Jan. 3, 1933. E. L. MESSLER ET AL 1,893,206

INGOT MOLD ASSEMBLY

Filed Jan. 22, 1932 2 Sheets-Sheet 1

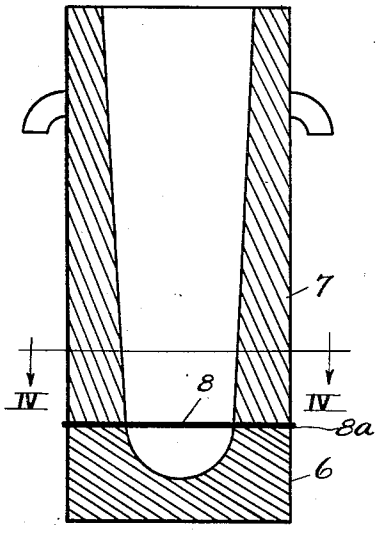


Fig. I

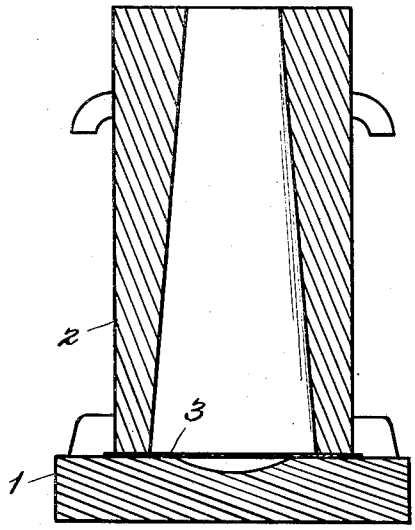


Fig. II

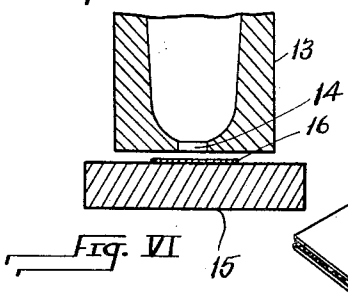


Fig. VI

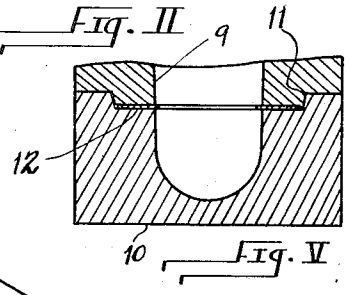


Fig. V

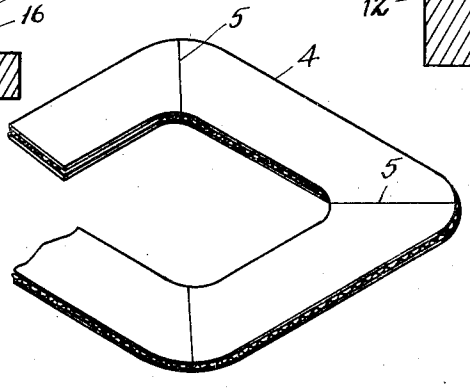


Fig. III

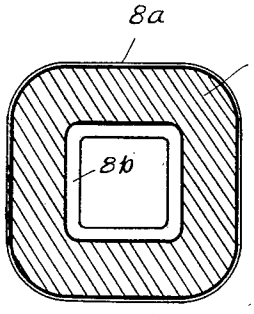


Fig. IV

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INGOT MOLD ASSEMBLY

Filed Jan. 22, 1932 2 Sheets-Sheet 2

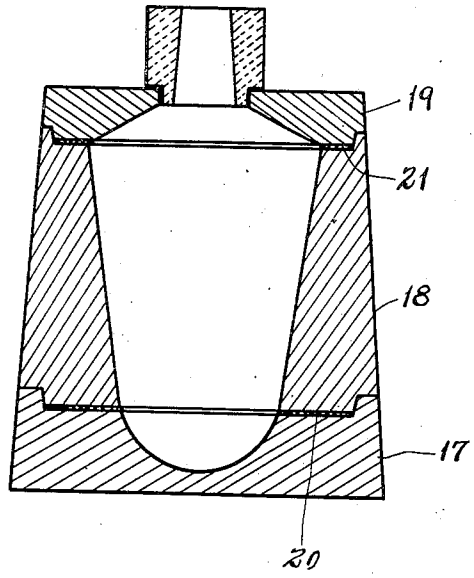


Fig. VII

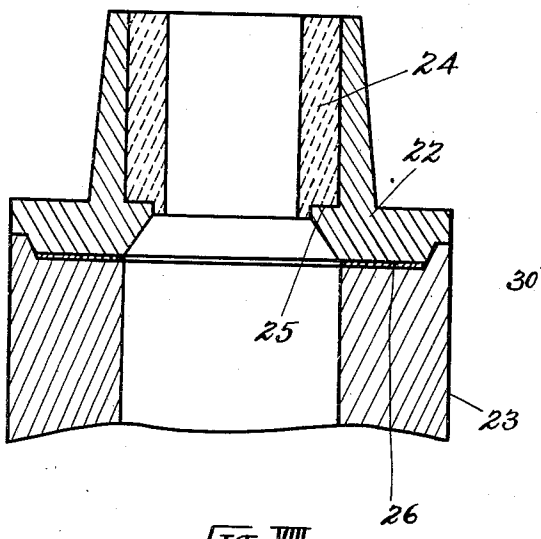


Fig. VIII

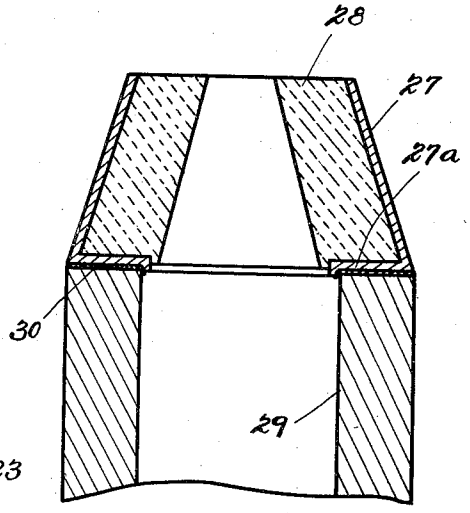


Fig. IX

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UNITED STATES PATENT OFFICE

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INGOT MOLD ASSEMBLY

Application filed January 22, 1932. Serial No. 588,063.

This invention relates to an ingot mold assembly.

One object of the invention is to provide sealing means between upper and lower ingot mold elements which so seal the same as to prevent escape of metal and the formation of fins, while avoiding the laborious and inefficient procedure of luting the joint between the sections with clay or similar plastic material.

Another object of the invention is to permit the use of an ingot mold formed in two sections in big-end-up practice, thus eliminating the usual plugged plunger orifice in the bottom of the mold, facilitating the stripping of the ingot, and permitting the use of an original upper or barrel section of the ingot mold with successive lower or stool portions, as the latter may be destroyed in use.

In the accompanying drawings Figure I is a vertical sectional view taken through a two piece ingot mold of the big-end-up type; Figure II is a similar view taken through a mold and stool of usual form, but illustrating our improved sealing means as lying between the mold and the stool; Figure III is an isometric view showing a form of our sealing layer for interposition between upper and lower mold sections; Figure IV is a cross-sectional view taken on the line IV—IV of Figure I; Figure V is a fragmentary view, taken in vertical section, and showing a specialized matching between upper and lower mold sections, as provided with our sealing means; Figure VI is a fragmentary view, taken in vertical section, showing our seal interposed between a stool and a big-end-up ingot mold of usual form and construction; Figure VII is a vertical sectional view through an ingot mold divided horizontally into three portions, the joints being sealed as in the previously described figures of the drawings; Figure VIII is a fragmentary view in vertical section, showing a cap portion, or element, or an ingot mold formed to retain a refractory lining, and with our seal interposed horizontally between the cap element and an adjacent underlying mold portion or element; and Figure IX is a view taken in vertical section, showing a metallic hot top with refractory lining, with our seal horizontally disposed between the metallic shell of the hot top and an adjacent underlying mold portion or element.

The sealing means comprised in our ingot mold assembly consists of a coherent layer of highly compressible fibrous material interposed between the lower mold section and the upper mold section and compressed in its interposed position by the weight of the latter. It is also important that the material be combustible at the temperature existing in the ingot mold during pouring. The material constituting our highly compressible sealing layer is corrugated board, this material being desirable both because it is inexpensive, and because it, being highly compressible, accommodates itself readily to any irregularities in the adjacent surfaces of the upper and lower mold sections, merely forming at the worst sealed pockets of small volume where such irregularities occur.

With particular reference to Figure II of the drawings, reference numeral 1 designates the usual stool employed with ingot mold barrels which are open at both ends, constituting a support and closure for the barrel 2 which is placed thereon. In making the assembly a layer 3 of corrugated board material is placed upon the upper surface of the stool 1 in the region upon which the barrel 2 rests, the material being desirably so proportioned that it extends a short distance into the ingot mold cavity. The slight extension of the sealing material into the mold cavity both avoids necessity for accurately preforming the piece or pieces of material, and also contributes to the efficiency of the seal between the upper and lower ingot mold elements.

In its condition, compressed by the weight of the upper or barrel element of the ingot mold, the sealing layer of corrugated board proves not only more convenient in use than a clay luting, but also is more serviceable in positively preventing the escape of molten metal, and in avoiding the inclusion of foreign substance in the ingot. It should be un-

derstood that when an ingot is teemed into the mold, the exclusion of air from the combustible sealing material by the ingot metal itself prevents instantaneous combustion of the material, but that on the contrary this material will char; the portion of the sealing material which extends into the mold cavity being decomposed by combustion or charring with relative rapidity, and the material which lies compressed between the two mold elements being consumed relatively slowly.

We have found that even though the sealing material be of a highly combustible nature, the seal formed by it persists for a sufficient length of time to permit the ingot metal to cool below its temperature of high fluidity. The extension of the sealing material within the mold cavity avoids possibility of the ingot metal in its highest state of fluidity, immediately upon teeming, from entering the space between the upper and lower mold elements by destroying the sealing material to a sufficient extent to form a fin of substantial dimensions on the ingot.

In Figure III a layer or gasket, 4, of corrugated board is shown in detail, this layer or gasket being cut away in one region to illustrate the structure of the board. It is to be understood, however, that such layer or gasket as actually used should be uninterrupted. As shown, the layer consists of a plurality of sections of corrugated board so cut that they may be matched along the lines 5 to provide a complete seal. If desired, sections cut from a relatively narrow strip of corrugated board may be cut and matched in advance, and interconnected as by means of gummed paper or the like to provide a preformed gasket.

Figures I and IV of the drawings illustrate an ingot mold of the big-end-up type, which is divided horizontally into a lower mold element 6 and an upper mold element 7, with a layer 8 of the corrugated board forming a seal between the upper and lower mold elements. As shown in these figures of the drawings, the layer 8 of this highly compressible material extends outwardly a short distance beyond the ingot mold as at 8*a*, and a material distance into the ingot mold cavity as at 8*b*.

It will be noticed that in Figure I of the drawings the lower mold element 6 is without the usual plunger orifice, which in customary practise with big-end-up molds is closed by a plug of metal or refractory material for teeming the ingot, and through which a knockout plunger extends to jar the ingot loose from the mold after solidification of the ingot metal. With the ingot mold divided horizontally into upper and lower elements, as shown, it is a simple matter to jar the ingot loose from the mold elements.

Big-end-up ingot molds have previously been made integral throughout. One objectionable feature of the big-end-up practice has been that the scouring effect of the ingot metal, which is of course highly fluid and at a relatively high temperature during teeming, has tended to undercut the lower region of the mold cavity. This causes ingot molds to be discarded while their upper portion is still in useful condition. By providing an efficient seal between the upper and lower mold portions of a horizontally divided mold, the upper element of the mold assembly may be used with successive lower elements as the latter become unusuable because of scouring.

The mold structure shown in Figure V is in general similar to the big-end-up mold shown in Figure I. In Figure V, however, upper mold elements 9 and lower mold element 10 are formed to provide a mortise joint 11 in which the horizontally disposed corrugated board 12 is placed. The purpose of this mortise joint between the upper and lower mold elements is to assure exact matching of the elements in assembling them to provide a complete mold. A failure to exactly match the elements causes an ingot of irregular contour, and greatly increases the difficulty of stripping.

Figure VI of the drawings shows a big-end-up mold 13 of usual structure, and provided with the usual bottom orifice 14. This mold is placed upon a stool 15 with a pad 16 of corrugated board lying between the stool and mold in the region of orifice 14. In this assembly of ingot mold elements, the use of a plug in orifice 14 is avoided, because the sealing material prevents escape of metal through orifice 14 and between the faces of the ingot mold and stool. The use of plugs is in some methods of casting disadvantageous, for the reason that there is a tendency for metal plugs to weld in the orifice, or to dislodge from the orifice and float in the cast metal, and for the reason that there is a possibility of refractory plugs becoming dislodged and floating upwardly through the metal.

Figure VII shows a special type of ingot mold designed in its form for the production of relatively short thick ingots for large forgings. In this general type of mold it is particularly desirable to cover the upper portion of the mold in order to prevent rapid cooling of the relatively great area exposed. This mold therefore comprises a lower mold element 17, an intermediate or barrel element 18, and an uppermost, or cap, mold element 19. Between the lowermost mold element and the barrel element is a horizontally disposed seal 20 of corrugated board; and between barrel element 18 and cap element 19 of the mold is another horizontally disposed seal 21 of corrugated board. This three-piece construction, rendered possible by our sealing means, encloses the ingot in an adequate manner for proper solidification, while per-

mitting stripping of the ingot by merely lifting off the uppermost and lowermost mold elements.

In Figure VIII of the drawings we show an assembly structure in which a combined cap and hot top element 22 of relatively heavy cast metal is used with an underlying mold element 23. The cast hot top is provided with a refractory lining 24 supported by seat 25 of the hot top, and the joint between the hot top and mold element proper is provided with a horizontally disposed seal 26 of corrugated board.

Figure IX of the drawings shows a hot top structure which is in general use. This structure comprises a metallic shell 27 and a refractory lining 28. Shell 27 is flanged, with its flange 27*a* resting upon the upper face of the ingot mold 29 thus in fact constituting an uppermost mold element.

In use of this type of hot top difficulty is experienced due to the escape of metal between the contacting faces of the ingot mold and hot top, when irregularities develop in either of the contacting faces of flange 27*a* and ingot mold 29. Our horizontal seal 30 of corrugated board interposed between these faces and compressed by the weight of the hot top solves this difficulty by providing an efficient seal regardless of irregularities in the surfaces, and thus preventing the entrance of metal between the hot top and the upper edge of the ingot mold.

It should be understood that, as provided with our seal, one barrel element, as illustrated in Figures I and II, may be used with different lower elements in either big-end-up or big-end-down practice.

We claim as our invention:

1. The herein described ingot mold assembly comprising upper and lower ingot mold elements matching horizontally to form a continuous mold cavity a substantial portion of which is within the lower mold element, and a highly compressible sealing layer of cellular fibrous material combustible under temperature conditions existing during the teeming of an ingot lying horizontally between the adjacent surfaces of the lower and upper mold elements.

2. The herein described ingot mold assembly comprising upper and lower ingot mold elements matching horizontally to form a continuous mold cavity a substantial portion of which is within the lower mold element, and a compressible sealing layer of corrugated board combustible under temperature conditions existing during the teeming of an ingot lying horizontally between the adjacent surfaces of the lower and upper mold elements.

3. The herein described ingot mold assembly comprising upper and lower mold elements, the lower mold element constituting a support and closure for the upper mold element, and a compressible sealing layer of corrugated board combustible under temperature conditions existing during the teeming of an ingot lying horizontally between the lower and upper mold elements.

4. The herein described ingot mold assembly comprising upper and lower mold elements, the lower mold element constituting a support and closure for the upper mold element, and a highly compressible sealing layer of cellular fibrous material combustible under temperature conditions existing during the teeming of an ingot lying between the adjacent surfaces of the lower and upper mold elements.

5. The herein described ingot mold assembly comprising an ingot mold divided horizontally into a plurality of ingot mold elements, and a thin sealing layer of corrugated board combustible under temperature conditions existing during the teeming of an ingot lying horizontally between adjacent faces of the mold elements.

6. The herein described ingot mold assembly comprising an ingot mold divided horizontally into a plurality of ingot mold elements, and a highly compressible sealing layer of cellular fibrous material combustible under temperature conditions existing during the teeming of an ingot lying horizontally between adjacent surfaces of the mold elements.

In testimony whereof we have hereunto set our hands.

EUGENE L. MESSLER.
JOHN J. ISHERWOOD.