Nov. 16, 1937. W. H. D. HORSFALL ET AL 2,099,208

APPARATUS FOR PREVENTING THE OXIDATION OF METALS

Filed March 2, 1936 3 Sheets-Sheet 1

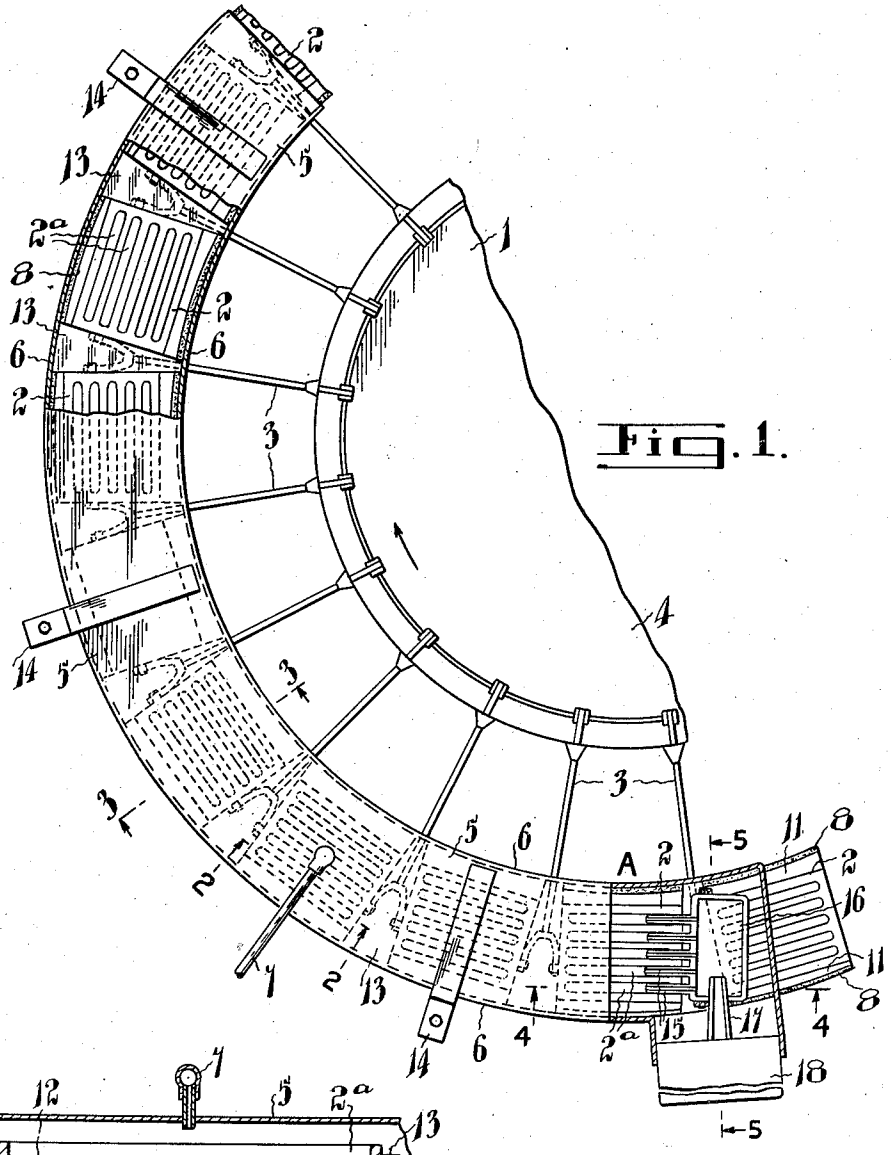

Fig. 1.

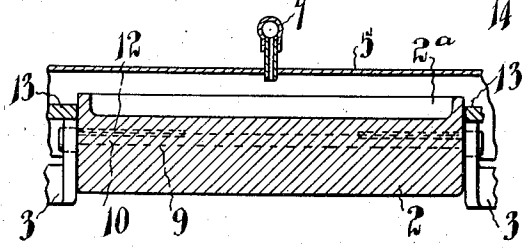

Fig. 2.

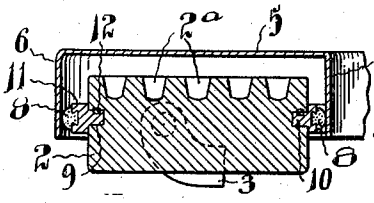

Fig. 3.

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APPARATUS FOR PREVENTING THE OXIDATION OF METALS

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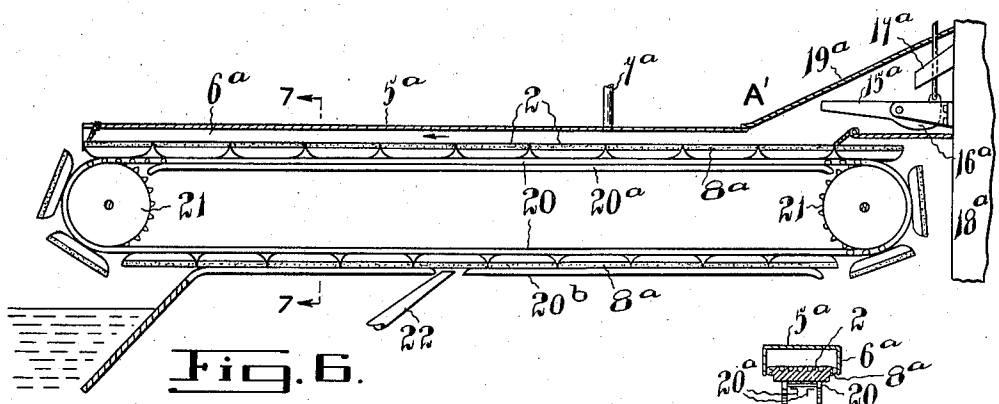

Fig. 6.

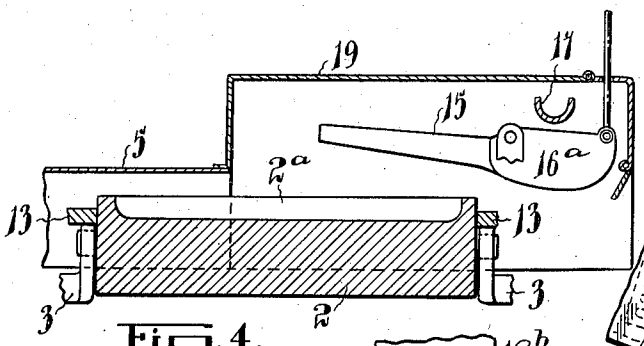

Fig. 4.

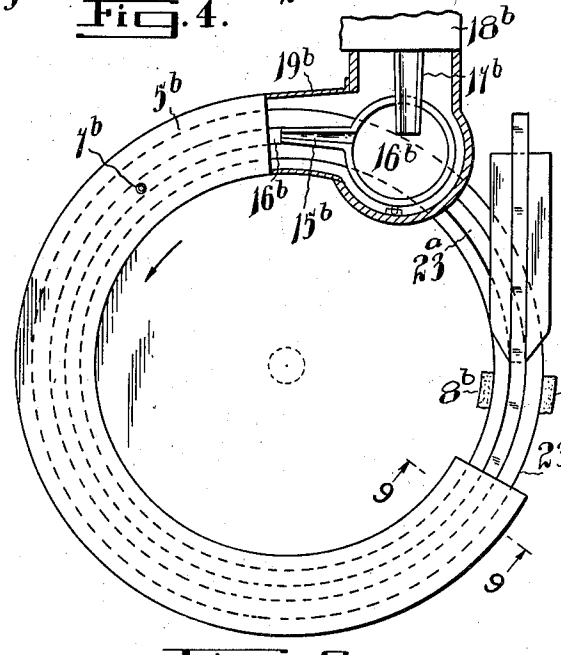

Fig. 8.

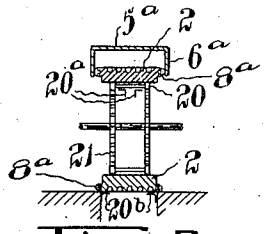

Fig. 7.

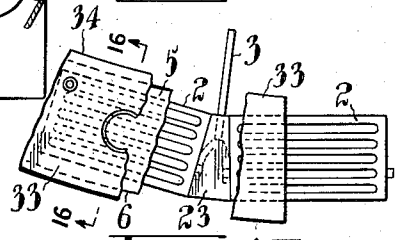

Fig. 15.

Fig. 16.

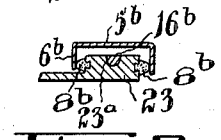

Fig. 9.

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APPARATUS FOR PREVENTING THE OXIDATION OF METALS

Filed March 2, 1936 3 Sheets-Sheet 3

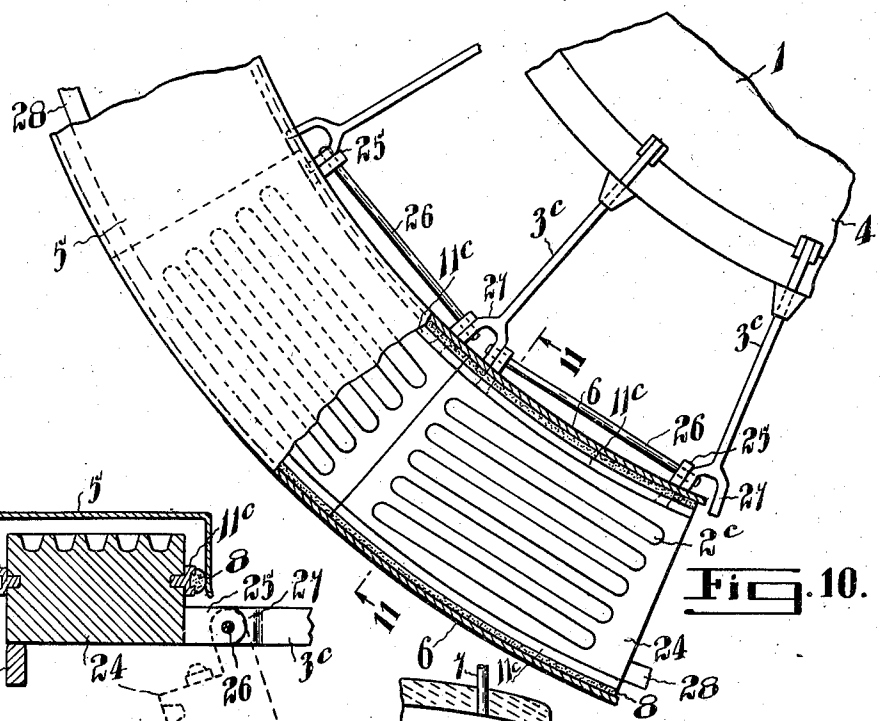

Fig. 10.

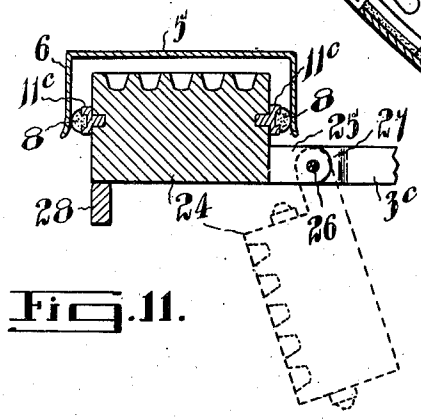

Fig. 11.

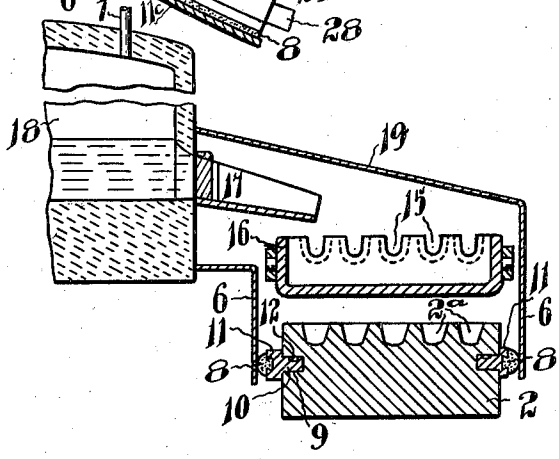

Fig. 5.

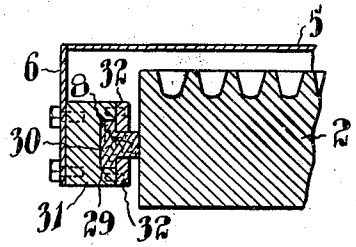

Fig. 12.

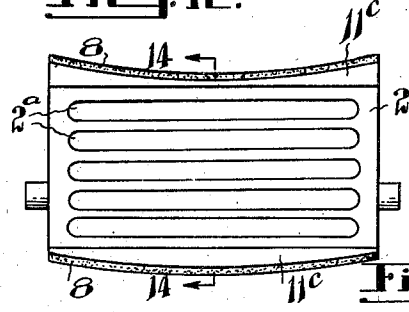

Fig. 13.

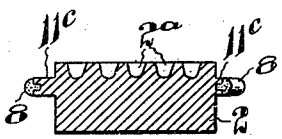

Fig. 14.

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Patented Nov. 16, 1937 2,099,208

UNITED STATES PATENT OFFICE

2,099,208

APPARATUS FOR PREVENTING THE OXIDATION OF METALS

William H. D. Horsfall and Maunsell B. Jackson, Toronto, Ontario, Canada

Application March 2, 1936, Serial No. 66,615

4 Claims. (Cl. 22—57)

This invention relates to means for preventing the formation of oxides on the surface of castings. Heretofore during the molten, plastic, and cooling periods in the process of making castings, it has been the practice to allow the metal employed to be exposed to the atmosphere or other sources of oxidation. This resulted in the formation of oxides, commercially called scale, on the surface of the casting and the removal of this scale involved both cost of machining and loss of material.

In the casting of copper wire bars this loss on account of the scale was very considerable and it is to the making of these wire bars without scale that this invention more particularly relates. The scale on the said bars is formed by the oxygen in the air combining with the highly heated copper to form a thin coating of CuO. The copper immediately below this oxidized coating combines with the CuO forming Cu_2O which results in the finished casting having a contaminated upper layer.

The object of the present invention is to provide simple means for producing cast metal which will be in proper condition for use when removed from its mold, and for preventing the formation of oxides on the surface of molten metal.

We attain our object by providing means for expelling and excluding air from the vicinity of the hot metal until such time as its temperature drops below the oxidation point.

The constructions are hereinafter more fully described and are illustrated in the accompanying drawings in which

Fig. 1 is a plan view of part of a casting machine showing our invention applied thereto;

Fig. 2 a section on the line 2—2 in Fig. 1;

Fig. 3 a section on the line 3—3 in Fig. 1;

Fig. 4 a section on the line 4—4 in Fig. 1 showing the feed spout, pouring ladle and spouts;

Fig. 5 a section on the line 5—5 in Fig. 1;

Fig. 6 a side elevation of a modified form of machine, the hood and casing being shown in section;

Fig. 7 a cross-section on the line 7—7 in Fig. 6;

Fig. 8 a plan view of another modified form of machine;

Fig. 9 a cross-sectional detail on the line 9—9 in Fig. 8;

Fig. 10 a plan view of part of a modified form of the invention in which the inner and outer sides of the molds are concentric;

Fig. 11 a cross-section on the line 11—11 in Fig. 10;

Fig. 12 a cross-sectional detail of a mold and hood showing a rubbing strip carried by the latter;

Fig. 13 a plan view of a modified form of mold in which the rubbing strip is carried by curved fins or projections cast integral with the mold;

Fig. 14 a cross-section of the mold shown in Fig. 13;

Fig. 15 a plan view of a modified arrangement of molds showing a hood and cover thereon; and

Fig. 16 a cross-section on the line 16—16 in Fig. 15.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

Referring to Figs. 1 to 5, 1 is a "Walker" casting machine which is well known in the copper casting art and comprises a plurality of molds 2 tiltably supported on radial arms 3 carried by a turntable 4. The latter is suitably supported and rotated to move the molds past the filling point A to a point (not shown) where the molds are turned upside down to dump the solidified metal therefrom. The surfaces of the molds which contact with the molten metal are thereafter covered with bone ash and the molds are then turned right side up for receiving fresh molten metal when they come round to the filling station A.

To exclude air from the castings in the molds until the temperature of the castings drops below the oxidation point, we provide a hood 5 extending transversely across but spaced from the tops of the molds. The hood has side flanges 6 which extend downwardly past the inner and outer sides of the molds so that the latter are free to travel through the hood which extends longitudinally from the filling point A to a point in the circumference of the machine where the castings have cooled to a temperature below the oxidation point and are therefore immune to the chemical action of oxygen. Any suitable means such as one or more pipes 7 may be utilized to introduce a non-oxidizing gas, such as a reducing gas, an inert gas or steam, beneath the hood 5 whereby all air therein will be driven out and excluded therefrom.

The quantity of gas used may be minimized by providing strips 8 of suitable material such as asbestos carried by either the molds 2 or the hood side flanges 6 for rubbing against the other of the said parts. In Figs. 1, 3 and 5, the molds are rectangular in plan and their sides are provided with longitudinal grooves 9 adapted to receive tangs 10 on side extensions 11 having their faces adjacent the flanges 6 curved. The said

faces are substantially concentric to the hood flanges 6 and carry the strips 8 for closing or substantially closing the space between the flanges 6 and extensions 11. The opposite ends of each tang may be tapered to receive wedges 12 between said ends and the adjacent sides of the groove 9 whereby the extensions 11 are detachably secured to the molds 2. Inserts 13 may be carried above the arms 3 and between adjacent molds 2, to prevent the non-oxidizing gas from passing downwardly between the molds. The hood 5 may be carried by a plurality of supports 14 which may be secured to any suitable stationary part such as the floor on which the machine rests.

Each mold 2 has a plurality of cavities 2^a into which the molten metal is simultaneously poured by a corresponding number of spouts 15 on a tiltable pouring ladle 16. The latter is filled by a feed spout 17 which conveys the molten metal from a furnace 18.

Preferably the space above the molten metal in the furnace 18 is filled with non-oxidizing gas and the feed spout 17 is enclosed by a casing 19 into which the gas is also introduced. The casing 19 is also adapted to enclose the tiltable pouring ladle 16 and its spouts 15. The casing communicates with the hood 5 so that air is excluded from the metal from the time it melts in the furnace until it cools in the molds to a temperature below that of the oxidation point.

Instead of carrying the molds 2 around in a circular path, they may be pivotally carried on an endless chain 20 which passes around sprockets 21, as shown in Fig. 6. The distance between the sprockets 21 and the speed of the chain 20 are such that the molten metal poured into the molds at one end A' of the machine will be solidified by the time it reaches the other end of the machine. The castings are discharged from the molds when the latter are turned upside down as they are carried around the sprocket 21 at the end of the machine remote from the filling end. During the return movement of the molds along the underside of the machine, the cavities of the molds will be covered with bone ash or other suitable material blown thereinto through one or more nozzles 22. Any suitable means such as the rails 20^a may be provided to support the chain 20 intermediate the sprockets 21 and rails 20^b are provided to support the molds while they are being returned in an upside down position. In this case the hood 5^a, which is similar to the hood 5 except for shape, extends from the filling point A' to a point where the temperature of the castings has dropped below that at which oxidation would occur. In this case, the furnace 18^a may be located in alinement with the molds and the casing 19^a encloses the feed spout 17^a, ladle 16^a and its spouts 15^a. The ladles 16, 16^a may be tilted, by any suitable means, to move the spouts 15, 15^a into and out of their pouring positions. The casing 19^a comunicates with the hood 5^a and non-oxidizing gas may be introduced thereinto by one or more pipes 7^a. The strips 8^a, corresponding to the hereinbefore strips 8, may be carried by the molds or the hood side flanges 6^a for contacting with the other of said flange and mold parts as the molds travel between the flanges.

In Figs. 8 and 9 is shown a modified form of copper molding machine in which the mold is formed as a rotatable table 23 having a cavity 23^a in its upper surface. The molten metal is poured into the cavity by a spout 15^b while the mold is rotated slowly and by the time the mold makes nearly one revolution the metal has cooled sufficiently to permit its removal from the cavity. This molding machine is known in the art and the cast metal is removed in a continuous bar or strip which is subsequently cut into lengths for conveniently handling the cast copper. To prevent the copper from being oxidized, we apply a hood 5^b over the mold 23, casing 19^b over the spout 15^b, its ladle 16^b and feed spout 17^b, and introduce a non-oxidizing gas beneath the hood 5^b and casing 19^b by any suitable means such as one or more pipes 7^b. The rotary speed of the mold 23 is so regulated that the temperature of the casting at its point of removal from the cavity is below the oxidation point so that the casting will not be oxidized when it passes into the atmosphere. The flanges 6^b of the hood 5^b or the vertical sides of the mold 23 may be provided with a rubbing strip 8^b for engaging the other of said mold and flange parts.

A modified form of the machine shown in Fig. 1 is disclosed in Figs. 10 and 11 in which the molds 24 are segmental in shape with their inner and outer sides concentric to the hood flanges 6. The molds in this case are provided with lugs 25 which are hinged on pins 26 carried by bosses 27 on the arms 3^c instead of by trunnions journalled in bearings carried by the arms 3 in Fig. 1. The extensions 11^c are curved throughout their length to lie against the sides of the molds 24 and to be concentric to the flanges 6 whereby the strips 8 will contact the latter as the molds pass between the flanges. Any means such as a rail 28 or other suitable means may be provided to support the lower outer edges of the molds as they travel from a position ahead of the filling station to the point where they are turned upside down. When the end of the rail is reached, the molds will drop by gravity to the position indicated in dotted lines in Fig. 11 and any suitable means such as a bent rail (not shown) may be employed to turn the mold upside down to permit the castings to drop out of or be removed from their cavities.

In Fig. 12 is shown a modified arrangement of means for carrying the strip 8, 8^a or 8^b by the hood flanges 6, 6^a or 6^b. In this case the T-shaped slot 29 for receiving the correspondingly shaped end 30 of the strip 8, 8^a or 8^b is formed by securing a channel 31 to each inner side of the flanges 6, 6^a or 6^b. To the inner edges of these channels are secured plates 32 which partially enclose the recesses in the channels to embrace the stems of the T-shaped strips which project beyond the plates for contact with the curved sides of molds which may be segmental as shown in Figs. 10 and 11 or rectangular with curved rubbing extensions carried thereby. As the curved hoods 5 do not form complete circles, it is obvious that not only may the flanges 6, or 6^b be readily drawn into shape to fit the curved edges of the tops of the hoods 5 and be secured thereto by any suitable means such as by welding, but the plates 32 may also be readily bent to follow the curvature of the channels 31.

In Figs. 13 and 14 is shown a rectangular mold having curved integral side extensions 11^d which may serve for engagement by strips 8 carried by the flanges 6 or for carrying the strips 8 so that they will engage the flanges 6.

Instead of using the strips 8, the hood 5, 5^a or 5^b may be enclosed by a cover 33 as illustrated in Figs. 15 and 16. The cover 33 is spaced from the top of the hood 5 and is provided with de-

pending flanges 34 which are spaced from the side flanges 6. The spaces between the flanges 34 and 6 at opposite sides of the cover communicate at their lower ends with the spaces between the flanges 6 and the sides of the molds. The cover 33 is provided with a suction outlet 35 whereby any gases introduced through the pipe 7 and escaping from the interior of the hood will be withdrawn through the outlet instead of escaping into the room in which the machine is set up.

It will be distinctly understood that the term non-oxidizing gas or gaseous means used throughout the specification and claims is intended to include any gas which will not liberate oxygen, any reducing gas with which oxygen will combine or any inert gas including superheated or dry steam.

What we claim as our invention is:

1. In apparatus of the class described the combination of a tunnel-shaped hood formed with a top and opposed sides depending from the top, the hood being open at the bottom throughout its length and at each end and formed as a continuous passage-way; a mold having its top above the level of the lower edges of the sides of the hood; means for moving the mold longitudinally into, through and out of the hood; and means for introducing a non-oxidizing gas or vapor into the hood above the level of the top of the mold so that the gas or vapor may flow lengthwise of the hood to the open ends to drive air from the hood and exclude it therefrom.

2. In apparatus of the class described the combination of a tunnel-shaped hood formed with a top and opposed sides depending from the top, the hood being open at the bottom throughout its length and at each end and formed as a continuous passage-way; a mold having its top above the level of the lower edges of the sides of the hood; means for moving the mold longitudinally into, through and out of the hood; means for introducing a non-oxidizing gas or vapor into the hood above the level of the top of the mold so that the gas or vapor may flow lengthwise of the hood to the open ends to drive air from the hood and exclude it therefrom; mold pouring means at one end of the hood; and a closed casing connected with the hood and enclosing said mold pouring means but leaving sufficient opening for the entrance of the mold.

3. In apparatus of the class described the combination of a tunnel-shaped hood formed with a top and opposed sides depending from the top, the hood being open at the bottom throughout its length and at each end and formed as a continuous passage-way; a mold spaced from the sides of the hood having its top above the level of the lower edges of the sides of the hood; means for moving the mold longitudinally into, through and out of the hood; means for introducing a non-oxidizing gas or vapor into the hood above the level of the top of the mold so that the gas or vapor may flow lengthwise of the hood to the open ends to drive air from the hood and exclude it therefrom; and rubbing strips arranged lengthwise of the molds and hood substantially closing the space at each side between the mold and the hood and connected to the sides of one of said mold and hood parts.

4. In apparatus of the class described the combination of a tunnel-shaped hood formed with a top and opposed sides depending from the top, the hood being open at the bottom throughout its length and at each end and formed as a continuous passage-way; a plurality of molds connected in series, each mold having its top above the level of the lower edges of the sides of the hood; means for moving the molds longitudinally into, through and out of the hood; and means for introducing a non-oxidizing gas or vapor into the hood above the level of the tops of the molds so that the gas or vapor may flow lengthwise of the hood to the open ends to drive air from the hood and exclude it therefrom.

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