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METHOD OF BORING METALS

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FIG.1

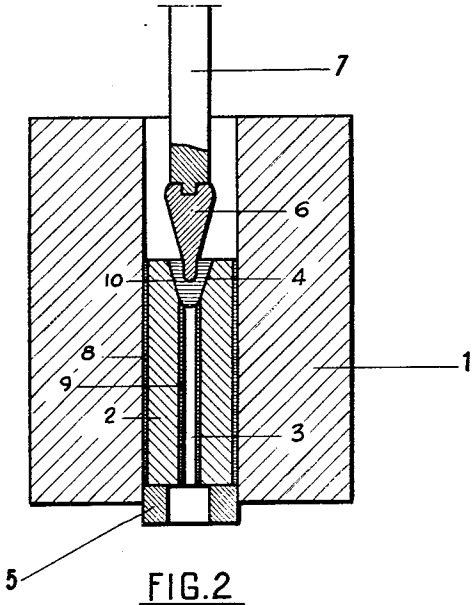

FIG.2

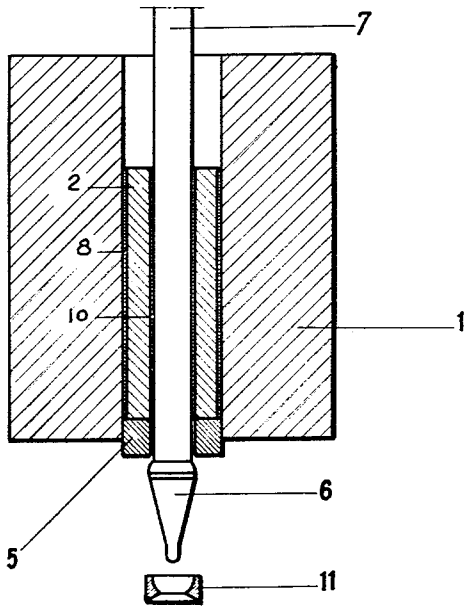

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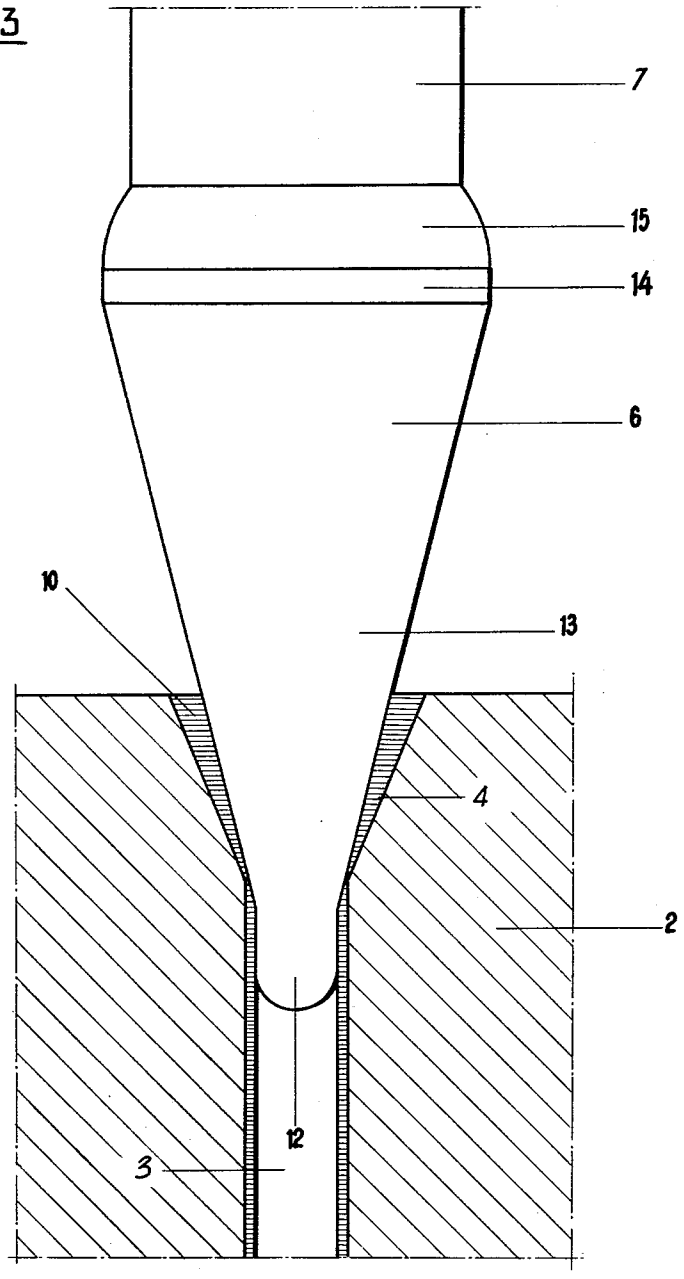
FIG.3



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2,956,337

METHOD OF BORING METALS

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4 Claims. (Cl. 29—555)

The present invention relates to a method of boring metals while hot for the manufacture of hollow bodies.

The present techniques of manufacture of metallic hollow bodies have recourse either to boring in the cold state by means of machine-tools, which has the major drawback of involving a loss of metals corresponding to the volume of the hole bored, or to drilling while hot.

Piercing while hot may be effected by compensation; in this case, the operation is begun with square billets which are introduced into a cylindrical container, in which billets a punch is forced while the billets are in the hot state. The sections of the billet and the container are calculated in such manner that after the formation of the hole, the billet takes up completely the volume of the container in which it is placed, the movement of the metal in a direction parallel to the axis of the container being reduced to a minimum.

Hot piercing may also be carried out by driving; in this case round billets are used to begin with, enclosed in a container, and they are pierced by means of a punch with a return flow of the metal along the walls of the container. The friction between the billet and the container is high and this technique has only been capable of development since the application and use of vitreous lubricants which enable the friction of the billet against the tools to be reduced..

The methods of hot working have the advantage that they do not give rise to any loss of metal, and they are therefore preferred on every occasion when this is possible.

They have however the following drawbacks:

The centering of the holes in the billets is only adequate when holes of large diameter are pierced which permit the use of punches having a sufficient rigidity, or when particularly powerful presses are used which have no play;

The holes pierced cannot have a great length by reason of the force which is required to be employed.

In the general case, presses always have a certain amount of wear, and holes pierced in the hot state are thus not perfectly centered.

The present invention has for its object to remedy these difficulties and to enable pieces to be obtained with holes of great length and perfectly centered, having perfectly smooth internal surfaces; the pieces may be composed of all metals and alloys, and more especially of metals and alloys which give rise to difficulty in hot working.

The method of hot boring in accordance with the invention is characterised by the fact that a billet, previously drilled while cold over at least a part of its length to a diameter less than the diameter of the bore desired, and provided with a conical entry at the orifice of the said bore, is coated externally and internally with a vitreous product which has a level part in its viscosity curve at the working temperature considered, the billet being heated and placed in the container of a press, a boring nose is then introduced into the entry of the conical

orifice, after which, with the aid of the said nose, the billet is hot-bored to the desired diameter, the metal flowing back parallel to the axis of the container.

The present invention will be explained in greater detail below, reference being made to the accompanying drawings which illustrate one preferred example of its application, and in which:

Fig. 1 is a view in elevation and in central cross-section of a container of a press showing the initial stage of the method of hot boring in accordance with the present invention.

Fig. 2 is a view in elevation and in diametral cross-section of the same container showing the final stage of the said method.

Fig. 3 is a view of a detail of Fig. 1.

As it has been shown in the drawings, the method of hot boring in accordance with the present invention consists essentially in introducing into a vertical container **1** of a press a metal billet **2** which is brought up to the required temperature to permit of its deformation whilst hot by any appropriate method of heating. This billet has a polygonal cylindrical external surface and is previously pierced with a preliminary cylindrical hole **3** having a conical entry **4**. The container comprises a ring **5** at its lower portion, the ring permitting the passage of the nose **6** of a punch **7**. Before its introduction into the container and after it has been heated, the billet is coated externally and internally at **8** and **9** after it leaves the furnace, with a vitreous product which lubricates the displacement of the metal in the container during the boring operation.

The vitreous product which can be utilised in the form of powder or fibre, is preferably a material which melts partly or wholly at the working temperature whilst remaining viscous at that temperature, for example a glass, an oxide, a salt or a slag which complies with these conditions.

In the case of steel and alloys which are hot-worked at temperature above 1050° C., ordinary powdered window glass can be used as the lubricant. In order to coat the external part of the billet, the latter is rolled along a table covered with a thin coating of glass powder. For the lubrication of the interior, the billet is placed horizontally; by means of a long spoon which is turned over, the powdered glass is inserted into the preliminary hole in the billet, and the billet is then rolled so as to distribute the glass. It is also possible to coat the exterior and the interior during the course of a single operation.

In order to lubricate the interior of the billet, it may also be placed vertically in the container of the extrusion press and a small quantity of glass powder may then be poured into the conical portion with the aid of a receptacle in the form of a funnel; the glass melts and flows along the wall of the preliminary hole and covers it with a lubricating film. It is also possible, either independently of the above operation or additionally thereto, to introduce a packet of commercial glass fibre into the conical part of the previously pierced pilot-hole. Where metals and alloys which are worked at lower temperatures are concerned, the same procedure is followed, but glass or enamels are used which melt at lower temperatures, and which also have a flat step in their viscosity curves at the working temperature.

When the billet is loaded into the container, the conical cavity of the billet is filled with a vitreous product **10** which is intended to ensure the lubrication of the boring nose. The vitreous product **10** may be inserted by any one of the methods described above.

The boring nose is brought in front of the conical cavity **4** and the boring operation is carried out to the required size, by using the punch **7** to thrust the nose **6** into the

previously-drilled hole. The metal 2 of the billet then takes the internal shape of the container and flows back along the container by reason of the expansion of the hole 3 to the diameter of the boring nose.

The completion of the boring stroke results in a very small waste of metal 11.

The form of the boring nose 6 which is used, such as has been shown by way of example in Fig. 3, may comprise a front cylindrical portion 12, a conical portion 13 which may be concave or flat, a cylindrical portion or finishing surface 14 and a portion 15 which serves as a clearance. As shown in this figure, the taper of the conical entry 4 is greater than the taper of the conical portion 13 of the boring nose 6.

Two practical examples of boring of billets in accordance with the method described above are given in the pages following.

Example 1

In a boring press of 300 tons, 100 billets of 18/8 stainless steel, cylindrical and of circular section, were bored to a diameter of 62 mm.

The initial dimensions of these billets were as follows:

	Mm.
External diameter	140
Length	450
Pilot hole	20

The conical entry of these billets was previously machined in accordance with Fig. 1 of the drawings, and the billets were heated to about 1200° C.

The external lubrication was effected by means of glass powder with a low melting point and the internal lubrication with ordinary window glass powder; in addition, a pad of glass fibre was placed between the boring nose and the conical front face of the billet.

The diameter of the container was 145 mm.

The billets, after the final boring, had the following dimensions:

	Mm.
External diameter	143
Internal diameter	62
Length	510

The same tooling was used for the boring of all the 100 billets, and its wear at the end of these operations was negligibly small.

Example 2

On a horizontal extrusion press of 1500 tons, 10 cylindrical billets of circular cross-section of 18/8 stainless steel were bored and extruded into tubes having an external diameter of 68 mm. and an internal diameter of 58 mm. by proceeding in the manner described in Example 1.

The initial dimensions of these billets were as follows:

	Mm.
External diameter	140
Length	540
Initial (pilot) bore	20
Diameter of container	145

The operations of boring and extrusion were carried out one immediately following the other, in accordance with the usual methods.

The tube obtained had the following dimensions:

	Mm.
External diameter	70
Thickness	6
Length	5

The same tools were employed for the boring of all the 10 billets without appreciable wear.

By operating in accordance with the method described above, it has been found that:

The loss of metal due to the cold drilling of the pilot bore is negligible;

The centering of the bored billets obtained is excellent and is practically independent of the press employed. Whilst the known methods necessitate the use of high-speed and particularly rigid presses, the method in accordance with the present invention is well suited to slow-speed presses in which the guiding of the punch is not perfect.

The force required to carry out the boring operation is considerably less than that which would be necessary for the boring of a billet, as this process is effected by other known methods.

The internal surface of the bore is smooth and has no defects, even in the case of metals or alloys which are difficult to transform.

This method has thus very many advantages as compared with the known art, and by its use it is possible, inter alia:

To carry-out hot boring operations with very much higher ratios of deformation, and to employ a given press well beyond its possibilities when starting with full billets;

To carry-out hot boring of alloys which are very difficult to work, for example alloys with a high nickel content such as Nimonics;

To effect the boring and the extrusion of a tube in a single operation on an extrusion press provided with a piercing tool;

Since the punching-out at the end of the boring operation can be carried out by the same operation as the boring, the rate of production can be increased and the press can be simplified.

What we claim is:

1. In a method of hot boring of metal billets by utilising the container of a press and a punch with a boring nose, the steps consisting in drilling in the cold state in a billet a pilot-hole having a diameter less than that of the desired bore, forming a conical entry at one extremity of said pilot-hole, heating said billet to a temperature which permits of its deformation, coating the surface of the pilot hole and the external surface of said billet with a vitreous product which becomes viscous at the said temperature, placing the billet in the container with the conical entry placed uppermost, and boring the billet by forcing said boring nose into the pilot hole in such manner that the metal fills the cross section of said container and flows back along the punch while preventing lateral expansion of the billet during boring.

2. In a method of hot boring of metal billets by utilising the container of a press and a punch with a boring nose, the steps consisting in drilling in the cold state in a billet a pilot-hole having a diameter less than that of the desired bore, forming a conical entry at one extremity of said pilot-hole, heating said billet to a temperature which permits of its deformation, coating the surface of the pilot hole and the external surface of said billet with a vitreous product which becomes viscous at said temperature, placing said billet in the container with said conical entry placed uppermost, placing a mass of said vitreous product in said conical entry, and boring the billet by forcing said boring nose into the pilot-hole in such manner that the metal fills the cross section of said container and flows back along the punch while preventing lateral expansion of the billet during boring.

3. In a method of hot boring metal billets wherein a billet heated to working temperature and provided with a pilot hole having a diameter less than that of the desired bore is placed in a container and a boring tool having a conical portion is forced through the pilot hole to enlarge it to the desired diameter, the steps comprising forming a conical entry at one extremity of said pilot hole, coating the external surface of said billet and the surface of said billet bounding said pilot hole with a vitreous material which becomes viscous at the hot working temperature of the billet, placing said billet with said conical entry arranged uppermost in a container having a forming chamber conforming in cross sectional shape and

size substantially to said billet, placing in said conical entry a mass of vitreous material which becomes viscous at the hot working temperature of the billet, and boring the billet by forcing the boring tool through the pilot hole to enlarge it and to cause the billet metal to flow back along the wall of the forming chamber while preventing lateral expansion of the billet during boring.

4. A method according to claim 3, wherein the taper of the conical entry at the extremity of the pilot hole in the billet is greater than the taper of the conical portion of the boring tool.

References Cited in the file of this patent

UNITED STATES PATENTS

2,628,516	Brace	Feb. 17, 1953
2,756,494	Sejournet	July 31, 1956

FOREIGN PATENTS

15,772	Great Britain	June 2, 1900

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

October 18, 1960

Patent No. 2,956,337

Jean Buffet et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 57, for "Length-------540" read -- Length-------450 --.

Signed and sealed this 25th day of April 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patent