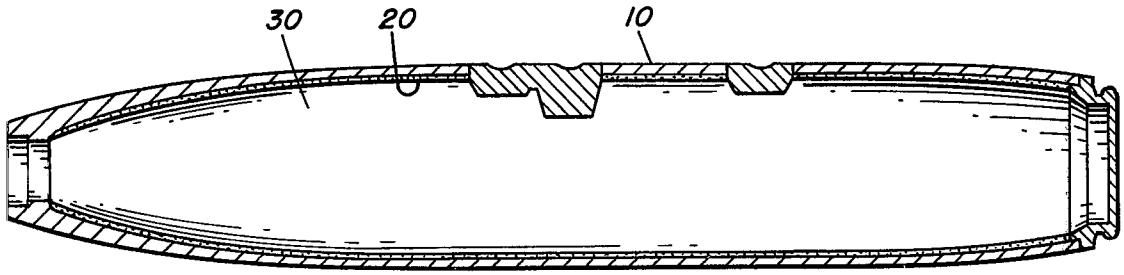
Primary Examiner—Leland A. Sebastian

[57] **ABSTRACT**

A process for adapting incendiary liner materials in ordnance items which are made from seamless or rolled and welded tubing, whereby the incendiary liner is in a tube form and is placed inside a preferably metal tubing before the ordnance item enters the production line.

5 Claims, 1 Drawing Figure




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INSTALLATION OF INCENDIARY LINERS IN BOMBS THROUGH USE OF PRELINED TUBULAR STEEL STOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a process of obtaining an incendiary lining in an ordnance device, and more particularly to a process of adapting certain incendiary liner materials to current bomb production techniques.

2. Description of the Prior Art

Casting of hot reactive metals (such as mischmetal) poses many problems. Casting must be done in an inert atmosphere and at very high temperatures (on the order of 1700°F), which would lower the body steel strength below specifications. A high spin rate is required (about 300 rpm) for the casting process and is not feasible because of the non-symetric weight distribution of the bomb body. As mischmetal is sensitive to water, the bomb could not be quenched after heating. Additionally, spin casting would create a bottleneck in the production line and would necessitate extensive safety precautions.

Bomb liners may also be made from preformed sections of pyrophoric material extruded rod which are potted against the inside of the bomb wall. Such liners would require hand installation and would dictate close fitting around the bomb lugs so as to avoid crevices in which explosive might be pinched. After liner installation, care must be taken to close all seams in the liner. In general, liners produced from extruded rod and preformed sections require hand installation, thereby creating a production bottleneck, and require meticulous installation techniques. Extruded liner material costs are greater than casting material costs.

The use of pyrophoric materils in pellet form has also been proposed. The pellets may be potted in the bomb as a liner or may be mixed in directly with the explosive. Potting of the pellets would require equipment to spin or roll the bomb as the liner is formed. The pellets may not suspend well in the liner material, causing nonuniformity in the liner. The liner material must be selected so as to be compatible with the explosive and must demonstrate effective fragmentation and incendiary characteristics. Pellets of incendiary material cast in the explosive may create voids in the explosive during casting and/or during transportation for example by aircraft vibration, a condition which could cause premature detonation under "G" loading due to adiabatic compression.

SUMMARY OF THE INVENTION

The present invention is a process of adapting certain incendiary liner materials to current bomb production techniques. While the invention process is primarily intended for bombs, it is certainly also applicable to all other ordnance items which are made from seamless or rolled and welded tubing. The incendiary liner can be made from any pyrophoric material which lends itself to both cold and hot forming and which can be brought to heat treatment temperatures (1600° – 1700°F) without igniting and then successfully quenched. The pyrophoric material described herein is zirconium but various zirconium alloys and any other pyrophoric materials and their alloys may be adapted to this process.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a safe method of installing incendiary liners at a low cost.

Another object is to provide a method of inserting an incendiary liner which is adapted to current production line methods without requiring special equipment.

A further object of the invention is to provide an incendiary liner along the full length of an ordnance device rather than partial-length liners.

Other objects, advantages, and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The single FIGURE of the drawings shows a completed bomb body with a formed incendiary liner after having gone through the entire production line.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A tubular bomb stock comprising a metal tube into which has been inserted an incendiary liner which is preferably of a diameter which is slightly less than is the inside diameter of the metal tubing so that it may be slipped inside thereof prior to introduction into the production line. The incendiary liner may be of any pyrophoric materials which can be readily cold formed, subjected to temperatures of 1650°–1700°F without ignition, and which can be water quenched. The pyrophoric tubing may be extruded or rolled sheet material, for example zirconium.

The prelined steel tubing is introduced into the production line as usual and proceeds normally through the production line, emerging as an incendiary lined complete bomb body, as shown in the drawing. For example, a zirconium tube inserted in a 1020 steel sleeve, heated to a temperature of 1650°F, water quenching, and cutting 0.03 inch zirconium sheet with a cutting torch under a normal atmospheric conditions is one set of conditions which has been successfully tested. The method of the present invention has successfully passed tests which simulate the most difficult conditions which zirconium would meet in current bomb production lines.

The drawing shows a completed bomb body **10** which entered the production line as tubular bomb stock. Incendiary liner **20** entered the production line as the incendiary liner of the tubular bomb stock. The drawing shows the shaping which the tubular stock must go through to be a complete bomb body and shows generally the inserts necessary to close one end of the bomb and also the inserts necessary to make the bomb adapted for carriage in a bomb rack. To complete the bomb, explosive material would be added to chamber **30.**

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A method of producing an incendiary casing for an ordnance device comprising the steps of:

inserting a tube of pyrophoric material into a tubular member to form a liner thereof, said pyrophoric material being susceptible of either hot or cold forming;

forming said tubular member and said tube of pyrophoric material into a desired final configuration; and

heat-treating the final configuration to produce the desired physical characteristics.

2. The method of claim **1** wherein said pyrophoric material is zirconium.

3. The method of claim **1** wherein said tubular member is made of 1020 Steel.

4. The method of claim **1** wherein the heat treatment comprises the steps of:

heating said tubular member and liner to a temperature of approximately 1600° to 1700° F.; and

water quenching the heated elements.

5. A method of producing an incendiary casing for an ordnance device comprising the steps of:

inserting a tube of zirconium into a tubular member of **1020** Steel to form a liner thereof;

cold forming said tubular member and liner into a desired final configuration;

heating said tubular member and liner to a temperature of approximately 1600° to 1700° F.; and

water quenching said tubular member and liner to produce an incendiary casing having the desired physical characteristics.

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