Oct. 23, 1928. 1,689,175

W. H. RAMAGE

HOT TOP FOR INGOT MOLDS

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Fig. 2.

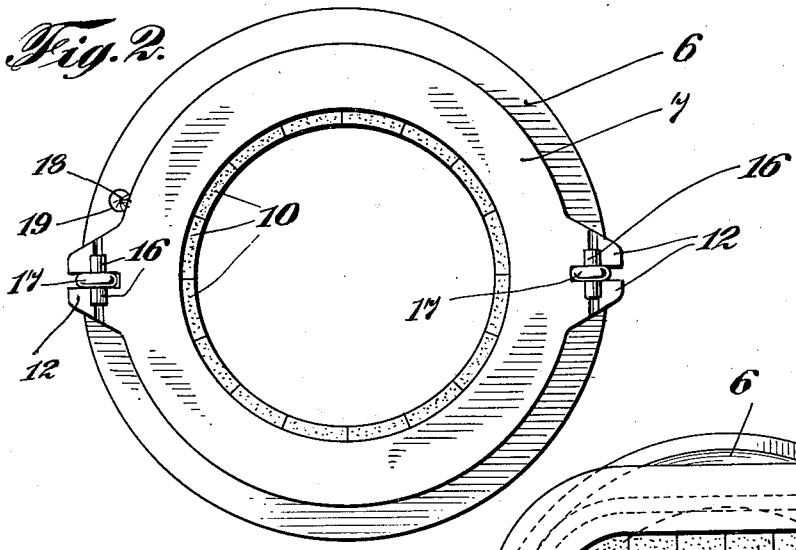



Fig. 3.

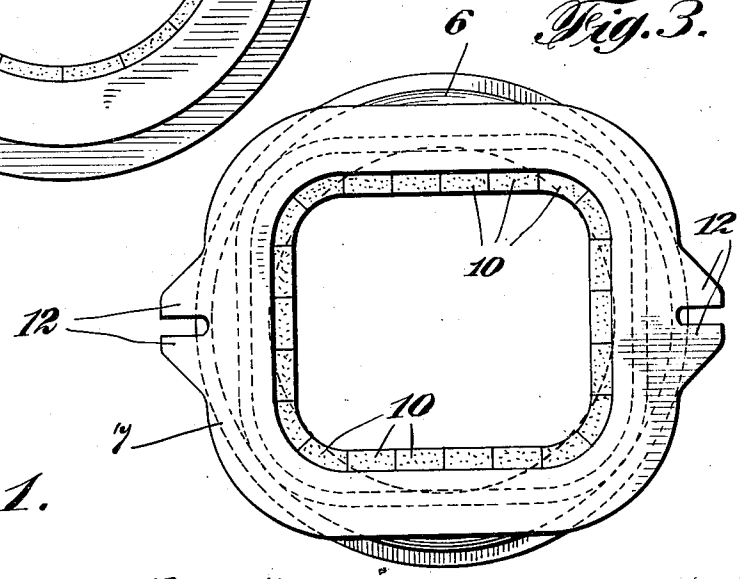
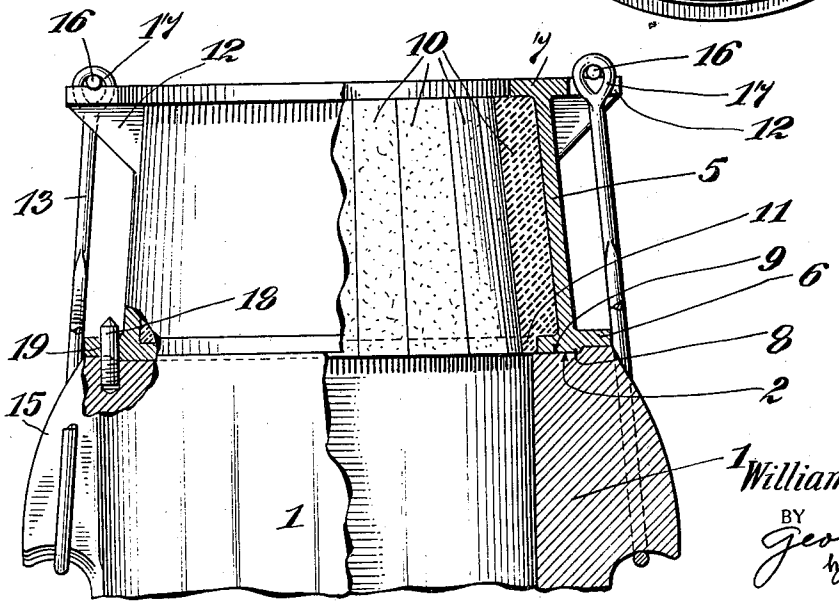



Fig. 1.




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Fig. 4.

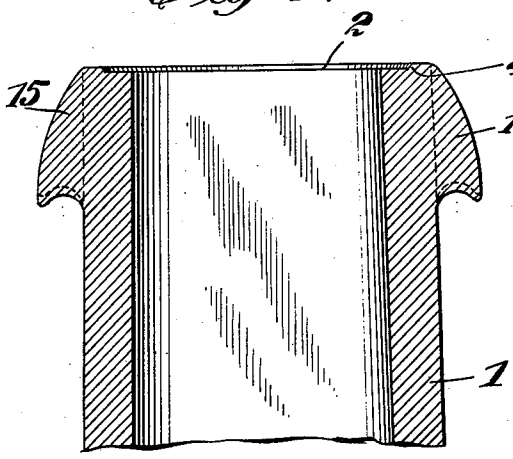
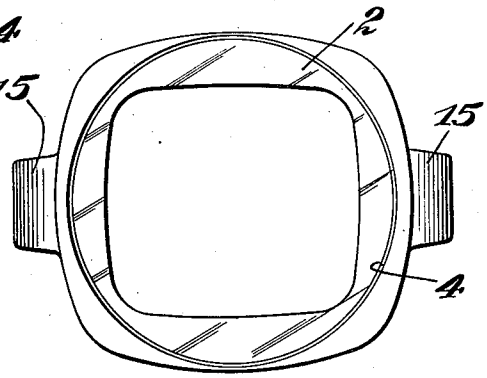



Fig. 5.




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# UNITED STATES PATENT OFFICE.

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## HOT TOP FOR INGOT MOLDS.

Application filed January 18, 1926. Serial No. 81,920.

The present invention relates to metallurgy and more especially to equipment for casting steel ingots and comprises a hot top construction adapted for use with ingot molds.

Heretofore in the art hot top constructions have usually comprised tubular tiles which were adapted for use only once. The arrangement being such that the tile was broken during the casting and stripping operation. The relation of the tile to the ingot was such that it was necessary to break the tile to remove it from the ingot. Another disadvantage heretofore encountered in connection with tile hot tops has been due to the fact that the tile does not form a close joint with the top of the mold. The steel runs into the joint and particles of tile adhere to the ingot and are carried by the ingot in its progress to and through subsequent heat treatment; usually heat treatment in the soaking pit at which time the brick particles and the steel melt together so that the portion of the ingot adjacent the hot top is contaminated, thereby requiring this part of the ingot to be cropped. It is not unusual for such particles of tile to melt and run down over the sides of the ingot and fuse into the steel so that when the ingot is subsequently fabricated a large portion of the whole ingot may be contaminated and cause trouble with the finished product. Another difficulty to be encountered by use of the tile hot tops is the liability of the steel to arise into the joint between the tile and the end of the mold so that when the ingot is frozen a substantial flange of steel from the ingot extends out over the end of the mold and with a big-end-down type of mold this flange interlocks the ingot with the mold so that the ingot sticks in the mold and great difficulty in stripping is encountered; so much so that an ingot occasionally cannot be stripped, thereby requiring the destruction of the mold to relieve the ingot.

From the foregoing, both from matters of economy, because of the destruction of the tile for each pour, and because of operating difficulties mentioned, tile hot tops are both expensive and troublesome and are not used unless necessity in steel manufacture demands them.

The present invention overcomes the difficulties of the known prior art by providing a hot top structure of a relatively permanent type which may be removed as a unit after the ingot is poured, without destructive effort, or it may be securely locked to the mold and remain in place during several heats of the mold when casting steel ingots, so that the same hot top device may be used over and over again many times and until worn out by usage. Furthermore, the hot top construction comprising the present invention is so designed as to form an accurate metal joint with the ingot mold and thereby prevent the formation of any fins at or adjacent the hot top structure. Also, the hot top structure of the present invention contemplates a device which is of substantial size and weight so that in effect it practically becomes a heat insulating removable section of the mold set-up and the pouring operation may be carried on continuously until the steel rises to the desired height into the hot top, and not interrupted as has been the practice where tile tops have heretofore been used.

One form of the present invention comprises a relatively heavy cast iron shell provided with an interlocking portion adapted to form a close metal to metal joint with the mold; and with the interior of the cast iron shell lined with suitable refractory material such as, fire brick, which are fixedly and permanently set into the cast iron supporting shell. Preferably the cast iron shell and the ingot mold are provided with interlocking guides and securing means so that the hot top assumes a definite position over the top of the mold in such manner that any part of the hot top which overhangs the matrix of the mold and which tends to accumulate scruff or the like will always occupy the same relative position to the matrix of the mold and the scruff accumulated portion will extend into the mold and not be set on top of the mold which might result in a bad joint between the hot top section and the mold body proper.

Other and further objects of the present invention will in part be obvious and will in part be pointed out in the specification hereinafter following by reference to the accompanying drawings forming a part of this application and throughout which like parts are designated by like characters.

It is realized that the present invention may be embodied in constructions other than those specifically disclosed herein and therefore the disclosure is to be considered as illustrative and not in the limiting sense.

Fig. 1 illustrates a preferred form of the present invention and shows a portion of the

mold proper and the hot top member in section.

Fig. 2 is a plan view of the hot top member illustrated in Fig. 1.

Fig. 3 is a plan view of a hot top portion having a circular base flange and with a matrix cross section substantially the same shape as that of the mold with which this hot top is to be used.

Fig. 4 illustrates the top portion of an ingot mold showing a depression cut therein comprising a seat for the hot top section.

Fig. 5 is a plan view of the top of the mold illustrated in Fig. 4.

Referring more particularly to Figs. 1 and 2, the mold section proper 1 may be of the usual type and is provided at the mouth with a slight depression (see Figs. 4 and 5) which comprises a seating surface 2 and a conical or inclined edge 4 adapted to guide the hot top section into place. This depression in the mouth of the mold may be formed in any desirable way, and one convenient way of producing this recess is to cut the same by means of a lathe operation.

The hot top section preferably comprises a substantial shell 5 of cast iron or other suitable metal and this shell may be provided with a lower flange 6 and an upper flange 7. Preferably the lower flange is provided with a slight extension 8 of sufficient depth to insure that the seating surface 9 will always contact with the seating surface 2 on the end of the mold to form a close metal to metal joint between the shell and the mouth of the mold. The opening in the shell may be circular as shown in Fig. 2 or it may correspond with the shape of the cross section of the matrix of the mold 1, as shown in Fig. 3. The interior of the shell is lined with suitable refractory material, preferably arcuate fire bricks 10 which may be set in the shell in any desired manner but in the preferred form these bricks are arranged vertically, as shown in Fig. 1. The bricks are laid in cementitious material 14 capable of standing high temperature. This cementitious material may comprise loam, mortar, etc., but preferably comprises a high temperature cement 14 which fills the cracks between the fire bricks and leaves a smooth interior to the hot top section. The bricks may be of any desired shape or form but preferably are constructed with a shoulder 11 adapted to set over the inner edge of the lower flange 6. The upper flange 7 may carry outwardly extending hinge lugs 12 which may carry clamping irons 13 adapted to be engaged beneath the lugs 15 on the mold section 1 and swung into position over the hinge lugs 12, where suitable bolt keys 16 may be inserted through the eyes 17 of these clamping irons to securely lock the hot top section in position. These bolt keys 16 lie in grooves 23 formed in the upper surface of the hinge locks 12. In view of the fact that clamping irons 13 engage under the undercut portions of the lifting lugs 15 on the mold and that the wedge key bolts 16 lie in the grooves 23 in the hinge locks 12, the clamping irons cannot be accidentally laterally displaced, but can only be removed by driving out the key bolts 16. This construction tightly clamps the bottom surface 9 on the lower flange of the hot top shell against the seating surface 2 on the end of the mold. The action of the clamping irons 13 is to produce a compression which at all times holds these two surfaces tightly in contact so that a fin of steel cannot form between the bottom of the hot top and the top of the mold, and furthermore, since the clamping irons are locked against any lateral displacement, the hot top and mold are used as a unit for several heats without removing the hot top. Where heavy hot tops are used the clamping irons may not be needed, but preferably the hot top when used with the big-end-down type of mold is so securely locked in position by the clamping irons 13 and keys 16 that it need not be removed when the ingot is stripped from the mold or when the mold is being handled by the crane. The retaining of the hot top fixedly secured on the mouth of the mold tends to lessen breakage of the bricks in the hot top because the mold body acts to guide the hot top away from the ingot during stripping, whereas if attempts be made to pick up a hot top from an ingot in the mold, it is not likely to be lifted in a perfectly vertical direction and any angular lift imposes forces on the bricks, tending to break the same. In view of the fact that the preferred form of the seat between the mold and the hot top is circular in character it is desirable that the hot top shall be positioned in such manner that the under portion of the flange 6, parts of which may overhang the matrix of the mold section 1, shall always be placed in the same definite rotative position relative to the mold section 1. This is because such overhanging portions may become covered with scruff which would make a bad joint if the top be turned in such manner that the scruff should set upon the mold top. One convenient way of insuring this definite position is to provide a tapered dowel pin 18 which may be set in the mouth of the mold in such manner as to enter a suitable opening, such as the hole 19, in the flange 6 on the hot top member, or any other suitable interlock may be provided.

From the foregoing, it will be apparent that the hot top construction comprising the present invention is substantial in character and may be used for a great number of heats without being injured or destroyed and in fact comprises an additional section of the mold structure.

Having thus described my invention, what I claim is:—

1. A hot top for ingot molds comprising a cast iron shell the lowermost part of which is a plane bottom adapted to rest on an ingot mold, internally extending flanges with the upper flange of less diameter than the lower flange, and fire brick permanently cemented between said flanges to form a refractory lining for the hot top, and with a portion of said brick covering the lateral face of the lower flange.

2. The combination of an ingot mold, a hot top for said ingot mold, said hot top comprising a metallic shell, a refractory lining carried by said shell, means to prevent lateral movement of said hot top on said mold, and locking means cooperating with the upper portion of said shell, and with said ingot mold to lock said hot top securely in position on said mold and to place a portion of the side wall of said shell under compression forces.

3. The combination of an ingot mold and a hot top therefor comprising a cast iron shell having upper and lower flanges, refractory material cemented in said shell between said flanges, means to secure said hot top on said mold, means to prevent lateral movement of said hot top on said mold, and means to prevent rotative movement of said hot top on said mold.

4. The combination of an ingot mold, a hot top comprising a metal shell lined with refractory material, a metal to metal unluted joint between the metal shell and the mouth of the ingot mold, and means to lock said hot top to said ingot mold against accidental separation and against lateral movement and against rotative movement.

5. In combination, a metallic ingot mold provided with a machined seating surface on the mouth thereof extending to the matrix of the mold, a hot top comprising a metal shell provided on its base with a machined surface adapted to form an unluted metal to metal joint with the seating surface on the end of the ingot mold, a refractory lining for said hot top, and means to permanently lock said hot top to said ingot mold.

6. In combination, a cast iron ingot mold having a substantially smooth seating surface on the end of the mold, a hot top member comprising a metal frame, said frame having a bottom flange forming the base of said frame, a refractory lining within said frame and having a portion of said lining extending inward beyond the flange, the base of said frame being a smooth surface adapted to form a metal to metal unluted joint with the top end of the mold and extending substantially to the matrix opening, and means to securely lock the hot top to said mold whereby the hot top and mold may be stripped as a unit from ingots cast within said hot top and mold.

7. As an article of manufacture, a hot top for ingot molds comprising a unitary supporting shell, a unitary flange extending inwardly and comprising the base portion of said shell, a lining of fire-brick mounted within said shell and resting upon said flange and with the joints between said brick extending lengthwise of said shell, high temperature cement filling the joints between said bricks and smooth with the inner surfaces of said bricks, and with the bottom of the said flange comprising a flat smooth surface adapted to be clamped to a suitable ingot mold to form a tight metal to metal joint to prevent the formation of a fin between said hot top and said mold when said hot top is used for casting steel ingots.

8. In combination a cast iron ingot mold adapted for casting steel ingots and provided with a machined substantially horizontal seating surface on the mouth thereof extending to the matrix of the mold, a hot top member comprising a metal shell provided on its base with an inwardly extending flange with the bottom of said flange being a machined surface comprising a tight metal to metal joint with the seating surface on the end of the mold, a lining of refractory brick within said shell, and locking devices securely clamping said flange to the mouth of the ingot mold and compressing the bottom surface on said flange tightly against a machined surface on the end of said mold to prevent formations of fins in the joint between the hot top and the mold when a steel ingot is cast in said hot top and mold, said locking means being so interlocked with the mold and the hot top to prevent lateral displacement of the locking means whereby said mold and hot top may be used as a unit for a plurality of heats without removing said hot top from said mold.

9. The combination of an ingot mold having a substantially plane seating surface formed on the mouth thereof and extending to the matrix thereof, a hot top member comprising a metal shell having a flange on the base thereof with the base of said flange formed with a substantially plane seating surface adapted to cooperate with the plane seating surface on the mouth of the mold, refractory brick mounted lengthwise within said shell, and interlocking means between said hot top and said mold to securely clamp the seating surface on the bottom of said flange directly against the seating surface on the end of the mold, said locking means being constructed to prevent lateral displacement thereof whereby said hot top and mold may be used for a plurality of heats without the separation of the hot top from the mold.

10. The combination of a cast iron ingot mold for casting steel ingots having a smooth seating surface formed on the mouth thereof with the seating surface extending to the

matrix of the mold, a hot top comprising a metal shell having a flange on the base thereof, the bottom of said flange being provided with a smooth seating surface adapted to contact directly with the seating surface on the end of the mold, refractory bricks mounted within said shell, and locking means to clamp the seating surface on the bottom of said flange tightly against the seating surface on the end of said mold, said locking means being constructed to prevent lateral displacement of the locking means during the handling of said mold and hot top whereby the hot top and mold may be used as a unit for a plurality of heats.

11. An ingot mold having a smooth annular seat on its upper end, said seat extending inwardly to the ingot forming chamber of the mold; in combination with a hot top comprising a one piece cast metal casing with a pair of vertically spaced annular flanges, both extending inwardly and the lowermost one positioned at the bottom of the casing, a lining of refractory bricks set between said flanges and permanently cemented in place with high temperature cement, the lower portion of said hot top having a smooth annular surface complementary to said seat and forming therewith a metal to metal joint extending substantially to the ingot forming chamber of the mold with no interior portions of the hot top located below the lowermost portion of said seat, and means to lock the hot top to the mold whereby the organization may be used for a plurality of heats without removal from the mold.

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