

Nov. 27, 1945.

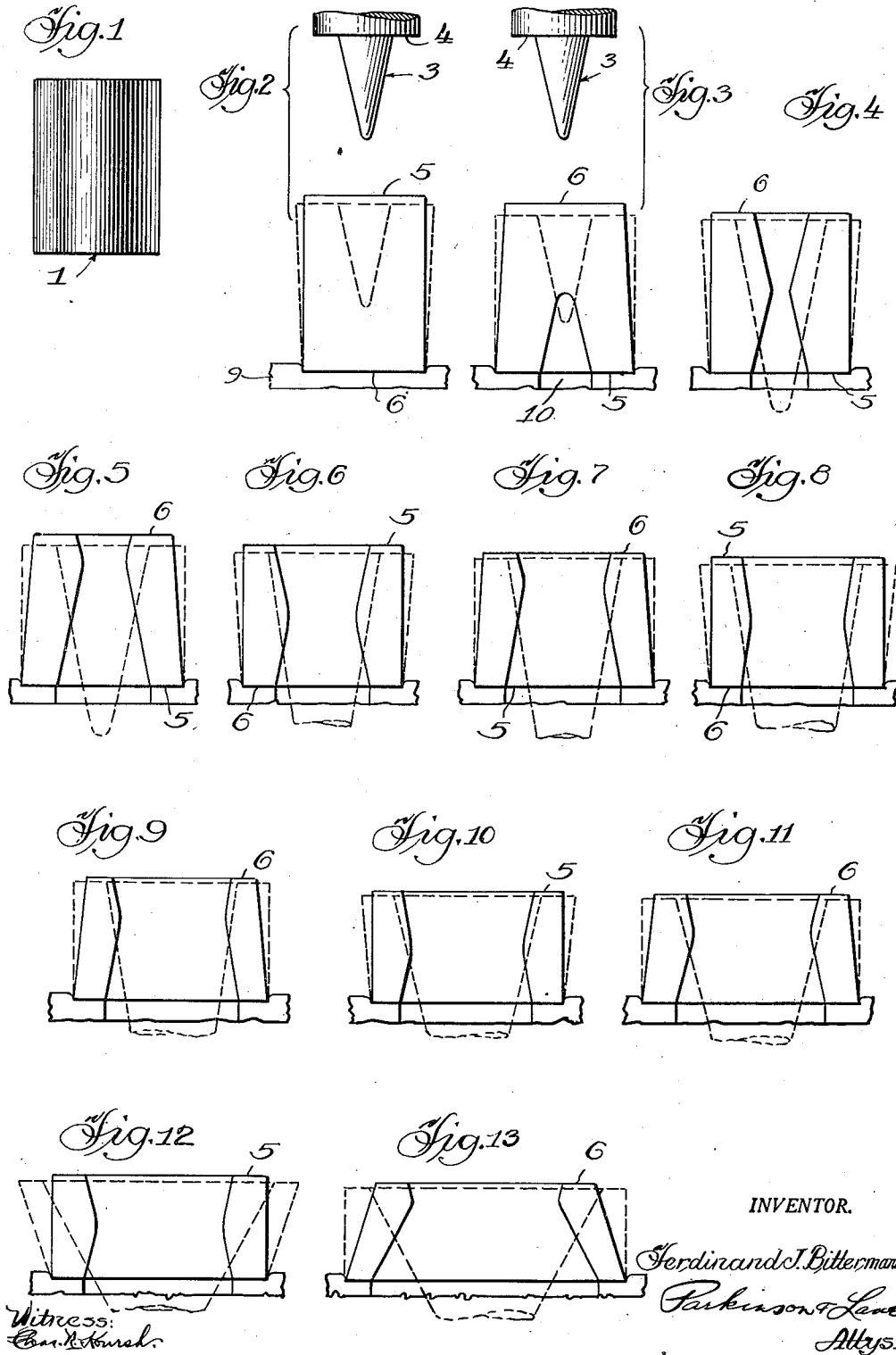
F. J. BITTERMANN

2,389,758

METHOD OF FORMING METALLIC BANDS

Filed Oct. 30, 1942

3 Sheets-Sheet 1



Nov. 27, 1945.

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METHOD OF FORMING METALLIC BANDS

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3 Sheets-Sheet 2

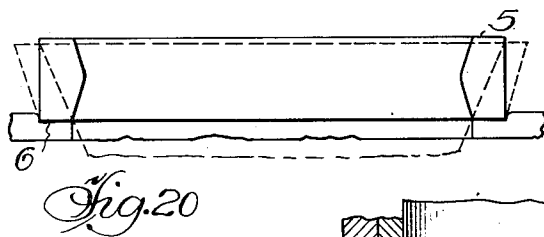
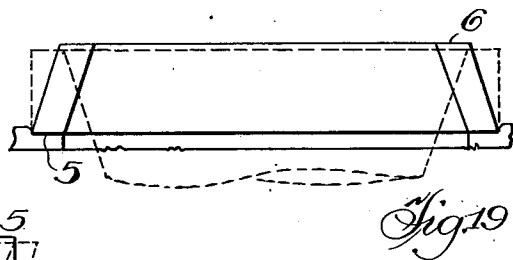
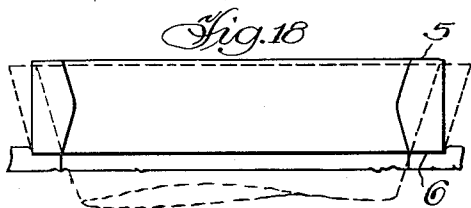
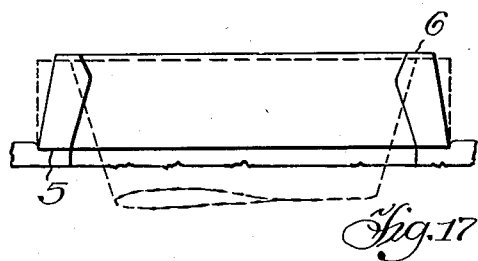
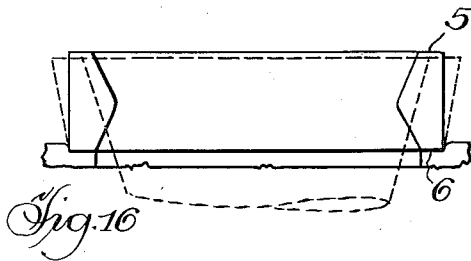
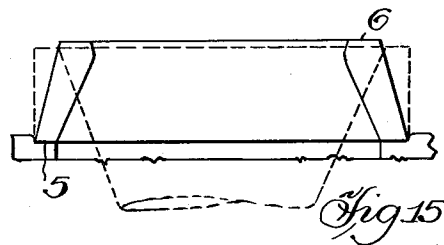
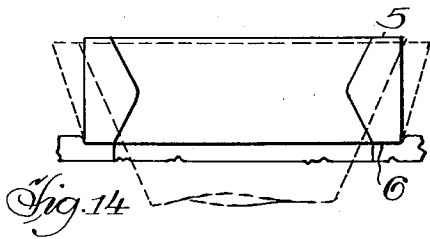
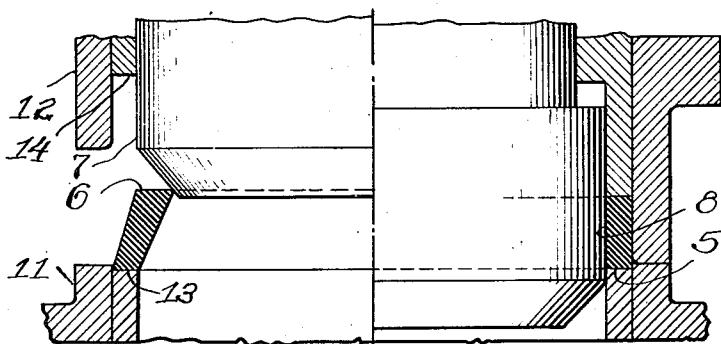


Fig. 21

Fig. 22



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2

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METHOD OF FORMING METALLIC BANDS

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3 Sheets-Sheet 3

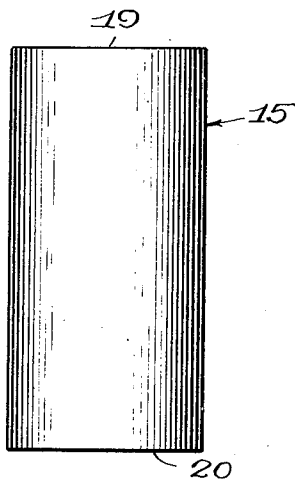


Fig. 23

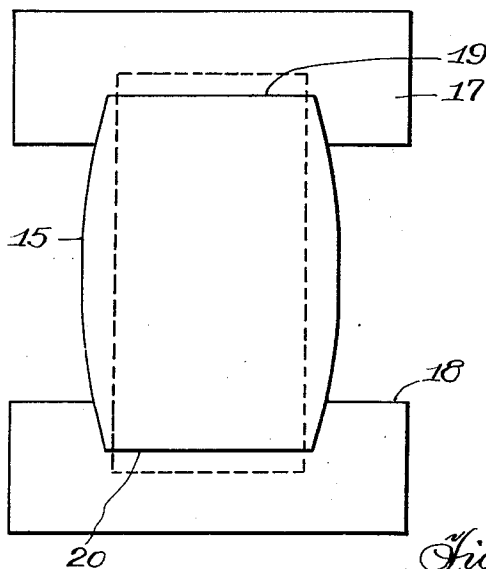


Fig. 24

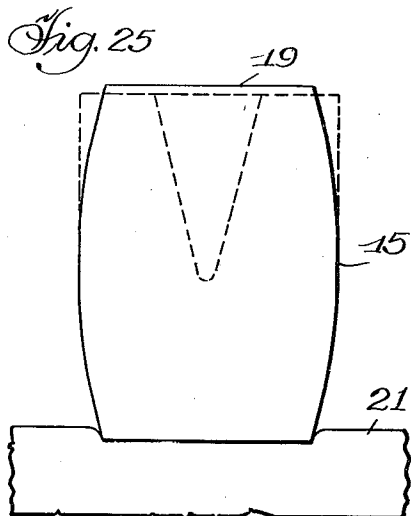


Fig. 25

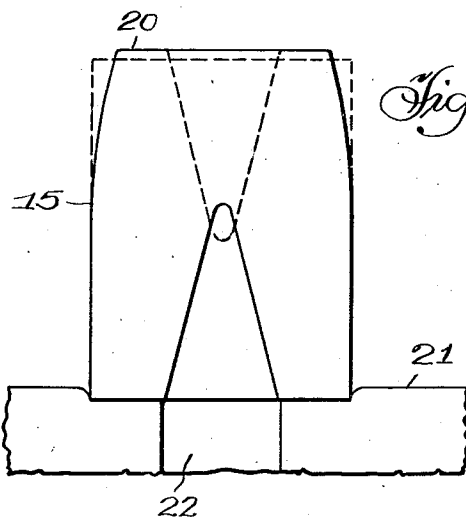


Fig. 26

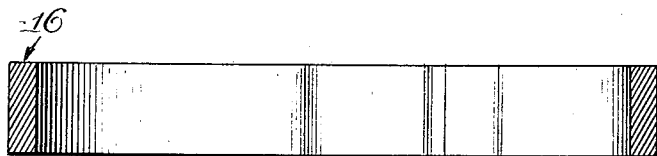


Fig. 27

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UNITED STATES PATENT OFFICE

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METHOD OF FORMING METALLIC BANDS

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Application October 30, 1942, Serial No. 463,991

2 Claims. (Cl. 29—156)

The present invention relates to metallic bands and especially to a band adapted to be positioned in an annular groove in the circumference of a projectile or shell. When so mounted the band has the dual purpose of causing the projectile or shell to rotate as it travels down the bore and the lands of the rifling cut into the relatively soft metal of the band, and to seal and prevent the explosion gases from escaping from the bore of the gun.

It is an important object of the present invention to provide a novel method and manner of producing such a band from a solid cylindrical block of copper, gilding or other metal suitable for the purpose. In this novel method and manner of manufacture, no waste or scrap results as the density and volumetric content of the metal is not altered from the initial block to the final band, and the band or article so produced retains the initial strength and characteristics of the metal.

The present novel method comprises certain predetermined steps in which a solid cylindrical metal structure or block through a sequence of operations, is transformed into a tubular band of predetermined dimensions. By this novel sequence of operations or steps, conical piercing and coining tools are forced successively into the opposite ends of the solid cylindrical structure and by reason of the gradually increasing cross section of the tools, cause the material of the original structure to be forced outwardly and downwardly until a cylindrical band or tubular structure of desired dimensions is produced. The resulting article is of increased diameter and decreased height producing a continuous band having the desired characteristics and dimensions essential to a rotating shell band.

Further objects are to provide a construction of maximum simplicity, efficiency, economy and ease of assembly and operation, and such further objects, advantages and capabilities as will later more fully appear and are inherently possessed thereby.

The invention further resides in the construction, combination and arrangement of parts illustrated in the accompanying drawings, and while there is shown therein a preferred embodiment, it is to be understood that the same is susceptible of modification and change, and comprehends other details, arrangements of parts, features and constructions without departing from the spirit of the invention.

In the drawings:

Figure 1 is a view in side elevation of a solid cylindrical structure or block which is to ultimately form a rotating shell band.

Figure 2 is a composite view showing a piercing and coining tool and the solid cylindrical structure or block before and after it is pierced by this tool.

Figure 3 is a view similar to Figure 2, but showing the block or structure reversed, the contour of the structure before it is pierced by the tool being shown in full outline, and the contour after the piercing operation, being shown in dotted outline.

Figures 4 to 21, inclusive, show diagrammatically the sequence of operations and the contour taken by the structure or block as it is being transformed into a band or tubular member, with the piercing and coining tool forcing outwardly and downwardly the displaced metal to form a hollow structure of continuously increasing diameter but of less height.

Figure 22 is a view in vertical cross section of the resulting band formed by the novel method.

Figure 23 shows a section or block of copper or gilding metal sheared from a length of rod and in which the opposite faces may or may not be parallel.

Figure 24 shows diagrammatically the section or block placed in a flattening die and showing the conformation of the block after the die has been compressed.

Figure 25 and Figure 26 are diagrammatic views showing succeeding operations in piercing the opposite ends of the block.

Figure 27 shows the finished band.

Referring more particularly to the disclosure in Figures 1 to 22, inclusive, of the drawings, Figure 1 discloses a solid cylindrical structure or block 1 of predetermined dimensions, density and volumetric content of metal suitable for forming an integral band. By the present novel method and manner of production, the dimensions of this structure or block are so altered and the metal content so arranged as to produce a resulting end product in the shape of a band or tubular member 2 having a final contour as shown in Figure 22, the resultant band having a volumetric content of that of the initial structure or block, and the density substantially the same throughout the novel sequence of steps or operations performed to produce the band 2.

Figure 2 shows the initial step or operation in which the solid cylindrical structure or block 1, shown in full lines, is placed on a support below a conical piercing and coining tool 3 having a

shoulder 4 adapted to impinge against the upper surface 5 of the structure or block when the tool has pierced the block to the desired extent. The dotted outline shows the opening formed by the tool piercing the structure or block and forcing 5 outwardly and downwardly the displaced metal.

The next step in the sequence of operations is shown in Figure 3 in which the structure or block 1 is inverted to expose the lower surface or opposite end 6 to the piercing and coining tool 3, 10 which tool in piercing the structure or block, forces the metal outwardly and downwardly as shown in dotted outline in this figure, or as shown in full outline in Figure 4. The following sequence of operations are diagrammatically shown in Figures 4 to 21, inclusive, in which piercing 15 and coining tools shown in broken outline and similar to the tool 3 but of gradually increasing cross section, are employed. It is to be understood that after each piercing in one direction, 20 the structure is inverted and the tool is projected into and through the structure in the reverse direction from that in the preceding operation.

The conical surface of the piercing and coining tools and their cross section are so designed and determined that in each operation the material of the structure is forced outwardly and downwardly, and although it displaces or forces the metal outwardly and downwardly as the tool is being forced down by the force or pressure 30 applied thereto, it has been found that no waste or scrap results, but the volumetric content and density remain the same and that the resulting band 2 retains the same cubic content of metal as that initially appearing in the solid cylindrical structure or block 1. For example, I have taken a solid cylindrical block 1 having a height of 2.29 inches and a diameter of 1.75 inches, and have formed by the present method a resulting 35 band 2 having the following dimensions: .97 inch high, .284 inch thick, with an outer diameter of 6.648 inches and an inner diameter of 6.080 inches. Each of these structures contains a volumetric content of 5.508 cubic inches of metal. This example is given for illustrative purposes only, as the band may be of any desired dimensions, and knowing the dimensions of the desired band, it is a simple matter to determine the dimensions of the solid cylindrical structure or member from which the band is to be produced. 40

The final piercing and coining tool shown in Figure 21 is provided at its upper end with a cylindrical surface 7 of predetermined length to determine the cylindrical surface 8 of the inner diameter of the completed band. 45

As shown in Figures 2 to 20, inclusive, the block 1 in its various sequence of formations is mounted or positioned on a centering support 9, those shown in Figures 3 to 21, inclusive, having an opening 10 of a size approximating the size of opening in the adjacent surface of the block being operated upon. The support shown in Figure 21 comprises a centering support 11 against which a sizing and finishing member 12 is adapted to engage, and these members in association with the surfaces 13 and 14, and the cylindrical surface 7 of the tool, determine the final surfacing and polishing operation for the finished band. Preferably the member 11 is adapted to be depressed a desired amount when the upper member 12 engages therewith, and for such purpose, the member 11 may be spring-tensioned to return to the centering position shown in Figure 21. This figure shows at the left hand side, the position of the tool and the 50

sizing and finishing members prior to the final operation, and at the right hand side, the position of the band as the members are closed. It is to be noted that the band is forced outwardly and downwardly to assume the form of the finished band prior to the final coining operation.

By reason of the novel disclosed method in which the piercing and coining tool forces the metal of the structure or block from which the final band is to be produced, outwardly and downwardly, no confining wall or enclosure is provided for the structure and the metal is not compressed, but is free to move in these directions. The degree of movement of material outwardly and downwardly is controlled by the angle of the entering piercing and coining tool, and occurs in such relationship that the density of the original material is not changed.

An important feature of this invention resides in the fact that the change from the initial solid block to the final band is accomplished without the removal or loss of any of the material of that block. In order to establish proper ductility, the metal is preferably annealed at the desired stage or stages in the sequence of operation. 55

Figures 23 to 27, inclusive, disclose an alternate form in which a block 15 of greater length but of less diameter than that shown in Figure 1, may by a similar sequence of operations as those shown in Figures 2 to 21, inclusive, be transformed into a band 16 without the removal or loss of material. In this form of the invention, a rod of copper or gilding metal stock may be cut or sheared into suitable lengths by a cut-off die. If the sheared ends are not parallel, the block may then be placed in a flattening die consisting of upper and lower die members 17 and 18, to assure parallel surfaces at the opposite ends 19 and 20 of the block and to eliminate any distortion caused in shearing. This flattening and conforming operation initiates the downward and outward movement of the metal of the block. 60

Figure 25 shows the block in full outline as it is removed from the flattening die and placed on a centering support 21, the dotted outline showing the initial piercing by a piercing and coining tool similar to that shown in Figure 2, and the outward and downward movement of the metal caused by that piercing operation. Figure 26 shows the block reversed for the second piercing and coining operation in a manner similar to Figure 3, with the centering support 21 provided with an opening 22. Subsequent operations are similar to those shown in Figures 4 to 21, inclusive. 65

Although the invention relates primarily to metallic bands and a method and manner of producing them for use on shells or projectiles, its use is not limited thereto.

Having thus disclosed the invention, I claim:

1. The method of forming a metallic band for rotating shells or projectiles from a solid cylindrical metal structure without the removal or loss of metal, comprising the steps of forcing a cone-shaped coining and piercing tool into the central portion of the structure to cause an outward and downward pressure upon the material of the structure without altering its density, reversing the position of the structure so pierced, forcing the cone-shaped coining and piercing tool into the opposite end of this structure, and successively forcing a series of cone-shaped piercing and coining tools each of successively greater size into the opposite ends of the structure with each tool in sequence being forced into one and then 75

the opposite end until a tubular band of predetermined dimensions is produced.

2. The method of forming a metallic band from a solid cylindrical metal structure and without the removal or loss of metal, comprising the steps of placing the structure upon a support without any confining enclosure, forcing a cone-shaped coining and piercing tool into the central portion of an end of the structure, inverting the structure

and forcing the cone-shaped coining and piercing tool into the central portion of the opposite end of the structure, and successively forcing a piercing and coining tool of successively greater cross section into one and then the opposite end of the structure to thereby progressively increase its diameter and decrease its depth to form a continuous band.

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