CONTAMINANT COLLECTION SYSTEM
FOR SHAKER TABLE

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ABSTRACT

For use with a shake-out system for removing mold sand from metal castings, the system including an elongated shaker table defining a plurality of positions therealong for receiving castings and a plurality of conveyors for delivering castings to the table and dumping them onto the positions, a contamination collection system comprising an elongated main exhaust duct extending above and along the shaker table, an elongated main support frame for supporting the duct above the table, a plurality of hoods mounted on opposite sides of the frame and adjacent, respectively, the table positions and fluid motors for moving at least some of the hoods from their positions blocking the conveyors to positions providing access to the table positions. The hoods on opposite sides of the table positions cooperate, in their downwardly extending positions, to define work spaces therebetween and above the shaker table and to exhaust those work spaces because the hoods are connected to the said main exhaust duct.

12 Claims, 7 Drawing Figures
CONTAMINANT COLLECTION SYSTEM FOR
SHAKER TABLE

The present invention relates to contamination collection systems and more particularly, to the provision of a contamination collection system for a shake-out system for removing mold sand from metal castings.

Conventionally, shake-out systems include an elongated vibratory shaker table which defines a plurality of positions therealong for receiving castings, a plurality of conveyor means for delivering castings to the table and dumping them onto said positions, a plurality of hood means mounted above the table to be over, respectively, the positions, a main exhaust duct, and individual duct means for connecting the various hood means to the main exhaust duct. Each of the hood means conventionally includes a flexible cover or curtain in its side wall and which is raised so that the castings can be introduced into the space exhausted by the hood means. Such shaker tables conventionally are spring mounted and a drive is provided for vibrating the shaker tables to shake and tumble the castings to remove the mold sand therefrom. Conventionally, the bottoms of the shaker tables are made from a screen material such that the mold sand will drop through the bottom of the shaker table and onto a belt conveyor running along and under the shaker table.

It will be appreciated that such a shake-out system is extremely dusty and that many air contaminants such as smoke, steam, fumes, and small particles of siliceous materials or oxides are produced as a result of shaking and tumbling the castings. It has been discovered that the layer of mold sand adjacent the metal surface or surfaces of the castings is quite poisonous. It is imperative, therefore, to provide a contamination collection system which is much more effective than conventional collection systems of the type above described.

It is an object of my present invention to provide such a contamination collection system wherein the improvement comprises an elongated main frame extending along and above the table, the main exhaust duct being mounted on the frame to extend along and centrally above the table. The main exhaust duct has a larger end adjacent one end of the table and a smaller end adjacent the opposite end of the table with the duct being reduced in size as it progresses from its larger end to its smaller end to provide progressively smaller portions above, respectively, the table portions. The larger end is connected to the blower means for exhausting the main duct. Each said hood means, then, includes a first hood mounted on one side of the main frame to extend downwardly toward one longitudinal side of the table and a second hood mounted on the opposite side of the main frame to extend downwardly toward the opposite longitudinal side of the table. The said first and second hoods cooperate, in their downwardly extending positions, to define a work space therebetween and above the shaker table position and to exhaust contaminants away from the work space. At least one of the first and second hoods is mounted on the frame for movement between its said downwardly extending position to an upper position to provide access to the work space from the conveyor which delivers the castings. The said individual duct means includes an individual duct connecting each hood to the portion of the main duct thereabove with the individual duct for the movable hood being movable to accommodate the movement of the hood between its said positions. Then, means such as fluid motors are provided for moving the movable hood between its said positions.

In this description and in the claims, the term "movable." when used to describe a duct, means that the duct is constructed to permit the hood to which it is connected to be movable. Several types of ducts may be used to accommodate the movable hoods. Flexible ducts and ducts which have one or more flexible sections may be used. Further, ducts having telescoping sections and swivel sections may be used.

Preferably, each hood is mounted on the main frame for swinging movement between its downwardly extending position and an upper position about a generally horizontal pivot axis extending along and above the shaker table, the pivot axes for the hoods being on the opposite sides of the table and on opposite sides of the vertically extending plane including the axis of the said main exhaust duct. The pivot axes are preferably parallel to the said vertical plane. Each hood preferably includes an outer shell defining a cavity opening toward the vertical plane and the shaker table and an inner cover closing the cavity. The said inner cover is preferably generally planar and has a plurality of laterally narrow, longitudinally elongated slots therein parallel to the pivot axis for the hood. The individual duct for the hood is connected to the central portion of the outer shell.

Since the pivot axes for the cooperating hoods are laterally spaced apart and on opposite sides of the centrally located vertical plane and since the inner covers of the hoods extend downwardly and outwardly toward the longitudinal sides of the shaker table, the work space defined by the hoods is a trapezoidally-shaped space, laterally wider at the bottom than at the top. The laterally narrow, longitudinally elongated slots, together with the proportioned main duct provide an accelerated air movement at the point of entry to each hood. Importantly, it is this generally evenly distributed air movement and the velocity of the air movement which picks up the contaminants and carries them away to the collection system.

Another object of my present invention is to provide control valve means for controlling the fluid motors which lift the movable ducts and then to provide means cooperatively associated with the conveyor means for automatically operating the control valve means. In such a manner, I can cause the movable ducts to be raised automatically when castings are to be dumped into the work space bounded in part by the movable duct.

I have provided, therefore, a completely integrated system including a mounting frame which supports the proportioned and sized main exhaust duct, the movable hoods, the individual ducts and the means for moving the hoods. Such an integrated approach to solving the problems of close capture of contaminants is an important accomplishment. The system of the present invention involves close capture of the contaminants, relatively reduced air flow, interaction of the contamination collection system with the work process, and integration of the total system approach. Even though the air flow is reduced, the contaminant collection efficiency is increased.

Other objects and features of my present invention will become apparent as this description progresses.

To the accomplishment of the above and related objects, this invention may be embodied in the forms illus-
trated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific constructions illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:
FIG. 1 is an end view of the contaminant collection system of the present invention;
FIG. 2 is an exploded perspective view of one of the hoods used in the collection system;
FIG. 3 is a brief diagram of an air cylinder control system for use in lifting the hoods;
FIG. 4 is a plan view of the collection system;
FIG. 5 is an elevational view of the collection system;

FIG. 6 is an end view of a slightly different embodiment of the present invention; and
FIG. 7 is a diagrammatical view showing the plurality of conveyors which feed the shaker table associated with the collection system.

Turning now to the drawings, and particularly to FIGS. 1-5 and 7, it will be seen that I have shown an elongated horizontally extending vibratory shaker table 10 of the type having a screen bottom 12, longitudinally extending side edge 14 and opposite longitudinally extending side edge 16. Such shaker tables are conventional and commercially available. The tables are conventionally mounted upon springs (not shown) and drivingly connected to drivers (not shown) which vibrate the table in the direction of its length. Castings with the mold sand thereon are loaded over the left-hand side 14 (FIG. 1) and conventionally removed from the right-hand side 16. While on the table, the castings are vibrated and tumbled to knock the mold sand therefrom.

Conventionally, the mold sand removed from the castings falls through the screen bottom 12 onto a belt conveyor 20 which runs along and underneath the bottom 12 as illustrated in the end view of FIG. 1. The belt conveyor 20 is shown mounted upon brackets 22, 24 which, in turn, are conventionally mounted upon support legs (not shown).

The collection system comprises a main frame including a plurality of upstanding legs 26, 28. In the embodiment of FIGS. 1-5, there are four such legs 26 and four such legs 28 spaced longitudinally along and on opposite sides of the shaker table 10. Extending between and mounted upon the upper ends of adjacent legs 26, 28 are cross braces 30. Extending upwardly from the central portion of each cross brace 30 is a column or post 32. A plate, such as indicated at 36 may be mounted upon the upper ends of the columns 32 to extend longitudinally along and above the central portion of the shaker table 10. The main frame is preferably separate from the shaker table 10 and belt conveyor 20.

As best seen in FIGS. 1 and 5, angle braces 42, 44 extend upwardly and outwardly from the plate 36 at five locations along its length. Then, a cross brace 46 joins the upper ends of the braces 42, 44 to provide a rigid support frame structure. Each such cross brace 46, as will be hereinafter described, locates a work station or work space above the shaker table 10.

The improvement of the present invention comprises a main exhaust duct 50 having a large end portion 52 adjacent the right-hand end (FIGS. 4 and 5) of the shaker table 10 and a small end portion 54 adjacent the opposite end of the shaker table. The duct 50 is progressively reduced in size as it progresses from its right-hand end to its left-hand end to provide the cylindrical reduced portions 56, 58, 60 and the conical transition portions or reducing portions 62, 64, 66, 68 above and adjacent each work station. The duct 50 is progressively reduced in size as it progresses from work station to work station in order to keep the velocity of the air movement at the far left-hand stations generally equivalent to the velocity of the air movement at the far right-hand stations. Of course, the large end or the right-hand end of the duct is connected to the blower means for exhausting the duct.

I show a plurality of support posts 72 supporting the duct 50 and its progressively reduced sections upon the plate 56. It will be appreciated, as viewed in FIG. 1, that the axis of the duct 50 lies in a vertically extending plane which extends along and through the center of the shaker table 10.

The belt conveyor 20 which is under the shaker table may carry the mold sand removed from the castings to another such belt conveyor indicated at 76 (FIG. 7) which conveys the sand as indicated by the arrow 78 to a storage pit for reuse. Then, as shown in FIG. 7, five sets of conveyor tracks 80 may terminate, respectively, at each of the work stations on the shaker table 10 with tilttable track sections 80a, i.e., track sections on tiltable tables 86. In the illustrative embodiment, carts 82 may be mounted upon the conveyor tracks to move toward and away from the shaker table and to carry castings such as indicated by the reference numeral 84. When such carts 82 are in dumping positions on the tiltable tables 86 supporting the track sections 80a, the carts themselves may be tilted downwardly to dump the castings onto the shaker table.

While I have shown tracks 80 and carts 82, the castings may be carried upon belt conveyors or other types of conveyors to the shaker table. The castings may be carried upon carts such as indicated at 82, but which do not tilt. Then, other devices may be used to push the castings off the carts onto the shaker table.

In the present invention, the hood means adjacent each shaker table position, i.e., adjacent each dump station 86, includes a first hood 92a, 92b, 92c, 92d, 92e mounted on one side of the main frame to extend downwardly toward one longitudinal side 14 of the shaker table 10 and a second hood 94a, 94b, 94c, 94d, 94e mounted on the opposite side of the main frame to extend downwardly toward the opposite longitudinal side 16 of the shaker table. As best seen in FIGS. 1 and 6, the hoods 92, 94 are mounted on the opposite sides of the longitudinally extending plate 36 for pivotal movement about pivot axes 95, 96 between their downwardly extending positions shown in solid lines and their upper positions shown in broken lines. The pivot axes 95, 96 are parallel, horizontally extending and on opposite sides and parallel to the said vertical plane which includes the axis of the main duct 50. In the illustrative embodiment, the hoods 92, 94, in their downwardly extending positions, extend downwardly and outwardly about 30° from the said vertically extending plane. The hoods move about 60° about the said pivot axes 95, 96 to their upper positions shown in broken lines.

An air cylinder 98 is preferably provided to move each hood 92, the cylinder being connected between a bracket 100 at the left-hand end (FIG. 1) of the associ-
ated cross brace 46 and another bracket 102 on the associated hood. A similar air cylinder is provided for each hood 94, each cylinder 104 being connected between a bracket 106 on the right-hand end of its associated brace 46 and a bracket 108 on its hood.

In FIG. 1, I show an air valve 112 connecting an air line 114 to another air line 116 leading to a compressed air source. The air line 114 is shown connected to the cylinder 98. A trip arm 118, for instance, may be used to open the air valve 112 so that compressed air is supplied to the cylinder 98 to retract its piston to raise its hood 92. Such trip arms 118 may be arranged, for instance, to be engaged by the castings 84 as shown in FIG. 1 or by the carts themselves as shown in FIG. 6 or by the action of the dumping table automatically to raise the hoods 92 when castings are to be dumped on the shaker table. It will be appreciated that any number of different types of valving arrangements may be used for controlling the actuation of the air cylinders 98, 104. The manner in which such control is accomplished, and the valves and other equipment for accomplishing such control are well known and need not be discussed, in detail, herein. In FIG. 3, I show a manually operated valve 120 for connecting the line 116 to a cylinder 104. Workmen may operate such a valve 120 to raise each hood 94 to gain access to the work stations.

Each hood is formed to include an outer shell 122 defining a cavity opening toward the said vertical plane and said shaker table and an inner cover 124 closing the cavity. The inner cover 124 is preferably generally planar. In the illustrative embodiment, the inner covers 124 are generally parallel to the pivot axes 95, 96. Each cover 124 is formed to include a plurality of laterally narrow, longitudinally elongated slots 126 which are parallel to the pivot axis for the hood and laterally spaced apart therefrom as best seen in FIG. 2. In other words, the hoods 92, 94 preferably do not have a wide-open mouth, but instead, their mouths are partially closed by the inner covers 124 with the restricted slots 126 therein. The restricted slots serve to accelerate and more evenly distribute the air movement at the point of entry to the hood.

When the hoods are in their downwardly extending positions, as shown in solid lines in FIG. 1, the inner covers 124 of the hoods and the plate 36 define a trapezoidally-shaped work space above the shaker table 10. The dust and other contaminants emanating from the castings are in close proximity to the elongated slots 126 through which air from the work space moves. The inner covers 124 move from their downwardly extending positions at about 30° from the said vertical plane to their upper positions approximately perpendicular to said plane.

In the embodiment of FIGS. 1–5, the hoods 92, 94 are individually connected to the portions of the main duct therefore by means of part flexible ducts 130. In the embodiment of FIG. 6, each individual duct includes a fixed portion 130a connected to the main duct 150 and a retractable portion 130b connected to the hood 92, 94. Each portion 130b is curved about the pivot axis for the hood 92, 94 and it moves upwardly into a correspondingly curved portion 130a.

Various types of movable ducts may be used between the hoods 92, 94 and the main duct 150. For instance, one such movable duct may comprise a swivel joint at the hood, another swivel joint at the main duct and a rectilinear telescoping section between the two swivel joints, the swivel joints accommodating pivotal movement about axes parallel to the pivot axis 95, 96.

In the present invention, the entire contamination collection system is integrated and mounted upon a main frame. In the embodiments of FIGS. 1–5, the main frame includes the support legs 26, 28, braces 30, posts 32, braces 42, 44, 46 and support posts 72, the support legs 26, 28 being spaced along and on opposite sides of the shaker table. In the embodiment of FIG. 6, there is one centrally located support post 134 at each end of the shaker table to support the hood mounting plate 36 and the main duct 50.

1. A claim:

1. For use with a shake-out system for removing mold sand from metal castings, said system including an elongated shaker table defining a plurality of positions therealong for receiving castings, and a plurality of conveyor means for delivering castings to the table and dumping them onto said positions, a contamination collection system comprising an elongated main exhaust duct extending above and along said shaker table, an elongated main support frame for supporting said duct above said table, a plurality of first hoods mounted on one side of said frame adjacent, respectively, said positions, a plurality of second hoods mounted on the opposite side of said frame adjacent, respectively, said positions, said hoods extending downwardly from their points of connection with said frame toward, respectively, the longitudinal sides of said shaker table, the hoods adjacent each position cooperating, in their downwardly extending positions, to define a work space therebetween and above said shaker table and to exhaust said work space, at least some of said hoods being mounted on said frame for movement between their downwardly extending positions and upper positions to provide access to said work spaces from said conveyor means, power means for moving said movable hoods to their upper positions, and duct means for connecting said hoods to said main duct, the duct means connected to said movable hoods being movable to accommodate the hood movement.

2. The invention of claim 1 in which each said movable hood is mounted on said main frame for swinging movement between its said positions about a generally horizontal axis extending along and above said shaker table, said power means for moving said movable hood including fluid motors.

3. The invention of claim 2 including control valve means for operating said fluid motors, means cooperatively associated with said conveyor means for operating said control valve means to raise said movable hoods to provide access when castings are to be dumped onto said table.

4. A shake-out system for removing mold sand from metal castings including an elongated shaker table defining a plurality of positions therealong for receiving castings, a plurality of conveyor means for delivering castings to the table and dumping them onto said positions, a plurality of hood means mounted above said table to be over, respectively, said positions, a main exhaust duct, and individual duct means for connecting said hood means to said main exhaust duct, wherein the improvement comprises an elongated main frame extending along and above said table, said main exhaust duct being mounted on said frame to extend along and above said table, said main duct having a larger end ad-
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jacent one end of said table and a smaller end adjacent the opposite end of said table, said duct being reduced in size as it progresses from its larger end to its smaller end to provide progressively smaller portions above, respectively, said table positions, said larger end being connected to blower means for exhausting said main duct, each said hood means including a first hood mounted on one side of said main frame to extend downwardly toward one longitudinal side of said table and a second hood mounted on the opposite side of said main frame to extend downwardly toward the opposite longitudinal side of said table, said first and second hoods cooperating, in their downwardly extending positions, to define a work space therebetween and above said shaker table position and to exhaust contaminants away from said work space, at least one of said hoods being mounted on said frame for movement between its said downwardly extending position to an upper position to provide access to said work space from said conveyor means, said individual duct means including an individual duct connecting each said hood to the portion of the main duct thereabove, the individual duct for the movable hood being movable to accommodate the movement of the hood between its said positions, and means for moving the movable hood between its said positions.

5. The invention of claim 4 in which each said movable hood is mounted on said main frame for swinging movement between its said positions about a generally horizontal pivot axis extending along and above said shaker table, said means for moving the movable hood including a fluid motor.

6. The invention of claim 5 including control valve means for operating said fluid motors, means cooperatively associated with said conveyor means for operating said control valve means to raise said movable hoods to provide access when castings are to be dumped onto said table.

7. The invention of claim 4 in which said conveyor means include a plurality of conveyors extending transversely to said table and terminating at a point adjacent said one longitudinal side of said table, dump carts movably mounted on said conveyors to carry such castings, said dump carts being arranged to tumble such castings through the spaces occupied by said first hoods when they are in their downwardly extending positions.

8. The invention of claim 7 in which each said first hood is the movable hood, said first hoods being mounted on said main frame for swinging movement between its said positions about a generally horizontal axis extending above and along said shaker table, said means for moving said movable hood including a fluid motor.

9. The invention of claim 8 including control valve means for operating said fluid motors, said conveyor means including means associated therewith for operating said control valve means to raise said movable hoods when castings are to be dumped onto said table.

10. The invention of claim 5 in which said main duct has a center axis extending generally horizontally along and centrally above said table, said pivot axis for said first hoods being spaced apart from and parallel to a vertical plane including said main duct axis, and said pivot axis for said second hoods being spaced apart from and parallel to said vertical plane, said pivot axes being on opposite sides of said vertical plane.

11. The invention of claim 10 in which each said hood includes an outer shell defining a cavity and an inner cover closing said cavity, said inner cover being generally planar and having a plurality of laterally narrow longitudinally elongated slots therein parallel to the pivot axis for said hood, said individual duct for said hood being connected to a central portion of said outer shell.

12. The invention of claim 11 in which said conveyor means include a plurality of conveyors extending transversely to said table and terminating at a point adjacent said one longitudinal side of said table, dump carts movably mounted on said conveyors to carry such castings, said dump carts being arranged to tumble such castings through the spaces occupied by said first hoods when they are in their downwardly extending positions.

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