April 16, 1968 R. B. WERNER ETAL 3,377,940

FUME CONTROL APPARATUS FOR HOT METAL LADLE CARRIERS

Filed Jan. 26, 1967 3 Sheets-Sheet 1

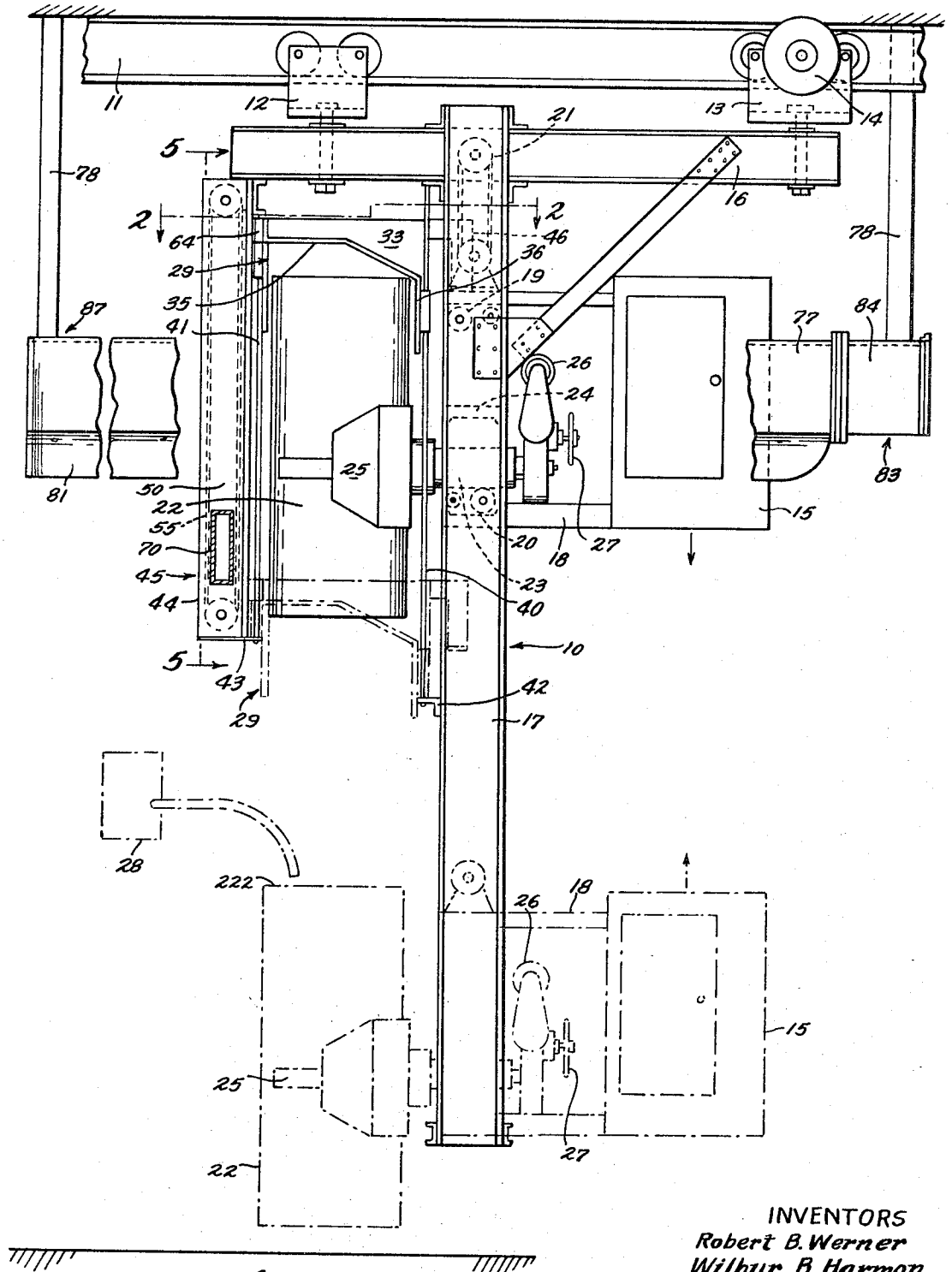

Fig. 1

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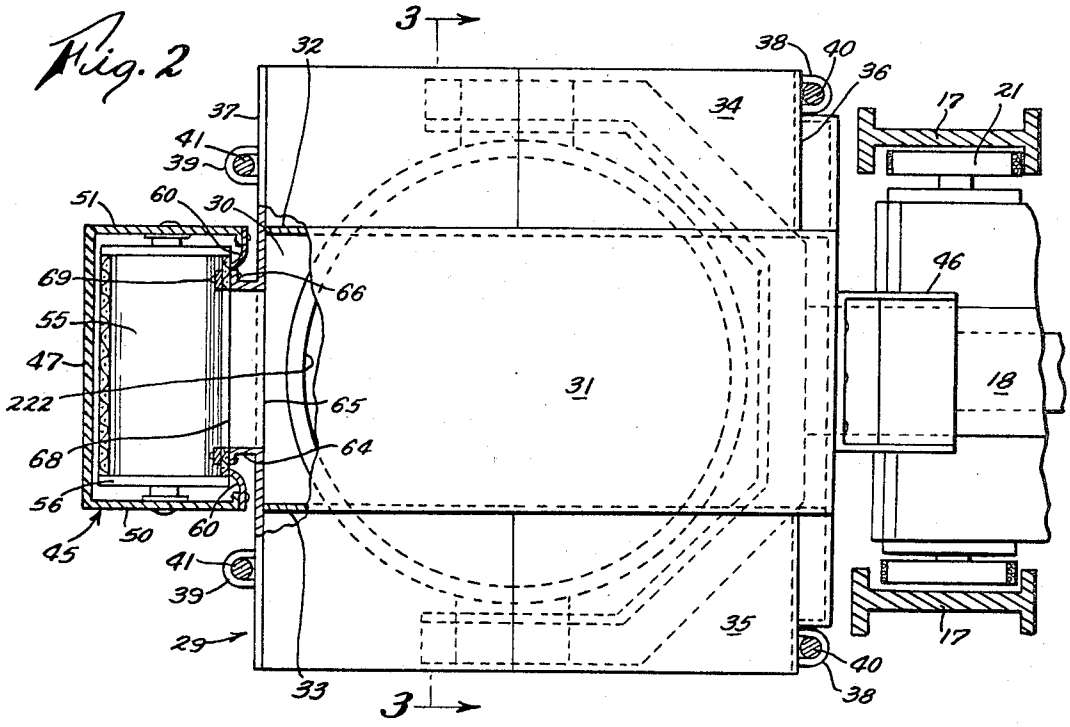
Fig. 2



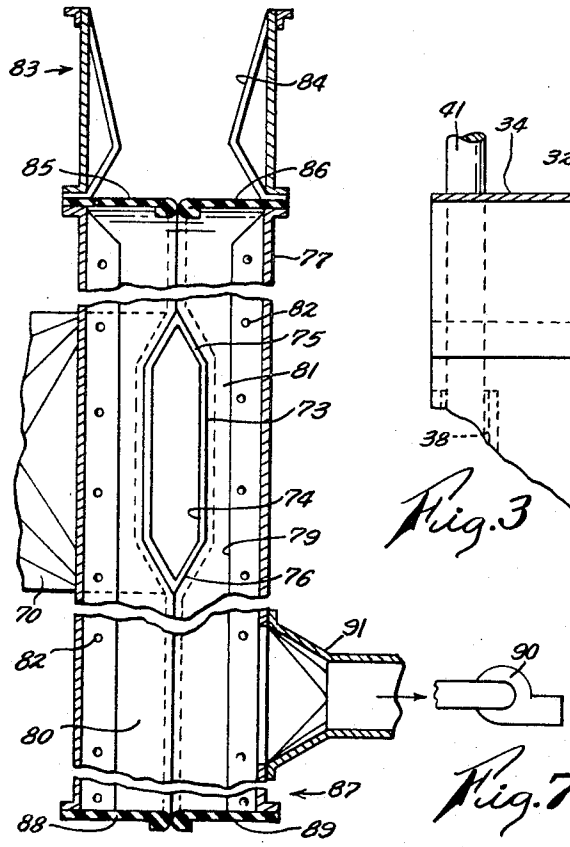


Fig. 7

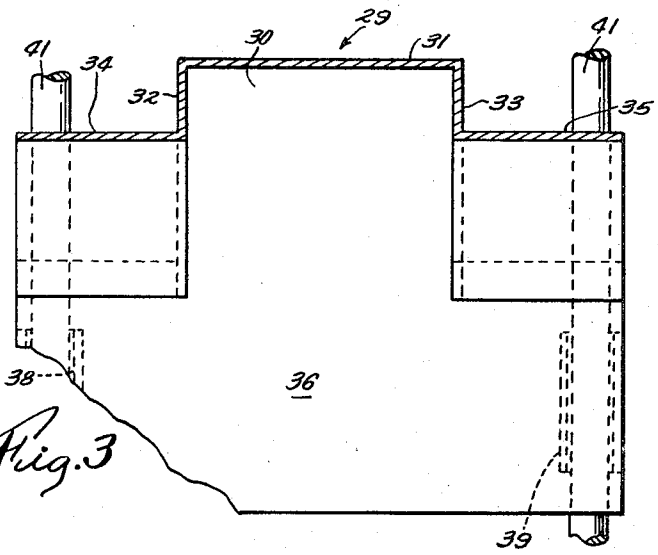


Fig. 3

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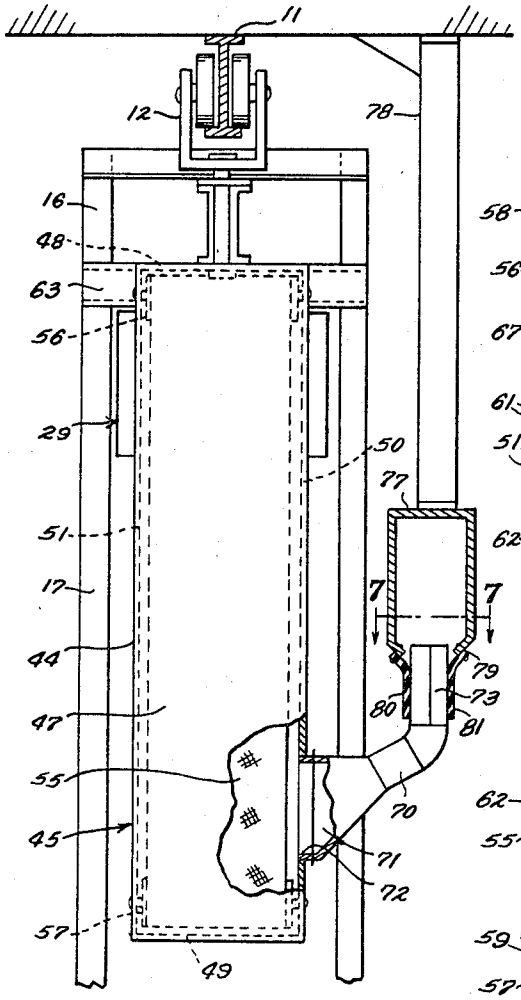

Fig. 4

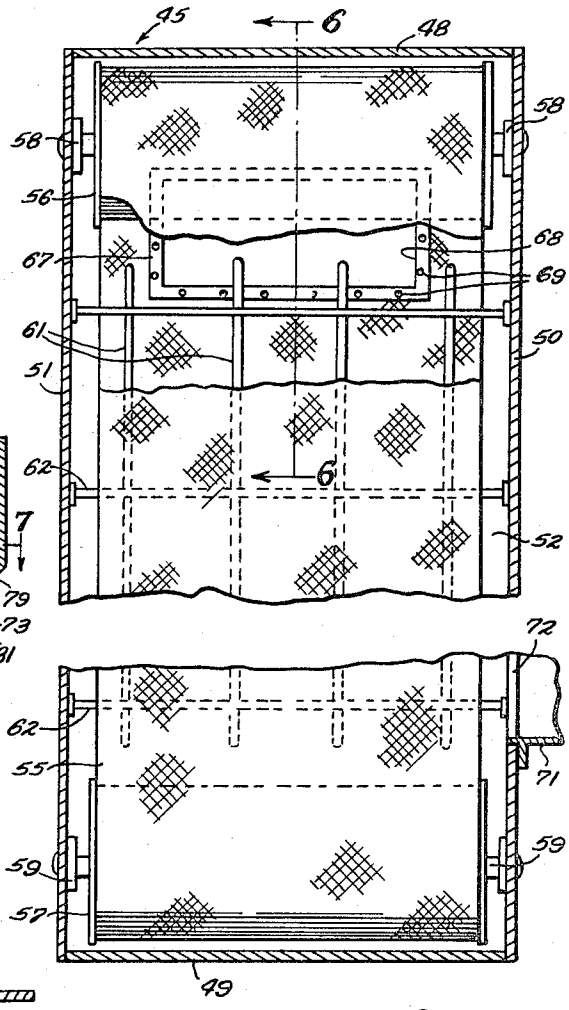

Fig. 5

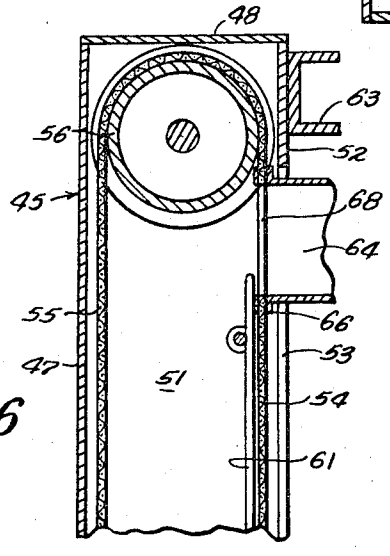

Fig. 6

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FUME CONTROL APPARATUS FOR HOT METAL LADLE CARRIERS

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7 Claims. (Cl. 98—115)

ABSTRACT OF THE DISCLOSURE

Foundry apparatus for entraining and disposing of noxious fumes emitted from the mouths of hot metal carrier ladles at a charging station and while the carrier ladles are in transit toward a metal casting station. Fume hood elevating means are associated with the vertical movement of the carrier ladle to maintain the hood in entraining proximity to the mouth of the ladle.

This invention relates to fume control apparatus and is specifically directed to a plenum exhaust system devised to withdraw and dispose of the deleterious fumes and harmful gases emitted during the treatment and transfer of hot metal within a foundry.

It is common foundry practice to provide one or more hot metal hold ladles that receive molten metal from a cupola electric arc furnace, or the like. A hot metal carrier system is utilized in these foundries to receive and convey relatively smaller quantities of the hot metal from the hold ladles to the various metal casting stations. As the hot metal is poured from a hold ladle into the smaller carrier ladles and during initial transport of the carrier ladles considerable fumes and harmful gases are evolved and the volume of these fumes is greatly increased when certain solid materials are added to the poured charge to secure a particular metallic characteristic in the finished castings.

It is an object of the invention to provide a fume control apparatus that will effectively carry off and dispose of fumes emitted from a foundry carrier ladle at the time the ladle is charged with molten metal and with additive solid materials.

Another object of the invention is to provide a fume control apparatus that is continuously operative from the time the carrier ladle receives its molten charge and an elapsed time thereafter as the charged ladle moves toward a metal casting station. This continuous exhaust of the fumes from the charged ladle during movement thereof facilitates transport of hot metal by the carrier system in that individual hot metal carrier ladles need not be stopped for a fume exhaust operation.

A further object of the invention is to provide a fume control apparatus that may be used by all hot metal ladle carriers of a foundry system that is served by a hold ladle with a minimum of equipment attached to each carrier and which individually cooperate with a stationary exhaust header located alongside the carrier ladle charging station.

Briefly our invention comprises a fume hood positioned above and movable by the hot metal ladle carrier, a plenum exhaust chamber mounted on the ladle carrier and having a movable connection with the hood, a fume exhaust header positioned alongside the path of the ladle carrier, and a severable and movable connection between the plenum exhaust chamber on the carrier and the fume exhaust header whereby fumes entrained by the hood may be exhausted to atmosphere or reclamation.

The preferred embodiment of our invention is illustrated in the accompanying drawing and described in the following specification, wherein like reference numerals indicate similar parts.

In the drawing:

FIG. 1 is a fragmental, side elevational view of our fume exhaust apparatus positioned on the foundry ladle carrier, a part being broken away and shown in section; the dash and dot lines illustrating the position of the ladle when molten metal is charged therein.

FIG. 2 is an enlarged section taken on line 2—2 of FIG. 1, parts being broken away and shown in section.

FIG. 3 is a fragmental section taken on line 3—3 of FIG. 2.

FIG. 4 is a fragmental, front elevational view of the fume control apparatus shown in FIG. 1, parts being broken away and shown in section.

FIG. 5 is an enlarged, fragmental section taken on line 5—5 of FIG. 1.

FIG. 6 is an enlarged section taken on line 6—6 of FIG. 5.

FIG. 7 is an enlarged, fragmental section taken on line 7—7 of FIG. 4.

In FIG. 1 of the drawings the numerals 10 generally indicates a conventional foundry ladle carrier stopped beside a hot metal charging and impregnating station and which is adapted to receive hot metal from a hold ladle (not shown) and to thereafter transport the hot metal to one or more casting stations (not shown). The hold ladle and the casting stations are well known in foundry practice and it is not deemed necessary for an understanding of our invention that they be shown or described herein. Suffice it to say that the ladle carrier 10 is self-propelled along an overhead rail 11 extending between the charging station and the casting stations by means of a front, wheeled rail follower 12 and a rear, wheeled rail follower 13, the latter wheels being driven through reduction gearing (not shown) by an electric motor 14 controlled from an operator's cab 15. The front and rear wheeled followers are swivel mounted upon a horizontal framework 16 of the carrier, said framework having a vertical track 17 depending from its central portion. A hot metal ladle elevator 18 is guided for vertical movement on the carrier track 17 by means of sets of rollers 19 and 20, the elevator being raised or lowered by means of a hoist arrangement 21 that is also controlled from the cab 15, said cab being mounted on and movable with the elevator 18. A hot metal ladle 22 is mounted on the elevator 18 for tilting movement around a horizontal axis by means of a trunnion 23 rotatable in a bearing 24 on the elevator, said trunnion having a yoke 25 at one end that supports the ladle 22 and is turned around its axis by a power means 26 operated by a hand control wheel 27.

The dot and dash lines appearing in FIGURE 1 of the drawings indicate the position of the carrier parts at the time the hot metal charge is to be received in the ladle 22 from a relatively larger hot metal hold ladle it being understood that the hot metal ladle 22 will be tilted on its horizontal axis into the proper position for receiving the hot metal charge. As the ladle assumes its upright position a solid chemical material is introduced into it by a dispenser 28 and at this point and for sometime thereafter the hot metal charge in the ladle 22 will fume and harmful gases will be emitted from the ladle mouth 222.

Our fume control apparatus comprises a hood 29 that is mounted on the carrier framework 16 for vertical movement above the mouth of the ladle 22. As best shown in FIGS. 2 and 3 the hood has a centrally located, downwardly opening fume exhaust tunnel 30 formed by a top wall 31 and upstanding sidewalls 32 and 33, the side walls being relatively narrow at their forward portions (the term forward identifying the leading end of the hood with respect to the direction of travel of the ladle

carrier 10) and having downwardly and rearwardly widened portions at their rear ends (FIG. 1). Two oppositely extending sidewalls 34 and 35 extend horizontally from the side walls 32 and 33, respectively, of the tunnel 30, the rear portions being inclined downwardly and rearwardly to intersect an upstanding rear wall 36. The hood is also provided with an upstanding front wall 37, the front wall and rear wall being adapted to receive the mouth of the ladle 22 when the latter is in its raised position and in positions intermediate its limits of vertical motion.

A pair of corner positioned guide sleeves 38—38 and 39—39 are mounted on the end plates 36 and 37 of the hood, respectively, each pair slidably receiving vertically disposed hood guide rods 40—40 and 41—41, respectively. With reference to FIG. 1 it will be noted that the upper ends of these guide rods are fastened to the carrier frame work 16 while the lower ends of the rods 40—40 are secured on brackets 42—42 welded to the track 17 while the lower ends of rods 41—41 are secured to brackets 43—43 carried by the lower end of a casing 44 of a plenum exhaust chamber, generally indicated by the reference numeral 45.

It will therefore be understood that we have provided a vertically moving, gravity actuated hood 29 disposed above the mouth of the ladle 22 and which has a centrally located and downwardly opening exhaust tunnel 30 having a relatively restricted area at its forward part and a rear part that gradually increases in area as it recedes rearwardly from said forward part.

The vertical movement of the hood 29 is controlled by a hood lifting bracket 46 welded to the rear wall 36 of the hood and which projects rearwardly into the path of travel of the ladle elevator 18. The lower limit of motion of the hood is determined by the guide rod support brackets 42 and 43 which engage the guide sleeves 30 and 39, respectively, on the hood.

It will therefore be understood that the hood is freely mounted on the carrier for gravity influenced vertical movement on the guide rods 40 and 41 and that such movement is controlled by engagement of the bracket 46 with the elevator 18.

We provide a vertically movable connection between the fume exhaust hood 29 and the carrier mounted plenum exhaust chamber 45 and with particular reference to FIGS. 2, 4, 5 and 6, said plenum chamber is formed by a front wall 47, a top wall 48, a bottom wall 49 and opposite side walls 50 and 51. As best shown in FIG. 6 of the drawings the rear side of the chamber is partially closed by a wall 52 provided with a relatively wide and vertically elongated opening 53 which in turn is closed by one reach 54 of an imperforate, endless belt 55. The belt is mounted on free running rollers 56 and 57 disposed, respectively, in the top and bottom parts of the plenum chamber. The roller 56 is mounted on bearings 58 on the side walls 50 and 51 while the roller 57 is mounted on bearings 59 positioned on said side walls. As best shown in FIG. 2 the space between the wall 52 and the belt reach 54 is made air tight by flexible seals 60—60 while the reach is supported in the opening against inward collapse by means of a series of back-up rods 61 vertically positioned behind the reach on cross rods 62 in turn mounted on the side walls 50 and 51 of and chamber. The plenum exhaust chamber is positioned on the framework 16 of the carrier by a cross channel 63 welded to the frame and to the upper portion of the front wall 52 of the chamber casing.

Open communication is provided between the interior of the plenum chamber 45 and the hood 29 by a short conduit 64 that extends through the opening 53 in the chamber wall 52 and as best shown in FIGS. 2, 5 and 6, is in open communication with the narrow portion of the exhaust tunnel 30 through an exhaust port 65 formed through the front wall 37 of the hood. The forward end of the conduit 64 is connected to the reach 54 of the belt 55 by a flange 66 (FIG. 6) that engages the exposed face of the belt reach and by a plate 67 (FIG. 5) that engages the inner face of the reach around an intake opening 68 formed in said reach. A row of rivets 69 each pass through the flange 66, the belt reach 54 and the plate 67 to permanently connect the short conduit 64 to the belt. The lower end of the plenum chamber 44 is provided with an exhaust pipe 70 which is in communication with the interior of said plenum by a fitting 71 connected to the side wall 50 of the chamber around an opening 72 formed in said sidewall (FIGS. 1 and 4) the free end of the pipe having fixed thereon a plow member 73 (FIGS. 4 and 7) that has an elongated exhaust opening 74 formed therein formed with prow shaped ends 75 and 76.

As indicated in FIG. 1 a slotted, manifold header 77 is positioned beside the carrier track 11 adjacent the hot metal filling station on hangers 78, said header being elongated and extending from a point up the carrier track 11 from the filling station to a point considerably down the track from said station. With reference to FIGS. 4 and 7 it will be seen that the header 77 has an elongated slot 79 in its lower side that is normally closed by a pair of opposed, flexible lips 80 and 81 each secured to the header on an opposite side of the slot by means of rivets 82, or the like. The free end portions of the lips are normally in air tight engagement with each other and are parted only at the portions that are spread apart by pressure of the plow 73 passing through the header. The up track end 83 of the header is provided with a plow entrance gate 84 which receives the plow 73 and guides it into the header normally closed by a pair of normally closed, flexible door members 85 and 86 (FIG. 7). The down track exit side 87 of the header is provided with a pair of flexible normally closed door members 88 and 89 which part to permit passage of the plow out of the header. The header is continually exhausted by means of one or more fume exhaust fans 90 connected to the interior of the header by fittings 91, exhausted fumes from the outlet sides of the fans being reclaimed, cleaned and/or exhausted to atmosphere, as desired.

In operation and as the foundry carrier 10 approaches the hot metal charging station depicted in FIG. 1, the plow 73 will be guided into the slotted manifold header 77 by the entrance gate 84 and the plow will slidably pass between the lips 80 and 81 on the header and move relative thereto in an air tight condition. Entrance of the plow into the slotted manifold header connects the interior of the header with the plenum chamber 45 which in turn is connected to the hood 33 by means of the movable belt connection between the hood and said plenum, thus conditioning the fume exhaust hood 33 for entrainment of all the fumes and noxious gases to be emitted at the ladle filling station. When the carrier attains the position shown in full lines in FIG. 1 the operator will lower the carrier to its dot and dashed position shown therein, the hood following the movement of the carrier because of its gravity actuated condition on the carrier and the bracket 46 thereon which engages upon the carriage 18. As the carriage descends the hood will be brought into contact with the lower stops 43 and 44 thus arresting its downward motion while the carrier descends to the position indicated by the broken lines. At this lower position the operator tilts the ladle 22 to an inclined position for receiving a hot metal charge from a hold ladle, the ladle 22 being then returned to its vertical position where the hot metal charge is treated with a solid chemical material from the dispenser 28. At this point considerable fuming is emitted from the mouth of the ladle and the operator then raises the hot metal ladle up to the position indicated in full lines in FIG. 1 all the fumes and noxious gases being exhausted from the mouth of the ladle through the hood, the plenum chamber, the header to the fan and to disposition therefrom. The carrier is then moved forward toward the first casting station and the fumes will continue to be ex-

hausted as long as the plow is slidably connected to the header 77, the length of said header being determined by the speed of the carrier and the amount of time it requires for the hot metal charge to discontinue its fuming action.

What is claimed is:

1. A foundry carrier having a frame and a vertically movable hot metal ladle having an upwardly opening mouth and mounted on the frame, fume exhaust apparatus comprising fume hood means mounted for vertical movement on the frame above the ladle, an upstanding plenum exhaust chamber positioned on the frame, a vertically movable connection between the hood and the chamber, a manifold header positioned beside the path of the carrier, a longitudinally movable connection between the plenum chamber and the manifold header, exhaust fan means for the manifold header, and hood elevating means associated with the vertical movement of the ladle adapted to maintain the hood in close, fume entraining proximity to the mouth of the ladle.

2. A foundry carrier as set forth in claim 1 wherein the vertically movable connection comprises a reach of a flexible belt forming one wall of the plenum exhaust chamber, and a conduit connected to the belt around an opening formed in said belt, said conduit being in open communication with the interior of the hood.

3. A foundry carrier as set forth in claim 2 wherein the hood has a centrally positioned, downwardly opening fume exhaust tunnel, and the conduit is connected to an opening in the hood in communication with the tunnel.

4. A foundry carrier as set forth in claim 1 wherein the fume hood is guided for gravity conditioned, vertical movement on the frame and has an operating bracket mounted thereon, and projecting into the path of the hot metal ladle.

5. In a foundry carrier as set forth in claim 4 wherein the hood has a number of corner positioned guide sleeves, and vertical guide rods mounted on the frame and freely passing through the sleeves.

6. A foundry carrier as set forth in claim 5 wherein the lower ends of the guide rods are mounted on the frame by brackets, said brackets providing stop means locating the lowermost position of the fume hood.

7. In a foundry carrier as set forth in claim 1 wherein the manifold header comprises a slotted opening normally closed by contacting flexible lips and having entrance and exit doors thereon for sliding engagement with a plow that is in communication with the interior of the upstanding plenum chamber.

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