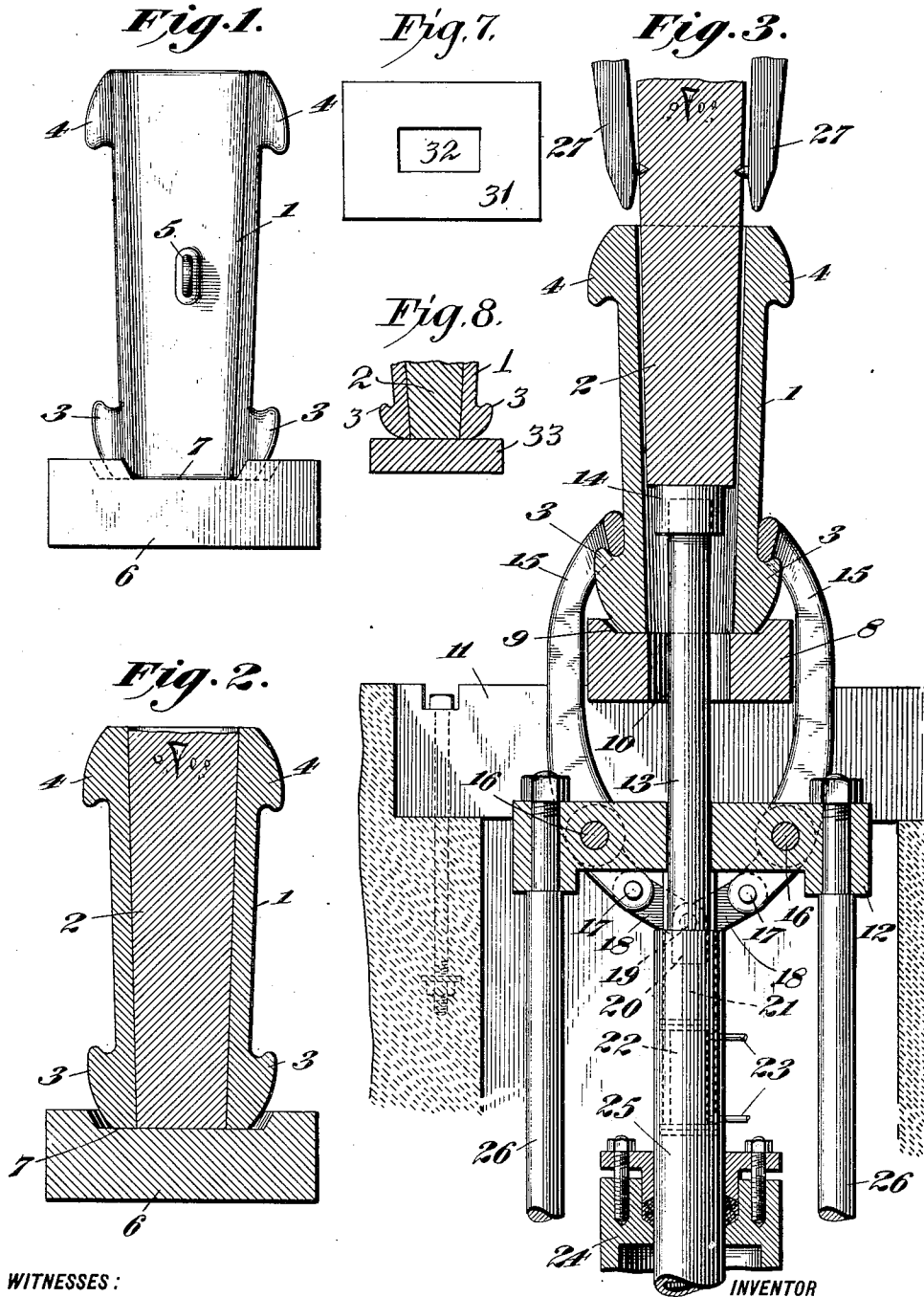


E. E. SLICK.
METHOD AND APPARATUS FOR STRIPPING INGOTS.
APPLICATION FILED APR. 20, 1914.

1,206,150.

Patented Nov. 28, 1916.

2 SHEETS—SHEET 1.



WITNESSES:

Chas. Levey
Robert A. Beers

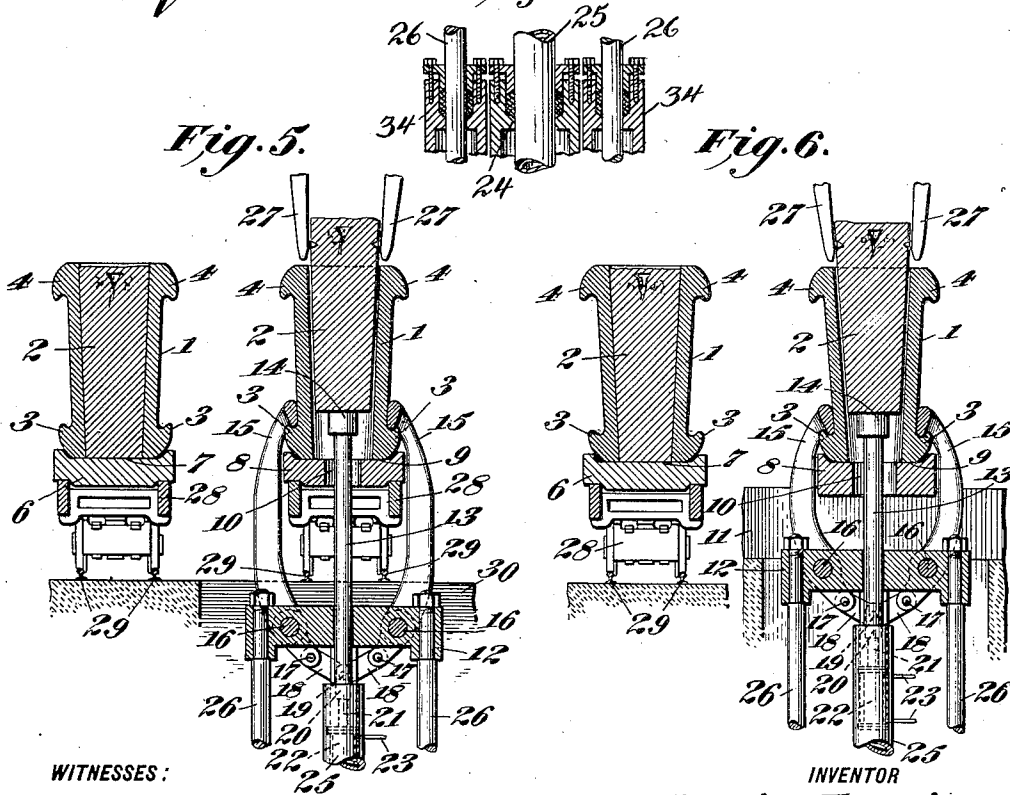
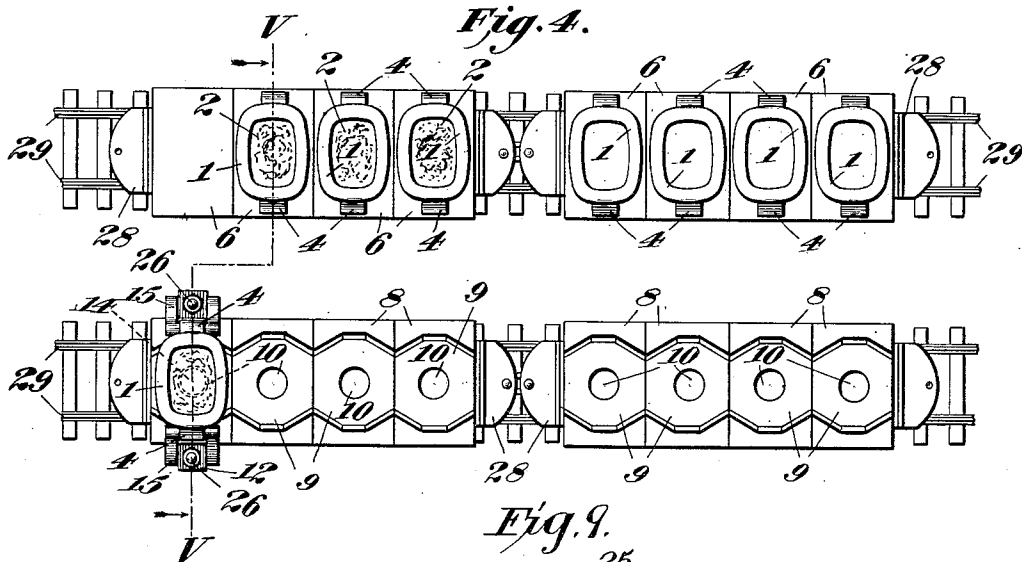
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UNITED STATES PATENT OFFICE.

EDWIN E. SLICK, OF WESTMONT BOROUGH, PENNSYLVANIA.

METHOD AND APPARATUS FOR STRIPPING INGOTS.

1,206,150.

Specification of Letters Patent.

Patented Nov. 28, 1916.

Application filed April 20, 1914. Serial No. 833,028.

To all whom it may concern:

Be it known that I, EDWIN E. SLICK, a citizen of the United States, residing in Westmont borough, in the county of Cambria and State of Pennsylvania, (whose post-office address is Johnstown, Pennsylvania,) have invented certain new and useful Improvements in Methods and Apparatus for Stripping Ingots; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to method and apparatus for stripping ingots and is particularly adapted to the removal of ingots from molds, the larger ends of which are upward, as by this arrangement, ingots more free from piping and segregation are formed, the result being that the upper larger end of the ingot remains fluid for a longer time than the smaller end located either at the upper or lower position, thus allowing the shrinkage cavity to localize itself in said larger upper portion, instead of extending much deeper into or throughout the ingot, as sometimes occurs with those ingots which are cast with the small end upward.

My invention consists generally of special apparatus and arrangement thereof, whereby this is accomplished in a positive, practical and economical manner. To this end, I provide a mold, having a pair of lugs at or near each end and such lugs are preferably undercut adjacent to the mold, so that they easily retain the pulling or lifting apparatus without slipping and without the necessity of undue pressure of the same against the sides of the molds or lugs.

The bottom of my mold is open and the lower end preferably flat and seated on a stool of corresponding formation, and the stool may, or may not, be provided with raised portions adjacent to the sides of the mold in order to guide and retain same thereon. The stool on which the ingot is cast is solid below the ingot and mold and is of considerable thickness, while the lower part of the mold is also of considerable thickness. These masses of metal of the lower portion of the ingot and the stool are adapted to quickly abstract the heat from the lower portion of the ingot, whereby said lower portion becomes solid and capable of mechanical handling in a short time and is consequently quickly ready and adapted for

the operation of my stripping method and apparatus.

After the mold is set in place on the aforesaid stool, metal, such as steel, or in fact iron or any other molten metal, may be poured therein to form an ingot or other casting, and shortly after this is done, the lower portion of the casting becomes solid, owing to the conduction of the heat therefrom by the heavy portions of the mold and the stool; the sides of the ingot are also cooled and solidified to a lesser degree by contact with the side walls of the mold, while the central portion may be even fluid or plastic. As soon as the ingot is in condition for handling, the mold and the contained ingot are lifted by the upper mold lugs from the stool on which the ingot was cast and both transferred to my stripping apparatus, which consists of another stool having a perforation through the bottom portion thereof, a pair of holding-down jaws adapted to hold the mold in firm contact with the perforated support, and a power plunger adapted to pass through the opening in the support and push the ingot upwardly from the mold which is being held stationary and firmly on the said perforated support. After the upper end of the ingot has been projected from the mold for a sufficient distance it is seized by a pair of tongs and placed in a soaking pit furnace or elsewhere, as may be desired.

The molds, when the ingots are cast therein, may be set on stools carried on cars as is customary in some instances, or the stools may be set on the ground or elsewhere, as desired. Similarly, the stripping stools with perforated bottoms may be set upon cars for convenience in presenting the mold and ingots contained therein to the stripping apparatus, although, if desired, these perforated stools may be set on a stationary foundation.

Having thus given a general description of my invention, I will now, in order to make the matter more clear, refer to the accompanying two sheets of drawings on which like characters of reference indicate like parts:—

Figure 1 is a side elevation of an ingot mold and a solid stool on which it is set, according to my invention, and Fig. 2 is a central vertical section through the construction of Fig. 1. Fig. 3 is a vertical sectional elevation of my stripping apparatus

with a stationary perforated stripping stool showing an ingot being pushed upwardly out of the mold and seized by a pair of lifting tongs to be delivered to a soaking pit furnace or elsewhere, as may be desired. Fig. 4 is a plan view, the upper portion of which shows a pair of cars carrying solid stools on which are mounted the ingot molds. The space on the stool at the upper 10 lefthand side of this figure is vacant, the mold and the contained ingot having been transferred thence to the adjacent stripping stool directly below and opposite said space as shown. The molds on the car at the 15 upper lefthand side of this figure contain ingots, while the car at the upper righthand side of the figure carries stools and molds, but no ingots are yet in the molds, but the molds are in position to receive molten ingot 20 metal. The lower portion of this figure shows a pair of cars on which are mounted stripping stools ready to receive molds and the contained ingots preparatory to pushing the ingots out of the molds, one mold and 25 its contained ingot being shown at the lower lefthand side of this part of Fig. 4. Fig. 5 is a cross sectional elevation taken on the broken line V—V of Fig. 4 and shows at the lefthand side the cross section of an ingot 30 mold and contained ingot setting on a solid stool carried by a car, while the righthand portion shows the mold and contained ingot transferred to the perforated stripping stool setting on an adjacent car, the mold being 35 firmly held down on said stool by a pair of holding-down jaws contacting with the lower lugs of the mold, the ingot having been pushed upwardly by the plunger, the upper portion of the ingot having been 40 grasped for lifting from the mold by the tongs as illustrated. Fig. 6 is a figure similar to Fig. 5, except that the perforated stripping stool in this case is set upon a solid or stationary foundation and is not 45 carried on a car, and in this respect Fig. 6 is similar to Fig. 3, which latter is on an enlarged scale. Fig. 7 is a plan view of a somewhat different form of stationary support for the perforated stools, this support 50 being made integral and with an opening in the center as shown. Fig. 8 is a vertical cross-sectional elevation of the lower part of my ingot mold, the lower part of the ingot resting upon a flat stool. Fig. 9 is a 55 cross-sectional elevation of the lower part of my apparatus taken on the lower portion of the line V—V of Fig. 4, showing the cylinder which operates the stripping plunger 25 and the cylinders which operate the rods 26, which rods are adapted to move the holding-down jaws upward or downward and cause them to grasp the ingot mold firmly and hold it down on the stripping stool. 60 The cylinders which operate the rods 26 are indicated as 34 in Fig. 9.

Referring now to the characters of reference on the drawings: 1 indicates the mold in general, 2 the ingot cast therein, 3 the lower lugs of the mold, which, when in the position shown in various figures, are used 70 for holding the mold down firmly in a fixed and stationary position on the stripping stool, as indicated in Figs. 3, 5 and 6.

4 are the upper lugs of the mold, whereby it alone, or it and the contained ingot may 75 be lifted and transferred by means of a crane or other appliance adapted to contact with the undersides of said lugs, which crane is not illustrated herein as it may be of any customary form for this purpose. It 80 should be noted that the lugs 3 and 4 are undercut or concaved on those portions adjacent to the sides of the mold, whereby the lifting or holding-down jaws can hold the mold firmly without slipping or without the 85 necessity of undue lateral pressure. A separate lifting staple 5 is sometimes provided as indicated in Fig. 1.

The solid stool is indicated as 6, which is 90 of considerable thickness, in order to provide necessary strength, material for wear or fusion, and at the same time, for a considerable heat conducting capacity, so as to extract heat rapidly from the lower part of 95 the ingot. The stool 6 is provided with an upper surface 7, which is substantially flat, and as indicated on the drawings, this is recessed in such a way that the lateral surfaces of the recess may act as guides in directing 100 the mold to proper position when lowered on the stool. I may, however, make these stools substantially flat on their upper surfaces without recesses as illustrated in Fig. 8, the flat top stool in this case being indicated as 33, the mold as 1, the contained ingot as 2, 105 and the holding-down lugs on the mold as 3. A perforated stool is indicated as 8, provided with a flat seating surface 9 adapted to receive an ingot mold as shown and this seating surface is also shown as recessed, 110 whereby the upwardly projecting side portions of the stool may serve as guides for directing the mold and the contained ingot into its position on said stool, but I may also make this perforated stool substantially 115 flat on its upper surface and without the side projections, the flat upper surface of this stool thus being similar to that of the flat stool of Fig. 8. This stool 8 is provided with a perforation 10 adapted to allow the strip- 120 ping plunger to pass therethrough.

As shown in Figs. 3 and 6—11 is a stationary support preferably of solid metal adapted to receive and support a perforated stool, there being two of these supports 125 spaced a suitable distance apart, or a support 31 may be made with an elongated opening 32 therethrough, registering with that of the stool as illustrated on a reduced scale in Fig. 7, while either form permits 130

the operation of the holding-down jaws and plunger, as illustrated. 12 is the cross head of my stripping apparatus which is mounted upon rods or plungers 26 which are adapted to be moved up or down, as required, by hydraulic cylinders 34, as illustrated in Fig. 9. 13 is a central stripping plunger which is preferably provided with an upper removable cap portion of larger diameter 14 as shown, thereby providing a renewable piece for the part which is subjected to wear and at the same time giving a larger surface of contact between the plunger and the ingot, so that if the ingot should be soft, the plunger would not be projected into it. The holding-down jaws indicated as 15 are provided with portions adapted to contact with the lower lugs of the mold and hold it down firmly on the perforated stool, as shown particularly in Fig. 3 and on a somewhat reduced scale in Figs. 5 and 6. The holding-down jaws are pivoted to the cross head 12 by the pivot pins 16 as shown, and the lower ends of these holding-down jaws are further pivoted at 17 to the links 18. The links 18 are further pivoted at 19 to the head 20 of the piston rod 21 which is actuated by the fluid pressure cylinder 22, the connections to and from said cylinder being indicated as 23. The stripping plunger 13 has an enlarged lower portion 25 which is reciprocally operated upward or downward as may be required, by the fluid pressure stripping cylinder 24, which may be controlled by any well known means, not shown. The rods or plungers 26 which are connected to the cross head 12 are similarly operated by a pair of fluid pressure cylinders, 34, and are adapted to move the holding-down jaws upward or downward and to cause them to grasp the ingot mold firmly and hold it down on the stripping stool. The opening or closing of the jaws is accomplished by the action of the cylinder 22 and its connections, as shown and previously described. Lifting tongs 27 for the ingot are indicated partially in the various views and these tongs may be of any well known construction and operated by a swinging or traveling crane, or by any other suitable means for lifting and transporting the ingot.

The car bodies which carry the stools are indicated generally as 28, and as shown in Figs. 4 and 5, and the lefthand portion of Fig. 6, these cars run on the usual track rails 29. As shown at the righthand portion of Fig. 5, portions of these rails rest upon the foundation pieces 30 which are adjacent to, and form the boundary edges of, the stripper pit, and said rails span the pit for the purpose of carrying the cars to the stripper and thereby presenting the molds and the ingots thereto. Instead of using two fixed supports 11, as illustrated

in Figs. 3 and 6, I may make this in one piece as illustrated in Fig. 7, in which 31 is a plan view of a one-piece stationary support, and 32 is the opening therein to permit the holding-down jaws 15, the central stripping plunger 13 and the other portions of the stripping apparatus to project therethrough and operate upon the mold, which is set upon the perforated stool 8 which rests on the stationary support 31, the perforations of the stool and the support registering with each other.

My method of operation is as follows: The ingots having been cast within the molds setting on the solid stools, as shown in Fig. 2, the heat is abstracted more quickly from the lower portions thereof by contact with the thick stool and the thick walls of the lower part of the mold; and as soon as this part of the ingot has become sufficiently solid, the mold and the contained ingot are lifted together by any suitable crane, operating in connection with the lifting lugs 4 of the mold and set upon the stripping stool with the ingot directly above the opening 10 in said stool. This being accomplished, the holding-down jaws are placed in position as indicated in Figs. 3, 5 and 6, and by the downward pulling action of the rods 26, which are actuated by fluid pressure cylinders or other means, not shown, the said jaws are caused to hold the mold firmly down on the stripping stool, whereupon the stripping plunger is projected with such force as may be necessary against the lower portion of the ingot, causing it to move upwardly, while the mold is held fixed and stationary, as indicated in Figs. 3, 5 and 6. After this is accomplished, the ingot is grasped by its upper portion by suitable tongs as indicated in Figs. 3, 5 and 6, and transported thence into a soaking pit furnace or elsewhere. After this is done, the holding-down jaws are released by the action of the various cylinders and connections, the mold is raised by its lifting lugs and transported to a solid stool, where it is again made ready for receiving molten metal to form another ingot.

Although I have shown and described my improvements in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention, or as pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. The method which consists in lifting a mold and the ingot therein from their supporting stool, then placing and holding the mold firmly while the lower end of the ingot is exposed, then pushing said ingot upwardly

partly out of the mold, then grasping the ingot by its upper end and removing it from the mold.

2. The method which consists in lifting
5 a mold and the ingot therein from their supporting stool, then placing and holding the mold firmly on a support, then pushing said ingot partly out of the mold, then grasping the ingot by its exposed end and removing
10 it from the mold.

3. The method comprising casting an ingot large end upward in a mold which is open top and bottom, the mold bottom being set on a seating stool and thereby temporarily closed; then taking the mold and
15 contained ingot from the seating stool, then holding the mold firmly fixed, then pushing the ingot upwardly therein until its top extends above the mold, then grasping
20 said top and removing the ingot from the mold.

4. The method which consists in casting an ingot in a mold open at top and bottom, quickly abstracting the heat from the lower
25 part of the ingot, then transferring the mold and contained ingot to another support with the lower end of the ingot exposed, then holding the mold firmly and pushing the ingot upwardly partly out of the mold, then
30 finally withdrawing the ingot by grasping its upper end and thereby lifting it from the mold.

5. The method which consists in casting an ingot in a tapered metal mold open at
35 top and bottom with the large end upward, the inner sides of said mold being straight the entire length thereof, the openings being therefore of full section, quickly abstracting the heat from the lower and smaller end of
40 the ingot causing said end to solidify considerably sooner than the upper portion, then transferring the mold and contained ingot to another and perforated support exposing the lower end of said ingot, then
45 holding said mold firmly down on said perforated support and pushing said ingot upwardly by positive means contacting with its lower end, thereby projecting its upper portion out of the mold, then grasping said
50 upper portion and removing the ingot thereby from the mold.

6. The combination of a mold open top and bottom and provided with lifting and holding lugs, a solid metal stool on which
55 said mold is set, means for lifting the mold and contained ingot from the stool aforesaid, to and setting them on a perforated stool, holding jaws cooperating with the holding lugs adapted to hold said mold
60 firmly stationary on said perforated stool, a

reciprocable plunger adapted to project through the perforation and positively push the ingot partly upward from the mold.

7. The combination of a mold open top and bottom and provided with lifting and
65 holding lugs, a solid metal stool on which said mold is set, a perforated stripping stool, means for lifting the mold and contained ingot from said solid stool and setting them on the perforated stool, holding jaws co-
70 operating with the holding lugs and adapted to hold said mold down in fixed position on said perforated stool, a reciprocable plunger adapted to project through the perforation and positively push the ingot partly
75 upward from the mold, and means for grasping the ingot by its upper portion and finally removing it from the mold.

8. The combination of a tapered mold open top and bottom with the large end up-
80 ward, lifting and holding lugs projecting from the sides of said mold, a solid metal stool on which the bottom of said mold is set, a perforated stripping stool, means for lifting said mold and contained ingot from
85 the solid stool to the perforated stool, reciprocable opening and closing jaws adapted to contact with the holding lugs and secure said mold fixedly on said perforated stool, a reciprocable plunger adapted to pro-
90 ject through the perforation, contact with the lower end of an ingot and push it partly upward out of the mold, and means for grasping the protruding end of the ingot and transporting it elsewhere thereby.
95

9. An ingot mold open at both ends, having lugs on opposite sides near the top and bottom, in combination with a perforated support, a pushing mechanism, adapted to contact directly with the ingot bottom.
100

10. The combination with an ingot mold having an opening at the top, a smaller opening at the bottom, of a perforated supporting stool, the perforation of which conforms to the opening in the bottom end of the
105 mold, and a pushing mechanism adapted to contact directly with the ingot bottom.

11. A tapered mold, open at top and bottom, provided with a pair of undercut lugs at each end, in combination with a supporting stool therefor, the supporting surface of which is recessed and conforms to that of the end of the mold.
110

In testimony whereof I hereto affix my signature in the presence of two witnesses.
115

EDWIN E. SLICK.

Witnesses:

PLUMA F. LONGSHORE,
A. DIX TITTLE.