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HOT TOP

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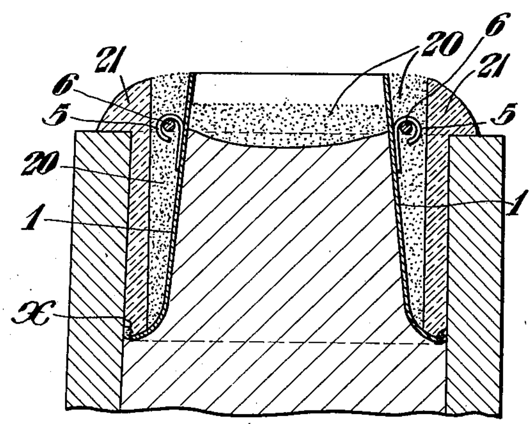

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HOT TOP

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3 Claims. (Cl. 22—147)

This invention relates to hot tops for ingot molds.

In the steel industry the molds which are used in casting steel ingots are made in variously proportioned dimensions, with the inside contour constructed to produce an ingot of any desired horizontal section.

All ingot molds, regardless of size or shape, are of necessity provided with thick metal walls and therefore have great heat absorbing capacity. When the molten steel is poured into an ingot mold, the metal immediately adjacent the walls is rapidly chilled or cooled. This chilling or cooling forms a shell of fine grained metal which encases the ingot and extends for its entire height. When pouring is complete the ingot being formed is confined within its own shell and the inner volume solidifies at a decreasing rate as the heat is absorbed and carried off by the side walls of the mold.

The solidification, and consequent shrinkage, travels from the shell toward the center and from the bottom of the ingot to the top thereof. The uppermost portion of the ingot, being chilled on its sides from the walls of the mold, assumes a firmness on the exposed top commonly known as freezing. As solidification, and consequent shrinkage, takes place in the center section, the upper center volume recedes, resulting in a cooled upper end with a spongy pocket or system of fissures which may extend to a considerable depth in the ingot. This spongy pocket or system of fissures is commonly known as piping.

The pipe, which varies in depth for certain grades of steel, must be completely removed by cropping after the ingot has been rolled into blooms, and this cropping or discard results in a low metal yield which is costly to the steel industry. It is therefore necessary that the mold top for these certain grades of steel have provision to retard chilling and retain a fluid reservoir of metal to feed into the space being formed by shrinkage, whereby piping is reduced. The most suitable and economical device for this purpose is the hot top, which consists principally of a formed shell inserted in the top of the ingot mold to form a sink-head or shrink-head of metal of less volume than the body of the ingot.

Hot tops are commonly made of an unlined, or refractory lined, casting or solid refractory material, the heat absorbing capacity of which is less than that of the walls of the heavy metallic ingot mold; and this helps to keep the top metal liquid while the center volume is solidifying and shrinking. This type of hot top is fragile, being subject to damage in transporting and handling, as well as during the time molten metal is being poured into the ingot mold. In addition, when the mold is stripped from the ingot the refractory type is broken; the debris creating an objectionable deposit in the soaking pit. Some of the broken pieces of the refractory hot top adhere to the ingot and create a problem to be met at the mill rolling the ingot. In some cases heavy chains are provided in advance of the rolls to guard against accident when these refractory deposits are thrown off by the rolls. The remaining refractory deposits also damage the product rolled.

Cast metal hot tops create undue chilling.

It is among the objects of the present invention to overcome the difficulties referred to hereinbefore.

Another object is to provide an efficient hot top which is easy and inexpensive to manufacture, transport and use.

The foregoing and other objects will be apparent after referring to the single figure of the drawing in which there is illustrated in vertical section the device of the present invention as it is applied to the upper end of an ingot mold, the latter being shown fragmentarily in sectional elevation.

Referring more particularly to the drawing, the hot top of my invention comprises a thin metallic shell open at the top and bottom to fit the inside contour or matrix of any vertical mold used for casting ingots. The walls 1 of the thin metallic shell are sloped from the vertical to the bottom, whereby a frusto-conical form is provided. The bottom outline is similar to the inside contour of the ingot mold, but of base dimensions sufficient for easy insertion into the mold and yet with nominal clearance from the inner faces of the walls. The walls 1 are formed to terminate with a bottom with a curvilinear flared portion. The walls may be formed with flat surfaces, with vertically or horizontally crimped or irregular surfaces, or with a combination or variation of these.

At the top, and at a predetermined distance down, two opposite walls 1 may be notched and the leaf of metal free from the shell curled over to form an ear 5, the width of which is sufficient for strength. If desired, a separate metal clip may be attached. In any event there is provided an opening large enough to admit a rod 6 or any section required of sufficient length to span the top opening of the mold. The ears 5 may be bent into form for using a bar 6 of any shape required, to serve for suspending the thin metallic shell. The ears 5 can be readily located vertically on the side walls 1 and this position, together with that of the rod or bar used gives the correct predetermined depth the hot top is to be suspended in the ingot mold used.

The main dimensions of the hot top are determined to provide a sufficient sink-head of hot metal to fill the void caused by shrinkage of the particular steel and size or form of ingot.

When the hot top is positioned as shown, the space between the bottom of the shell of the hot top and the walls of the ingot mold may be dammed with a layer X of clay, asbestos rope, rock wool, or any noncombustible material to serve as a seal to protect the molten ingot from extraneous substances and to check it from backing up into the space occupied by the insulation which will be later described. This entire space is thus occupied with a suitable insulation of low thermal conductivity, such as granulated refractory, rock wool, cork, granulated slag, combined mixtures of these or other good quality insulators.

The thin metallic shell is formed with suitable side wall and bottom construction to furnish the required insulation thickness which lends itself to a desirable use of a high temperature insulation 20 closest to the ingot and the remaining space in back of the shell to be filled with a preformed low temperature insulation 21. The space provided for insulation diverges from the bottom of the shell 1 so that the insulation thickness increases toward the top, providing the greatest amount of insulation where it is most required and therefore most effective in impeding the heat abstraction from the top fluid metal. The metallic shell 1 may also be formed to provide a space bounded by parallel sides in the vertical section so that an even thickness of insulation may be used between the shell 1 and the mold walls.

The shell itself is made of a thin gage metal and has a minimum heat capacity when results in a minimum chilling. The top metal of the ingot therefore is most efficiently protected against heat loss and an assured volume of hot metal is retained in the sink-head to feed the shrinking center volume as it cools and shrinks in solidification.

When the solidification is complete the ears 5 are easily pried open allowing the removal of supporting rods or bars 6 and the mold is free from any obstruction to stripping from the ingot. The insulation is comparatively free to drop off or be easily removed and the ingot is delivered with what remains of metallic shell on it but comparatively free from extraneous substance.

The thin metallic shell is made of proper thickness sufficient to hold form for the sink-head of ingot poured, and due to the adhesion of the liquid steel as poured in the hot top, it becomes amalgamated with the ingot. In the later heating process in the soaking pit, the oxidation by heating removes a major proportion of the hot top form metal, so that no quality effect from a different analysis steel in the hot top form metal is noticeable in the steel as rolled.

The use of the thin metal shell open at the top and bottom and suspended from the ingot enables the teeming or casting of the ingots by a novel method, with the advantageous result that the metal of the shell, which amalgamates with the ingot during solidification, lessens the chance of damage to the rolls in the subsequent rolling of the ingot in the slabbing or blooming mill. Upon stripping of the ingot from the mold, the refractory material readily disintegrates. Any metal of the shell which becomes welded, amalgamated or otherwise integrated with the ingot proper will not have a deleterious effect upon the resulting product rolled from the ingot, and much of this metal shell will be oxidized or partially consumed during the heat treatment of the ingot in the soaking pit.

While I have shown and described several specific embodiments of the present invention, it will be seen that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of my invention, as defined by the following claims.

I claim:

1. A hot top for ingot molds comprising a preformed insulation lining the interior of the upper end of the mold, a metallic shell disposed interiorly of said preformed insulation, and loose insulation disposed between said preformed insulation and said metallic shell, said metallic shell being constructed and arranged to amalgamate with the hot top portion of the ingot during solidification, the lower end of said metallic shell being extended beneath the lower end of said preformed insulation and forming a joint therewith.

2. A hot top for ingot molds comprising a preformed insulation lining the interior of the upper end of the mold, a metallic shell disposed interiorly of said preformed insulation, and loose insulation disposed between said preformed insulation and said metallic shell, said metallic shell being frusto-conical in shape and constructed and arranged to amalgamate with the hot top portion of the ingot during solidification, the lower end of said metallic shell being extended beneath the lower end of said preformed insulation and forming a joint therewith.

3. A hot top for ingot molds comprising a preformed insulation lining the interior of the upper end of the mold, a metallic shell disposed interiorly of said preformed insulation, and loose insulation disposed between said preformed insulation and said metallic shell, said metallic shell being frusto-conical in shape and constructed and arranged to amalgamate with the hot top portion of the ingot during solidification, the interior surface of said preformed insulation being substantially parallel with the walls of the mold to thereby provide between said preformed insulation and said frusto-conical metallic shell a downwardly tapering recess for the accommodation of said loose insulation, the lower end of said metallic shell being extended beneath the lower end of said preformed insulation and forming a joint therewith.

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