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Schillinger

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[54] **METHOD OF BONDING AN ANNULAR BAND OF MATERIAL TO AN OBJECT**

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[52] **U.S. Cl.** **164/72;** 164/80; 164/98; 164/112

[51] **Int. Cl.** **B22c 3/00**

[58] **Field of Search** 164/80, 98, 112, 332, 72

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[57] **ABSTRACT**

A method of bonding a rotating band to the shell of an explosive projectile in which the entire mass of band material is melted so as to fuse it to the shell.

3 Claims, 2 Drawing Figures

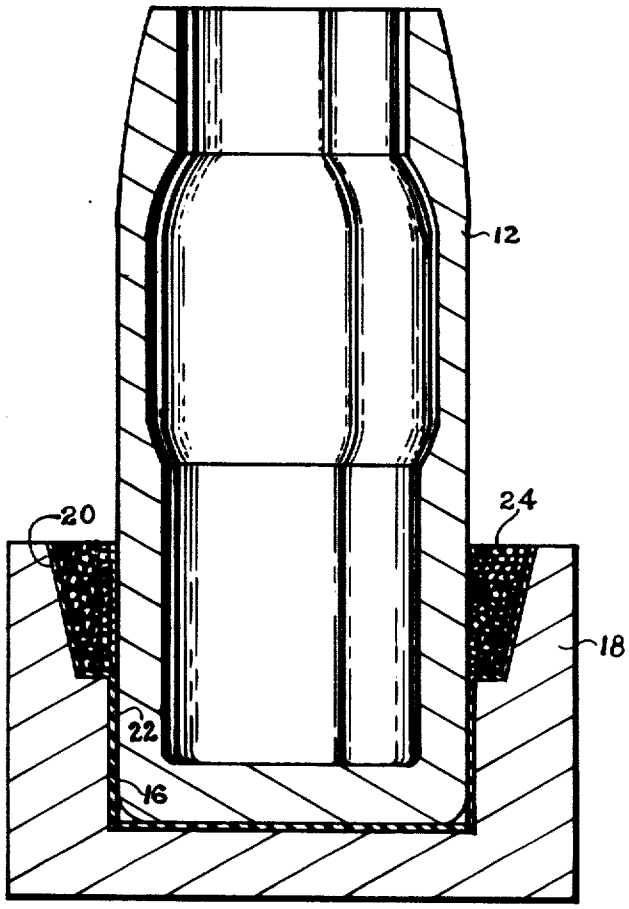


Fig. 1

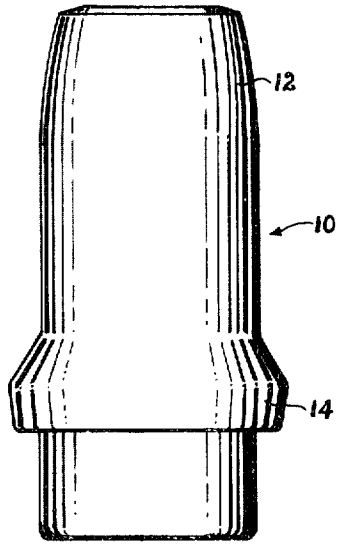
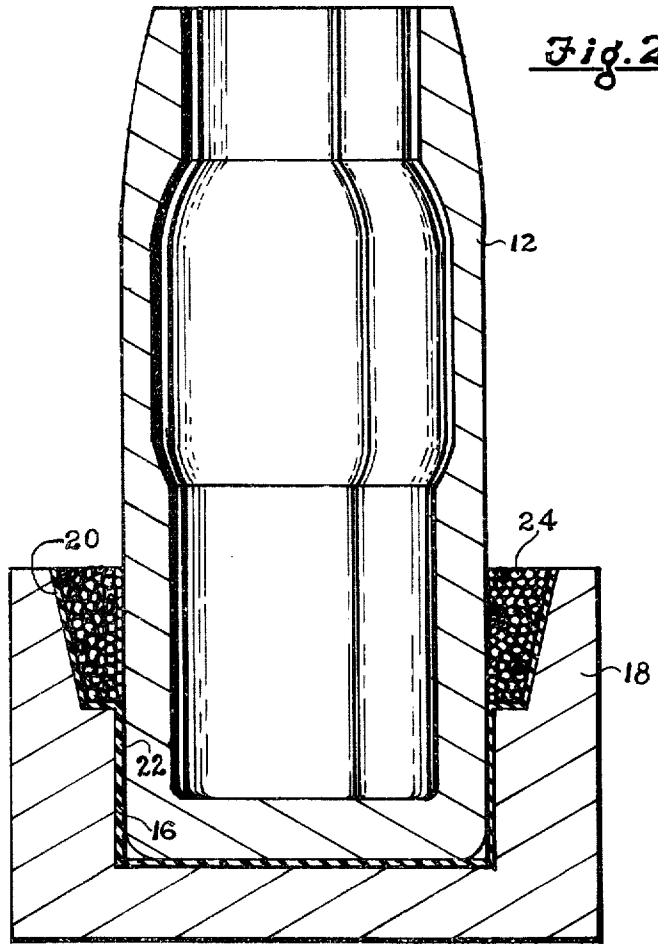


Fig. 2



METHOD OF BONDING AN ANNULAR BAND OF MATERIAL TO AN OBJECT

STATEMENT OF GOVERNMENT INTEREST

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.

BACKGROUND OF THE INVENTION

This invention relates generally to methods of joining materials, and particularly to a method of bonding an annular band of material to an object. While not limited thereto, the invention finds special application for applying a rotating band to the shell of an explosive projectile and therefore the invention will be described hereinafter in connection with such use.

Known methods of bonding a rotating band to a projectile include swaging a ring of soft metal into a knurled band seat cut or otherwise formed in the projectile wall, and applying an arc-welded overlay deposit to the wall of the projectile. In many respects, the swaging method is satisfactory, however, it does require a thick-walled projectile to withstand the swaging forces and provide adequate wall thickness to allow for cutting or forming the band seat. Swaged bands are also open to the objection that they are not always securely bonded to the projectile and occasionally are thrown from the projectile during firing so as to present a danger to friendly personnel or equipment. The arc-welding method is not particularly suitable for small caliber projectiles such as 20mm, 30mm, or 40mm, for example because of the excessive time required to apply the bands.

SUMMARY OF THE INVENTION

An object of the invention is to provide improvements in the art of bonding an annular band of material to an object.

Another object of the invention is to provide a method of bonding a rotating band to a projectile which permits the use of thinner walls in projectiles.

Another object of the invention is to provide a method of bonding a rotating band to a projectile which can be practiced at reduced costs of labor and band material.

A further object of the invention is to improve the bond between a rotating band and its associated projectile shell.

A more specific object of the invention is the elimination of pitting and the lessening of intergranular penetration, both of which are by-product conditions of the arc-welding process.

In accordance with the above objects and considered first in one of its broader aspects, a method of bonding an annular band of material to an object which has a higher melting point than the band material in accordance with the invention may comprise the steps of surrounding the object with an annular mass of the band material, heating the object and band material until the band material melts, orienting the band material so that when molten it will flow to and fuse to an annular surface of the object, and allowing the banded object to cool.

The invention will be more clearly understood when the following detailed description of the preferred embodiment thereof is read in conjunction with the accompanying drawing which is described below.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 illustrates the shell of an explosive projectile and a rotating band bonded to the shell in accordance with the principles of the invention.

FIG. 2 is an enlarged sectional view of the projectile shell, a mold, and an annular mass of the rotating band material.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, the banded shell **10** (FIG. 1) comprises a projectile shell **12** and an annular band **14** bonded to the periphery of the projectile shell **12.** The annular band **14** is known in the art as a "rotating band" and, following bonding to the shell **12,** as will be explained, is usually machined or otherwise formed to a desired configuration.

The banded shell **10** is made by first inserting the closed end of the shell **12** into the nest **16** (FIG. 2) of a mold **18** constructed of graphite or other suitable refractory material. The nest **16** has a size so as to provide a close fit with the diameter of the closed end of the shell **12.** The upper end of the mold **18** is provided with an annular cavity **20.** The inner surfaces of the mold **18,** namely, the surfaces of the nest **16** and cavity **20** are coated with a mold wash **22** in the form of a refractory oxide such as Zirconia flour, for example. The mold wash **22** prevents diffusion of elements from the mold **18** into the material of the shell **12,** which is generally steel, and permits easy removal of the banded shell **10** from the mold **18.**

The cavity **20** is filled to the desired level with band material **24** which may be in the form of shot, as shown, or other suitable form such as, for example, a tubular ring. The entire assembly consisting of the mold **18,** shell **12,** and shot **24** is heated under an appropriate shield such as, for example, flux or inert gas until the band material **24** melts and bonds to the wall of the shell **12.**

Copper, 80–20 Brass, and 90–10 Tin Bronze are examples of band materials that have been applied successfully to steel shells **12.** Both induction and furnace heating methods have been used successfully.

The use of a shield is required to prevent oxidation of the shell which, if present, would prevent wetting of the shell steel by the molten band material. Argon is one example of a gaseous shield which is satisfactory for use in both the furnace and induction heating methods.

I claim:

1. A method of bonding a rotating band to a projectile shell which has a higher melting point than the band material and a portion of substantially uniform outside diameter comprising the steps of

placing the shell into a refractory graphite mold having an annular cavity which surrounds the shell and a close-fitting nest which receives said portion of said outside diameter,

loading the annular cavity with band material so as to constitute an assembly of the mold, shell, and band material,

heating the assembly by induction heating until the band material melts, the annular cavity being constructed such that when the band material is melted

it will flow to and fuse to the adjacent annular surface of the shell, and

allowing the banded shell to cool.

2. A method according to claim 1 characterized further by coating the interface surfaces of the mold between the mold and the shell and between the mold and the band material with a refractory oxide mold wash to both prevent diffusion of elements from the mold into the shell and to facilitate removal of the banded shell from the mold.

3. A method according to claim 2 wherein the band material contains a volatile element and the assembly is heated only under an inert nonhydrogenous shield.

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