Jan. 12, 1937. C. J. GEJROT 2,067,389

METHOD OF AND MEANS FOR PRODUCING HOLLOW BILLETS FOR HOLLOW DRILLS AND THE LIKE

Filed Nov. 14, 1933 2 Sheets-Sheet 1

Fig. 1.

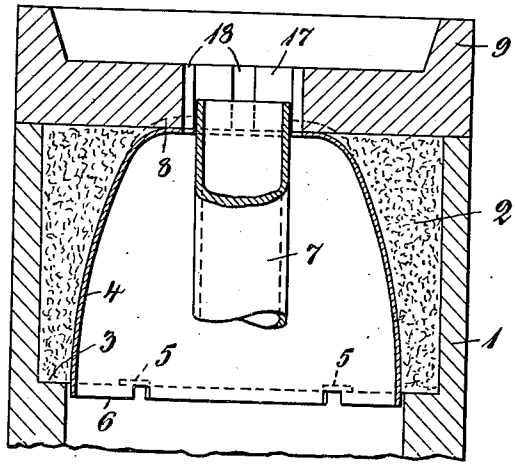

Fig. 2.

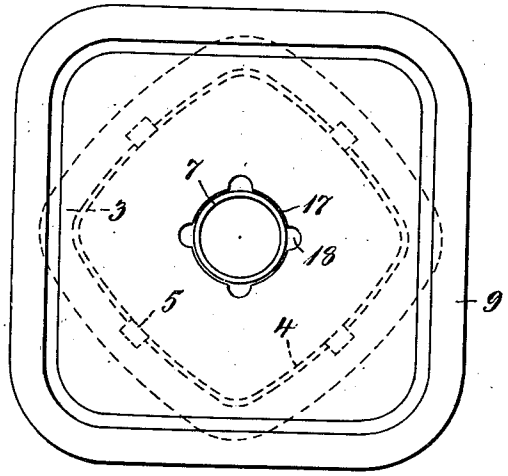

Fig. 3.

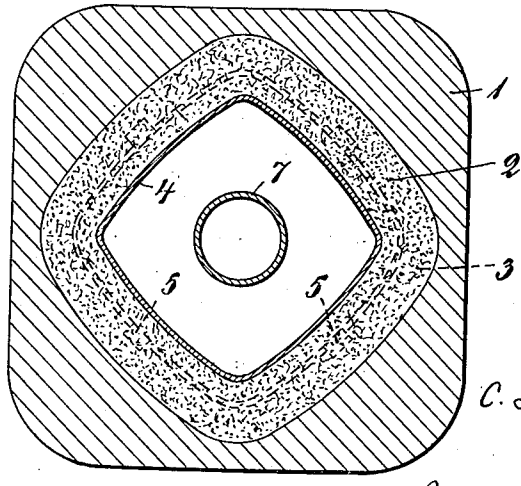

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Fig. 4.

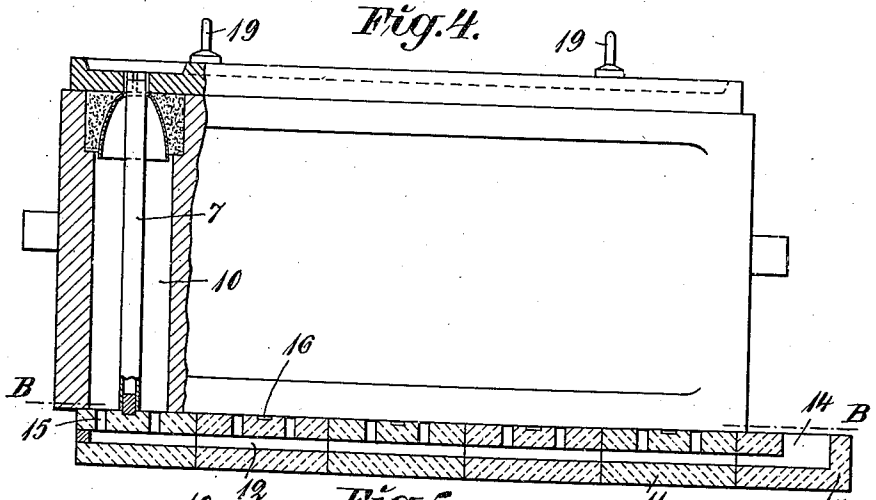


Fig. 5.

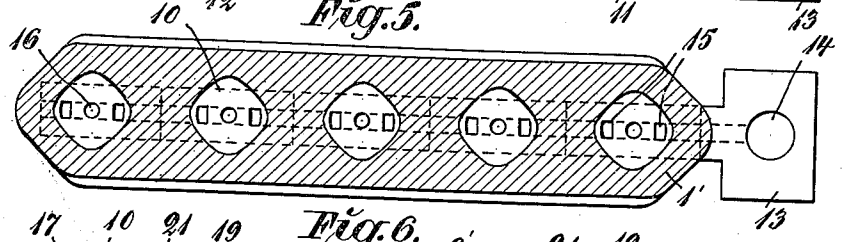


Fig. 6.

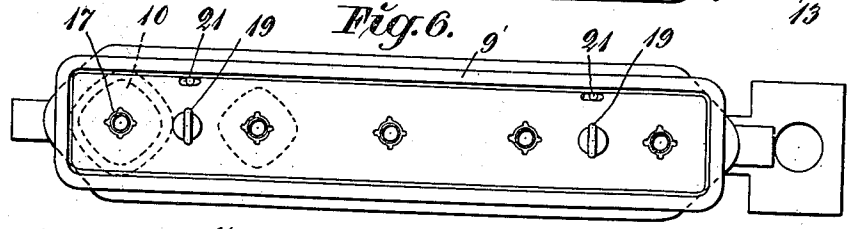


Fig. 7.

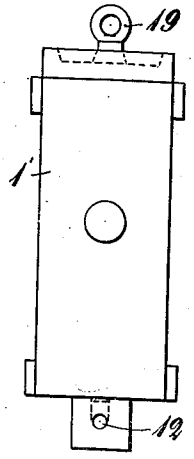
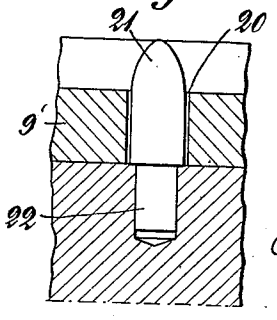


Fig. 8.



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UNITED STATES PATENT OFFICE

2,067,389

METHOD OF AND MEANS FOR PRODUCING HOLLOW BILLETS FOR HOLLOW DRILLS AND THE LIKE

Claes Joel Gejrot, Bofors, Sweden, assignor to Aktiebolaget Bofors, Bofors, Sweden, a limited company of Sweden

Application November 14, 1933, Serial No. 697,987
In Sweden November 19, 1932

10 Claims. (Cl. 22—140)

This invention relates to the manufacture and production of hollow bars or other tubular or hollow bodies and more particularly to the manufacture and production of hollow ingots for hollow drills and the like.

It is already known in the production of hollow billets, blooms, bars or the like, for instance ingots for the manufacture of hollow drills, to cast molten metal around a solid or tubular core of suitable material.

This method is usually carried out by casting iron or steel in moulds of such a size that ingots suitable for direct rolling are obtained, thus eliminating any additional reducing operation of the ingots. In this casting operation, a number of moulds are united in a single group for the simultaneous production of a number of ingots. According to these methods, the molten metal is supplied to the moulds from below through openings communicating with a common intake channel so that the metal rises upwards in the moulds.

The moulds used in said known methods of manufacture are assembled of several parts, the moulds being, at the bottom, connected with a receptacle of refractory material, said receptacle being provided with a channel for the supply of molten metal and communicating with the interior of the mould by means of two openings arranged symmetrically in the bottom of the mould in relation to the core around which the metal is to be cast, the receptacle being also provided with a recess for centering the lower end of the core. To prevent the metal from flowing over, the mould is provided with a lid, or cover, which also serves to center the top end of the core.

The described methods have several great disadvantages, which in reality render the same practically useless, especially due to the construction of the moulds.

Thus, on account of the small dimensions of the ingots and, consequently, the moulds, the inlet openings for the molten metal in the bottom of the mould will either be situated so close to the core, around which the casting is to be performed, that the lower part of the core near to the inlet openings will at places melt and, if of tubular form, break through, or, if the inlet openings are arranged closer to the mould walls, the latter will be damaged by the molten metal. Further, the pipe or funnel formed at the solidification of the cast metal will extend far down into the ingot. None of the types of feeder (or discard heads) heretofore known, for preventing the formation of pipe in the ingot proper by limiting the pipe to the metal within the discard head, could be used in these methods, as for reasons stated above, the top of the moulds had to be closed.

A further disadvantage of said known methods is that, owing to the use of a number of moulds united to one group, it is necessary to use a very large number of different parts to produce a comparatively small aggregate weight of ingots, which renders rational manufacture difficult or impossible.

One of the objects of the present invention is to provide a means whereby it becomes possible to use discard heads in connection with the method of casting from below, and the invention also concerns a suitable form of such a discard head box.

Another object of the invention is to provide the means for the rational manufacture, in a technically and economically perfect way, of hollow bars, billets and the like, by bottom pouring around a tubular or solid or compound core inserted into a mould.

In carrying the invention into effect, the discard head box may be shaped so as to obtain the least possible volume consistent with efficiency, that is without reducing its solidification retarding action. Further, the discard head box may be given such a form that no seams or junctures are formed on the ingot, in the casting operation, which might be apt to make difficult the removal of the ingot from the mould. The discard head box also may serve as a cover for the mould, with the exception of necessary air vents, but it will be readily understood that another cover may be arranged above the discard head, to keep the latter in place, for centering the core, or for other purposes.

Further, the mould according to the invention is given such a shape and the inlet openings for the molten metal arranged in such a way that neither the core inserted in the mould nor the walls of the mould will be damaged by the molten metal. This effect may for instance be obtained by giving the mould chamber such a cross-section that the distances between the walls of the mould and the core are different at different places and by arranging the inlet openings for the molten metal at those places, in which said distances are the greatest, for instance a mould chamber of a substantially polygonal or square section with somewhat rounded corners and with the inlet openings for the molten metal arranged on a diagonal line or the di-

agonal lines in the bottom of said mould chamber.

Instead of a plurality of separate small composite moulds united to form one group it is preferred according to the invention to use a single mould provided with a plurality of mould chambers (hereinafter referred to as multiple mould), in which a corresponding number of ingots may be cast simultaneously, whereby the above-named disadvantages connected with the use of a great number of mould parts are avoided.

Means for carrying out one variety of the method of manufacture in accordance with the invention are illustrated by way of example in the accompanying drawings but it will be understood that many modifications or alterations are possible without departing from the spirit of the invention.

Figure 1 shows a vertical section through the upper part of a mould provided with a discard head box according to the invention as well as an extra cover, Figure 2 shows the same seen from above and Figure 3 is a cross section thereof.

Figure 4 shows an elevation of a mould provided with discard head box and extra cover, partly in section provided with a plurality of mould chambers, only one of which is shown in section.

Figure 5 is a section on line B—B of Figure 4, all of the mould chambers being indicated therein.

Figure 6 shows the same mould seen from above.

Figure 7 is an end view of the mould shown in Figure 4. Figure 8 illustrates a guiding pin for facilitating the attachment of the lid or cover to the mould.

In Figure 1, 1 designates the mould, the upper end of which is provided with an enlargement 2 in the inside wall of the mould, the bottom of said enlargement being defined by a shoulder 3 in the mould wall. In the upper part of the mould there is inserted a thin plate 4 to form a discard head box, at the lower end provided with outwardly bent (or welded thereto) strips 5 bearing against the shoulder 3, the lower edge of the plate projecting into the mould below the shoulder 3, as indicated by numeral 6 in Figure 1. Towards the top, the plate 4 is contracted as shown in Figure 1, to form a box, which at the top is provided with an opening or a hole whereby a tube 7 may be inserted into the mould and air vents at the edges of said hole. The top part of the plate is so dimensioned, that, when the lid or cover 9 is not put in place, the plate projects somewhat above the top surface of the mould, as indicated by dashed lines in Figure 1, and so that when the cast iron cover 9 is put in place on the mould, the plate will be pressed down to bear against the sides of the tube 7, i. e. in the position indicated by full drawn lines in Figure 1. The cover 9 is provided with a central opening 17 for centering the tube 7, the sides of said opening being provided with air holes 18.

Before putting the cover in place the interspace between the plate 4 and the upper part of the mould walls is filled with sand, asbestos, or some other suitable insulating material. The whole upper part of the ingot inside the plate (the discard head) will, consequently, be insulated and not even the cover will act as a cooling agent during the solidification process. On account hereof the formation of pipe is restricted to the discard head, which afterwards is removed so that sound ingots are obtained.

By shaping the plate 4 in the aforementioned way, the discard head will obtain the least possible volume consistent with efficiency, and at the same time the molten cast metal will be prevented from flowing in at the shoulder 3 or at the top around the tube 7 to form seams or junctures on the ingot. The latter circumstance is very important, as it makes it possible to give the ingots such a shape that even if the moulds are made in one piece, the ingots can be driven out of the moulds downwards without difficulty.

Of special importance in obtaining said result is the fact that the tube 7 does not project out of or even reach through the whole of the opening or hole in the lid or cover, but only enters the same sufficiently, for instance a few mm., say 2 to 3 mm. (the extent of the inserted portion as shown in Fig. 1 being exaggerated) to hold the tube in the right position so as to prevent suspension of said tube to the cover after completion of the casting operation.

Figures 4 to 7 show a multiple mould 1, in which a plurality of mould chambers 10 are arranged, in this case five, of a substantially square cross-section with somewhat rounded corners. The bottom of the mould consists of receptacles, or runner bricks, 11 of refractory material arranged closely together, one plate for each mould chamber, said runner bricks being provided with a central channel 12 forming an intake channel for the molten cast metal and common to the whole mould. One end of the chamber 12 communicates with a box 13 provided with a common inlet opening 14 for the molten metal, whereas the opposite end of the channel is plugged. From the channel 12 two inlet openings 15 lead to each of the mould chambers above the runner bricks 11, said inlet openings being arranged on a diagonal line in the bottom of the mould chamber, as shown in Figure 5, whereby they will be situated sufficiently far away from both the wall of the mould chamber and the tube to be inserted into the mould chamber and around which the casting takes place, that none of them will be damaged by the flowing molten metal. On the top sides of the runner bricks 11 there are provided recesses 16 for centering the lower end of said tubes.

The mould chambers 10 in the mould are provided at the top with discard head boxes, arranged in the same way as already described. In Figure 6 is disclosed a lid or cover 9 for the mould which may or may not be used, and if used is provided with holes 17 for centering the tubes 7 as well as air vents and with ring handles 19 for lifting the cover. In the cover are arranged oblong holes 20 for the reception of guiding members 21 (Figure 8), which by means of a pin 22 are inserted in the mould wall and intended to facilitate the positioning of the cover.

In the above described example it has been assumed that use is only made of a single mould with a plurality of mould chambers, but, according to the invention, the casting may also be carried out simultaneously in a plurality of such moulds, connected to a common metal intake around which the different moulds may be arranged in any suitable way, for instance radiating therefrom.

Instead of the discard head box being made of sheet iron or sheet steel with insulating material packed on top or around same, it may be made of refractory material, such as bricks or pottery, in which case special insulating material may be dispensed with. Instead of the multiple mould, with several mould chambers, being made in one piece (in which case the mould chambers are preferably slightly tapered, to facilitate the removal of the ingots) the multiple mould may be split into two halves with the mould chambers having parallel sides. Again, a number of individual moulds, made in one piece with slightly tapered mould chambers may be used. Also in other respects modifications of different kinds may be made in the described forms of the invention without departing from the spirit of the invention. Thus, for instance, several multiple moulds or rods of individual moulds may be arranged on a common base plate, in which channels for placing the runner bricks 11 are arranged.

Having now particularly described the nature of my invention and the manner of its operation, what I claim is:

1. The method of producing tubular bodies by casting, which comprises inserting a tube, adapted to become welded to the cast metal, into a mould, arranging a discard head box into the upper part of said mould around the top end of said tube in such a way that it, with the exception of a hole for the tube and necessary vent openings, closes the mould at the top, centering the projecting top end of the tube by placing a cover on the mould, said cover having a hole for receiving the top end of said tube and necessary vent openings, and then pouring molten metal from below into said mould around said tube.

2. The method of producing tubular bodies by casting, which comprises inserting a tube adapted to become welded to the cast metal, into a mould of such form that in one and the same cross-section the distances between the walls of said mould and said tube are different at different places, inlet openings for the molten cast metal being arranged at those places in the bottom of the mould, in which said distances are the greatest, and then pouring molten metal from below into said mould around said tube.

3. The method of producing tubular bodies by casting, which comprises inserting a tube, adapted to become welded to the cast metal, into a mould of such form that in one and the same cross-section the distances between the walls of said mould and said tube are different at different places, inlet openings for the molten metal being arranged at those places in the bottom of the mould, in which said distances are the greatest, placing a discard head box into the upper part of said mould around the top end of said tube in such a way that it, with the exception of a hole for the tube and necessary vent openings, closes the mould at the top, centering the projecting top end of the tube by placing a cover on the mould, said cover having a hole for receiving the top end of said tube and necessary vent openings, and then pouring molten metal into said mould around said tube.

4. Means for casting tubular bodies comprising, in combination, a mould having inlet openings at its bottom, a tube inserted into said mould, means for centering said tube in said mould, a heat insulating discard head box arranged in the upper part of said mould, and extending to the top thereof and a cover placed on said mould, said cover having a hole which receives the upper end of said tube, and vent openings between the walls of said hole and said tube.

5. Means for casting tubular bodies, comprising in combination, a mould having inlet openings for the molten metal at its bottom, a tube inserted in said mould, means for positioning said tube in said mould and a heat-insulated discard head box made of sheet metal arranged in the upper part of said mould around the top end of said tube inserted therein, said discard head box being tapered upwardly towards the top, so as to obtain the least possible volume thereof without reducing its solidification retarding action and arranged to bear at its bottom against the walls of said mould and with its upper end against said tube, which box with the exception of vent openings arranged therein closes said mould at the top.

6. Means for casting tubular bodies, comprising, in combination, a mould having inlet openings at its bottom, a tube inserted into said mould, means for positioning said tube in said mould, a heat-insulated discard head box made of sheet metal arranged in the upper part of said mould around the top end of said tube inserted therein, and a cover placed on said mould having a hole for said core and vent openings, said discard head box being tapered upwards towards the top and having a hole at the top for said tube and vent openings at the edges of said hole, the edges of said hole being adapted to be pressed down to bear against said tube when the cover is put in place on said mould.

7. Means for casting tubular bodies comprising, in combination, a mould having inlet openings at its bottom, a tube inserted into said mould, means for positioning said tube in said mould, the chamber of said mould having a form such that in one and the same cross-section the distances between the walls of said mould and said tube are different at different places, inlet openings for the molten case metal being arranged at those places in the bottom of the mould in which said distances are greatest.

8. Means for casting tubular bodies comprising, in combination, a single mould having a plurality of mould chambers connected at their bottoms with a common intake channel for molten metal, a tube inserted into each of said mould chambers and means for positioning said tube in said mould chamber, said mould chambers having a form such that in one and the same cross-section the distances between the walls of said mould and said tube are different at different places, inlet openings for the molten case metal being arranged at those places in the bottom of the mould in which said distances are greatest.

9. Means for casting tubular bodies comprising, in combination, a mould having a chamber of a substantially square cross-section and inlet openings for the molten metal on the diagonal lines in the bottom thereof, a tube inserted into said mould chamber, means for positioning said tube in said mould chamber, and a discard head box arranged in the upper part of said mould chamber around the top end of said tube inserted therein.

10. Means for casting tubular bodies for hollow drills comprising, in combination, a single mould having a number of mould chambers connected at their bottoms with a common intake

channel for molten metal, a tube inserted into each of said mould chambers, means for positioning said tube in said mould chamber, and a heat-insulated discard head box of sheet metal arranged in the upper part of each of said mould chambers around the top end of said tube therein, said mould chambers having a substantially square cross-section with the feed openings arranged on the diagonal lines in the bottom of the mould chamber, so as to obtain the greatest possible distance from the tube inserted therein and the walls of said mould chamber, and said discard box being tapered upwards towards its top and arranged to bear, at its bottom against the walls of said mould chamber and with its upper end against said tube in such a way that said box, with the exception of vent openings arranged therein, closes the mould chamber at the top.

CLAES JOEL GEJROT.