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INGOT MOLD LINER

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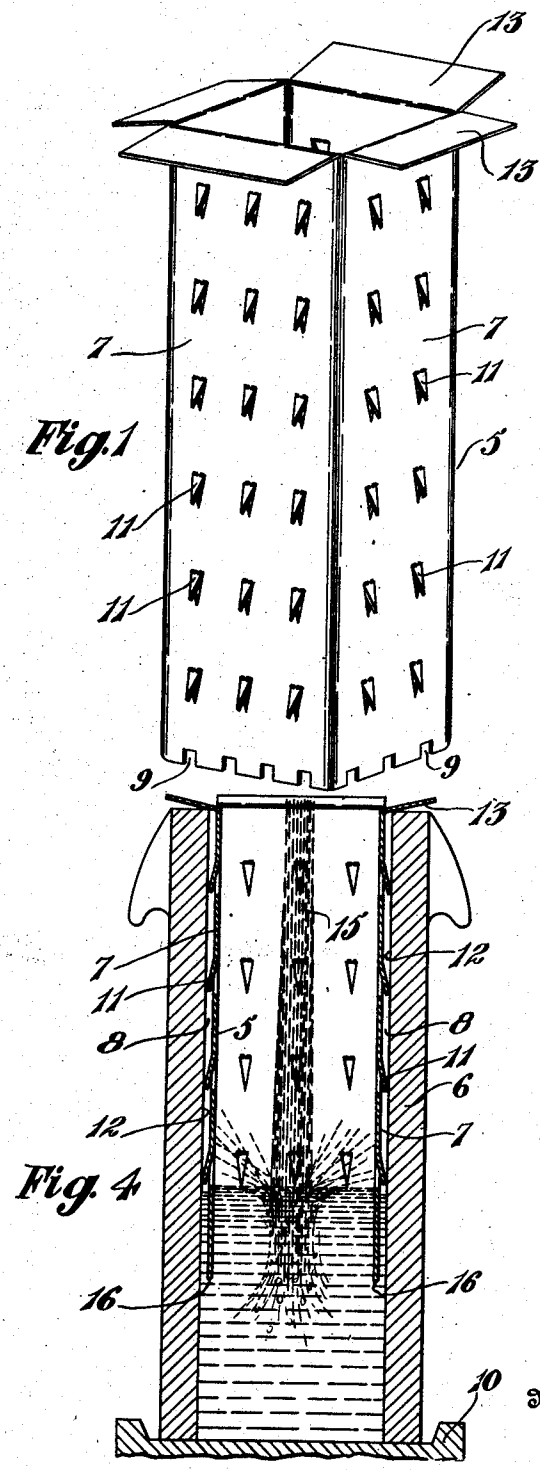



Fig. 1

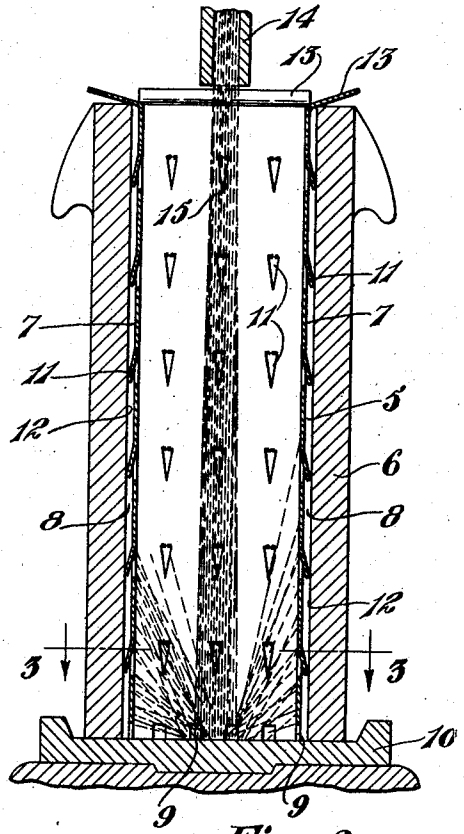



Fig. 2




Fig. 4

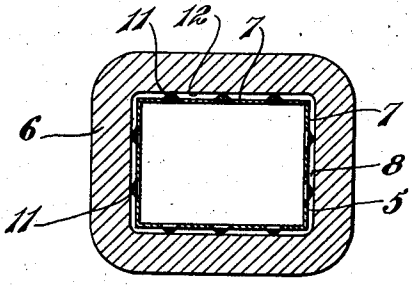



Fig. 3

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## INGOT MOLD LINER

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7 Claims. (Cl. 22—139)

The invention relates generally to the pouring of metal into molds for casting ingots, and more particularly to improved means for facilitating the casting of steel ingots substantially free from surface defects.

In pouring molten steel from a ladle into ingot molds, it is generally recognized in the art that the splashes of the metal tend to stick on and weld or fuse into the walls of the mold, causing scabs and blow-holes in the outer portion of the ingot, and these produce surface defects in the steel when the ingot is rolled or otherwise worked.

Moreover, as the stream of molten metal discharged from the pouring spout of the ladle strikes the molten metal in the mold, occluded bubbles of air are formed in the molten metal, and these, along with bubbles of occluded gas released in the molten metal, are carried toward the sides of the mold and tend to become entrapped in the chilled metal adjacent to the mold walls. These entrapped bubbles also cause surface defects when the ingot is rolled or worked.

Various mold liners have been proposed for preventing the formation of such defects, but all of such liners have had numerous disadvantages, for example, they have been too expensive to make and to apply; they have not had satisfactory means for holding them in place as the molten metal rises in the mold; they have not permitted the molten metal to rise rapidly enough between the liner and the mold; and they have not prevented the molten metal from running down or splashing against the side of the mold as the pouring spout is moved into position above the mold.

It is therefore a general object of the present invention to provide improved means for casting metal ingots substantially free from surface defects.

A more specific object is to provide a novel and improved liner for ingot molds for protecting the sides of the mold from the splashing of the molten metal poured therein.

Another object is to provide a novel and improved ingot mold liner which will tend to prevent the entrapment of occluded bubbles adjacent the mold walls.

A further object is to provide a sheet metal ingot mold liner having novel means for engaging the mold to hold the liner in place during pouring of the molten metal into the mold.

Another object is to provide a sheet metal ingot mold liner having spaced outlets at different levels to allow the molten metal to flow through the liner.

A further object is to provide an improved ingot mold liner having means at its top end for preventing molten metal from running or splashing onto the side wall of the mold as the pouring spout is moved into position above the mold.

A still further object is to provide an improved sheet metal ingot mold liner embodying all of the foregoing advantages in a simple, inexpensive construction which is quickly and easily forced or driven into a mold, and which is melted by the molten metal as the same rises in a mold.

These and other objects are accomplished by the improved constructions, combinations and arrangements comprising the present invention, a preferred embodiment of which is shown by way of example in the accompanying drawing, and which is hereinafter described and claimed.

The invention may be stated in general terms as including a sheet metal liner adapted for fitting into an ingot mold and having an apron overlapping the top of the mold, said liner having vertically spaced openings in its walls formed by tangs bent outwardly from the walls of the liner and frictionally engaging the mold walls to the hold the liner in position in spaced relation to the mold walls.

Referring to the drawing forming part hereof,

Figure 1 is a detached isometric view of the improved ingot mold liner;

Fig. 2 is a vertical sectional view showing the improved liner positioned in an ingot mold;

Fig. 3 is a cross sectional view as on line 3—3, Fig. 2; and

Fig. 4 is a vertical sectional view similar to Fig. 2, showing the mold partly filled with molten metal.

Similar numerals refer to several parts throughout the several views of the drawing.

As shown in the drawing the improved ingot mold liner 5 is tubular and has a cross sectional shape which is adapted to fit in a conventional tubular ingot mold 6 having a rectangular cross section. Obviously, the liner can be made of such cross sectional shape as is required to fit into other mold shapes including circular, square, or polygonal molds, or tapered molds.

The walls 7 of the liner 5 are made of sheet metal preferably of the same analysis as the metal to be poured into the mold, and the outside dimensions of the liner are preferably such that when it is centered in the mold as shown in Fig. 3, there will be a relatively small space 8 between the liner and the mold at all sides, said space being preferably about one-half inch.

As best shown in Fig. 1, the bottom edge of the liner is provided with spaced notches 9 and when the liner is positioned within the mold with its bottom edge resting on the mold bottom or stool 10, these notches form openings through the walls of the liner adjacent to the stool, as shown in Fig. 2.

As best shown in Fig. 1, the walls 7 of the liner are provided with vertically spaced series of triangular tangs 11, the tangs of each series being spaced laterally around the mold walls. The

triangular tangs are preferably formed by bending their points outwardly from the walls to form triangular openings therein, and the points of the tangs are preferably bent outwardly from the walls of the liner a distance slightly greater than the space between the liner and the ingot mold after the liner is inserted therein, so that the liner must be driven or forced into the mold which causes the points of the tangs 11 to frictionally engage the inner surfaces 12 of the mold walls.

The sheet metal liner 5 is preferably provided at its upper end with wings or aprons 13 extending laterally outward therefrom, and these wings or aprons overlap the top of the mold when the liner is inserted therein, as shown in Figs. 2 and 4.

The sheet metal liner is inexpensive to make, because the whole liner can be made out of sheet metal, by first punching out the triangular tangs 11, and then forming the sheet into rectangular shape as shown in Fig. 1, after which the aprons 13 can be bent outwardly from the upper end as shown.

After the liner 5 has been driven into a mold 6 as shown in Fig. 2, when the pouring spout 14 of the ladle containing molten metal is moved over the top of the mold to a central position, any molten metal dripping or being discharged from the pouring spout as it passes over the edge of the mold is prevented from running or splashing onto the inner surface of the mold walls by the aprons 13, so that one source of surface defects in the ingot being cast is eliminated by these aprons.

As the stream of molten metal 15 from the pouring spout 14 first enters the mold, as shown in Fig. 2 the molten metal striking the mold bottom splashes in all directions and the mold liner 5 prevents these splashes from striking the mold walls and subsequently forming scabs or other defects on the surface of the ingot. The particles of material splashed onto the liner are soon melted and fused into the molten metal as the same rises in the mold and melts the walls of the liner. The molten metal at the bottom of the mold flows out through the notches 9 and starts to fill the space 12 between the mold walls and the liner at the same time as it is filling the space within the liner.

As the molten metal rises in the mold, as indicated in Fig. 4, the thin sheet metal walls of the liner become melted off below the level of the molten metal as indicated at 16 and the tendency of the liner to be raised by the molten metal is resisted by the frictional engagement of the points of tangs 11 above the molten metal with the mold walls, so that the liner stays in position until the mold is filled and then becomes melted or fused in the ingot itself.

As the molten metal rises in the mold it progressively reaches the spaced series of openings formed by the tangs 11 and is permitted to flow out through the walls of the liner into the space 12 at those points. This prevents the molten metal rising in the space 12 from becoming chilled and solidifying too rapidly which would tend to promote the entrapment of any occluded bubbles which reach the space 12.

The improved liner 5 prevents the molten metal poured into the mold from striking the inner surface of the mold to cause surface defects in the ingot cast in the mold, and at the same time prevents occluded air and gas bubbles formed in the molten metal from being carried directly to the sides of the mold to become entrapped in the chilled metal adjacent thereto.

I claim:

1. A tubular sheet metal liner for an ingot mold including a wall having laterally spaced openings at its bottom end, said wall having vertically spaced tangs bent outwardly therefrom forming openings therein, and the outer ends of said tangs being adapted to frictionally engage the inner surface of the mold walls when the liner is positioned in the mold.

2. A tubular sheet metal liner for an ingot mold including a wall having laterally spaced openings at its bottom end, said wall having vertically spaced tangs bent outwardly therefrom forming openings therein, the outer ends of said tangs being adapted to frictionally engage the inner surfaces of the mold walls when the liner is positioned in the mold, and laterally outwardly extending wings at the upper end of said liner adapted for overlapping the upper end of said mold.

3. A tubular sheet metal liner for an ingot mold including walls having laterally spaced openings at their bottom ends, each wall having vertically spaced series of laterally spaced tangs bent outwardly therefrom forming openings therein, and the outer ends of said tangs being adapted to frictionally engage the inner surfaces of the mold walls when the liner is positioned in the mold.

4. A tubular sheet metal liner for an ingot mold including walls having laterally spaced openings at their bottom ends, each wall having vertically spaced series of laterally spaced tangs bent outwardly therefrom forming openings therein, the outer ends of said tangs being adapted to frictionally engage the inner surfaces of the mold, and laterally outwardly extending wings at the upper end of said liner adapted for overlapping the upper end of said mold.

5. An ingot mold including a tubular casing, a tubular sheet metal liner in said mold casing in spaced relation thereto, said liner having laterally spaced openings at its bottom end and vertically spaced tangs bent outwardly from its sides to form openings therein, and said tangs being frictionally engaged with said mold casing.

6. An ingot mold including a tubular casing, a tubular sheet metal liner in said mold casing in spaced relation thereto, said liner having laterally spaced openings at its bottom end and vertically spaced tangs bent outwardly from its sides to form openings therein, said tangs being frictionally engaged with said mold casing, and an apron extending laterally outwardly from the upper end of said liner and overlapping the mold casing.

7. An ingot mold including a tubular casing, a tubular sheet metal liner in said mold casing in spaced relation thereto, said liner having vertically spaced tangs bent outwardly therefrom forming openings therein, and said tangs engaging the inner surface of the mold casing to hold the liner in position.

PERCY M. TERRILL.