Dec. 10, 1929. R. FURNESS 1,738,882

INGOT MOLD

Filed Feb. 21, 1928

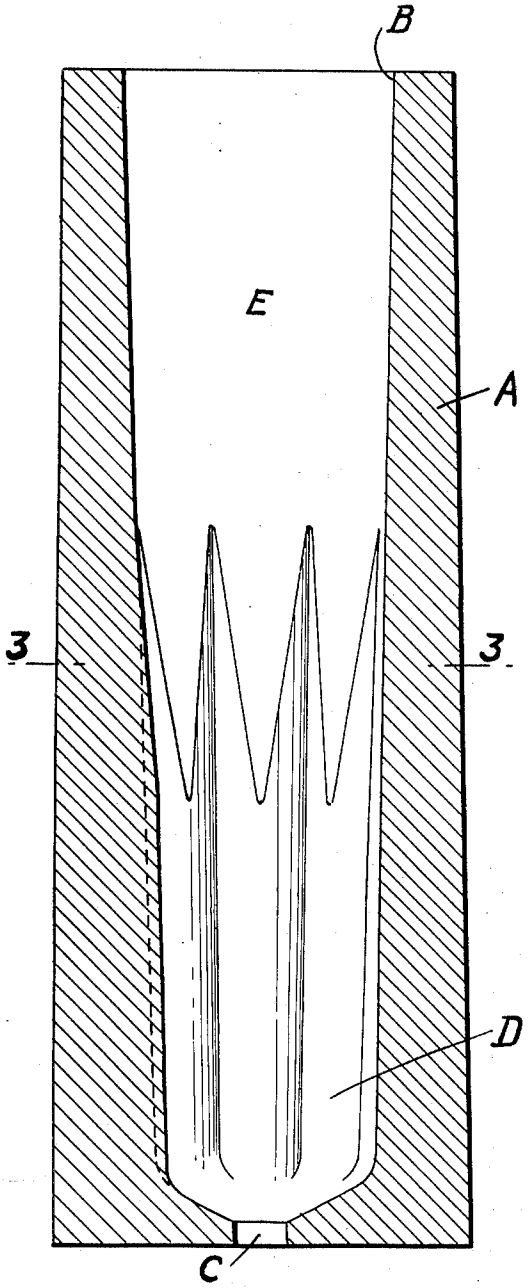


FIG. 1.

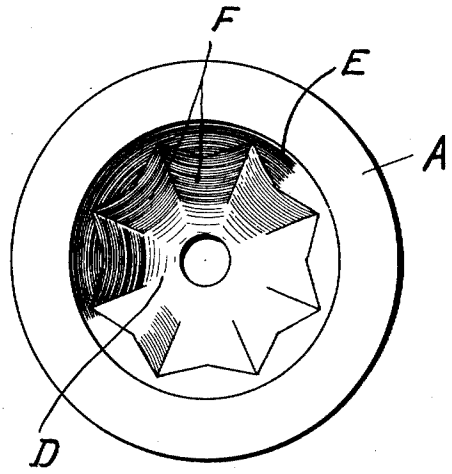


FIG. 2.

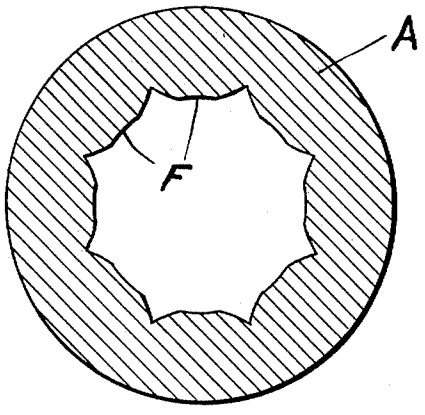


FIG. 3.

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UNITED STATES PATENT OFFICE

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INGOT MOLD

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My invention relates to an improvement in ingot molds.

As is well known in the manufacture of forgings of steel, or other malleable metal, metal of the desired composition is melted and poured into a mold in which it is allowed to solidify to form an ingot which, after removal from the mold, is usually reheated and forged or rolled as closely as practicable to the final size and shape desired.

It is desirable in the casting of ingots that the shape of the mold cavity be one easily produced and at the same time one that will conduce to the homogeneity, solidity and freedom from surface defects of the ingot produced.

In practice, for the manufacture of forgings and the rolled products of a tire mill, it has been customary to use ingot molds having a polygonal cross section because that form especially lends itself to the casting of a higher percentage of sound ingots than does a round mold although, particularly for tire mill products, the round shape is much to be preferred.

The polygonal shape lends itself to a quicker chilling of the section because of its comparatively high proportion of perimeter to area, and so is well suited for the lower part of an ingot which should solidify first. This shape has a further advantage in that it can be more quickly, and hence more cleanly, poured than a round one because a circle, having the least perimeter as compared with its area of all geometrical figures, is least able to stand internal pressure without bursting or cracking.

As the upper part of an ingot mold feeds the underlying layers, it should cool more slowly than they, hence it is of advantage to have there a lower order of relation of cooling perimeter to solidifying area than in the lower portion of the mold, while at the same time there is not the same tendency to burst or crack as lower down, where the head of liquid metal is greater. There is also the great advantage of a closer approximation of the shape of the cast ingot to that of the finished product. So far as I am aware, no one has ever tried to combine these advantages in one mold.

Now in accordance with my invention I provide an ingot mold the cavity of which is formed with upper and lower portions of different shape or contour in cross section connected by an intermediate portion of varying shape or contour in cross section. Preferably in accordance with my invention I provide an ingot mold having a cavity the lower portion of which of substantial extent is of polygonal contour in cross section, the upper portion of which of substantial extent is of circular contour in cross section and having an intermediate portion of substantial extent of varying contour in cross section. The intermediate section connects the upper and lower sections and changes from polygonal to circular, or fairs the lower section into the upper section.

The mold formed in accordance with my invention, as indicated above, will be found to possess great advantage in that the upper circular portion of the cavity possesses the lowest ratio of perimeter to area thus affording the optimum conditions for feed from a sink head, the intermediate section provides for a rapid increase in the ratio of perimeter to area, thus affording improved feeding conditions in the intermediate portion of the mold, and offering a resistance to cracking increasing toward the bottom of the mold as the tendency to crack increases, and the lower portion polygonal in cross section offers maximum resistance to cracking.

In the design of the mold in accordance with my invention it will be found convenient, though not essential, to form the lower portion of an 8 or 12 sided polygonal contour in cross section, the walls of the cavity being preferably convex giving the cavity itself a concave polygonal cross section. The upper portion may be in the form of a truncated cone, with the base at the top of the mold giving the upper portion of the cavity a circular contour in cross section, though it will be understood that the contour need not be a true circle, a polygon of a number of sides greater and preferably substantially greater than in the lower portion will be effective.

The intermediate portion will desirably vary in cross sectional contour from polygonal to circular, or to the contour of the upper portion if such be not circular.

The cavity of the mold desirably tapers from end to end, the taper being preferably at a uniform rate on the extreme diameters of the cavity.

Having now indicated the nature, purpose and advantage of the ingot mold according to my invention, I will proceed to a detailed description of a practical embodiment thereof with reference to the accompanying drawing in which:

Figure 1 is a vertical section of an ingot mold embodying my invention.

Figure 2 is a plan view of the mold shown in Figure 1.

Figure 3 is a sectional view on line 3—3, Figure 1.

In the several figures A indicates an ingot mold provided with a metal receiving cavity B and with an aperture C in its bottom to enable bottom pouring. The mold cavity is divided into three adjacent portions each of substantial extent, a lower portion D preferably of polygonal contour in cross section, a top portion E preferably of circular contour in cross section and an intermediate portion F of varying contour in cross section, preferably gradually changing in its upward extension from polygonal to circular and acting to fair the lower portion of the cavity with the top portion.

The walls of the lower portion of the cavity are preferably, though not necessarily, made convex giving to the cavity a concave polygonal contour or, in other words, productive of a polygonal ingot, the faces of which are concave. The intermediate section may be caused to fair the lower polygonal portion into the upper portion by increasing the number of sides over that of the lower portion, as shown in Figure 3, by flattening the walls of the cavity, or by changing the walls of the cavity from convex to concave, thus in the intermediate section decreasing the ratio of perimeter to area of the cavity in cross section.

As an example of the relative extent of the several sections of the mold in accordance with my invention, a mold having a total cavity height of 88 inches may desirably have a lower portion of a height of 30 inches, an upper portion of a height of 36 inches, and an intermediate portion of a height of 22 inches, however it will be understood that the relative heights of the several sections may vary widely, it being only necessary that the several portions be in extent sufficient to provide the desired conditions in the lower, top and intermediate portions of the mold. It will further be understood that I do not intend that my invention shall be limited to the cross sectional contours more particularly described herein for the lower, top and intermediate portions of the mold, since my invention from the broad standpoint contemplates the provision of a mold, the lower and top portions of which are of different contour in cross section, as from polygonal of a certain number of sides to polygonal of a different number of sides or to circular, and the intermediate portion of which is of varying contours in cross section, for example, such as to fair the lower portion into the top portion.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. An ingot mold including a body provided with a metal receiving cavity having upper and lower portions of substantial extent which have different cross sectional contours, and an intermediate portion of substantial extent of varying cross sectional contour.

2. An ingot mold including a body provided with a metal receiving cavity having upper and lower portions of substantial extent which have different cross sectional contours and an intermediate portion of substantial extent of varying cross sectional contour whereby the lower portion of the cavity is faired into the upper portion.

3. An ingot mold including a body provided with a metal receiving cavity increasing in area of cross section from the bottom towards the top, having a lower portion of substantial extent of a given cross sectional contour, an upper portion of substantial extent of a different cross sectional contour such that its ratio of perimeter to area of cavity is less than the corresponding ratio of perimeter to area of cavity of a cross section of equal area of the contour of the lower portion, and an intermediate portion of substantial extent of varying contour in cross section.

4. An ingot mold including a body provided with a metal receiving cavity having a lower portion of substantial extent of concave polygonal contour in cross section, an upper portion of substantial extent of circular contour in cross section and an intermediate section of substantial extent whereby the lower portion of the cavity is faired into the upper portion.

5. An ingot mold including a body provided with a metal receiving cavity having upper and lower portions of substantial extent which have different cross sectional contours, and an intermediate portion of substantial extent of varying cross sectional contour, the said cavity tapering from end to end.

6. An ingot mold including a body provided with a metal receiving cavity increasing in area of cross section from the bottom towards the top, having a lower portion of substantial extent of a given cross sectional con-

tour, an upper portion of substantial extent of a different cross sectional contour such that its ratio of perimeter to area of cavity is less than the corresponding ratio of perimeter to area of cavity of a cross section of equal area of the contour of the lower portion, and an intermediate portion of substantial extent of varying contour in cross section, the said cavity tapering on its extreme diameters from end to end on a continuous taper.

In testimony of which invention, I have hereunto set my hand at Philadelphia, Pennsylvania, on this fourteenth day of February, 1928.

RADCLYFFE FURNESS.