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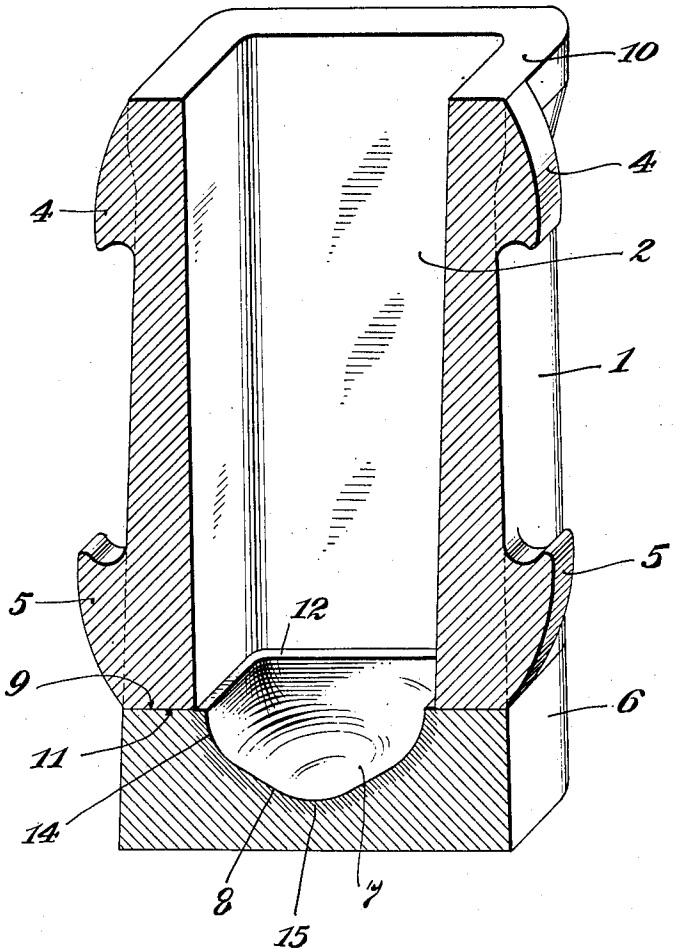

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INGOT-MOLD SET-UP.

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This invention relates broadly to metallurgy and more particularly to ingot molds and the like.

Heretofore in the art, ingot molds have been formed with matrices having rounded closed bottoms. The curvature of the bottom walls of such molds was to avoid dendritic crystallization in ingots cast in such molds. The bottom of such an ingot mold is subjected to the most severe cutting action due to being struck directly by the stream of molten steel when the ingot is being cast. The result is that the curved bottom portion of the matrix of such molds quickly becomes cut away. The ingot then sticks in the mold and when stripped often tears out a portion of the mold wall or else the ingot sticks and cannot be stripped from the mold. In either event, the mold is ruined. The life of such closed bottom molds is short, as compared with straight sided molds used in connection with casting stools. Furthermore, in the prior art type of rounded closed bottom ingot molds, it was necessary to leave openings in the bottoms of the molds in order that the ingots might be stripped from the molds by introducing a stripping member through the openings. It was the usual practice to close such openings by means of bricks or plugs. Particles of these bricks frequently stuck to the ingots and when such ingots were reheated, the portions of the bricks would melt and spoil that part of the steel where the melted brick particles stuck. Short lived molds add greatly to the ultimate cost of the steel products fabricated from ingots cast in such molds. In using short lived molds, the full advantages, economy, etc., to be gained from the use of rounded bottom big-end-up type molds are lost.

The present invention overcomes the difficulties of the known prior art by providing a mold body having a straight sided matrix of the big-end-up type in combination with a stool having a deep recess therein of such conformation as to form a properly rounded end on a steel ingot to obviate dendritic crystallization and to obtain all of the advantages heretofore obtained in the one piece rounded bottom mold, without encountering the disadvantages of such mold. In the present invention, the mold body and stool are in effect a two piece mold; the straight sided portion being in the mold body and the curved end being in the stool. Furthermore, in accordance with the present invention, the matrix surfaces of the recess in the stool may be chilled and thereby avoid rapid cutting away of this matrix surface. If any cutting does occur, it occurs in the stool, the mass of which is small compared to the ingot mold body proper. Therefore, the combination comprising the present invention is such that the mold body has a relatively long life and the shorter lived stool portion may be replaced from time to time when necessary without replacing the entire set-up. Furthermore, with the present invention, since the mold and stool are separable, a stripping opening in the bottom of the stool is unnecessary, and the entire end of the ingot is uniformly chilled and the disadvantages incident to the use of a brick in the bottom of the set-up is avoided. Preferably, the bottom of the mold and the top of the stool are so finished as to provide a metal to metal joint thereby avoiding any fins on the ingot adjacent this part of the set-up. Preferably, a slight shelf is provided between the upper edge of the recess in the stool and the lower edge of the matrix portion of the ingot mold to facilitate quickly freezing the metal at the juncture of the mold and the stool, thus preventing cutting away of the lower inner corner of the ingot mold.

It is realized that the present invention may be embodied in constructions other than that herewith disclosed and therefore it is desired that the disclosure herewith shall be considered as illustrative and not in the limiting sense.

The figure of the drawings is a vertical sectional view through one form of set-up illustrative of the present invention.

Referring now more particularly to the drawings, which illustrate a preferred form of the present invention, an open ended mold body 1 is provided with a matrix 2, comprising straight sided walls with a slight taper. The mold body is provided with lifting lugs 4 and stripping lugs 5. The stool 6 is of unusual depth and is provided with a matrix recess 7 comprising a continuation of the matrix 2 of the mold body of the set-up. Preferably, though not necessarily, the metal 8 adjacent the surface of the matrix

in the stool is chilled metal having a close smooth grained surface. The ends 9 and 10 of the mold body are finished surfaces in order to cooperate with the top surface 11 of the stool. Preferably, the mouth of the cupped matrix portion 7 of the stool is designed to correspond to the perimeter of the matrix portion 2 at the end of the mold, but the mouth of the recess matrix 7 is preferably slightly less in area than the cross section of the mold matrix 2 in order to provide a shelf 12 adjacent the metal to metal joint between the mold and the stool. This shelf or shoulder 12 provides re-entering angularly disposed cold metal surfaces causing the metal adjacent the metal to metal joint to very quickly freeze and thereby obviate burning out the corner of the mold.

Preferably, the surfaces at 14 in the recess 7 are substantially at right angles to the top surface 11 of the stool and are substantially parallel to the side walls of the matrix 2. The bottom of the recess 7 is a cupped zone 15 which quickly fills with molten steel and protects the stool for the impact of the stream of molten steel.

While the construction illustrated in the drawing shows the matrix of the mold arranged as a big-end-up set-up, it is to be understood that the present invention is also applicable to set-ups wherein the construction comprises a matrix of the big-end-down type and such a set-up merely requires the reversal of the body section on a suitable stool.

In the present invention dendritic crystallization of the steel ingot is avoided by shaping the end of the ingot into curved surfaces by forming a curved surfaced recess in the bottom of the deep stool. The depth of the recess will depend largely on the width of the matrix at the bottom of the body section. Preferably, the depth of the recess shall be between 25% and 37½% of the largest dimension of the cross section of the matrix at the bottom of the mold body. The heavy body of metal in the stool quickly absorbs heat from the molten steel, thereby obviating cutting away of the stool and also forming a good end on the ingot by freezing the molten steel before any substantial segregation takes place and also by causing the chilling action to progress rapidly in an upward direction.

Having described my invention, I claim:—

1. An ingot mold set-up comprising a body section having an opening comprising the major portion of the matrix of the set-up, and a stool forming an unluted metal to metal joint with the body portion, said stool being provided with a recess and with a continuous narrow right angled shoulder on the stool between said recess and the side walls of the matrix in the body section of the mold.

2. An ingot mold set-up comprising a body section having a matrix with substantially straight side walls, in combination with a stool section forming a metal to metal unluted joint with the body portion and being provided with a recess forming a part of the matrix of the set-up and with the depth of said recess being from twenty-five to thirty-seven and one-half percent of the largest diameter of the bottom of the matrix in the body section.

3. An ingot mold set-up comprising in combination a body section having a substantially plane surfaced finished end, a deep stool having a substantially plane surfaced finished top adapted to form an unluted metal to metal joint with said body section, a deep recess in said stool comprising a continuation of the matrix of said body section, said recess having a cupped zone in the bottom thereof with the upper portions of the walls of said recess being at substantially right angles to the top surface of the stool and curving downwardly and inwardly toward said cupped zone.

4. An ingot mold set-up comprising a body mold section in combination with an end mold section, said end of the mold section having a cupped recess adapted to round the end of an ingot cast in the set-up, said recess comprising curved surfaces forming continuations of the matrix surfaces of the body section, said body section and said end section meeting in an unluted metal to metal joint extending to the matrix of the set-up, and a continuous narrow shoulder on the end section surrounding the mouth of the recess adjacent to said joint.

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