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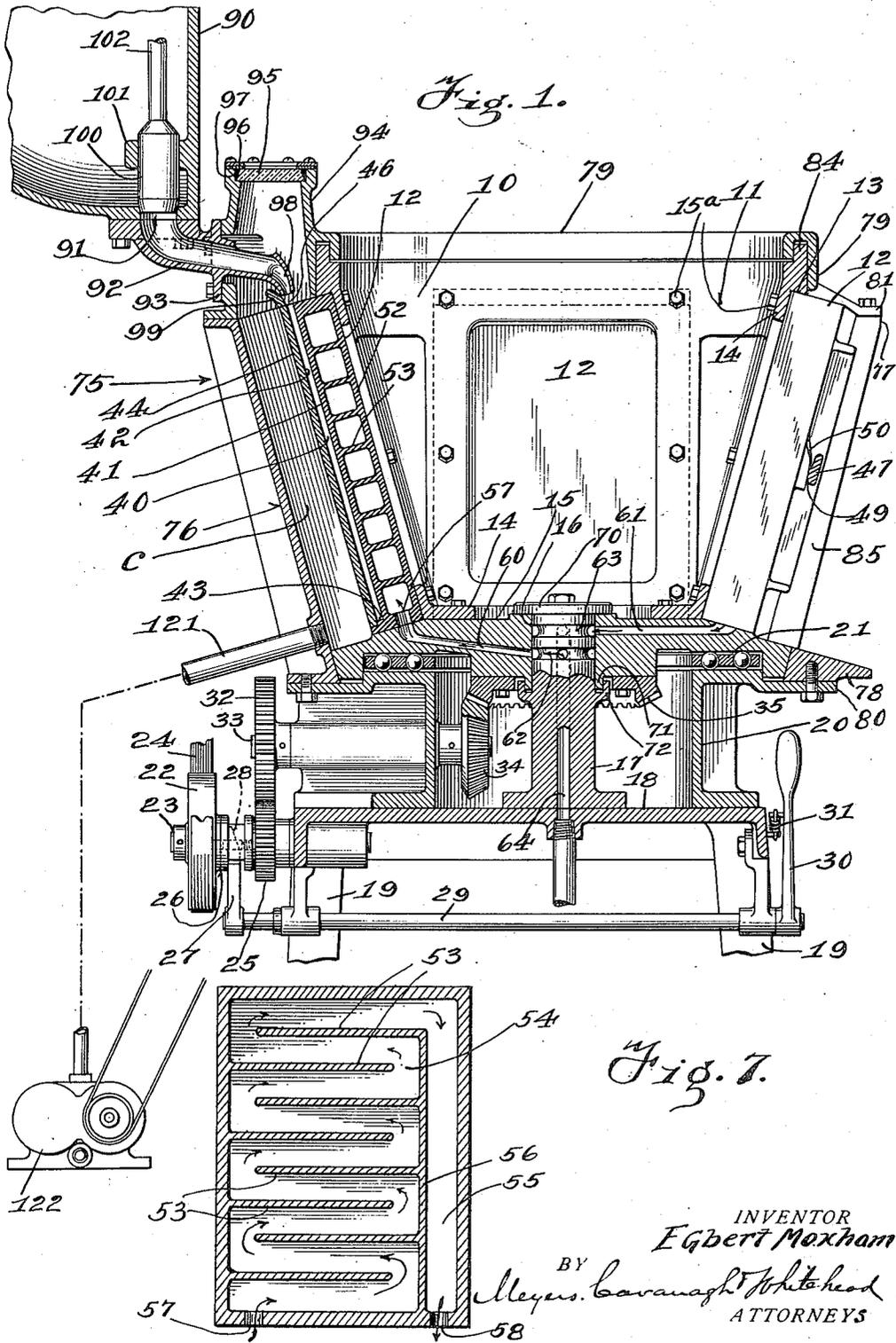
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E. MOXHAM

ART OF CASTING METAL SLABS

Filed Sept. 26 1922

3 Sheets-Sheet 1



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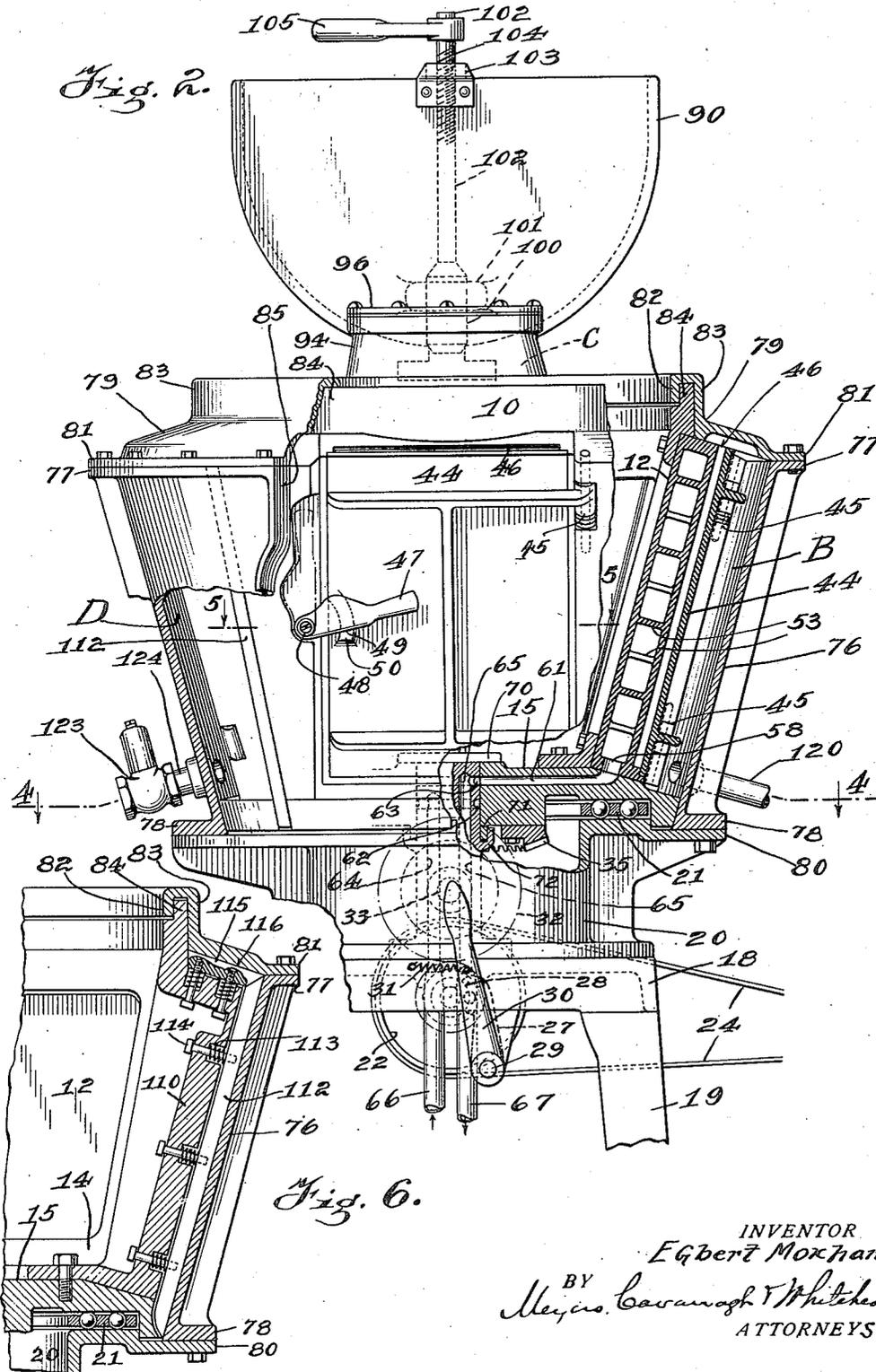
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3 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

EGBERT MOXHAM, OF GREAT NECK, NEW YORK, ASSIGNOR TO CONLEY TINFOIL CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ART OF CASTING METAL SLABS.

Application filed September 26, 1922. Serial No. 590,615.

To all whom it may concern:

Be it known that I, EGBERT MOXHAM, a citizen of the United States, and resident of Great Neck, Long Island, in the county of Nassau and State of New York, have invented certain new and useful Improvements in the Art of Casting Metal Slabs, of which the following is a specification.

My invention relates to the art of casting metal slabs or ingots, and includes a novel method of casting, and a machine for casting slabs in accordance with the method.

While the invention is capable of use in various arts where conditions are more or less similar, it has been especially developed with reference to the casting of metal slabs which are rolled down to produce metal foil, and particularly tin foil, or composition foil.

Tin foil may consist of pure tin or an alloy of lead and tin in various proportions. This metal or alloy when melted is particularly susceptible to oxidation, and in the methods of casting the slabs employed up to the present time, the molten metal is very freely exposed to air in pouring and in the mold, with the result that a considerable amount of oxidation takes place, the oxidized metal being incorporated in the slab.

A principal object of the invention is to eliminate or greatly reduce oxidation by reducing to a great extent the amount of air in the mold or in the neighborhood of the molten metal when poured. This is accomplished by maintaining a partial vacuum, or a vacuum which is as complete as is practicable under working conditions, in the mold and in the neighborhood of the poured metal as the mold is filled. Oxidation is thus greatly reduced or practically eliminated, with accompanying improvement in the composition and texture of the metal slab. The provision of the partial vacuum during pouring also tends materially to reduce or eliminate air bubbles or porosities in the casting.

In addition to the features above mentioned, the invention includes various improvements in casting mechanism sufficiently explained in the following detail description.

The accompanying drawings show one exemplifying form of a machine embodying the invention, and also sufficiently exemplify the performance of the process. After considering the drawings as explained here-

after, persons skilled in the art will understand that many variations may be made within the principles of the invention; and I contemplate the employment of any structures, and the performance of the method in any ways which are properly within the scope of the appended claims.

Fig. 1 is a vertical section of a casting machine embodying the invention in one form.

Fig. 2 is a view from the right of Fig. 1, partly in elevation and partly in section.

Fig. 3 is a top plan with some parts broken away.

Fig. 4 is a horizontal section at 4—4, Fig. 2.

Fig. 5 is a horizontal section at 5—5, Fig. 2.

Fig. 6 is a vertical section of one side of the rotary mold carrier and casing approximately in the plane 6, Fig. 3.

Fig. 7 is a vertical section through one of the mold jackets in a plane parallel to one of the broad sides of the mold.

A rotary mold carrier 10 has, in the present embodiment of the invention, a substantially bucket-shaped wall 11 arranged to provide frames or seats for a plurality of molds 12, four molds in the present arrangement. These frames or mold holders consist of recesses 13 surrounded by inward flanges 14 through which cap screws 15^a are inserted to secure the molds detachably in position. The bottom of wall 11 is formed with an annular flange 14 secured to a base 15 which has a central bore 16 turning on the upper cylindrical portion of a standard 17 which rests on a table 18 supported by legs 19. The rotary carrier base 15 is also supported on a framework 20 which rests on the stationary table 18, this additional support conveniently consisting of an anti-friction thrust bearing 21. This thrust bearing as here illustrated is a double row ball bearing which is ample to support the weight of the rotary mold carrier and practically eliminate friction.

While various modes of rotating the mold carrier may be employed, and in some cases the carrier may even be turned by hand, it is desirable to provide an intermittent and readily controllable power drive. In the present embodiment of the invention this power drive comprises the driving pulley 22 rotatably mounted on a short shaft 23

and driven by a belt 24 from any suitable source of power. Shaft 23 also carries a pinion 25 rotatably mounted thereon, and a suitable clutch 26 is provided to connect the pulley with the pinion. Desirably this clutch is any suitable or known form of one-revolution clutch, the particular form shown being a pin clutch in which the pin is urged to clutch engaging position by a spring, and the pin is withdrawn at the end of one revolution by an arm 27 having an angular face 28 cooperating with a shoulder on the pin. The arm is carried by a rock shaft 29 having a handled lever 30 provided with a spring 31 tensioned to urge the arm 27 to active position, that is, to the position where the arm face 28 will engage the pin shoulder to withdraw the pin and disconnect the clutch. Pinion 25 engages a gear 32 on a counter shaft 33 which is connected by a bevel pinion to a bevel gear 35 bolted to the bottom of the mold carrier base 15. Corresponding to the four mold arrangement shown, the gearing is arranged so that each revolution of pinion 25 turns the carrier one-quarter revolution. To cause each carrier movement, the operator simply moves the handle of lever 30 sufficiently to move clutch arm 27 out of engagement with the clutch pin. The clutch thereupon immediately commences to revolve; the operator releases the handle; the mold carrier is moved one-quarter turn; the clutch pin engages the bevel face 28 of arm 27; and the clutch is released, bringing the carrier to a stop in a new position. While the carrier is stationary a slab is removed from the mold at one side of the carrier; the mold is closed; the carrier is again moved by operating the lever 30, and so on.

Each mold body 12 has a mold space 40 defined by a back wall 41, shallow side walls 42 and a shallow bottom wall 43, and by a front wall 44 in the form of a door hingedly connected to the mold body at 45, the top side of the mold space being left open at 46. Each mold door is secured in closed position by a handle 47 pivoted to the carrier body at 48 and having a face 49 engaging a bevelled lug 50 on the door.

The molds are cooled by a water jacket formed between the rear mold wall 41 and back wall 52 of the mold body. Desirably water is caused to flow in a circuitous course through the jacket by providing horizontal partitions 53 having openings 54 at alternate ends, the space above the upper partition communicating with a vertical channel 55 formed by a vertical partition 56. A port 57 in the lower wall of the mold body communicates with one end of the lower horizontal water passage, and another port 58 communicates with the lower end of the vertical passage 55. To circulate water through the mold jacket, the rotary carrier

base 15 is provided with four radial water passages 60 leading from the central bore 16 to the supply ports 57 of the four mold jackets, and is also provided with four other radial water passages 61 leading from the four jacket discharge ports 58 to the bore 16. The ends of the passages 60 terminate in the bore 16 at one level opposite an annular water channel 62 in the face of the bearing spindle, and the ends of the other passages 61 enter the bore at a higher level opposite another annular channel 63. The standard 17 is provided with internal channels 64 and 65 communicating with the annular channels 62 and 63 respectively. A water supply pipe 66 communicates with the vertical channel 64, and a discharge pipe 67 communicates with the channel 65. Any suitable means may be provided for supplying or circulating cooling water, and the described arrangement of channels provides for the circulation of the water through the mold jackets during the rotation of the mold carrier as well as during the time when the carrier is stationary. To insure a water-tight rotary connection between the channels in standard 17 and the rotary mold base channels, any suitable packing means may be provided, sufficiently represented in the present embodiment of the invention by a disk 70 secured to the upper end of the standard 17 and overlying the central portion or hub of the carrier base 15, and an annular flange 71 formed on the bottom of the carrier base and engaging in a recess formed by an annular flange 72 on the standard 17.

To provide for exhausting air from the mold spaces at the time of pouring, the rotary mold carrier and molds are enclosed within a jacket designated in general as 75. This comprises a central outer jacket wall 76 having upper and lower flanges 77 and 78, an upper approximately ring-shaped plate 79, and the framework 20 previously mentioned which is of approximately cylindrical or annular form and tightly bolted to the base 18 to provide a practically air-tight enclosure for the under part of the rotary carrier. This framework has a horizontal flange 80 to which flange 78 of the outer jacket wall 76 is bolted. The ring or cap member 79 has a flange 81 bolted to flange 77 of the wall 76. The cap member 79 has an inner annular flange 82 closely fitting and enclosing between it and the vertical wall 83 of the cap member, a flange 84 formed on the upper end of the mold carrier wall 11. The air jacket enclosure is completed at the inside by the wall 11 of the carrier frame and the upper face of the carrier base 15 together with the flange 14.

The air casing or jacket wall 76 has at one side an opening 85 which is large enough to give access to the mold door and handle and to permit the mold door to be opened,

and which is also desirably large enough to permit the mold to be removed bodily when necessary or desirable after the mold body is released from the carrier by removing the set screws 15^a.

At another point, and most desirably at a point opposite the opening 85, means are provided for filling the molds successively presented at that point. This means comprises in the present embodiment of the invention any suitable or ordinary melting pot 90 provided with any suitable heating means (not shown) having a discharge opening at 91, communicating with a spout 92 which is secured by means of a flange 93 to a part of the top ring 79. Desirably the top ring or plate 79 is formed at this point with upwardly projecting walls 94 formed to provide a seat for an elongated or approximately oval glass plate 95 secured by a metal plate 96 and suitable air-tight packing 97. The laterally elongated mouth 98 of the pouring spout is located below the glass or window 95, so that the flow of metal in filling the mold may be observed. The elongated spout is close to and directly above, and conforms to a central portion of the open upper edge 46 of the mold, and a guide lip or flange 99 is desirably secured in the lower portion of the spout housing directly below the mouth of the spout and with its lower edge close to the upper edge of the mold door 44 and arranged so as to assist in guiding the molten metal into the mold as clearly shown in Fig. 1. A plug valve 100 is arranged in the melting pot to close the discharge opening 91, and this valve is guided in a lug 101 and is carried on a vertical stem 102 which passes through a fitting 103 at the top of one of the pot walls and is provided with a coarse pitch screw thread 104 engaging a similar internal thread in the fitting; and the stem is also provided at its upper end with a handle 105.

In cooperation with the air jacket or casing, the air space is divided into compartments or sections each corresponding to one of the molds in the following way: The rotary mold carrier 10 is provided between the molds with upright portions 110 having outer segmental faces 111 conforming to the contour of the inner face of the casing wall 76 and engaging that wall with a close running fit. To assist in rendering the air jacket sections approximately airtight, vertical packing strips 112 are provided located in suitable recesses formed in the carrier uprights 110. These packing strips are urged outward by springs 113, and outward movement is limited by the heads of screws 114 engaging against inner faces of the carrier uprights. Other packing strips 115 are desirably provided, engaging inner approximately horizontal surfaces 116 of the jacket ring member 79.

When the screws 114 are properly adjusted, the vertical strips 112 will move outward very slightly as they pass across the casing opening 85, but to prevent these strips bumping the vertical edges of the casing, these edges may be inwardly rounded or bevelled as at 117, Fig. 4.

While the air jacket spaces defined by the mold carrier uprights 110 have no fixed position but move around with the mold carrier, whenever the mold carrier is stationary with one of the molds in casting position, that is at the left in Figs. 1, 3 and 4, the air jacket space of each mold is definitely located in relation to the casing. One such space is freely open to atmosphere through the casing opening 85, and two other sections are located at points between the pouring and mold discharging positions, that is, at the top and bottom, Figs. 3 and 4, and these sections or mold positions are designated by the characters A, B, C and D respectively. At a point in the outer casing wall 76 communicating with the section B, an air exhaust pipe 120 is tapped into the casing wall. Similarly an air exhaust pipe 121 is tapped into the casing wall communicating with the air jacket section C at casting position. These pipes may lead to any suitable air exhausting mechanism, for instance to air exhaust pumps 122, one of which is shown in Fig. 1 connected to pipe 121; or the two exhaust pipes 120 and 121 may be connected by a union and the common exhaust pipe may be connected to a single exhaust pump of sufficient capacity. A suitable relief valve 123, Fig. 2, is connected by means of a short pipe 124 to the casing section D, this being any ordinary or suitable relief or pressure reducing valve, for instance one which is arranged to close against external atmospheric pressure when the pressure within the air jacket section D is approximately one half atmosphere.

The operation, briefly described, is as follows: The melting pot 90 is supplied with melted metal or alloy of suitable character such as previously described, and the air exhaust pump or pumps are operated at a suitable speed. Air is exhausted from the air jacket section B anterior to the casting position up to the capacity of the air exhausting means. It is not practicable in mechanism of this class to provide packing means which will entirely prevent leakage, nor is this necessary or especially desirable. There is therefore more or less leakage past the packing devices into the space B. Supposing that the air exhausting mechanism has a capacity which would enable it to produce a vacuum of approximately 28 inches of mercury in a sealed chamber, a partial vacuum equal approximately to 14 inches mercury will be produced in the chamber B. At the same

time air is exhausted from chamber C to produce a vacuum up to the capacity of the exhaust apparatus. At the same time also, supposing that the machine has been in operation a short time and the maximum possible vacuum had previously existed in the mold space D before it moved to the position indicated in Fig. 4, this vacuum is relieved by admission of external air through the relief valve 123 to the point where the depression in chamber D is substantially 14 inches mercury. By the described means a partial vacuum less than the total vacuum the suction apparatus is capable of producing, is maintained in each of the jacket sections adjacent to the section in casting position, and therefore the amount of leakage into the section C at casting position is very greatly reduced compared to the leakage which would occur if air were present at atmospheric pressure directly at each side of section C. Therefore with packing devices which do not entirely prevent leakage, and with exhaust apparatus of reasonable or practicable capacity, it is possible to maintain a reasonably near approach to a complete vacuum in the casting section of the jacket, or in other words a very great proportion of all the air is exhausted from that section. The plug valve is now withdrawn by moving handle 105 permitting the molten metal to flow through the spout 46 over the guide lip 99 and into the open top of the mold space until the mold is filled, the pouring operation being observed through the glass 95. The valve is closed and the attendant then throws back the handle 47 of the mold which is located at the opening 85, opens the mold door 44 and removes the slab previously poured at the position C and which has had ample time to cool and harden before it reaches the position A. The mold is then closed and locked and the clutch operating lever 30 is moved to cause the carrier to advance one-quarter revolution in the manner previously described, bringing a new empty mold into position for pouring, and so on. A partial vacuum is continually maintained in the jacket space at position B, and also at position D, and a much greater or approximately complete vacuum up to the practical capacity of the apparatus is maintained at the pouring position C.

The means described for removing air from the pouring zone is especially important and desirable in the case of relatively thin metal slabs for the purpose previously mentioned, formed of readily oxidizable metal or alloy. Since the slab is relatively thin, a very large surface is exposed to oxidizing influence when air is freely present. By my described apparatus and method, very little or at the most a very reduced amount of air can come in contact with the molten metal as it leaves the spout and as it enters

the mold space, and a very great part or substantially all of the oxidation is thus eliminated and cast slabs are produced which are largely or practically entirely free from oxidized metal. Air holes or bubbles and porosities are also largely eliminated by the partial or practical absence of air, which facilitates the easy and smooth flowing of the metal into the mold space.

I claim:

1. A method of casting oxidizable metal or metal alloys with materially reduced oxidation effect, comprising advancing a mold in a predetermined path past a pouring position, creating a partial vacuum in the mold space and around a pouring spout at pouring position, pouring molten metal into the mold with materially reduced exposure to air in the mold space and between the spout and the mold, and relieving the vacuum about the mold at a position beyond the pouring position.

2. A method of casting oxidizable metal or metal alloys with materially reduced oxidation effect, comprising moving a mold through a series of stations including a pouring station in predetermined order, exhausting air from the mold space at a station anterior to the pouring station, exhausting more air from the mold space and from a mold enclosure including a pouring spout at the pouring station, and pouring molten metal from the spout into the mold at the pouring station with materially reduced exposure to air.

3. A method of casting oxidizable metal or metal alloys with materially reduced oxidation effect, comprising moving a mold through a series of stations including a pouring station in predetermined order, exhausting air from the mold space at a station anterior to the pouring station, exhausting more air from the mold space and from a mold enclosure including a pouring spout at the pouring station, pouring molten metal from the spout into the mold at the pouring station with materially reduced exposure to air, and supplying air to the mold space at less than atmospheric pressure at a station posterior to the pouring station.

4. A method of casting oxidizable metal or metal alloys with materially reduced oxidation effect, comprising moving a mold through a series of stations including a pouring station in predetermined order, exhausting air from the mold space at a station anterior to the pouring station, exhausting more air from the mold space and from a mold enclosure including a pouring spout at the pouring station, pouring molten metal from the spout into the mold at the pouring station with materially reduced exposure to air, and supplying air to the mold space at less than atmospheric pressure at a station posterior to the pouring station, and expos-

ing the mold freely to atmosphere at a delivery station.

5. A method of casting oxidizable metal or metal alloys with materially reduced oxidation effect, comprising moving a mold through a series of stations including a pouring station in predetermined order, exhausting air from the mold space and a mold enclosure at a station anterior to the pouring station, exhausting more air from the mold space and a mold enclosure including a pouring spout at the pouring station, and pouring molten metal from the spout into the mold at the pouring station with materially reduced exposure to air.

6. The method of casting thin slabs of oxidizable metal or metal alloys comprising advancing a series of molds in a continuous course past a pouring station, a mold discharging station, an intermediate station anterior to the pouring station and another intermediate station posterior to the pouring station, maintaining an independent partially air-tight enclosure about each mold at the pouring station and intermediate stations, exhausting a part of the air from the mold enclosure and mold space at the intermediate anterior station, exhausting additional air from the mold space and enclosure including a pouring spout at the pouring station, pouring molten metal into the mold at the pouring station, supplying air at less than atmospheric pressure to the mold space at the posterior intermediate station, and removing the cast plate from the mold at the discharge station.

7. Casting apparatus comprising an approximately air tight mold enclosure, a pouring spout therein, a mold movably positioned in the enclosure in operative relation to the spout, means for exhausting air from the enclosure, and means for supplying molten metal through the spout to fill the mold.

8. Casting apparatus comprising an approximately air tight mold enclosure, a pouring spout therein, a mold movably positioned in the enclosure in operative relation to the spout, means for exhausting air from the enclosure, and means for supplying molten metal through the spout to fill the mold, and a transparent window in the mold enclosure arranged to permit observation of pouring.

9. Casting apparatus comprising a mold carrier, a mold thereon, an enclosure for the mold at a plurality of successive stations including a pouring station, means for exhausting a part of the air from the enclosure and the mold space at a station anterior to the pouring station, means for exhausting more air from the enclosure and mold space at the pouring station, a pouring spout in operative relation to the mold within the enclosure at the pouring station, and

means for supplying molten metal to the spout.

10. Casting apparatus comprising a mold carrier, a mold thereon, an enclosure for the mold at a plurality of successive stations including a pouring station, means for exhausting a part of the air from the enclosure and the mold space at a station anterior to the pouring station, means for exhausting more air from the enclosure and mold space at the pouring station, a pouring spout within the enclosure in operative relation to the mold at the pouring station, means for supplying molten metal and controlling metal flow to the spout, and means at a station posterior to the pouring station for admitting air to the enclosure at less than atmospheric pressure.

11. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds, said jacket having an opening at a casting discharge station, means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, and means for exhausting air from the mold enclosure at pouring position.

12. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds, said jacket having an opening at a casting discharge station, means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, and means for exhausting air from the mold enclosure at pouring position, and means for partially exhausting air from the mold enclosure to a point anterior to pouring position.

13. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds, said jacket having an opening at a casting discharge station, means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, means for exhausting air from the mold enclosure at pouring position, means for partially exhausting air from the mold enclosure at a point anterior to pouring position, and means for partially restoring air pressure in the mold enclosure posterior to pouring position.

14. Casting apparatus comprising a rotary mold carrier, means for moving the carrier intermittently, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds and carrier, said jacket having an opening at a casting discharge station, packing means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, and means for exhausting air from the mold enclosure at pouring position.
15. Casting apparatus comprising a rotary mold carrier, means for moving the carrier intermittently, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds and carrier, said jacket having an opening at a casting discharge station, packing means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, means for exhausting air from the mold enclosure at pouring position, and means for partially exhausting air from the mold enclosure at a point anterior to pouring position.
16. Casting apparatus comprising a rotary mold carrier, means for moving the carrier intermittently, a plurality of molds spaced about the carrier, an air jacket enclosure for the molds and carrier, said jacket having an opening at a casting discharge station, packing means conformable to the rotary movement of the carrier for maintaining approximately air-tight divisions between the molds in cooperation with the air jacket, a pouring spout within the jacket arranged to supply molten metal to the mold at a pouring position, and means for exhausting air from the mold enclosure at pouring position, means for partially exhausting air from the mold enclosure at a point anterior to pouring position, and means for partially restoring air pressure in the mold enclosure posterior to pouring position.
17. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced thereon, an air jacket partially surrounding the carrier and molds and including an upright peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, and means for exhausting air from the mold jacket space at pouring position.
18. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced thereon, an air jacket partially surrounding the carrier and molds and including an upright peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, and means for exhausting air from the mold jacket space anterior to pouring position.
19. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced thereon, an air jacket partially surrounding the carrier and molds and including an upright peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, means for exhausting air from the mold jacket space at pouring position, and means for exhausting air from the mold jacket space anterior to pouring position, and means for supplying air up to less than atmospheric pressure in the mold jacket space posterior to pouring position.
20. Casting apparatus comprising a rotary mold carrier, a plurality of molds spaced thereon, an air jacket partially surrounding the carrier and molds and including an upright peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, means for exhausting air from the mold jacket space at pouring position, and a sight glass inserted in the jacket adjacent to the spout to permit inspection of pouring.
21. Casting apparatus comprising a rotary mold carrier, a plurality of molds regularly spaced thereon, an air jacket partially surrounding the carrier and molds and including an approximately vertical peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, a metal pot and valve for delivering molten metal to the spout, and means for exhausting air from the mold jacket space at pouring position.
22. Casting apparatus comprising a rotary mold carrier, a plurality of molds regularly spaced thereon, an air jacket partially

surrounding the carrier and molds and including an approximately vertical peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, a metal pot and valve for delivering molten metal to the spout, means for exhausting air from the mold jacket space at pouring position, and means for exhausting air from the mold jacket space anterior to pouring position.

23. Casting apparatus comprising a rotary mold carrier, a plurality of molds regularly spaced thereon, an air jacket partially surrounding the carrier and molds and including an approximately vertical peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, a metal pot and valve for delivering molten metal to the spout, means for exhausting air from the mold jacket space at pouring position, means for exhausting air from the mold jacket space anterior to pouring position, and means for supplying air up to less than atmospheric pressure in the mold jacket space posterior to pouring position.

24. Casting apparatus comprising a rotary mold carrier, a plurality of molds regularly spaced thereon, an air jacket partially surrounding the carrier and molds and including an approximately vertical peripheral wall of circular contour, packing means on the carrier between each two molds cooperating with the air jacket to provide an individual air chamber for each mold, a pouring spout within the air jacket and arranged to deliver molten metal to the mold at pouring position, a metal pot and valve for delivering molten metal to the spout, means for exhausting air from the mold jacket space at pouring position, and a sight glass inserted in the jacket adjacent to the spout to permit inspection of pouring.

25. Casting apparatus comprising a rotary mold carrier, an approximately air-

tight casing therefor, means for exhausting air from the casing at pouring position, a plurality of molds in spaced relation on the carrier within the casing, pouring means, and means for rotating the carrier intermittently a part turn at each movement.

26. Casting apparatus comprising a rotary mold carrier, a casing surrounding the carrier, a plurality of mold bodies in spaced relation on the carrier within the casing, a movable door on each mold body forming one face of the mold space, and a latch for each door.

27. Casting apparatus comprising a rotary mold carrier, a casing surrounding the carrier, a plurality of mold bodies in spaced relation on the carrier within the casing, a movable door on each mold body forming one face of the mold space, a latch for each door, the casing being provided with an opening giving access to the mold latch and door at one side of the casing to permit discharge of a casting from the mold.

28. Casting apparatus comprising a rotary mold carrier, a plurality of mold bodies in spaced relation thereon, each body comprising a mold space and a water jacket, a water supply and a water discharge port communicating with each water jacket, centrally located means for supplying water to all the mold supply ports and carrying off water discharge from all the mold discharge ports during rotation of the carrier, and means for rotating the carrier.

29. Casting apparatus comprising a rotary mold carrier, a plurality of mold bodies in spaced relation thereon, each body comprising a mold space and a water jacket having partitions for directing cooling water in a circuitous course through the jacket, a water supply and a water discharge port communicating with ends of the water channel of each mold, centrally located means for supplying water to all the mold supply ports and carrying off water discharge from all the mold discharge ports during rotation of the carrier, and means for rotating the carrier.

Signed at New York city, in the county of New York and State of New York, this 21st day of September A. D. 1922.

EGBERT MOXHAM.