

March 26, 1940.

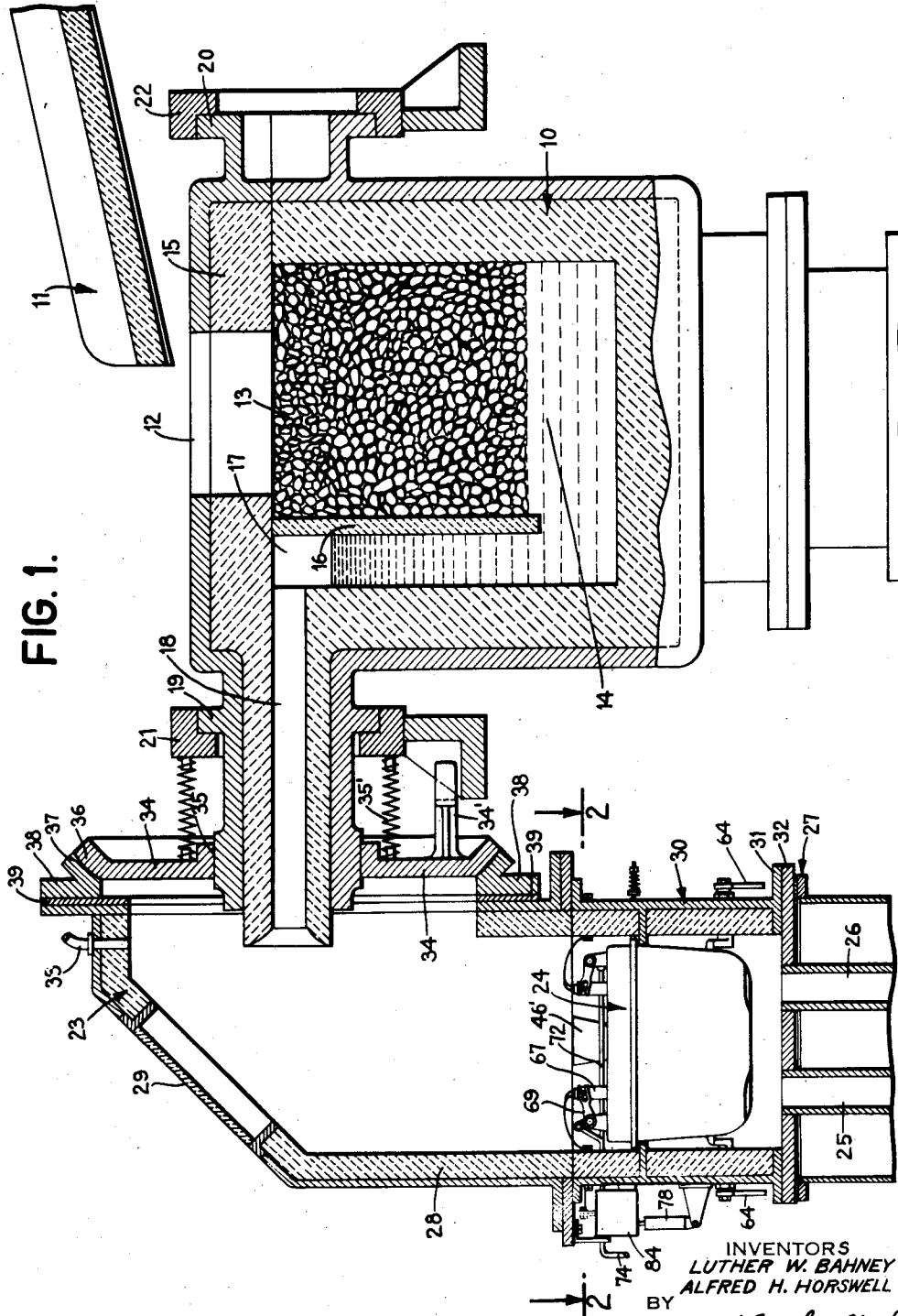
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2,195,071

APPARATUS FOR POURING MOLTEN METAL

Filed March 7, 1938

5 Sheets-Sheet 1



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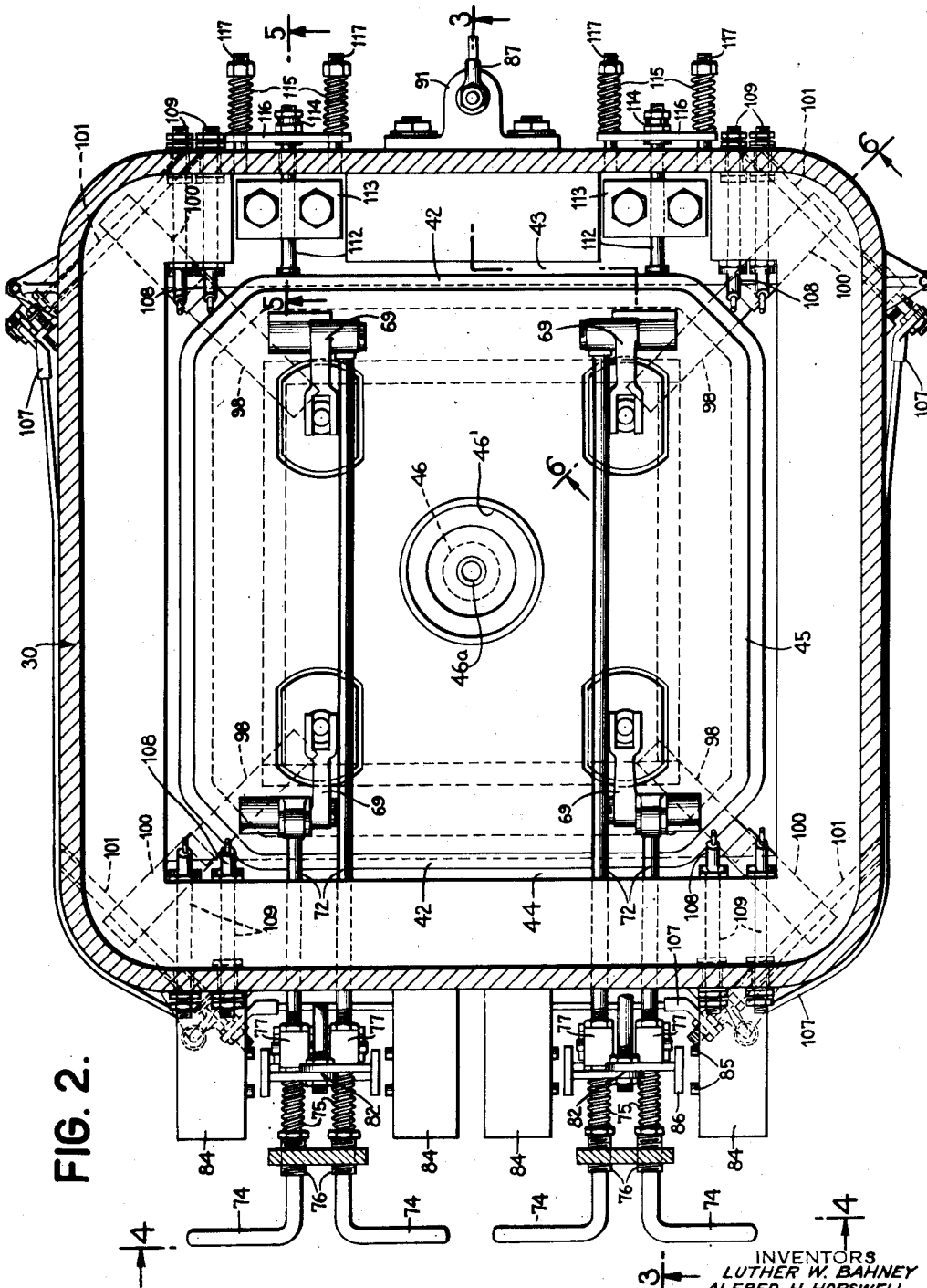
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5 Sheets-Sheet 2

FIG. 2.



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5 Sheets-Sheet 3

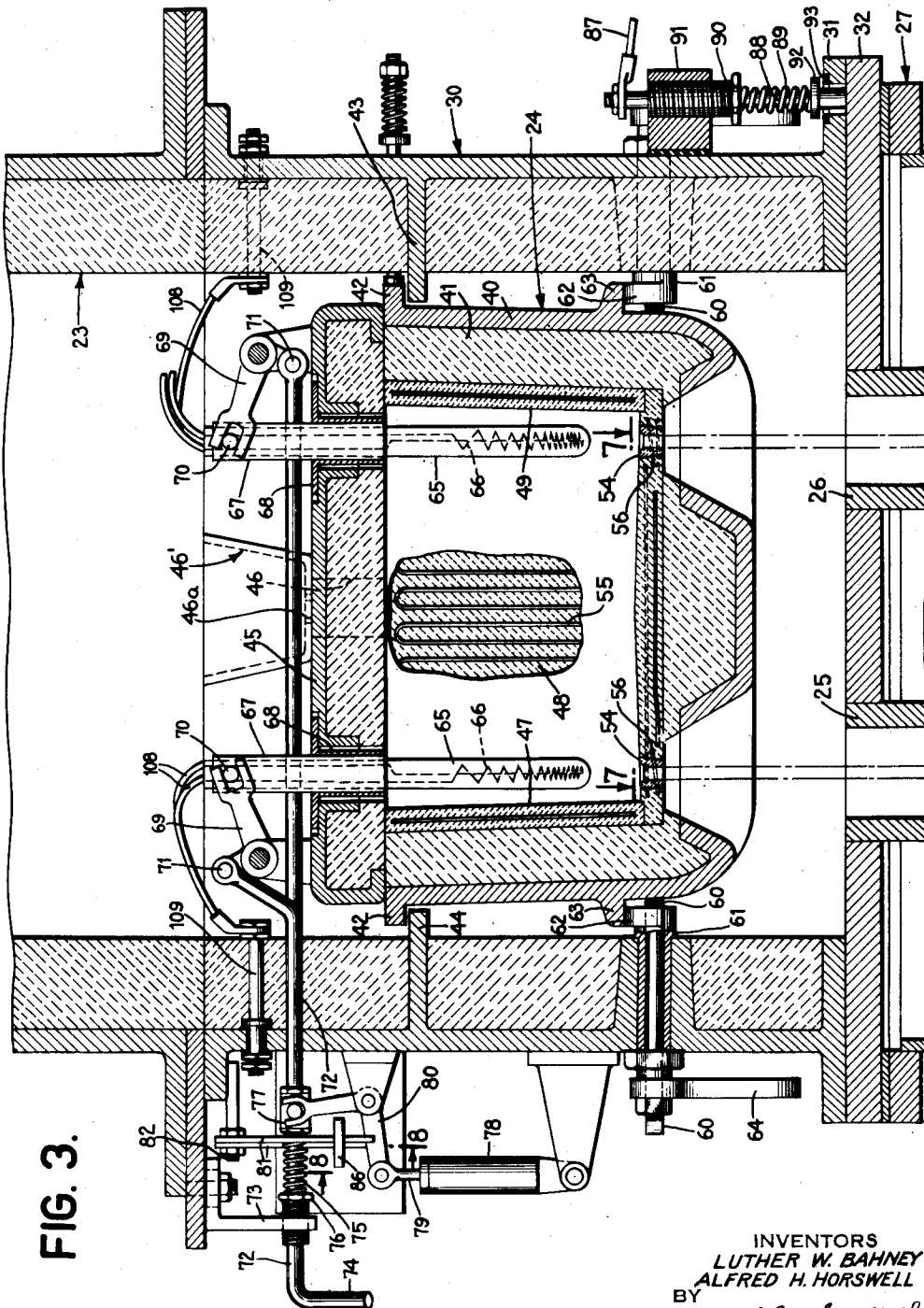


FIG. 3.

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5 Sheets-Sheet 4

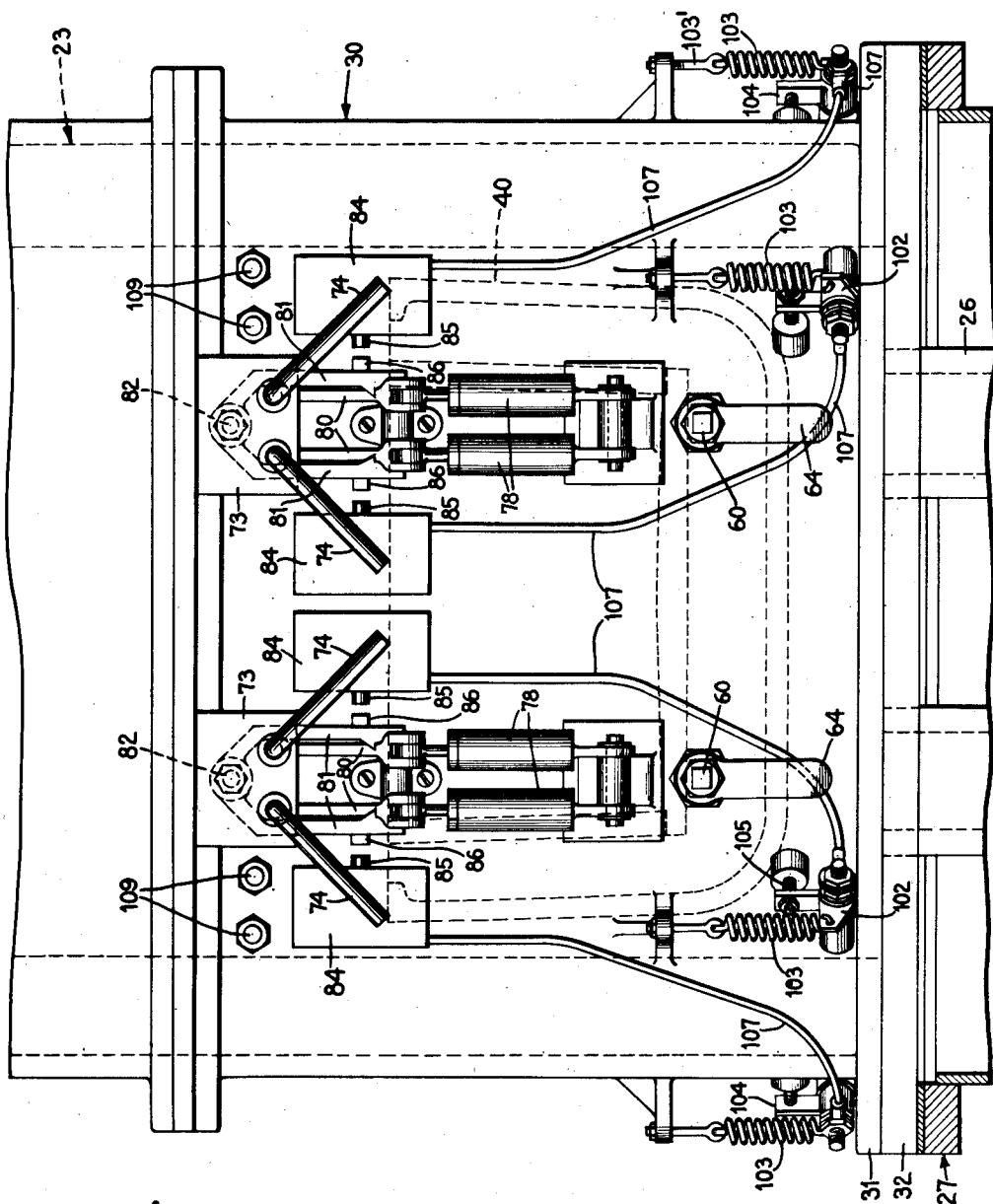


FIG. 4.

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FIG. 5.

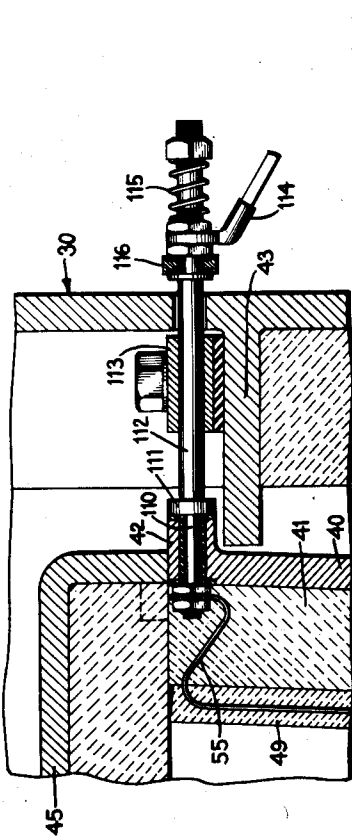


FIG. 6.

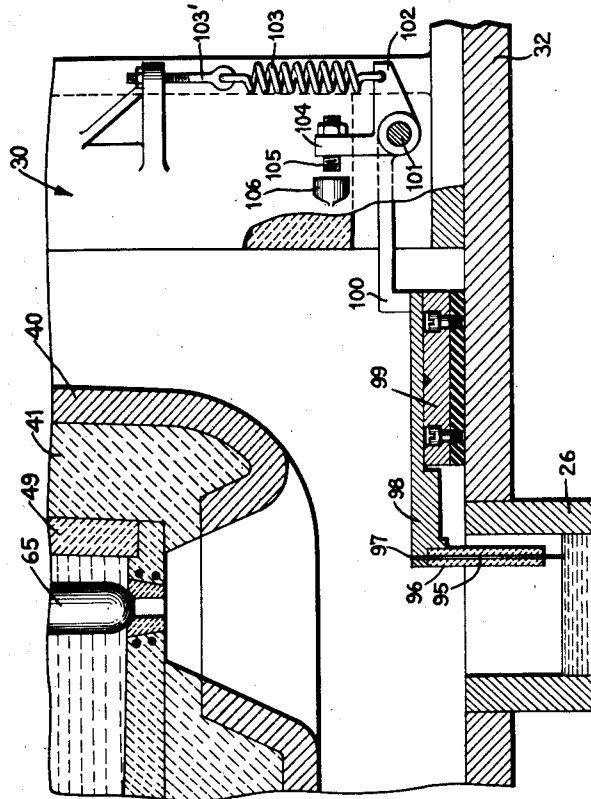


FIG. 7.

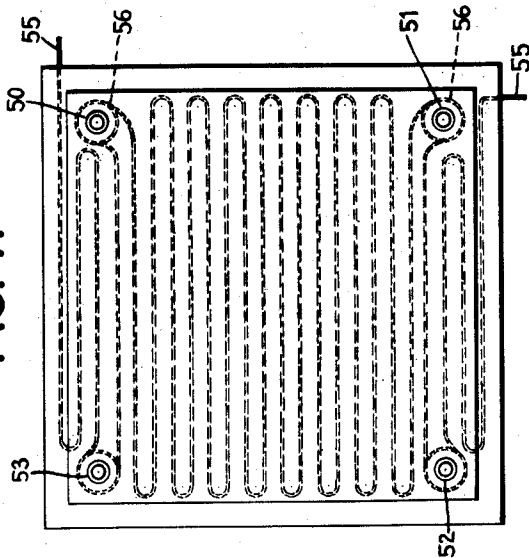
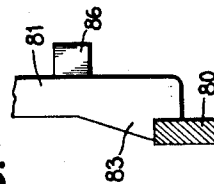


FIG. 8.



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UNITED STATES PATENT OFFICE

2,195,071

APPARATUS FOR POURING MOLTEN METAL

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Application March 7, 1938, Serial No. 194,314

12 Claims. (Cl. 22-79)

This invention relates to apparatus for pouring molten metal. The apparatus is particularly adapted for simultaneously producing a plurality of castings, billets, wire bars, etc., of metal such as deoxidized or oxygen-free copper, for example, from which air must be excluded during the pouring.

If several molds are filled substantially simultaneously from a single source of supply of the molten metal, it has heretofore been difficult to apportion the flow of metal uniformly to the several molds, with the result that one or more of the molds may sometimes become filled to overflowing before others are filled. In such cases considerable time and expense is generally involved in chipping away the excess metal when hardened, from the top of molds which have overflowed, and the top plate to which the mold tubes are welded tends to become expanded by such procedure. This invention according to one of its phases, involves relatively simple, compact, and dependable apparatus for insuring proper apportionment of the molten metal to the several molds being poured, and if desired also, means for independently shutting off the flow of molten metal to each mold when filled to the proper level, thus insuring the making of castings of a desired or specified length. Other features of the invention involve improved electrically heated means for receiving and controlling the supply of molten metal being poured.

Various further and more specific features, objects and advantages will clearly appear from the detailed description given below, taken in connection with the accompanying drawings which form a part of this specification and illustrate merely by way of example, a preferred embodiment of the apparatus of the invention.

The invention consists in such novel features, arrangements and combinations of parts as may be shown and described in connection with the example of the apparatus herein disclosed as illustrative of a preferred embodiment.

In the drawings

Fig. 1 is a vertical sectional view of an assembly of apparatus involving the invention in one of its various possible forms;

Fig. 2 is a horizontal sectional view taken substantially along the line 2-2 of Fig. 1;

Fig. 3 is a vertical sectional view taken substantially along the line 3-3 of Fig. 2;

Fig. 4 is a front view of the apparatus shown in Fig. 2;

Figs. 5 and 6 respectively are enlarged vertical sectional views taken substantially along the lines

5-5 and 6-6 respectively of Fig. 2 and showing certain details of the apparatus;

Fig. 7 is a plan view of one of the electrical heating units which may be used in the device, this unit forming the bottom of a receptacle for the metal being poured, this receptacle being hereinafter referred to as a "strainer pot"; and

Fig. 8 is a view of certain of the parts taken substantially along the line 8-8 of Fig. 3.

Referring now to Fig. 1, the assembly as there shown may comprise a furnace 10 such as used for deoxidizing molten oxygen-bearing copper for example, the molten metal being delivered thereto by a launder or trough 11 from a suitable melting furnace (not shown). The stream of oxygen-bearing copper may enter the furnace 10 through an opening as at 12 and then pass down through a deep bed of wood charcoal or the equivalent as at 13. This charcoal may partially float on the surface of a body of the molten metal as at 14 within the furnace, and part of the charcoal may be forced, as shown, down into the molten metal bath and held submerged by the furnace cover portion 15. A baffle of suitable refractory material is shown at 16 separating the bed of charcoal and the main body of the molten metal from a smaller compartment 17 adjacent a furnace outlet 18, so that all of the metal received by the furnace must travel through the entire depth of the bed of charcoal before it reaches the outlet spout 18. The bed of charcoal serves to deoxidize the molten metal and prevent access of air to the metal beneath the charcoal, and at the same time permits gases to escape from the metal up through the furnace inlet. As shown, air is kept from access to the smaller compartment 17 by the furnace cover.

The furnace 10 may for example be an induction type and may be tiltably supported on suitable trunnions as at 19 and 20, which in turn are supported by suitable bearings as at 21 and 22. If desired the furnace may be of a type wherein the metal may be melted as well as deoxidized, or it may be of a type such as to function merely as a pouring hearth for retaining a reservoir of molten metal previously deoxidized. As shown, the interior of the furnace, its cover, and the outlet spout may be lined with suitable refractory material. The main body of the metal-containing cavity within the furnace is in a position eccentric to the spout, so that when the furnace is tilted either toward or away from the observer (as viewed in Fig. 1) about the trunnion means, a molten metal stream will be discharged from the spout.

It will be noted that the outlet spout or opening 18 is arranged coaxial with the trunnion 19 so that when the furnace is tilted for pouring out molten metal, the outlet of the spout 18 will not change its position. Hence, even regardless of the angle to which the furnace is tilted, such outlet and accordingly the stream of molten metal issuing therefrom, will constantly remain in a predetermined desired position. The advantages of this feature will be hereinafter further explained.

The outlet end of the trunnion spout of the furnace may be received through the side wall of a hood structure 23, which serves to prevent access of air to the molten metal as poured from the furnace. The stream of metal from the furnace spout falls through the hood to the "strainer pot" 24 and thence may be directed by suitable means hereinafter described into a plurality of water-cooled molds as at 25 and 26, carried by a suitable well-known type of casting wheel structure, a portion of which is indicated at 27. That is, the casting wheel may be provided at its periphery with a series of groups of molds so that the wheel may be turned step-by-step, whereby at each step, one group of the molds comes into pouring position beneath the strainer pot 24. In the particular embodiment of the apparatus hereinafter described, provision is made for simultaneously pouring into a group of four molds. However, it will be understood that the invention is similarly applicable for use with a casting wheel on which the molds may for example be arranged in groups of 6, 8 or more. Or if desired, two furnace spouts and two of the strainer pots may be provided side-by-side, for simultaneously pouring metal into a group of 16 molds for example.

The construction of the hood 23 will now be described in further detail with reference to Fig. 1. This structure may comprise a suitable outer metal casing lined with refractory insulating material as at 28. Windows may be provided as at 29, at one or more points in the upper part of the hood, permitting the operator to watch the stream of metal issuing from the furnace spout as it falls to the strainer pot and also preferably permitting the operator to inspect the metal as it is poured from the strainer pot into one or more of the molds.

The hood 23 at its lower end may be provided with an extension as at 30 for enclosing the strainer pot. The lower end of this extension 30 is open except when the hood is lowered into pouring position over a group of molds. That is, the hood and its extension may be raised and lowered as a unit with the strainer pot therein, as by means of apparatus (not shown) such for example as used to raise and lower the hood, as described in the patent to Summey, No. 2,060,135, granted November 10, 1936, reference to which is hereby made. When the metal is being poured into a group of molds, the hood will be lowered so that a flange as at 31 surrounding the lower edge of the extension 30 will abut against a face plate as at 32, surrounding the inlets of each group of molds on the casting wheel. That is, a group of the molds on the casting wheel may be stepped into the position shown in Fig. 1, after which the hood structure is lowered into the position shown. Thereupon a supply of charcoal producer gas, or the equivalent, may be introduced into the hood structure as through an inlet 33, at a pressure somewhat above atmospheric, and sufficient to force any

air out of the hood structure down through the molds and out through the bottom doors of the molds. Thus, before the pouring starts and before the bottom doors of the molds are closed, the hood as well as the molds are made free of air. And after the molds have been poured, the supply of gas may be cut off, the hood assembly raised, and the casting wheel stepped to its next position.

In order to provide a substantially gas-tight connection between the furnace trunnion spout and the hood structure, an annular plate as at 34 may be mounted on the exterior of the trunnion spout. That is, the plate may be formed with a central aperture as at 35 closely fitting the exterior of the trunnion spout. The plate 35 is however preferably slidable along the trunnion spout and may be biased toward the left as viewed in Fig. 1, as by the use of several springs arranged around the exterior of the spout, and one of which is shown at 35'. A lug as at 34' should also be provided on the plate member 34 with a fork-like portion for slidably engaging a part of the bearing member 21, so as to prevent rotation of the plate 34. The periphery of the plate 34 should be formed with a convex surface area as at 36, which preferably conforms substantially to the surface of a portion of a sphere, for engaging with a substantially gas-tight sealing relationship, a correspondingly curved concave surface as at 37, formed on a sealing ring 38. The ring 38 should also have a flat machined surface for slidably engaging a wearing plate 39, fixed upon the adjacent side wall of the hood structure, and thereby permitting the hood structure to be raised and lowered as above explained, while still maintaining a substantially sealed relationship between the furnace spout and the hood. The plate 34 and engaging spherical surfaces 36 and 37 permit of a substantially gas-tight seal while the furnace is being tilted, even though the axis of the furnace trunnions may be somewhat out of alignment with the axis of the sealing ring 38.

This joint structure between the furnace spout and the hood is also such that the angular position of the hood structure with the strainer pot therein, may be adjusted somewhat as desired during installation of the apparatus, to insure that the stream of molten metal issuing from the furnace spout will fall accurately in a predetermined position to the strainer pot. Preferably the falling molten stream should enter the strainer pot at a point exactly equidistant from the several outlet orifices of the pot hereinafter described. This is of substantial importance for insuring that the rate of flow of the several streams issuing from the strainer pot, into the several molds will be the same. That is, if the heavy falling stream of metal is not in proper position, it will cause the metal to be poured faster into some molds than others of the group. In view of this fact, it will now be apparent that it is highly advantageous to provide a stream of metal from the furnace which will remain in constant position throughout the period of pouring from the furnace. This may be satisfactorily accomplished by the location of the furnace spout coaxial with the furnace trunnions, i. e., the trunnions upon which the furnace is tilted during pouring, and in addition if desired, the stream may be arranged to fall into a conical funnel as at 46' having a central bottom opening located at the middle of the top of the strainer pot. Such a funnel will break the fall of the descend-

ing molten stream and insure its proper direction into the strainer pot without causing spattering or undue turbulence.

While melting furnaces and ladles as heretofore constructed, have been mounted on trunnions sometimes more or less near the pouring spout or lip, the trunnions are ordinarily on an axis at right angles to the path of the molten stream and such that there is considerable variation in the position of the path of the molten stream during tilting of the furnace. On the other hand, the above described arrangement provides a means for maintaining a precise location of the stream from the very beginning of pouring until the complete furnace charge has been cast. And in cases such as with the apparatus of the present invention, where the metal of the molten stream is to be subdivided and directed into a plurality of molds, this arrangement permits a decided improvement in the apportionment of the metal uniformly to the several molds. Also wherever the molten stream from the furnace is poured through a hood structure for excluding air, as is necessary to exclude oxygen from oxygen-free metals, the maintaining of the stream in a fixed position is of advantage in that it permits of a more compact and smaller hood structure. The constant position of the stream also minimizes spattering and aids in the control of the stream so that there will be no danger of its falling on to parts of the mechanism.

The details of the construction of the strainer pot 24 will now be described with particular reference to Fig. 3. This structure may comprise an outer casing as at 40 preferably cast of a suitable heat resisting alloy and provided with a lining of any suitable well-known refractory insulating material as at 41. The upper peripheral edges of the casting 40 may be formed with flanges as at 42, these flanges being initially slidable along inwardly extending ledges as at 43 and 44 which may be integrally formed on the casting forming the hood extension 30. One side of the hood extension 30 may be provided with a suitable door (not shown), permitting the strainer pot to be slid into place along the ledges 43 and 44. The top of the strainer pot may be provided with a cover as at 45 with an insulating refractory lining as shown, and having a central inlet opening as at 46 for permitting the molten metal to enter, from the funnel 46' if desired, through an orifice bushing 46a.

In order to maintain the strainer pot and the molten metal therein at the desired temperature, the pot may be lined with a plurality of electrical heating units. That is, each of these units may comprise a slab of electrical insulating material which is also of such character as to be a good conductor of heat, whereby electrical heating coils may be imbedded therein. Each of the four side walls may comprise one of these heating units constructed for example as indicated at 47, 48 and 49 (Fig. 3) and the bottom surface may be covered with a fifth unit or slab of this type, the details of construction of which are more fully shown in Fig. 7. A suitable electrical insulating material which is however satisfactorily heat-conductive for the purpose, is available on the market under the trade name "Sem-Het", and methods for manufacturing the same with heating coils imbedded under pressure therein, are disclosed in the patents to Morgan 2,007,111 and 2,010,768, and the patent to Morgan et al. 2,061,099, reference to which is hereby made.

The heating units or slabs may be fitted together and suitably cemented in position as shown in Fig. 3.

As shown in Figs. 3 and 7, the heating unit which forms the bottom of the interior of the pot may be provided with a number of openings as at 50-53 corresponding to the number of molds in each group to be simultaneously poured, each opening being positioned at a point directly above the inlet axis of one of the molds. Each of these openings is designed to receive a bushing as at 54, the interior apertures of which comprise carefully calibrated orifices for the streams of molten metal falling into the several molds. These bushings may be formed for example of high temperature resistant porcelain such as used for spark plugs, and the orifice apertures should be carefully made of uniform dimensions, if molds of equal size are to be uniformly filled. As shown, the exterior of each of the porcelain orifice members may be tapered (outwardly and upwardly) and the openings in the heating unit may be correspondingly tapered so that the bushings or orifice members will be firmly seated in position. The electrical resistance wire as at 55 for heating the heating units or slabs may extend back and forth within the slabs as shown in Figs. 3 and 7, for substantially uniformly heating the entire areas thereof, except that in order to always insure a sufficient temperature for the free flow of the metal through the orifices and to prevent any danger of freezing the metal therein, each of the orifices may be closely surrounded by several convolutions of the resistance wire as at 56. The convolutions 56 may be either formed in situ within the bottom heating unit or slab, or may be arranged around the exterior surfaces of the orifice members and secured by a suitable heat resisting cement. The resistance wire used may comprise what is known in the trade as "Kanthal A", or its equivalent, capable of functioning at 2400° F. The coils should have sufficient heating capacity to heat the interior of the pot to a temperature above the melting point of the metal to be poured with the apparatus, for example above 1150° C. in the case of copper.

Heretofore it has been the practice to heat strainer pots of this general class, by the use of resistance elements located between the side walls or bottom wall of the pot, and the hood. The above described construction of the heating units located within the pot itself, is however much more compact and efficient, making possible the use of a smaller hood maintained at a lower temperature.

Means will now be described for insuring that the strainer pot may be so positioned that each of the pouring orifices will be coaxial with its corresponding mold and at a uniform height above the mold. For this purpose, three or more horizontally extending screw rods or bolts as at 60 may be mounted at various points around the side walls of the hood extension 30, to extend therethrough and into contact with the side walls of the strainer pot. As shown, these screw rods may be threaded within bushing members as at 61, which in turn are rotatably mounted within suitable bearings formed in the side walls of the hood extension 30. The inner ends of the bushings 61 may be formed with cam members as at 62, for engaging suitable lugs as at 63 formed on the side walls of the strainer pot. The outer ends of the bushing members 61 may be suitably affixed to handle members as at 64 so that by turning these handles, the cam members 62

variably engage the lugs 63 to slightly raise or lower each side or corner of the strainer pot as desired to bring the orifices to a uniform elevation. In order to adjust the position of the strainer pot horizontally, and to secure it firmly in the desired position, with the pouring orifices in axial alignment with the mold inlets, the screw bolts 60 may be variably adjusted.

While the features of the apparatus thus far described, particularly the means for properly positioning the strainer pot in respect to the molds, and the coaxial furnace trunnion and pouring spout, all serve to greatly improve the possibility of uniformly distributing the molten metal to the several molds, and the production of high grade castings of uniform length, there may still at times be danger of one or more of the molds becoming filled to overflowing while other molds are only partially filled. That is, for example, one or more of the pouring orifices may become worn or injured, permitting an increase of the rate of flow therethrough, while others of the orifices may become partially obstructed by particles of carbon or other solids. Accordingly with the preferred embodiment of the invention, means which will now be described, are provided for independently closing each of the pouring orifices upon proper filling of the corresponding mold. This means as shown in Fig. 3 may comprise vertically slidable valve members or stoppers as at 65, one for each of the pouring orifices. These members may be formed of material which is the same or similar to the heat-conductive electrical resisting material used for the lining of the strainer pot as above referred to. Accordingly, each of these stoppers as in the case of the strainer pot lining, may be formed under pressure with a heating coil as at 66 imbedded therein. Toward the lower end of each stopper member the convolutions of the heating coil may become more closely spaced so as to insure that such lower ends will be heated to a temperature sufficient to always prevent any danger of freezing of the molten metal in or around the orifices and sufficient to melt any fusible obstructions that may there occur.

The lower ends of the stoppers may be suitably shaped, for example hemispherically, and the upper edges of the orifices may be similarly shaped to insure a close fit when the stoppers are lowered, thereby completely cutting off the flow of metal through each orifice. The stoppers when moved to closed position may also aid in freeing the orifices of obstructions such as particles of carbon. The upper ends of the stopper members may be fixed within suitable metallic bushings as at 67, slidable within flanged bushings as at 68, the latter in turn being mounted within suitable apertures formed in the cover of the strainer pot as shown.

Each stopper 65 may be controlled either manually or automatically so as to be lowered as each mold is filled. The apparatus for this purpose will now be described, first with particular reference to Fig. 3. A bell crank member as at 69 may be pivotally mounted on the top of the cover of the strainer pot adjacent the upper end of each of the stoppers 65. One arm of this bell crank member may have a pin and slot connection as at 70 with the stopper bushings 67 while the other arm of each bell crank member may be pivotally connected as at 71 to an operating rod 72 running to the exterior of the hood structure. The outer end of each of the operating rods 72 may be slidably supported as by a

bracket 73 so that upon pulling the rod 72 outwardly as by a handle 74, the corresponding stopper 65 will be raised to open a pouring orifice. On the other hand, when each of the rods 72 is pushed inwardly, the corresponding stopper will be slid downwardly to close such orifice. A spiral spring as at 75 may be provided on each of the rods 72 for normally tending to move the rod into a position for holding the corresponding stopper down in closed position. That is, each spring as at 75 may surround one of the rods 72, with the ends of the spring engaging respectively an adjustable bushing 76 and a collar member 77. By adjusting the position of the collar member 77 or the bushings 76, the tension of the spring may be suitably adjusted.

In order that the stoppers will not be thrust downwardly by the spring when released, with a force sufficient to injure the same or the orifices, each of the control rods 72 may be connected with an air check valve or dash pot as at 78. That is, a plunger 79 of the dash pot or air check may be suitably connected as by a bell crank member 80 to the collar 77 as shown. When pouring is to start, the operator may pull out the rods 72 for raising the stoppers and in order to lock the rods in this position, each rod may be accompanied by a latch as at 81 (Fig. 4), the latches being pivoted as at 82 and having a lug or dog portion 83 (Fig. 8) for engaging the adjacent arm of the bell crank 80.

While each of the latches 81 may at any time be released manually either simultaneously or separately, means is preferably provided for releasing the same automatically as each mold is filled to a predetermined height. Such automatic means may comprise solenoids as at 84, each positioned respectively with pole pieces 85 adjacent an armature as at 86, formed on each of the latches 81.

Electrical power for operating these solenoids may be brought to the apparatus by a lead wire 87 (Fig. 3) connected to an insulated and vertically slidable contact member 88 arranged to make contact with the mold face plate 32 whenever the hood assembly is lowered into pouring position. The slidable contact member 88 may be normally urged downwardly into proper contacting position by a coil spring as at 89, the tension of which may be adjusted as by an adjustable bushing 90 mounted within an insulating supporting block 91. The lower end of the contact member 88 may be provided with a flange as at 92, which may engage an insulated area 93 on the flange 31 of the hood extension 30 when the hood assembly is raised. But whenever the hood assembly is lowered into pouring position, a source of current is supplied, through member 8, to the casting wheel assembly including the molds therein, as well as the metal within the molds.

A suitable means for contacting with the molten metal when it reaches the proper height within the mold inlets and for thereby actuating the solenoids 84, will now be described with particular reference to Fig. 6. A contact element comprising a short length of copper wire, for example, is indicated at 95, the lower end of this wire being positioned at such a height that it will be engaged by the molten metal within the mold inlet when the mold becomes filled to the proper height. The contact wire 95 may be largely surrounded by a protective tube 96 of porcelain or the like, so that in case the metal should spatter, contact will still not be made

until the level of the molten metal reaches the desired height. If the contact element 95 is made of metal such as copper, it will usually become welded to the top of the casting and therefore when the casting is dropped out through the bottom of the mold, the contact wire will pass out with the casting. Thereupon for the next operation, a new contact wire may be inserted in an aperture as at 97 formed for such purpose in a contact supporting bar 98, by which the porcelain sleeve 96 may also be supported. If desired, it may be possible to use a graphite rod instead of the wire contact member 96.

The contact supporting member or bracket 98 may rest upon a suitably insulated pad as at 99 which is placed in position on the face plate 32 of the mold assembly just before the hood assembly is lowered into pouring position. A contact member 100 may be fixed upon a shaft 101, upon which is also fixed an arm 102, this arm being biased upwardly as by an adjustable coil spring 103, so that contact member 100 is biased downwardly. The spring 103 may be adjustably suspended as by an eyelet member 103' extending up through a lug formed on the hood casting, and provided with an adjusting nut as shown. Another arm 104, also fixed to the shaft 101, carries an adjustable stop screw 105 for normally engaging an abutment 106 under pressure of the spring 103 whenever the hood assembly is raised. However, when the hood assembly is lowered as during pouring, the contact member 100 under tension of the spring 103 is brought into firm contact with the member 98. The shaft 101 may be carried in suitable insulating bearings and also connected as by a lead wire 107 (Figs. 2 and 4) to one of the solenoids 84. It will be understood that each of the molds of the group being poured, may be accompanied by a set of contact devices as above described for applying current respectively to each of the solenoids 84 at the moment each mold becomes filled. As indicated in Fig. 2, these contact assemblies may be conveniently located respectively at the lower corners of the hood assembly. It will be further understood that a return circuit from each of the solenoids 84 may be provided in any convenient manner (not shown), suitable cut-out switches as desired being inserted in the circuit for each solenoid or in the main source of current supply for all the solenoids. As above indicated, as soon as a circuit through one of the solenoids is completed upon filling each mold, the corresponding latch 81 will be tripped, permitting one of the springs 75 to push one of the operating rods 72 to the right (Fig. 3), thereby moving the corresponding stopper 65 to closed position.

It will be observed that with this apparatus, the strainer pot may be kept filled to approximately a predetermined level at all times so that it will be unnecessary for the operator to take the precaution of pouring into the strainer pot only the amount of copper to be needed for one group of molds. Furthermore, the heated stoppers as well as the heating units forming the lining of the strainer pot will serve to keep the body of copper which is lodged in the strainer pot between times of pouring, at a sufficient temperature so that it will begin to immediately and uniformly pour through the orifices the moment the stoppers are raised without necessarily awaiting the flow of metal from the furnace. Thus, some appreciable time may be saved and also there will be less danger of spattering of the

falling stream from the funnel or furnace outlet, since it will fall into the molten metal instead of against the solid bottom of the strainer pot. This in turn will save wear on the strainer pot and avoid any possibility of irregular and uncontrolled spattering or draining of metal through the orifices at the beginning and ending of each pouring operation.

If desired, in some special cases all of the solenoids 84 may be connected to be operated by a single contact such as at 95.

The electrical connections to the heating coils 66 within the stoppers may comprise suitable flexible leads as at 108 running to suitable contact rods as at 109 and extending through, but insulated in respect to the side walls of the hood assembly. The outer ends of the rods 109 may be connected to a suitable source of current supply in any convenient manner through cut-out switches and adjustable rheostats if desired.

The resistance wires within the heating units forming the lining of the strainer pot may be connected to a source of power in a manner shown in Figs. 5 and 2 for example. That is, the ends of wires 55 may be secured to insulated binding posts as at 110 having contact surfaces 111 at their outer ends for contacting with longitudinally slidable rods as at 112. Each of the rods 112 may be slidably mounted in an insulated support as at 113 and so as to extend to the exterior of the hood assembly at which point the source of power may be connected as to a terminal 114. Each of the rods 112 may be yieldably pressed inwardly as by a pair of springs 115, which engage the ends of an insulated yoke piece 116, the latter in turn being secured to the rod 112. As shown, the springs 115 may be mounted upon stud bolts as at 117 provided with nuts for adjusting the tension of the springs. When the strainer pot is to be slid out of the hood assembly or at times before the strainer pot is inserted in place, the contact rods 112 may be partially withdrawn by inserting wedges between the yoke members 116 and the adjacent side walls of the hood assembly. The source of power may be connected to the terminals 114 through suitable cut-out switches and rheostats as desired.

While the above described equipment has been referred to particularly as adapted for use in the pouring of deoxidized or oxygen-free copper, the same or similar equipment may readily be used for the pouring of other metals such as molten aluminum or magnesium, from which it is desirable to exclude air. In such cases the charcoal in the furnace would act as a mechanical filter for removing from the molten charge the particles of oxides or other undesirable solid particles.

While the invention has been described in detail with respect to a particular preferred example, it will be understood by those skilled in the art after understanding the invention that various changes and further modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for pouring molten metal, comprising a hood structure adapted to cover and enclose the inlets to a group of molds, against access of air, a pot within the lower portion of said structure for receiving a body of the molten metal and having outlet orifices located above

and respectively in substantial alignment with the inlets of the molds, a furnace adjacent said hood structure for containing a mass of the metal to be poured, said furnace having an outlet spout opening into said hood structure above said pot, and said furnace being tiltably mounted on a fixed axis coaxial with said spout, whereby a stream of the molten metal may be discharged in substantially fixed position to said pot upon tilting the furnace.

2. Apparatus for pouring molten metal, comprising a hood structure adapted to cover and enclose the inlets to molds which are to receive the metal, a furnace adjacent said hood structure for containing a mass of the metal to be poured, said furnace having an outlet spout opening into a side of said hood structure, and said furnace being tiltably mounted on a fixed axis coaxial with said spout, whereby a stream of the molten metal may be discharged in substantially fixed position upon tilting the furnace about the spout axis.

3. In apparatus for pouring molten metal, in combination with a furnace or the like for containing a mass of the metal to be poured, a pouring spout extending to one side of the furnace, said spout having a generally annular shaped pouring lip substantially coaxial with the spout, trunnion means for tiltably mounting the furnace, the axis of said trunnion means being in fixed position, said trunnion means being coaxial with said spout and the metal-containing cavity within the furnace being eccentric in respect to the trunnion axis, whereby upon tilting the furnace to varying degrees on said trunnion means, a stream of the molten metal may be discharged in substantially fixed position from said spout.

4. In apparatus for pouring molten metal, a pot for receiving a body of the molten metal to be poured into a group of molds beneath the pot, an inlet opening at the top and a plurality of outlet orifices at the bottom of said pot, one of said orifices being provided for each of the mold inlets, a hood structure for excluding air from the molten metal entering and leaving said pot, and means for adjusting the position of said pot to give said orifices an effectively uniform elevation with the orifices respectively in alignment with said inlets, comprising a plurality of cam means engaging the exterior of the pot at spaced points around its walls to respectively adjust the desired elevation of adjacent parts of the pot, a plurality of longitudinally adjustable rods also engaging the exterior of the pot at spaced points around its walls to adjust its position in horizontal directions, and means carried by said hood structure adjacent the pot for supporting said cam means and rods.

5. In apparatus for pouring molten metal, a pot for receiving a body of the molten metal to be poured into a group of molds beneath the pot, an inlet opening at the top and a plurality of outlet orifices at the bottom of said pot, one of said orifices being provided for each of the mold inlets, a hood structure enclosing said pot and the inlets to the molds, for excluding air from the molten metal being poured into the molds, and a plurality of means extending through the walls of said hood structure and operable from the exterior thereof for adjusting the position of said pot for bringing said orifices into alignment with the mold inlets, said means including members with surfaces engaging the pot walls at spaced points for moving the pot in various horizontal directions.

6. In apparatus for pouring molten metal, a pot for receiving a body of the molten metal to be poured into a group of molds beneath the pot, an inlet opening at the top and a plurality of outlet orifices at the bottom of said pot, one of said orifices being provided for each of the mold inlets, a hood structure enclosing said pot and the inlets to the molds, for excluding air from the molten metal being poured into the molds, and means extending through the walls of said hood structure and operable from the exterior thereof for adjusting the position of said pot for varying the effective elevation of one orifice in respect to another, said means including a plurality of members engaging the pot at spaced points thereon, and acting when the adjusting means is operated, to raise or lower adjacent portions of the pot.

7. In combination with a mold for casting molten metal, an electrical contact member within the inlet of the mold and adapted to contact with the molten metal when the mold is filled to a predetermined height, means for detachably and replaceably suspending said contact, and electrically controlled means under the control of a circuit through said contact for causing the flow of molten metal into the mold to be shut off, said contact being formed of a material which will weld to the cast metal and thus be removed from the mold with the removal of the casting.

8. Apparatus for pouring molten metal into a plurality of molds, comprising a pot for receiving a body of the molten metal, the bottom of said pot having a plurality of orifices located respectively above and in substantial alignment with the inlets to said molds when the latter are in position for pouring, a hood construction for enclosing the area above the molds and containing said pot, for excluding air from the metal as poured into the pot and from the pot into the molds, means on the hood for supporting the pot in adjustable positions within the hood, stoppers within said pot for each of said orifices, and means operable from the exterior of the hood for lowering and raising said stoppers respectively into orifice closing and opening positions, said last named means including mechanism for normally yieldably holding the stoppers in orifice closing positions.

9. Apparatus for pouring molten metal into a plurality of molds, comprising a pot for receiving a body of the molten metal, the bottom of said pot having a plurality of orifices located respectively above and in substantial alignment with the inlets to said molds when the latter are in position for pouring, stoppers of refractory material within said pot for each of said orifices, and mechanism operable from the exterior of the pot for raising said stoppers into orifice opening positions and including spring means controlled by dash-pots for slowly lowering said stoppers respectively to orifice closing positions and to normally yieldably retain the stoppers in the latter positions.

10. In apparatus for pouring molten metal, a pot for receiving a body of the molten metal to be poured into a group of molds beneath the pot, an inlet opening at the top and a plurality of outlet orifices at the bottom of said pot, one of said orifices being provided for each of the mold inlets, a hood structure enclosing said pot and the inlets to the molds, for excluding air from the molten metal being poured into the molds, means for supporting said pot in adjustable position in re-

spect to the molds, comprising rods slidable in generally horizontal directions and extending through the side walls of the hood and engaging the sides of the pot at spaced points to adjust its position in horizontal directions, and cam means rotatably mounted coaxially with said rods respectively and engaging the pot at spaced points to determine the elevation of each adjacent portion of the pot.

11. Apparatus for pouring molten metal into a plurality of molds, comprising a pot for receiving a body of the molten metal, the bottom of said pot having a plurality of orifices located respectively above and in substantial alignment with the inlets to said molds when the latter are in position for pouring, said pot being provided with a cover, and a receptacle on said cover for receiving a poured stream of molten metal, said cover having an aperture for admitting the molten metal from said receptacle into the pot, said orifices being

positioned at points symmetrically located in respect to said aperture.

12. In an apparatus for pouring molten metal, having a casting wheel, and having a hood structure movable to and from a position for covering inlets of molds carried by said casting wheel, the combination of means within said hood structure for simultaneously controlling the distribution of molten metal to a plurality of the mold inlets, electrical contact means for extending into the mold inlets for contacting with the molten metal when the mold is filled to a predetermined height, circuits and mechanism controlled by said contact means to then stop the pouring into each mold, and contact means carried by the hood structure and adapted to contact with said wheel when the hood structure is lowered, to prepare circuits for said first named contact means.

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