Sept. 18, 1951 R. H. WADDINGTON ET AL 2,568,525

GAS HOOD FOR CASTING MACHINES

Filed Oct. 2, 1948 3 Sheets-Sheet 1

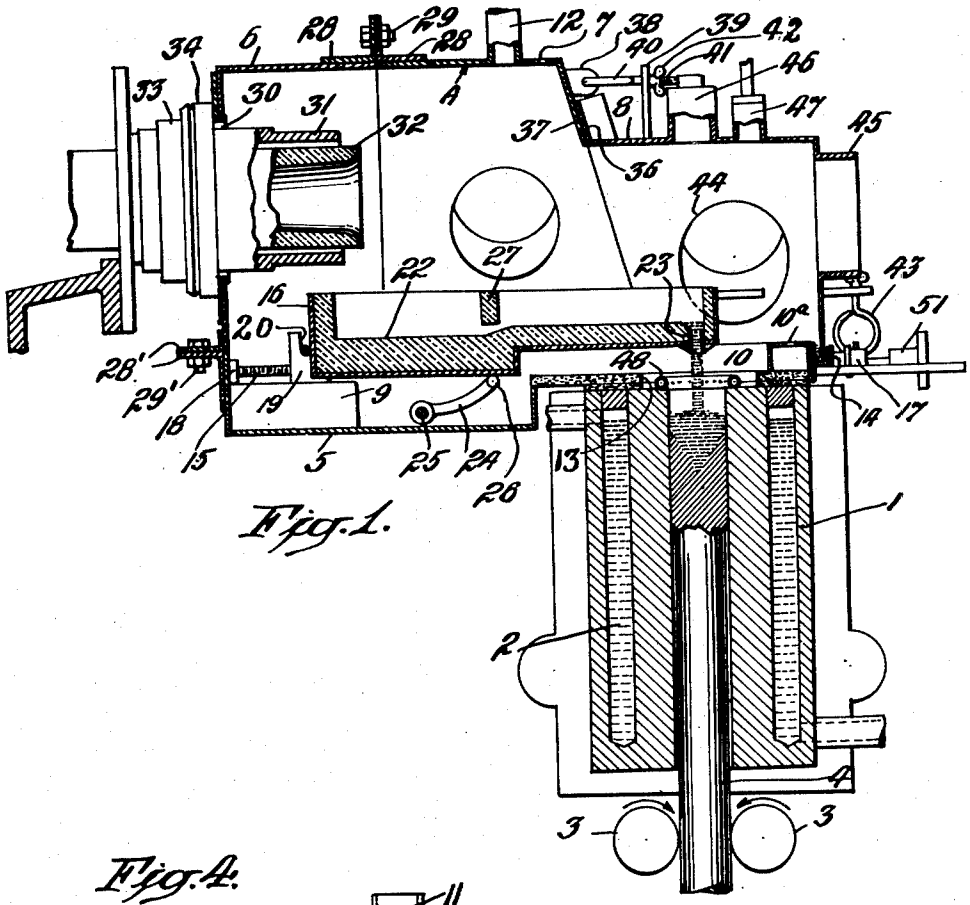


Fig. 1.

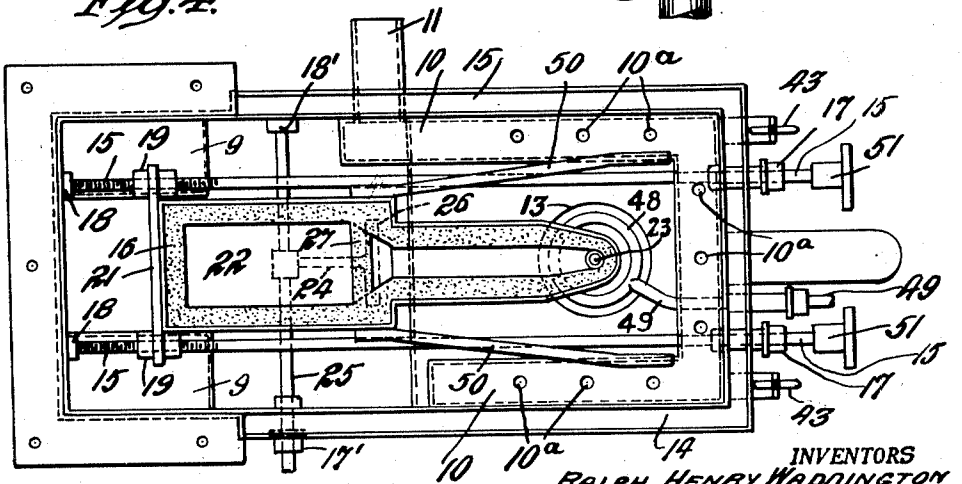


Fig. 4.

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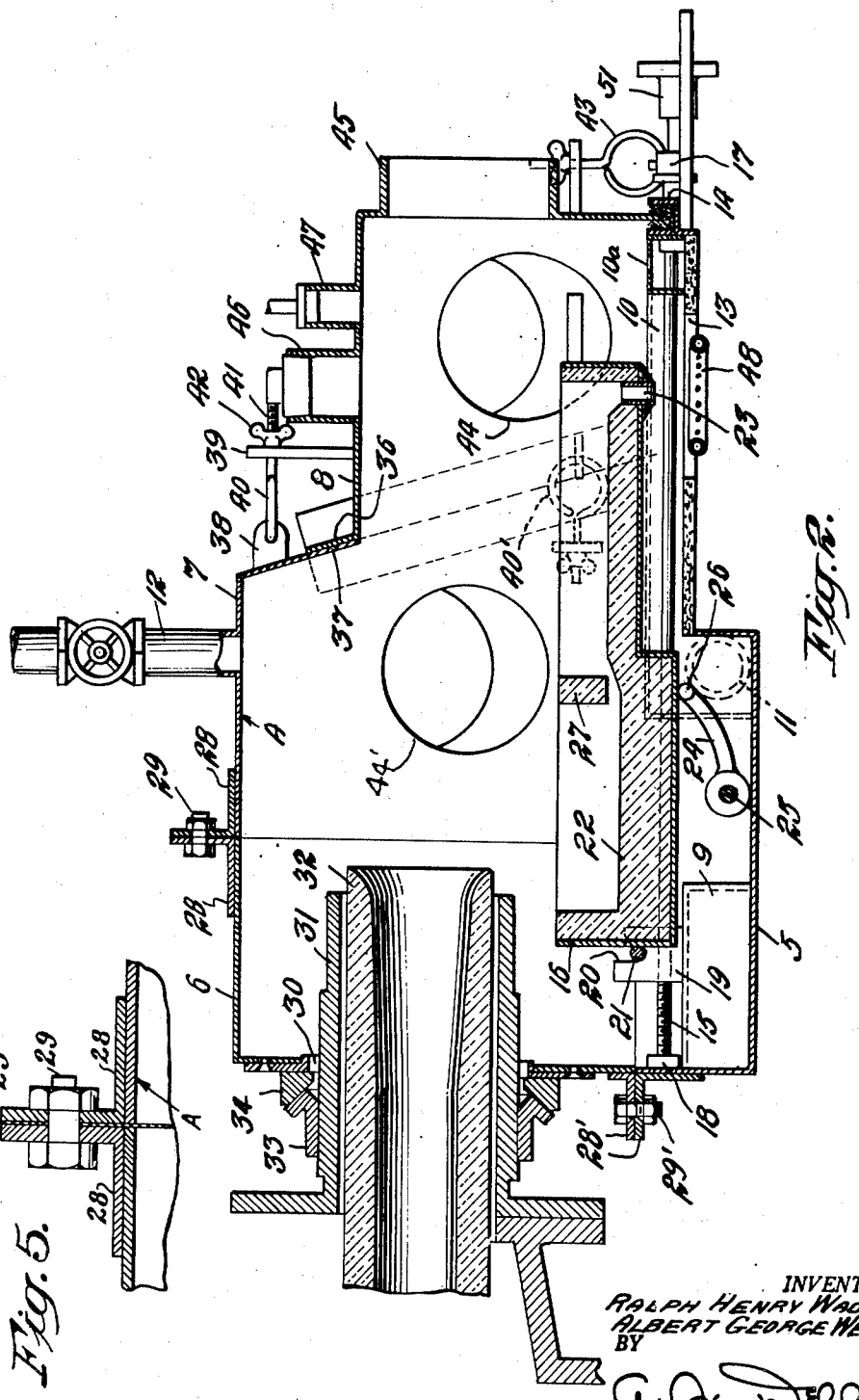


Fig. 2.

Fig. 5.

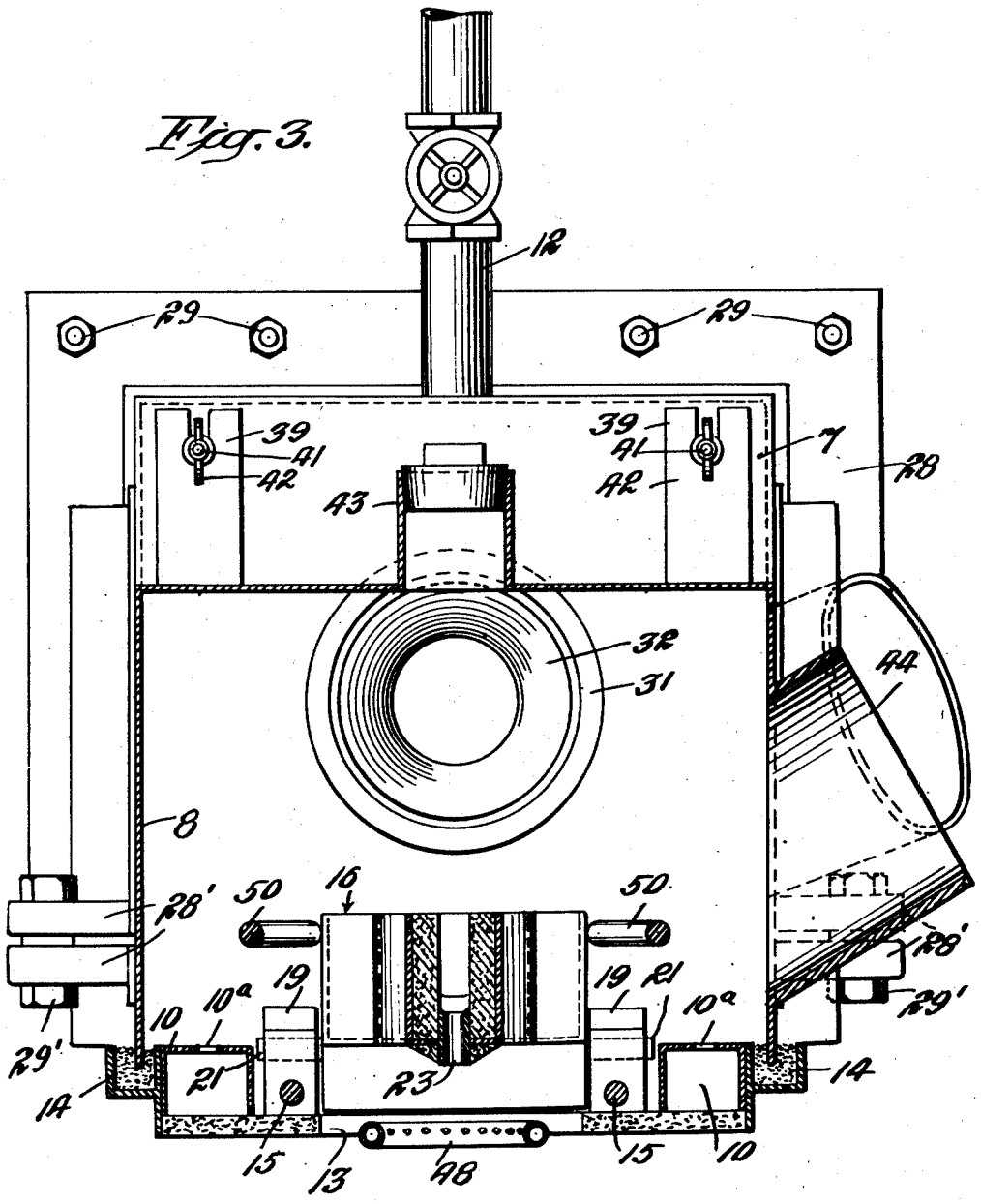
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Fig. 3.



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GAS HOOD FOR CASTING MACHINES

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2 Claims. (Cl. 22—79)

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The present invention relates to an improved machine for continuously and protectively molding metals and alloys in which molten metal is poured into the top of a mold from a tiltable ladle and the hot ingot formed is continuously withdrawn from the bottom of the mold cavity.

It is well recognized, in the founding art that metals in the molten state are particularly susceptible to contamination by some of the gases with which they may come in contact, such contamination resulting in either undesirable surfaces on the finished casting or in the occlusion of undesirable gases within the casting itself. It has already been proposed in the prior art to enclose the ladle within a hood-like covering. These prior art arrangements, however, were cumbersome and expensive, and time-consuming removal of the hood was required when replacement or adjustment of the ladle became necessary.

We have invented an improved machine in which pouring of molten metal from the furnace to the ladle and subsequent pouring from the ladle to the mold is carried out within an improved hooded enclosure. This hooded enclosure is provided with means for making vertical, longitudinal and transverse adjustment of the ladle from controls outside the hood and is also provided with means for rapid and easy removal of a section of the hood to permit easy exchange of ladles. During operation, the hooded enclosure is preferably filled and supplied with a gas under slight pressure. The gas used for filling the hooded enclosure is substantially inactive toward and is not absorbed to any substantial extent in the molten metal being poured.

An object of the present invention is to provide an improved method and machine for continuously casting molten metal in which the molten metal during pouring is maintained in contact with non-oxidizing and/or reducing gases during the pouring and casting operation.

A further object of the present invention is to provide an improved machine for continuously casting molten metal with means for adjusting the ladle in relation to the furnace pouring spout and the casting mold filling port by control means which are located outside a protective hood.

The foregoing and other objects and advantages of the present invention will become apparent from the following description taken in connection with the accompanying drawings, in which—

Fig. 1 illustrates a longitudinal, sectional view, taken on a central vertical plane and partly in elevation of a vibrating, vertically split, sectional

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mold casting apparatus embodying the present invention;

Fig. 2 is a similar vertical sectional view depicting the hooded enclosure and the upper part of Fig. 1 on an enlarged scale with the casting mold and other details omitted for the purpose of clarity;

Fig. 3 shows a vertical cross-sectional view taken axially of the ingot mold; and

Fig. 4 depicts a plan view with the upper parts of the hood and the furnace spout omitted.

Fig. 5 is a detailed view of a portion of Fig. 2 illustrating the manner of interposing gaskets between the securing members of the respective hood sections.

Generally speaking, the new improvement for a machine for continuously casting molten metal embodying the present invention comprises a sectional hood, the mold end section of which is easily removable, assembled around and enclosing all parts of the machine in which the molten metal would normally be exposed to the atmosphere. By the use of the novel combination embodying the present invention, the furnace pouring spout, the ladle, the ladle outlet and the filling port of a vibrating, vertically split, sectional mold are all enclosed within a sectional hood. Means are provided for circulating within the hood a gas which is non-reactive with and substantially insoluble in the molten metal. The molten metal emerging from the furnace pouring spout and passing through the ladle and ladle outlet to the filling port of the vibrating, vertically split, sectional mold is thus protected from contamination by oxidizing or occluded gases while in the molten state. Control means located outside the hood are also provided by means of which vertical, longitudinal and transverse adjustment of the ladle within the hood may be made.

Referring more particularly to Fig. 1, the hood assembly is generally designated by the reference character "A" and is disposed over an open-ended, vibrating, vertically-split mold 1, having a water jacket 2 and driven rolls 3 for withdrawing a finished casting 4. As may be seen more clearly from Figs. 2 and 3, the hood consists of a bottom or pan section 5 and a sectional cover member consisting of a rear section 6, an intermediate section 7 and a front section 8. These cover sections are joined together in gas-tight arrangement and are assembled with the pan section 5 in gas-tight assembly as hereinafter described. The bottom or pan section 5 is provided with a raised bearing base 9 at each

side of the furnace outlet on the pan bottom and with a continuous gas duct 10 along two sides of the pan member and across the ladle outlet end of the pan.

The gas duct 10 is an open-bottom duct of sheet metal or other suitable material and is provided with a gas inlet pipe 11. Slots or holes in the sides of the gas duct 10 and a plurality of apertures 10—*a* in the top surface thereof permit escape of the gas into the hood assembly A, whence it is withdrawn through gas outlet 12 in the top of the hood assembly. The pan section 5 is provided with a bottom opening 13 disposed centrally above the open end of the open-end mold 1.

A channel member 14 forms an extension of the outer walls of the bottom pan section 5 at its forward end and along two sides thereof. In use, this channel member is filled with powdered asbestos or other packing material to form a gas tight seal with the hood as hereinafter described.

A pair of rods or shafts 15 pass longitudinally through the pan bottom section 5 on each side of the ladle 16 as may be more clearly seen in Fig. 4. At the forward end of the pan bottom these rods pass through and are supported by a stuffing box 17 and at the opposite or furnace outlet end of the pan these rods are supported in a piece of bearing steel 18 carried on the inner side of the end wall of the pan 5. The furnace outlet end of each of these rods is threaded and carries thereon a threaded sliding bearing block 19 having a notch 20 therein. The bearing block 19 is also slidably supported on the raised bearing base 9 and is adapted to move therealong on rotation of the longitudinal adjusting rods 15. A bar 21 is carried in notches 20 and is secured between the sliding bearing blocks 19 to the rear end of ladle 16 by welding or other convenient means, thus providing for longitudinal adjustment of the ladle. The bar 21 and the notch 20 are so arranged that the bar fits loosely in the notch. By this arrangement, the outlet 23 of the ladle 16 may also be moved from side to side within the hood by rotating only one of the adjusting bolts 15, thus providing transverse adjustment and it will be apparent that longitudinal adjustment of the ladle may be made by rotation of both of the rods 15. Rotation of these rods from outside the hood is made by rotation of the hand wheels 51 thereon.

The ladle 16 is provided with a lining 22 which is preferably of fire clay brick cemented in but may be of any other suitable refractory material which is adapted to withstand the temperature of the molten metal and which is inactive thereto. The forward end of the ladle 16 is provided with an outlet 23 which is preferably lined with a zircon or equivalent bushing. This ladle outlet is preferably disposed centrally above the opening of the open-end mold 1 and it will be clear from the drawing that this preferred disposition of the ladle outlet may readily be obtained by use of the longitudinal adjusting rods 15. The ladle is supported intermediate the two ends by a ladle tilting member 24 which, as shown, is preferably in the form of an arcuate arm which is keyed at its lower end to a rotatable shaft 25. Suitable mechanism for rotating the shaft, such as a worm and gear (not shown), may be provided. The worm and gear or other shaft rotating mechanism is disposed outside of the pan wall and outside of the channel member 14. The shaft 25 is journalled within a

stuffing box 17' and a steel bearing support 18', the stuffing box providing a gas-tight seal. The upper end 26 of the ladle tilting arm 24 is preferably in the form of a circular rod extending at right angles to the arcuate arm and parallel to the shaft 25. The bottom of the ladle rests on the circular rod and on rotation of the shaft the level of the ladle outlet 23 is moved in a substantially vertical direction, movement being upward with counter-clockwise rotation of the shaft 25 and downward with clockwise rotation.

The ladle 16 is also provided with a skimming baffle 27 extending downwardly into the lined ladle and serving to prevent the movement to the ladle outlet 23 of any small amount of slag and other impurities which may be floating on the surface of the molten metal. It will be noted that there is a rise in level of the bottom of the ladle immediately beyond the skimming baffle 27 and that this change in level occurs approximately beneath the skimming baffle. With this arrangement it is possible to keep a larger pool of molten metal in the ladle and it is also possible to drain the molten metal back to the ladle by tilting the outlet end of the ladle upward thereby preventing spillage from the outlet end.

As stated hereinbefore, a sectional cover section designated by the reference characters 6, 7 and 8 is provided and is so arranged as to provide a gas-tight seal with the pan section. Angle pieces 28 are provided along the adjacent edges of cover sections 6 and 7 and these are bolted together with bolts 29, a gasket of asbestos sheet or other suitable material 29' being compressed between the outwardly extending legs of the angle pieces. Similar angles 28' are provided along the lower rear edge of cover section 6 and along the rear and upper edge of pan 5 and these are similarly bolted together by bolts 29' and a suitable gasket material therebetween to provide a gas-tight seal.

As referred to, means are provided in the improvement embodying the present invention whereby pouring from the furnace to the ladle is carried out within an enclosure substantially devoid of contaminating gases. For this purpose an opening 30 is provided in the rear wall of cover section 6 through which the collar 31 and the furnace pouring spout 32 pass. A gas-tight seal between the rear wall of the cover section 6 and the collar is provided by any convenient means such as an annular seal ring 33 and a ring packing 34.

Front cover section 8 is joined in gas-tight engagement with intermediate cover section 7 in a manner somewhat similar to that by which intermediate section 7 and rear section 6 are so joined. Angle pieces similar to those used for joining sections 6 and 7 are secured to the adjacent side edges of cover sections 7 and 8. An angular upwardly extending flange 36 is provided across the top of cover section 8 and a downwardly inclined wall 37 is provided across the forward side of cover section 7, these portions 36 and 37 being adapted to retain a gasket (not shown) interfacially therebetween in the manner shown in Fig. 5 as will be described hereinafter. Inclined wall 37 is provided, as shown, with two or more brackets 38. In cooperative relation to the brackets 38 there are provided two or more brackets 39, at right angles to the brackets 38 and in longitudinal alignment therewith, and mounted on the top of cover section 8. Eye bolts 40 are engaged in each of brackets 38 and a

threaded portion 41 passes through slots in the brackets 39. By the use of wing nut 42 the cover sections 7 and 8 may be pulled together. Identical eye bolts 40' are provided on the sides of the cover assembly 7 and 8 and it will be seen that a gas-tight joint is obtained when a gasket of sheet asbestos or other suitable packing material is placed between the parts 36, 37 and between the angle pieces, and when the wing nuts 42 are tightened sufficiently to compress the gasket. This method of assembly of the forward sections 7 and 8 allows the front part of the hood, i. e., section 8 to be removed quickly and permits replacement of ladles during operation.

Elements 50 (see Fig. 4) are provided to facilitate handling of the hot ladle. As will be seen in the drawing, the elements 50 are in the form of rods and are welded or otherwise secured to the ladle. The ladle 16 is always preheated before being placed under the hood to prevent congealing of the molten metal when the operation is started. If the operation must be stopped temporarily because of a breakdown, the ease of removal of section 8 permits the insertion of a bolt in the still liquid copper or metal in the mold, which bolt serves as a contacting link when operation is resumed, in effect thus serving as a new dummy bar such as is commonly used at the start of the operation.

With the cover sections 6, 7 and 8 assembled in accordance with the foregoing description, the lower edges of these cover sections are pressed into the powdered asbestos or other packing material contained in the channel member 14, thus completing the gas-tight seal. Means are provided for retaining the cover section in this position, this means consisting of eye bolts 43, attached to suitable brackets on the pan section 5 and having a wing nut engaging a vertical bracket on the hood section 8. Flanged sight glass holders 44 and 45 are provided on one side and the end, respectively, of cover section 8 and these holders are each fitted with a sight glass (not shown) through which the operator may observe the adjustment of the ladle outlet 23 over the open-end mold 1. Cover section 7 may likewise have a glass holder 44' to observe the metal streams flowing from the furnace to the ladle. The cover section 8 is also provided with flanged extensions 46 and 47 which are fitted, respectively, with a clean-out plug in axial alignment with the ladle outlet 23 and a gas pressure test pipe. A gas ring 48 is positioned in the pan outlet 13 between the ladle opening 23 and the opening in the mold 1 and a ring gas inlet 49 is provided through which gas is introduced to the ring. The gas so introduced may be a gaseous hydrocarbon which is decomposed to produce finely divided free carbon which is deposited on the meniscus of the molten metal in the mold.

In the operation of the improved machine for continuously casting molten metals, gas inlet 11 is opened, allowing gas to flow into the gas-tight hood. The gas used is preferably charcoal producer gas but may be any suitable gas which is substantially non-reactive with the molten metal and substantially insoluble therein and which, furthermore, satisfies the conditions herein set forth. At the same time that gas inlet 11 is opened, a valve or other controlling means in gas outlet 12 is opened, thus permitting air or other undesirable gas within the hood to be displaced before molten metal is introduced into the ladle 16. Observations are made through the sight glasses and any adjustments of the ladle outlet 23 are made to insure that ladle outlet 23 and mold 1 are substantially coaxial. The furnace is then tilted or rotated to permit molten metal to flow into the ladle 16 and at the same time gas inlet 49 is opened. While it is preferred to use the apparatus embodying the present invention in association with a vibrating sectional mold whose sections are vibrated transversely to the direction of movement of the congealing metal within the mold, it will be apparent to those skilled in the art that the improvements of the present invention can be readily adapted to other types of continuous or discontinuous casting apparatus.

Although the present invention has been described in conjunction with specific preferred embodiments thereof, it will be apparent that modifications and variations may be made, such as other means for tilting the ladle, without departing from the spirit and scope of the present invention as defined in the following claims.

We claim:

1. In a machine for continuously casting metal shapes having a furnace spout, a ladle removably supported adjacent said spout and positioned to receive molten metal therefrom and having an outlet end portion provided with an outlet opening from said ladle and a mold beneath the ladle outlet opening adapted to receive the effluent molten metal from the ladle outlet opening, the combination therewith of a sectional hood consisting of a base section coextensive with the assembly and formed with a marginal sealing channel and an opening underlying the ladle outlet opening and side and top wall sections consisting of a furnace spout section having gas sealed connection with the spout, a removable section enclosing the ladle outlet end portion and an intermediate section, said sections being united to provide a gas-tight unitary structure with the base section for enclosing said spout, said ladle and said outlet, said hood being provided with means for circulating inert gas therethrough including a perforated gas duct mounted on the base marginal portion to be coextensive with the side walls of the removable section, said base section being provided with adjustable supporting means for the ladle and having operating connections thereto extending externally of the hood, said removable section having its top wall in a plane lower than the top wall of the furnace spout and intermediate sections and being formed with a clean-out opening vertically aligned with the ladle outlet opening, a removable plug for the clean-out opening and readily detachable securing means for the removable section consisting of threaded bolts carried by brackets in one member and engaging slotted brackets in an adjacent member and having wing nuts threaded thereon to facilitate replacement of the ladle.

2. In a machine for continuously casting metal shapes having a furnace spout, a ladle removably supported adjacent said spout and adapted to receive molten metal therefrom and having an outlet end portion provided with an outlet opening from the ladle and a mold beneath said outlet opening adapted to receive the effluent molten metal from said outlet opening, the combination therewith of a protective gas hood comprising sectional hood members consisting of a base section coextensive with the assembly and formed with a marginal sealing channel and with an opening underlying the ladle outlet opening, and side and top wall sections consisting of a furnace spout section having gas sealed connection with

the furnace spout, a removable section having its top wall overlying the ladle outlet portion and an intermediate section provided with a gas discharge port in its top wall, said removable section having its top wall in a plane lower than the top wall of the furnace spout and intermediate sections, said sections being united to provide a gas-tight unitary structure with the base section for enclosing said spout, said ladle and said ladle outlet opening, said hood being provided with means for circulating an inert gas therethrough, said circulating means consisting of a perforated gas duct formed in the base member for introducing the gas within the hood coextensive with and adjacent the side walls of the removable section and an outlet conduit connected to the discharge port of the intermediate section, said base section being provided with adjustable supporting means for the ladle having

operating connections thereto extended externally of the hood and readily detachable securing means for the removable hood section to facilitate replacement of the ladle.

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