United States Patent

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[73] Assignee **Harris-Muff, Inc.**

[54] **FOUNDRY MOLD VENTILATION SYSTEM**
3 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** ..... **98/115 R,** 164/253, 164/410, 266/13
[51] **Int. Cl.** **F23j 11/08,** B22d 45/00
[50] **Field of Search** ..... 164/410, 254, 57, 144, 61, 253; 98/115, 115 VM; 266/13, 15; 68/209; 314/26, 28

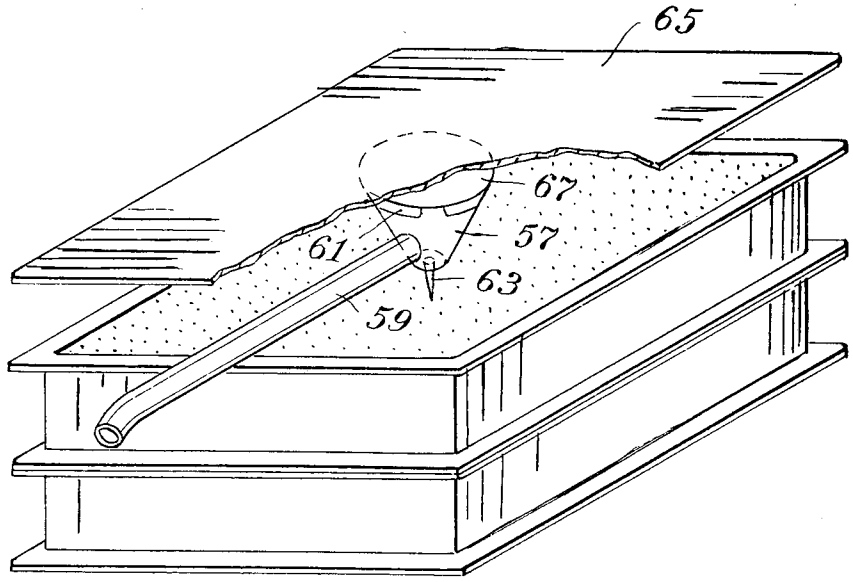
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Attorney—Woodcock, Washburn, Kurtz & Mackiewicz

ABSTRACT: A technique for removing steam, smoke and fumes given off by a foundry mold during cooling of poured metal wherein each mold within a foundry is individually vented through either a vacuum hose connection with an exhaust system permanently built into the foundry or by an individual mold self-contained collection device. Several specific devices are disclosed which capture the fumes and smoke immediately above and around the mold.



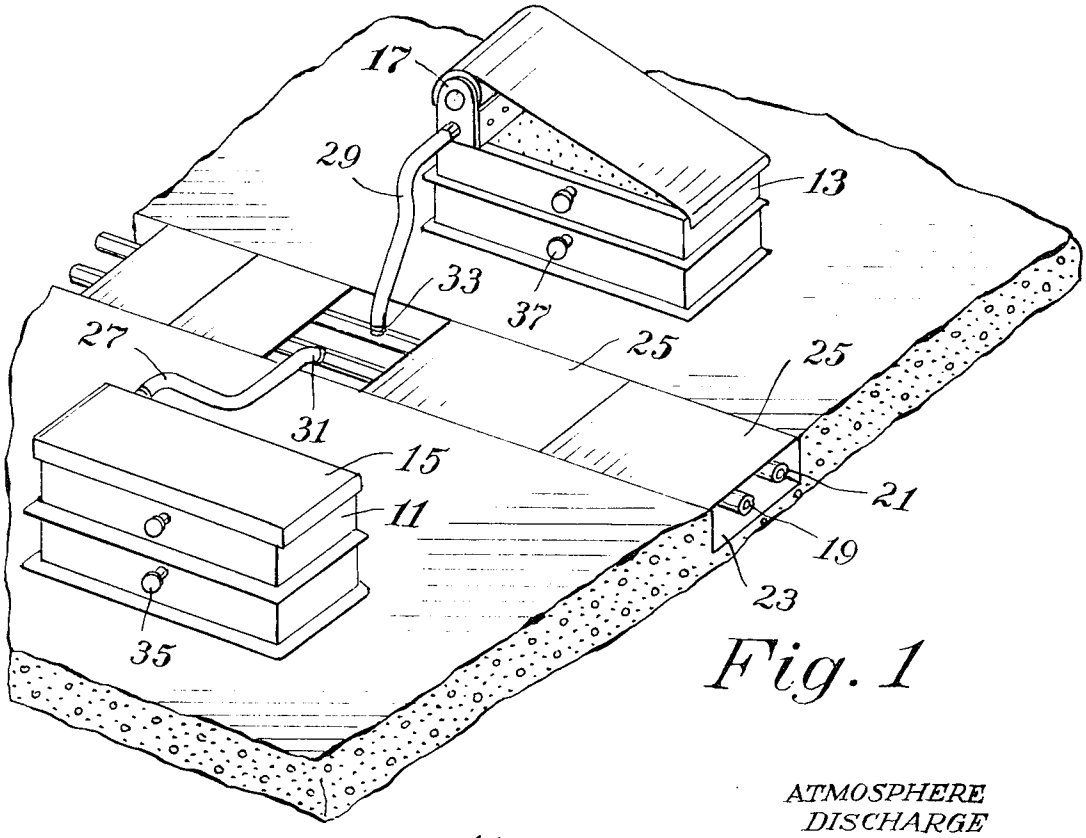


Fig. 1

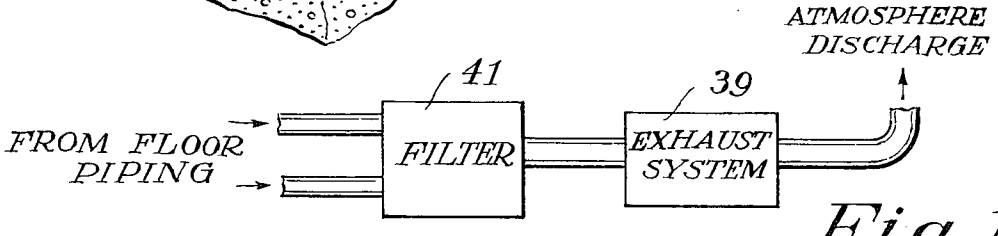


Fig. 1A

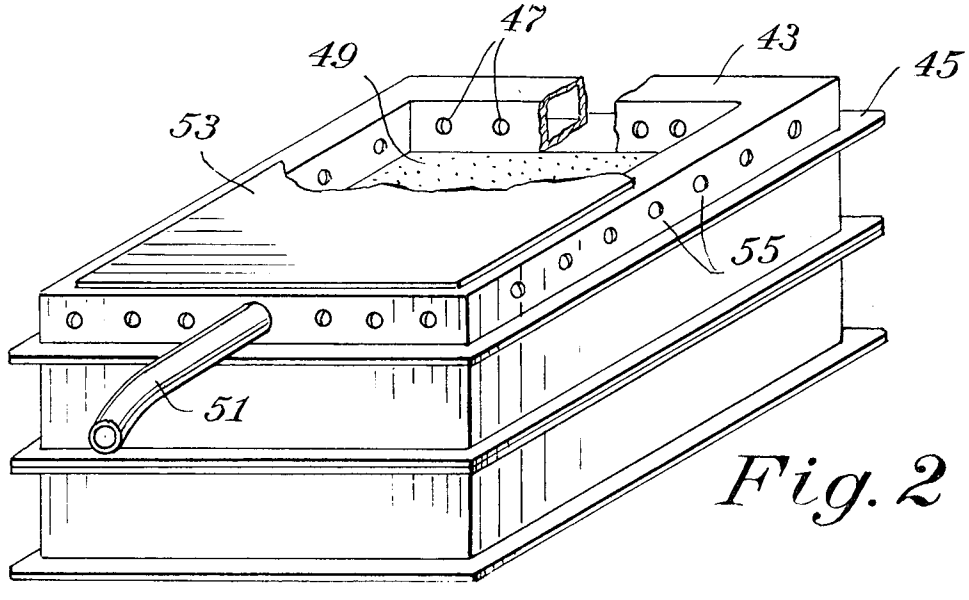


Fig. 2

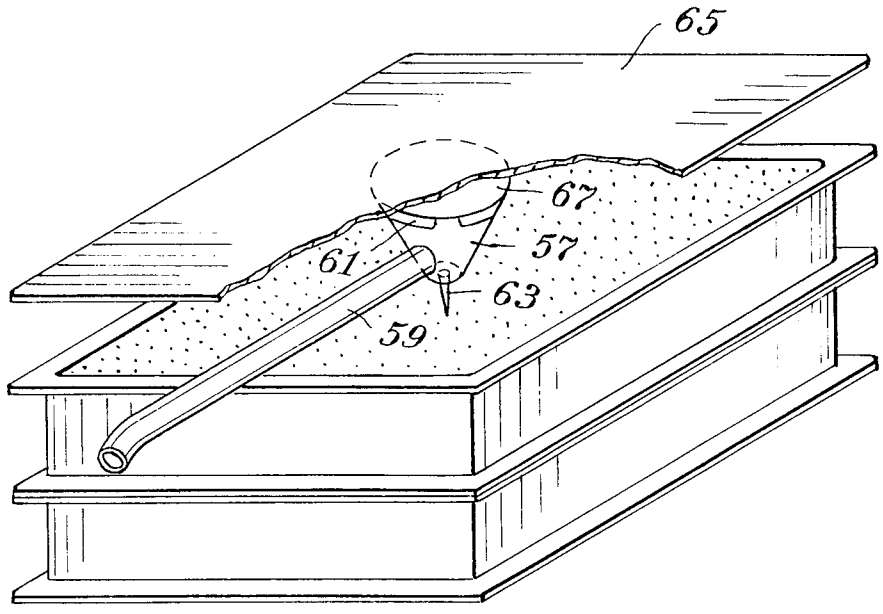


Fig. 3

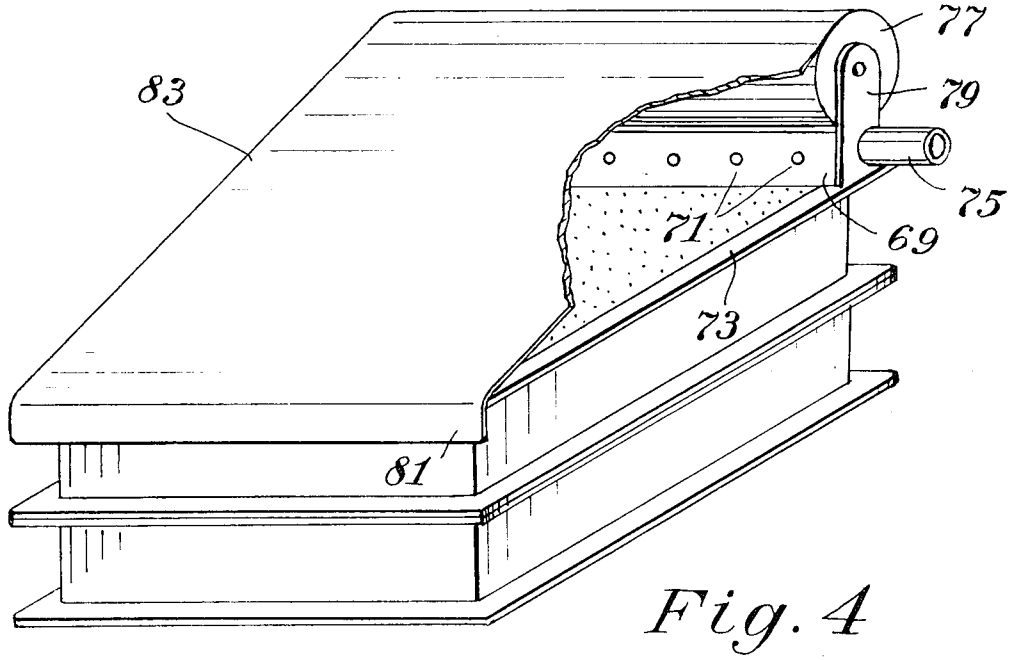


Fig. 4

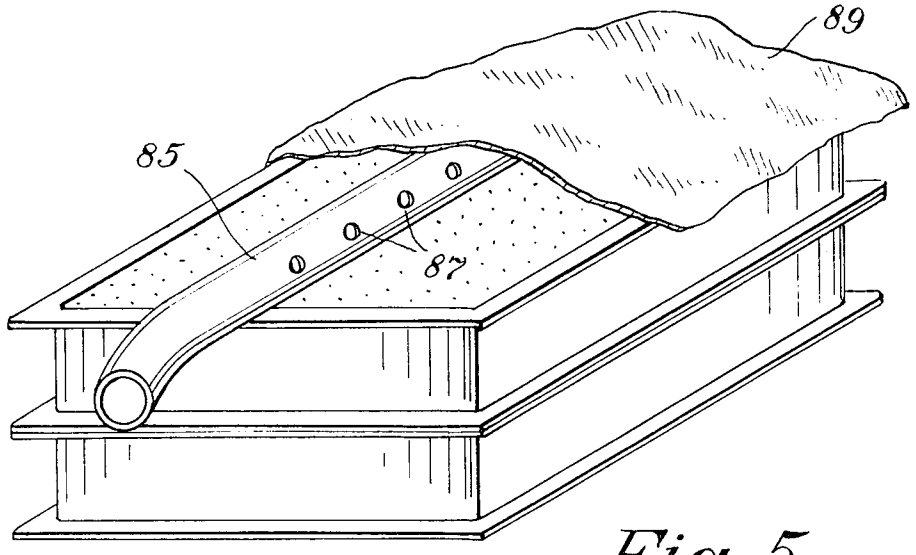


Fig. 5

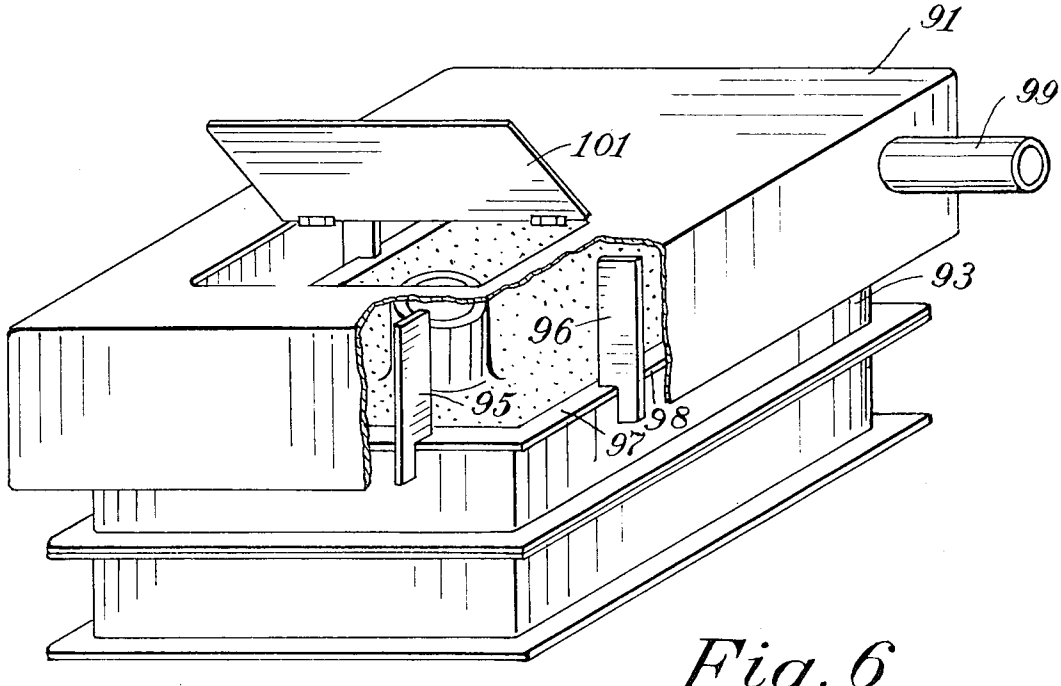


Fig. 6

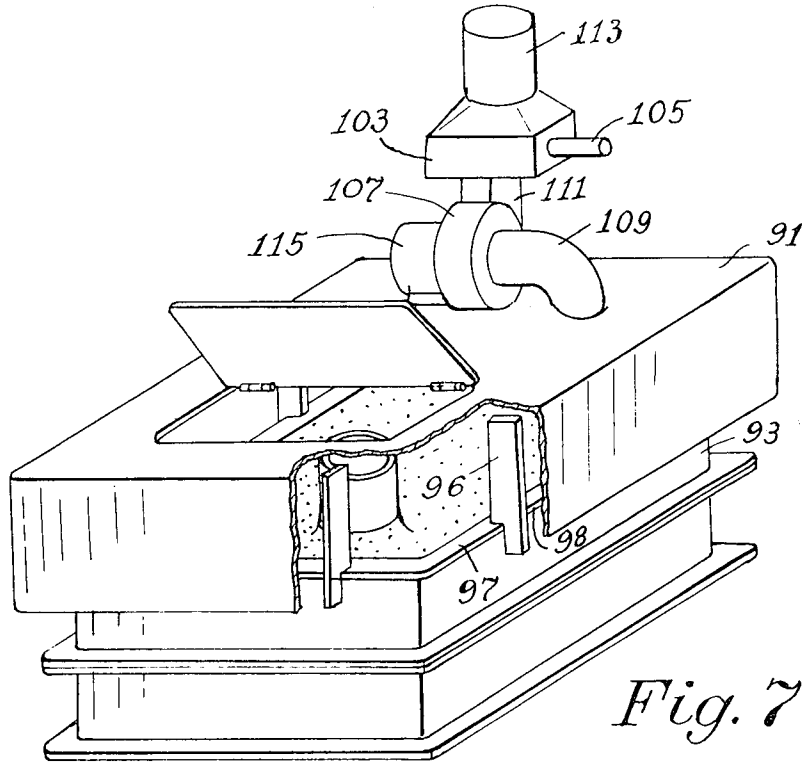

113
103
105
107
111
109
115
91
93
96
98
97

Fig. 7

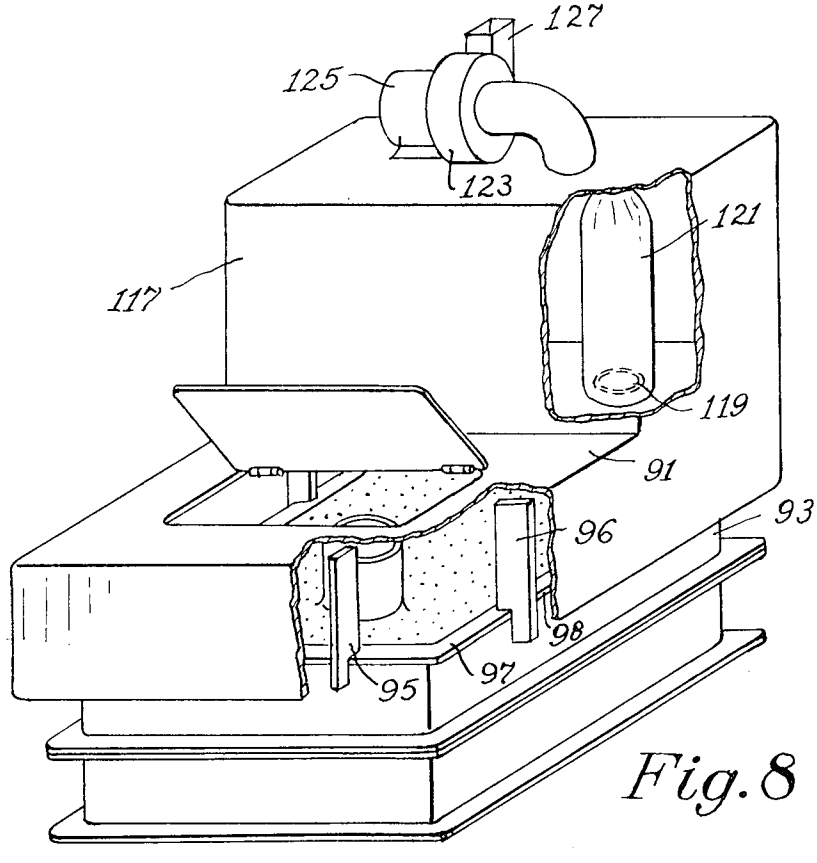

127
125
123
121
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119
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95

Fig. 8

FOUNDRY MOLD VENTILATION SYSTEM

BACKGROUND OF THE INVENTION

This invention relates generally to metal founding and more specifically to a method and apparatus for venting smoke and fumes from foundry molds.

The usual foundry includes a large open area with a number of molds of various sizes spaced throughout. As in other factory situations, standards of tolerable in-plant air pollution are increasing and foundry operators are faced with the necessity of cleaning the foundry atmosphere in order to improve working conditions. A primary source of such air pollutants is the foundry mold itself which gives off steam, smoke and fumes after pouring of the metal and during the cooling thereof. The molding material is typically silica sand, zirconite sand, chamotte, olivine, or similar granular refractory material bonded together by clays, bentonites, resins, oils or other organic or inorganic binders. The molding material is usually contained at the e sides by a metal box, generally referred to as a flask. When hot molten metal is poured into a mold formed of such materials, the binders and other organic and inorganic materials, including water, are burned or distilled off, releasing various pollutants into the foundry atmosphere. Most all of the pollutants escape directly from the top of the molding material but a portion may pass through joints along the sides of the flasks and into the foundry atmosphere. The emission of pollutants continues until the metal has sufficiently cooled which may be from one-half hour under certain conditions up to several hours or more under other conditions.

One possible way of removing these pollutants from the foundry atmosphere is to install hoods with associated exhaust fans over areas where the molds are left to cool. The pollutants gathered in such a manner are collected by a device such as a bag house, wet scrubber, etc., or where conditions permit, the pollutants are merely discharged into the atmosphere outside the foundry. In many foundry installations, this method may have serious disadvantages. One disadvantage is a restriction placed upon the areas of the foundry in which the molds may be cooled to those locations that are hooded. It is generally impractical and very expensive to install enough hoods to give a complete flexibility wherein a mold may be placed to cool in any convenient location on the foundry floor. A second disadvantage of using hoods exists where cranes and similar overhead equipment must pass over and around a mold pouring area. A hood which extends downward low enough to do an efficient pollutant collecting job will interfere with such overhead equipment movement.

It is always possible to ventilate the entire foundry, or at least the mold pouring area, by making a large number of air changes each hour. However, a great deal of equipment is necessary to handle changes of such a large volume of air. Furthermore, this technique requires providing large quantities of make up air to replace the exhausted polluted air. When the outside atmosphere is colder than a suitable temperature for working inside the foundry, added equipment becomes necessary to heat the makeup air. The equipment and energy costs become very high especially for a foundry located in a cold climate.

Therefore, it is a primary object of this invention to provide a venting system for adequately removing pollutants from foundry molds during pouring and cooling without extraction of large quantities of heated air from the foundry.

It is also an object of this invention to provide a venting system which does not interfere with the movement of overhead cranes necessary to move molds and other equipment from place to place.

It is a further object of this invention to provide a mold venting system of high efficiency which maintains the pollutant level in the atmosphere within the foundry at very low levels.

SUMMARY OF THE INVENTION

These and additional objects are accomplished according to the present invention wherein pollutants are captured immediately above and around each mold by portable apparatus which draws air from a volume immediately above and around the mold thereby drawing therewith pollutants given off from the mold. The pollutants are captured by either rapid velocity airflow across the normal ascending path of such pollutants (air curtain), or by use of a baffle, hood or other solid pollutant deflecting device across such a path, or a combination of both techniques.

According to one aspect of the present invention, each individual mold venting device communicates with a central foundry exhaust system. Vacuum receptacles may be conveniently located throughout the cooling area of the foundry, such receptacles being connected with the central exhaust system by permanently installed piping. A portable venting device is placed onto the mold either before or immediately after pouring molten metal into the mold, depending upon whether the specific venting device utilized interferes with the pouring. A flexible hose is connected between the venting device and a vacuum receptacle closest to the mold.

According to another aspect of the present invention, each individual mold venting device has attached thereto its own pollutant collection or removal apparatus, thereby making the entire system self-contained and portable for each mold. In one embodiment, the pollutant collection device includes a fan for drawing air across the mold and through the venting device into a bag house, wet collector, precipitator or similar filtering device. The filtered air is discharged into the foundry atmosphere. In another embodiment, the pollutant collection device includes an afterburner to consume the smoke and fumes drawn from a volume immediately above the mold.

In one form of the venting device, a hollow tube is formed in a rectangular shape to approximately match the upper flask surfaces and is placed thereon to provide a ring around the sand mold. Perforations are provided in both the inner and the outer surfaces of the rectangularly shaped tube for drawing air and pollutants therethrough from both the sand mold and the outside of the flask. The sand mole area may be covered by asbestos or some other fireproof material by laying the same across the rectangularly shaped tube for containing the pollutants escaping from the sand mold through the top thereof.

In a second form of the venting device, an air collection chamber is attached to an end of the vacuum hose and has therein a plurality of ports through which air and emitted pollutants are drawn. One or more legs or spikes are attached to the bottom of the chamber for contacting the mold to support chamber. A baffle cover may also be employed to gather the rising pollutants and is rigidly attached to the top of the chamber.

In a third form of the venting device, a perforated tube connected to an end of the vacuum hose has attached thereto a roll of asbestos or other flexible heat resistant material suitable for acting as a cover over a sand mold. This perforated tube and roll cover assembly is placed upon an upper surface of one side of the flask with the asbestos drawn from the roll and attached to the opposite side of the flask to serve as a cover therefor.

In a fourth form of the venting device, a perforated tube is laid across the flask and supported by the upper surfaces thereof. A flexible heat-resistant cover of a material such as asbestos may then be draped over the entire upper flask and sand mold area over the perforated tube.

In a fifth form venting device, a metal box is formed to sit on the top of the flask and hang sufficiently thereover to provide a baffle to the normal rise of the pollutants from the sand mold area and those escaping from the sides of the flask. A vacuum hose is connected to the boxlike baffle for drawing air and trapped pollutants away from the mold area. With this type of baffle, the air velocity drawn by the vacuum system need not be so great as in certain of the other specific devices which do not include a complete mold cover.

For a more detailed disclosure of the invention and for further objects and advantages thereof, reference should be had to the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 and 1A illustrate one aspect of the present invention wherein a plurality of foundry molds are vented by individual venting devices through a central foundry vacuum system;

FIG. 2 shows one embodiment of a foundry mold venting device according to this invention;

FIG. 3 shows another embodiment of a venting device according to the present invention;

FIG. 4 illustrates yet another embodiment of a venting device according to the present invention.

FIG. 5 shows still another embodiment of a venting device according to the present invention;

FIG. 6 shows a further embodiment of a venting device according to the present invention.

FIG. 7 shows a modification of the venting device illustrated in FIG. 6 according to another aspect of the present invention.

FIG. 8 shows another modification of the venting device illustrated in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates two foundry molds 11 and 13 which include attached to the top thereof venting devices 15 and 17. These venting devices are portable and placed upon the top of a flask either before or immediately after molten metal is poured into the mold within the flask and left to cool. The foundry cooling area may be equipped with a series of vacuum pipes 19 and 21 lying beneath the surface of the foundry floor in a trough 23 which is covered with removable plates 25. The pipes 19 and 21 have a plurality of receptacles therealong, preferably quick connecting hose connections. Venting devices 15 and 17 preferably also have quick connecting hose connections so that after the molten metal is poured and the venting devices are placed atop the flasks, hoses 27 and 29 are connected, respectively, between the venting device 15 and a receptacle 31, and between the venting device 17 and a receptacle 33.

It may be noted that flasks generally contain attachments for overhead lifting cranes, such as the attachments 35 and 37 illustrated. When the flasks are to be moved, the portable nature of the venting devices allows their removal therefrom to make the moving job easier. Furthermore, there is no ventilation equipment suspended from the foundry structure to interfere with movement of an overhead crane.

Other forms of permanent in-plant vacuum piping systems may be used, other than that illustrated in FIG. 1, with equally successful results. For instance, if a foundry has a number of columns extending upward from the floor, a vacuum system could be installed in the overhead with a pipe extending down each column in the mold cooling area to a location near the floor where a vacuum receptacle is located. In either case, it is desirable to have vacuum outlets permanently installed in convenient, out-of-the-way locations in a foundry area which are close enough together so that a hose connection from a mold venting device to a receptacle remains short, thereby avoiding an obstructing network of hoses lying over s substantial portion of the foundry floor when a number of molds are being cooled and vented.

The vacuum piping throughout the plant is connected with a central exhaust system 39, as schematically illustrated in FIG. 1A. Preceding the pump, in the path of the flow of air and pollutants from the vacuum piping in the plant, is a filter 41 of some convenient type to remove undesirable pollutants from the mixture.

A specific form of the venting device is illustrated in FIG. 2 wherein a hollow tube 43 is formed in a closed path with a shape substantially conforming with a top surface 45 of the flask so that the tube is supported thereby. The tube is perforated on the inside of the closed rectangle by a plurality of holes 47 to draw air across the open sand mold 49 through the tube 43 and out through a vacuum hose 51, thereby exhausting pollutants rising from the sand mold 49. For greater efficiency in removing such pollutants, a cover 53 of heat-resistant material such as asbestos is installed or loosely laid across the tube 43 to trap the rising pollutants from the sand mold area and thereby guide them into the air flow through holes 47 into the vacuum system. The cover 53 is not necessary if the velocity of air drawn through the holes 47 is great enough to draw the rising pollutants into the vacuum system before the pollutants rise high enough to be beyond the effect of such an air curtain created by the plant's vacuum system.

A plurality of holes 55 may also exist on the outside of the rectangularly shaped hollow tube 43 to draw air therethrough and also any pollutants which may escape from the sides or from the underneath of the mold flasks. As such pollutants normally rise upward, the airflow through the holes 55 draws a significant portion of the pollutants into the vacuum system.

In FIG. 3, a different form of a venting device is illustrated wherein an air collection chamber 57 is attached to the end of a vacuum hose 59 and has a plurality of ports 61 for drawing air and pollutants into the vacuum system. This form of venting device is attached to the sand mold itself by one or more spikes 63 which penetrate the mold under application of a downward force upon the air collection chamber 57. Alternative to the use of mold penetrating spikes, one or more legs may be attached to the underside of the chamber 57 for resting the chamber upon the mold without penetration. To the top of the chamber 57 is attached a rigid baffle plate 65 constructed of heat resistant material which blocks the ascension of pollutants from the mold in a manner that they are caught up by the airstream flowing into the ports 61. Chamber 57 is made a conelike shape so that only a small underneath area contacts the sand mold but a larger top area 67 is available for making a rigid mechanical connection to the baffle 65. The ports 61 are placed near the upper surface of the collection chamber 57 since this has been found to cooperate with the baffle 65 to produce a preferred air flow which gathers most of the pollutants without allowing them to escape into the foundry atmosphere. It should also be noted that the venting device illustrated in FIG. 3 has a somewhat wider range of applications than the venting device illustrated in FIG. 2, since it may be made to fit a larger variety of mold sizes.

Another specific form of a venting device according to the present invention is illustrated in FIG. 4 wherein a hollow tube 69 with a plurality of holes 71 is cut to a length convenient to fit along the top surface of one end of a flask 73. The hollow tube is connected to a vacuum hose 75 for drawing air and pollutants through the holes 71 into the plant's vacuum system. A roll 77 of flexible heat resistant material (preferably asbestos sheet material) is rotatably attached to a bracket 79 which in turn is solidly fixed to the hollow tube 69. In using such a device, the tube 69 is clamped to the flask with the asbestos cover completely rolled up. The asbestos material is then unrolled and affixed to the opposite end 81 of the flask to form a cover 83 for containing the rising pollutants and direct them into the air flow through the holes 71 instead of into the plant atmosphere. A specific venting device of this form has a wide degree of flexibility in the sizes of foundry molds that may be fitted, and further is a very small unit which is complete in itself as a venting device for storage when the asbestos cover is in its rolled form.

The venting device in FIG. 5 utilizes a hollow tube 85 having a plurality of holes 87 along a length of the tube which lies across the flask. To trap gases escaping from the sand mold, an asbestos cover 89 is laid across the tube 55 and the flask. The tube 55 is preferably placed across the long dimension of the flask, if the flask is rectangular in shape as shown herein. This venting device has an advantage of a high degree of flexibility as to the different types and shapes of flasks with which it may be used.

An alternative venting device is illustrated in FIG. 6 to utilize a boxlike structure 91 (hood) which is shaped to fit a specific flask 93 and be supported by the top surface thereof. The hood 91 is equipped with a number of ribs such as ribs 95 and 96 for supporting its weight upon the top surface 97 of the flask. The hood 91 is shaped large enough and the supporting ribs such as the ribs 95 and 96 are shaped such that the sides of

the hood **91** overlap the edges of the flask along its side to provide an opening **98** for air to be drawn up into the hood and through the hose connection **99** by the foundry's exhaust system. This overhang and its effect upon airflow also helps gather any pollutants which may escape from the sides of the flask **93** by drawing them in through the hood **91** and out through the hose connection **99**. For access to the sand mold area after the cover **91** has been placed on the flask, a hinged cover **101** is provided which is normally held closed but is useful as a means for inserting materials during cooling, such as exothermic materials.

The cover illustrated in FIG. **6** has the advantage that it traps rising pollutants completely and thus does not need a very high air velocity around the mold in order to draw the pollutants into the airflow. However, the specific venting device is limited somewhat as to the range of flask sizes that may be vented.

According to another aspect of the present invention, the venting devices may have attached thereto their own pollutant collection or removal apparatus as an alternative to use of a central exhaust system shown in FIGS. **1** and **1A**. Referring to FIG. **7**, the venting device of FIG. **6** is modified to include an afterburner **103** attached to the hood **91**. A gas line **105** supplies fuel to the afterburner **103** from a gas outlet (not shown) in the foundry located conveniently to the mold. A fan **107** draws air across the mold to draw the rising pollutants into the hose connection **109**. The air-pollutant mixture is directed into the afterburner **103** by a duct portion **111** which is connected to the fan **107**. The after-bruner **103** is adjusted to effectively consume the smoke and fumes drawn from immediately above the mold. Essentially nonpolluted air is discharged upward from an exhaust duct **113**. The fan **107** is driven by an appropriate electric motor **115**. The advantage of this self-contained unit is its portability with only small gas and electric connections to be made to foundry receptacles.

The requirement for foundry gas receptacles can be reduced or eliminated by use of a self-contained venting and filtering device according to FIG. **8** which also is a modification of the venting device shown in FIG. **6**. Attached to the hood **91** is a bag house **117**. Within the top surface area of the hood **91** which is covered by the bag house **117** is an opening **119** with provisions for attaching a bag filter **121**. The bag filter **121** is constructed of a material through which air may be drawn by a fan **123** from the volume below the hood **91**. Particulate matter drawn off the mold by this airflow is trapped in the bag filter **121**. The fan **123**, driven by an appropriate electric motor **125**, discharges the filtered air into the foundry atmosphere through an exhaust duct **127**.

It should be understood that the specific venting devices described herein other than the device shown in FIG. **6** may also be modified to include the self-contained filtering elements according to FIGS. **7** or **8**.

It shall be understood that the invention is not limited to the specific arrangements shown, and that changes and modifications may be made within the scope of the appended claims.

We claim:

1. A foundry mold venting device, comprising,

a gas collecting chamber adapted for connection at an end of a flexible hose, said chamber including a plurality of openings through which air may be drawn,

at least one spike rigidly attached to an underneath side of said chamber, and

a rigid baffle sheet fixed to a top side of said chamber.

2. A foundry mold venting device according to claim **1** wherein said chamber is generally of a conical shape between a small underside and a wider top area, and wherein said openings are located around said conical shape near the top side thereof.

3. A portable foundry mold venting device, comprising,

a length of hollow tube with perforations therethrough along one side thereof, and

a roll of flexible heat resistant sheet material rotatably mounted upon said perforated tube.

* * * * *