March 4, 1930. S. H. CARBIS 1,749,314

CASTING APPARATUS

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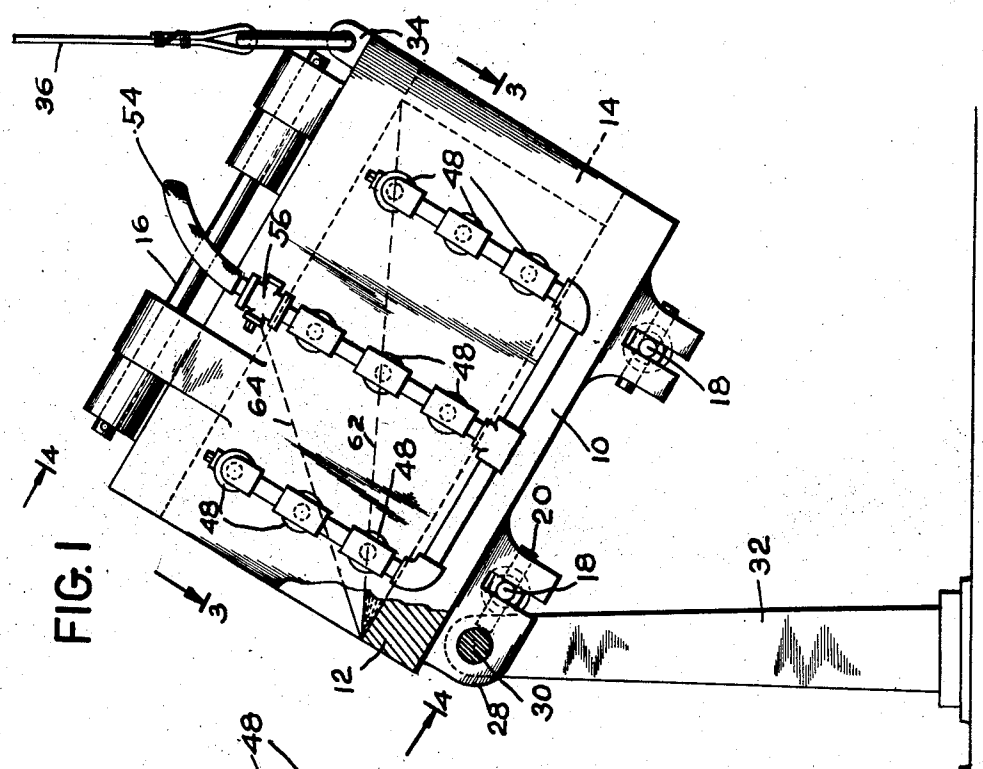


FIG. 1

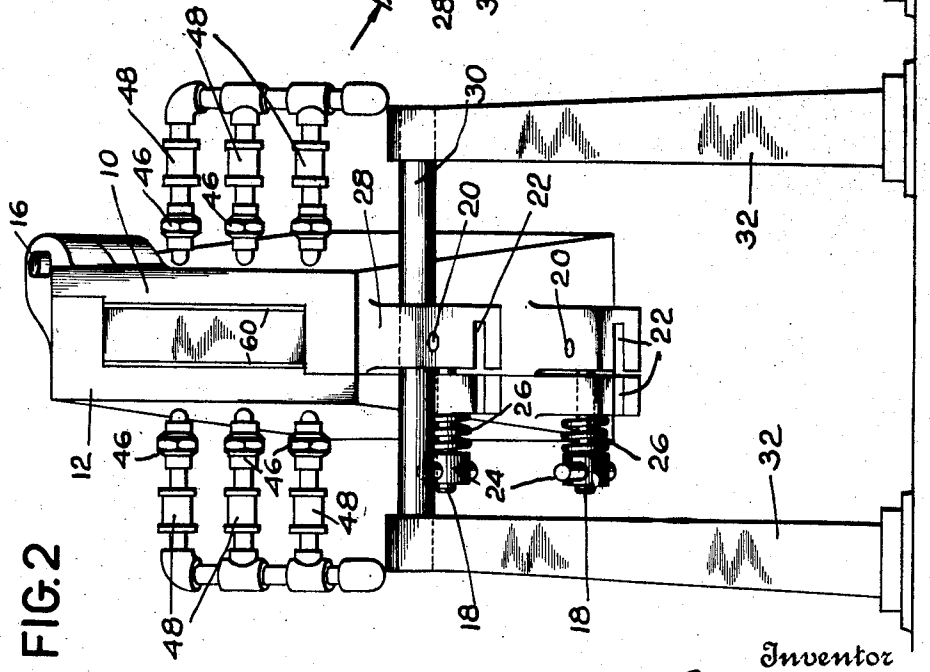


FIG. 2

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FIG. 3

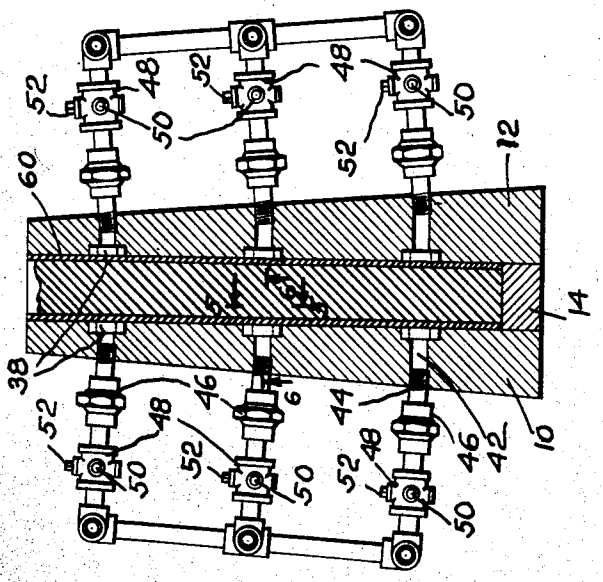


FIG. 4

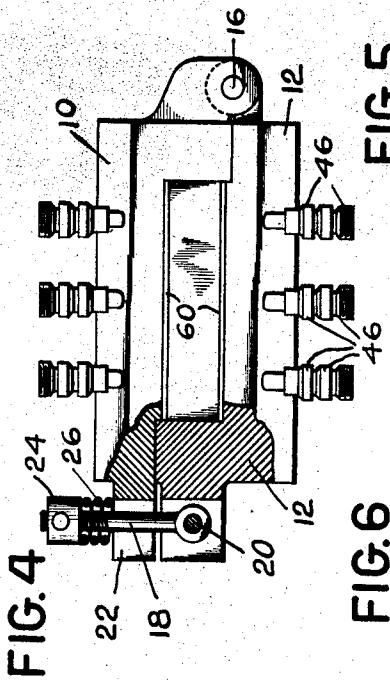


FIG. 5

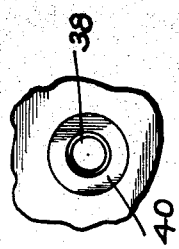


FIG. 6

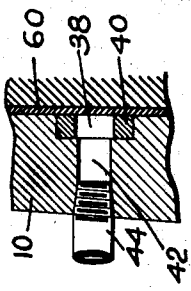


FIG. 7

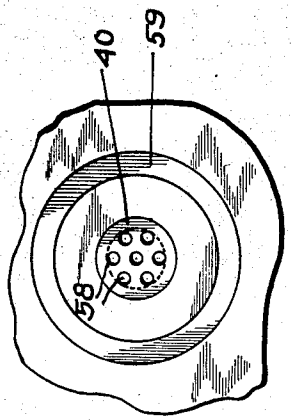
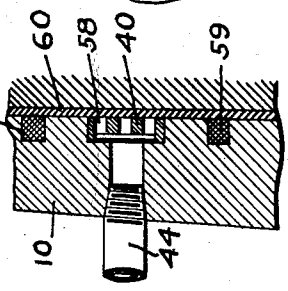


FIG. 8



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UNITED STATES PATENT OFFICE

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CASTING APPARATUS

Application filed January 27, 1928. Serial No. 249,807.

This invention relates to the production of duplex ingots or billets in which the outside section of the ingot differs in composition from the inner body or core of the ingot.

In one method of producing such ingots the billet comprises an aluminum alloy body covered by layers of corrosion-resistant aluminum or aluminum alloy.

The inner surface of the mold in which the ingot is to be cast is first lined with plates of the corrosion-resistant coating metal and the pouring of the core metal into the mold is so regulated that as the core metal solidifies it forms a superficial bond with the lining plates and the plates become affixed to the casting.

In the practice of forming castings of the above description certain precautions must be observed in holding the lining plates in the mold during the casting operation, and in allowing proper freedom of movement of the plates during the solidification of the molten metal.

The principal object of the present invention is to provide a new apparatus and method by which the lining plates may be held and controlled in the mold during the casting of duplex ingots.

Further and other objects and advantages will be hereinafter set forth in the accompanying specification and claims, and shown in the drawings which by way of illustration show what is now considered to be the preferred embodiment of the invention.

Fig. 1 is a side view of the mold, partly in section, showing piping and also showing method of supporting the mold.

Fig. 2 is a view of Fig. 1 from the left.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a view, partly in section, taken in the direction of lines 4—4 in Fig 1, all piping being omitted beyond the unions.

Fig. 5 is a view of a suction plate, on the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary cross-section, on the line 6—6 of Fig. 3, showing details of suction plate in Fig. 5.

Figs. 7 and 8 are similar to Figs. 5 and 6 respectively, showing a different form of suction plate and a surrounding packing ring.

The mold comprises a fixed half or section 10, a hinged half 12, and a bottom block 14 (Figs. 1 and 3). Section 12 is hinged to fixed half 10 by hinge pin 16 passing through suitable brackets on the two sections. When the mold is closed the two halves are clamped together by latch bolts 18 hinged by pins 20 to the fixed section of the mold and passing through slots 22 in the hinged mold section. The free ends of bolts 18 are threaded and are provided with wing nuts 24. A helical spring 26 is placed between each nut 24 and the hinged half of the mold.

Fixed half 10 is provided at one corner with an ear 28 through which passes a round rod 30. The ends of rod 30 are supported by pedestals 32 resting on the floor. This arrangement permits the entire mold to swing about pin 30, as may best be seen in Fig. 1.

At the corner of the fixed half of the mold, diagonally opposite pin 30, is another ear 34 to which is attached a vertical hoisting cable 36, the utility of which will hereinafter appear.

The inner surface of each half of the mold is provided with nine ports or openings 38 (Figs. 3 and 6), arranged in three rows of three ports each. One form of port is shown in Figs. 5 and 6, in which port 38 is a circular opening in a circular plate 40 set into the face of the mold with the inner surface of plate 40 flush with the mold face. From port 38 a drilled hole 42 leads to the outer surface of the mold where 42 is provided with pipe threads 44. To each threaded opening 44 is connected a union 46 and valve 48. Each valve 48 is preferably of the three-way type having a relief opening 50 to atmosphere, and having a stem 52 for connection of an operating handle, not shown. The nine valves on each half of the mold are interconnected by suitable pipe fittings as best shown in Fig. 1. A suction hose 54 may be connected to each nine-hole system through a valve 56, as shown in Fig. 1, or if greater suction power is desired a hose may be connected to each three-hole system. A partial

vacuum is maintained in hose 54 by any suitable vacuum pump.

Figs. 7 and 8 show an optional and preferred form of suction plate in which the single port 38 is replaced by a plurality of smaller ports 58, and in which a ring of packing 59 is set into the surface of the mold in order to localize the suction area within ring 59 and thus prevent the suction from extending to the edge of the coating plate and mold wall. Packing 59 is of asbestos or other suitable material.

With the above apparatus in mind the method of operation may be readily understood. Coating plates 60 are placed in the mold, one plate against each side of the mold. To hold the plates against the inner mold surfaces, valves 56 are opened, thereby connecting both suction pipes 54 to all ports 38. So long as a vacuum or partial vacuum is maintained at the ports, so long will plates 60 be held by suction tightly against the inner mold walls.

With plates 60 held as above described, the mold is raised by cable 36 until the mold is in a position about as indicated in Fig. 1. Molten metal to form the core of the ingot is then poured gently into the mold through the open end thereof.

To insure a successful casting it is necessary that the lining plates remain in close contact with the mold surface until the metal partially solidifies. If the contact with the mold surfaces is not maintained during pouring the heat transferred from the molten metal to the lining plates may not be dissipated rapidly enough through the mold and the lining plates may fuse as a result. Furthermore, if the plates are not rigidly held they may soften and bulge or warp due to the heat of the metal and, therefore, allow the metal to flow between the lining plates and the mold surface and permit as well local overheating and fusion of the lining plates. It is further necessary that as the metal solidifies or shrinks away from the mold surface that the lining plates be free to follow so that the bond already formed between the plates and the first metal to solidify will not be destroyed.

These requirements are fully met by the present apparatus. When the molten metal reaches the level of the pouring edge as indicated by line 62, valves 48 of the lower (right hand) row of ports are turned to close them to the vacuum line 54 and open them to atmosphere through relief openings 50, thereby releasing the suction and permitting the plates to follow the core as it solidifies. Pouring continues and the mold is gradually lowered by means of cable 36 until the molten metal reaches the approximate position shown by line 64, whereupon after the metal has sufficiently solidified the second row of valves is closed to break the suction on the middle row of ports. When the mold finally reaches a vertical position and is nearly full of metal the remaining valves are closed and all suction on the plates is broken.

The pouring operation, which may consume from one and one-half to three minutes, is then complete with the exception of the "heading" operation which consists in pouring metal from a hand ladle into the center of the ingot as the metal shrinks, thus producing a sound ingot without large or undesirable shrinkage cavities. The successive elimination of the suction force from the openings allows the plates to move inward as the metal solidifies.

This method of holding the lining plates is simple and flexible in contrast with clamps, screws or other clumsy mechanical devices. It permits rapid mold operations and eliminates the time-consuming adjusting of clamps and the like. Further, the lining plates are so controlled as to eliminate the objectionable bulging or warping due to pressure and heat so that the ingots are cast in a satisfactory state.

It is to be understood that the invention is not limited to the specific apparatus and procedure herein described but may be carried out in various ways without departure from its spirit, as defined by the appended claims.

I claim—

1. The method of casting duplex ingots which comprises holding coating plates by suction against the inner walls of a mold, pouring molten metal slowly into said mold, and progressively releasing the suction on said plates as they become covered with molten metal.

2. The method of casting duplex ingots which comprises holding coating plates by suction against the inner walls of a mold, pouring molten metal slowly into said mold, changing the angular position of the mold so that said plates will be gradually covered with molten metal, and progressively releasing the suction on said plates as they become covered.

3. A mold for casting duplex ingots comprising in combination, suction means for holding coating plates against the inner walls of the mold, and means for releasing said suction from selected portions of said plates as desired.

4. Apparatus of the class described comprising in combination, a mold, means for pivotally supporting said mold, suction devices for holding coating plates against the inner walls of said mold, means for changing the angular position of said mold about said pivotal support while molten metal is being poured into the mold, and means releasing the suction of any of said devices at the will of the operator.

5. A tiltable mold for casting duplex ingots, having a plurality of suction devices

distributed over the inner walls thereof, in combination with means for rendering said devices inoperative in sequence as the degree of tilting increases.

In testimony whereof I hereto affix my signature.

SAM H. CARBIS.