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Gaw

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[54] **CONTAINMENT OF DUST AND FUMES FROM A METALLURGICAL VESSEL**

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[52] **U.S. Cl.** ..... **266/16,** 98/115 R

[51] **Int. Cl.** **C21c 5/40**

[58] **Field of Search** ..... 122/7 A; 266/13, 15, 16, 266/35, 36 P; 98/115 R

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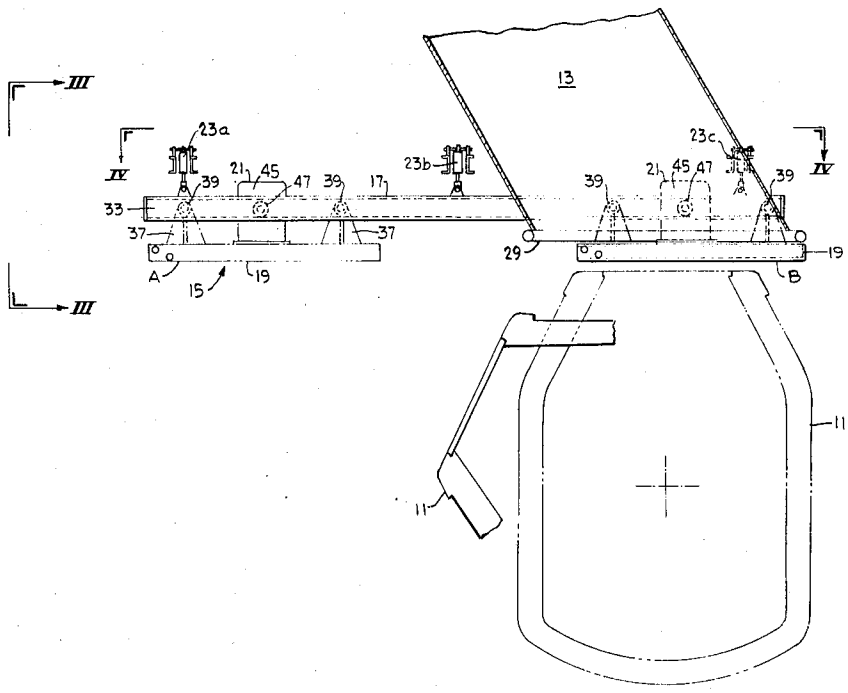
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[57] **ABSTRACT**

A device for use with the exhaust hood of a metallurgical furnace to improve its ability to capture waste gas effluent escaping from the furnace especially when the mouth of the furnace is rotated away from the mouth of the hood for tapping or charging comprises a pair of parallel tracks that are mounted adjacent to the hood and that straddle the mouth of the hood and extend beyond it, a movable closure plate for partially closing and restricting the cross-sectional area of the mouth of the hood that is carried by the tracks and means for moving the closure plate from a position remote from the mouth of the hood to a position adjacent to and partially restricting the cross-sectional area of the mouth of the hood. When the closure plate partially restricts the cross-sectional area of the mouth of the hood there will be an increase in the face velocity, thus drawing the effluent through the unrestricted cross-sectional area of the mouth of the hood so that the effluent from the furnace will be captured and drawn into the hood.

21 Claims, 7 Drawing Figures



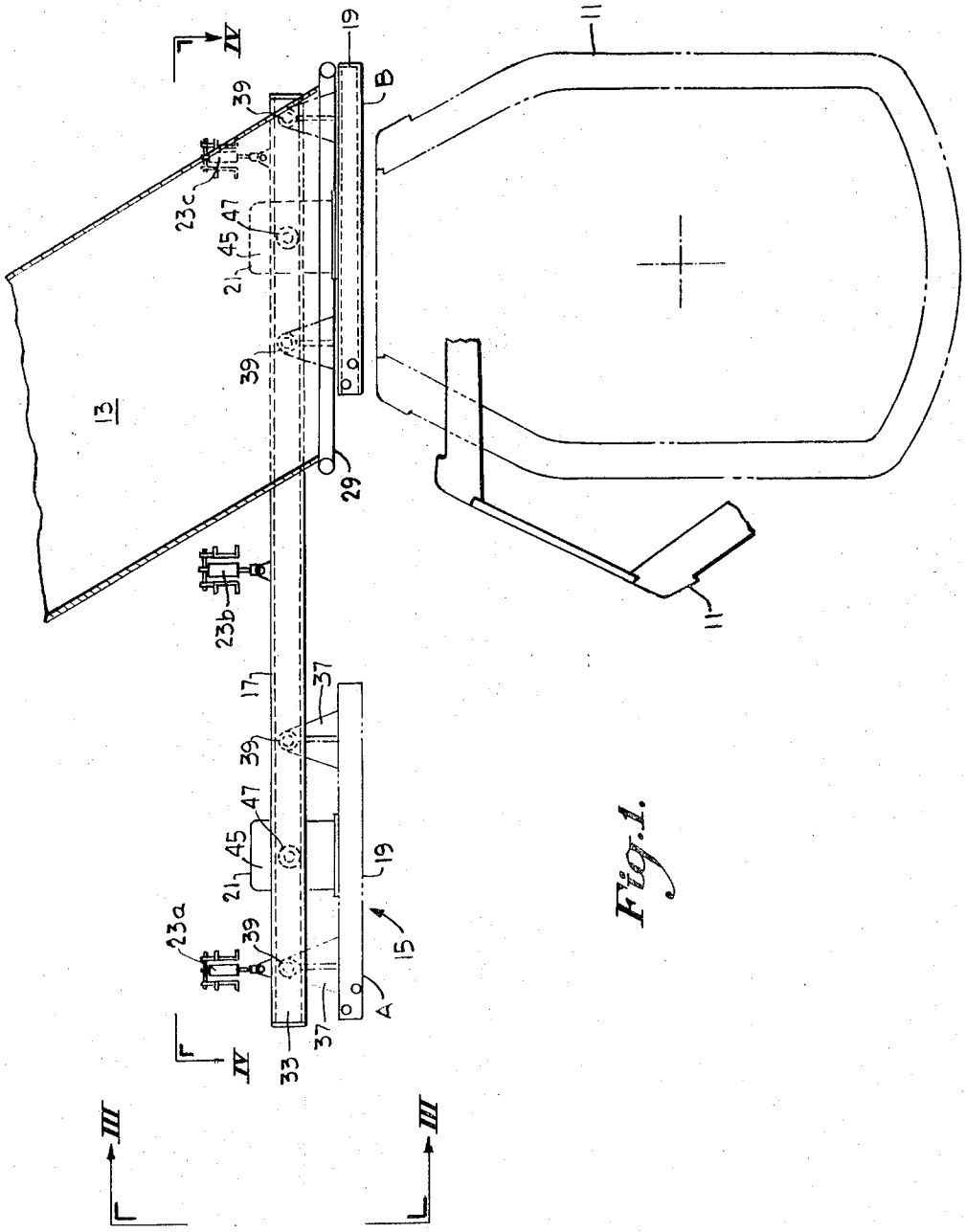

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Fig. 1.

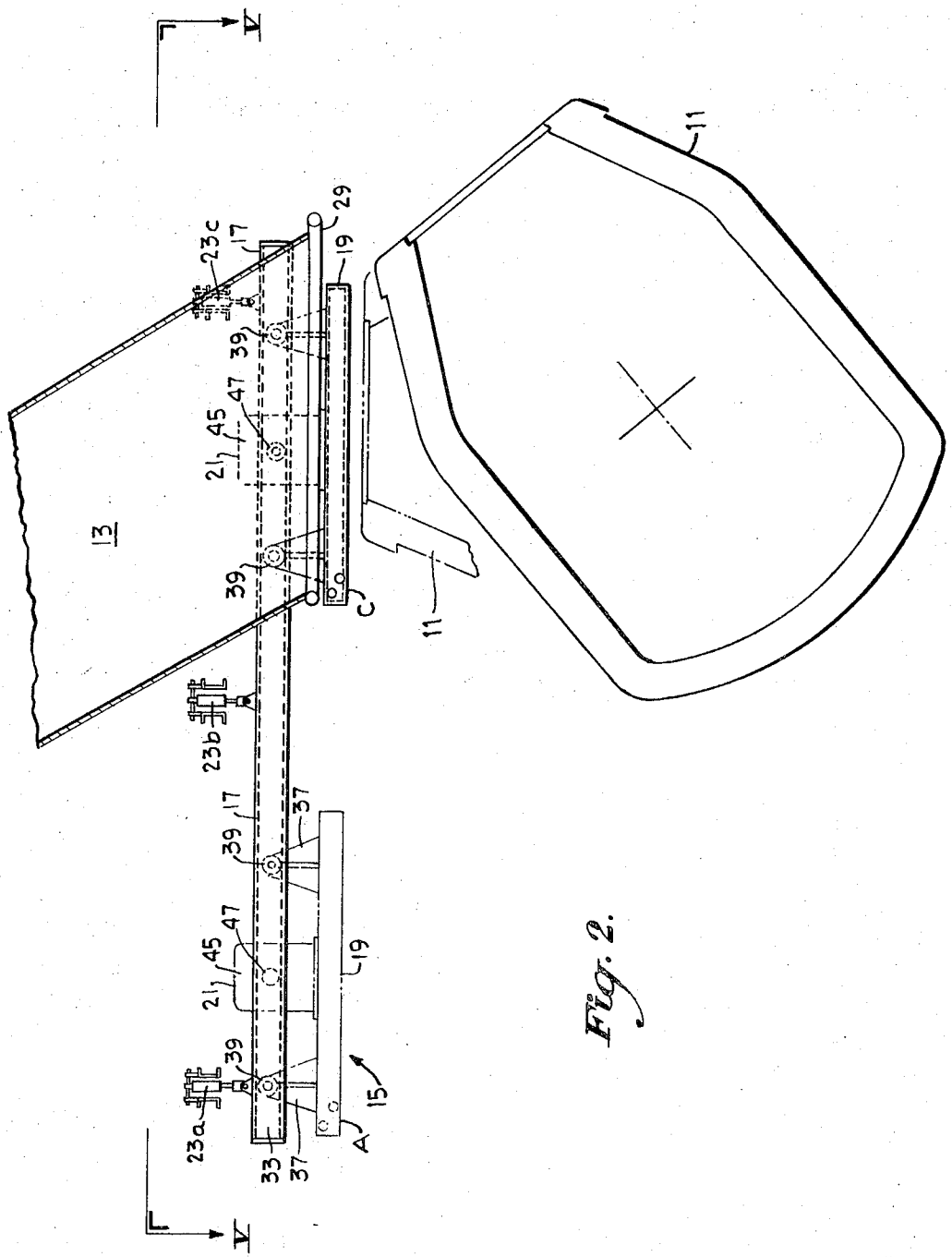

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Fig. 2.

Fig. 3.

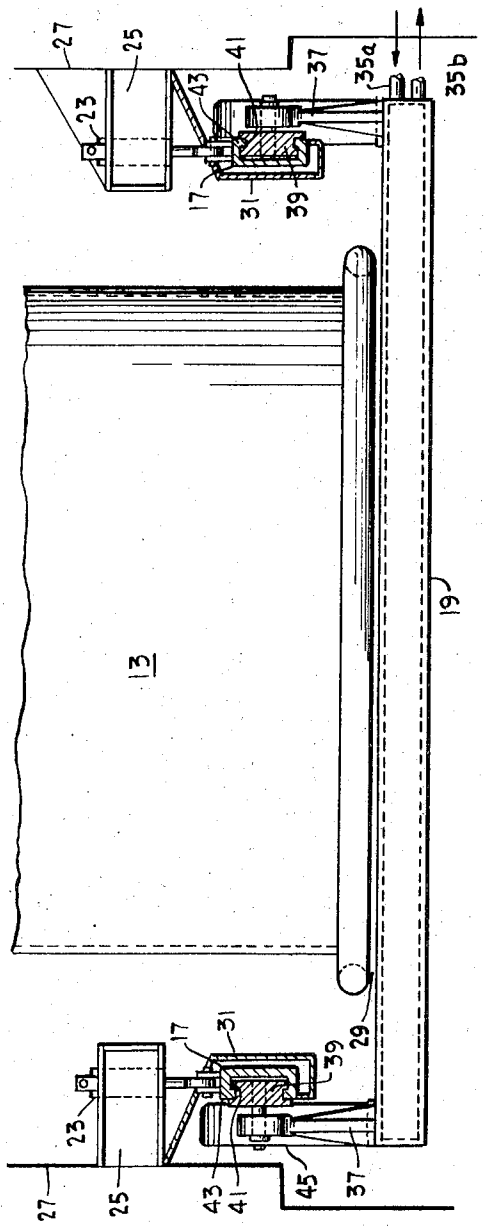
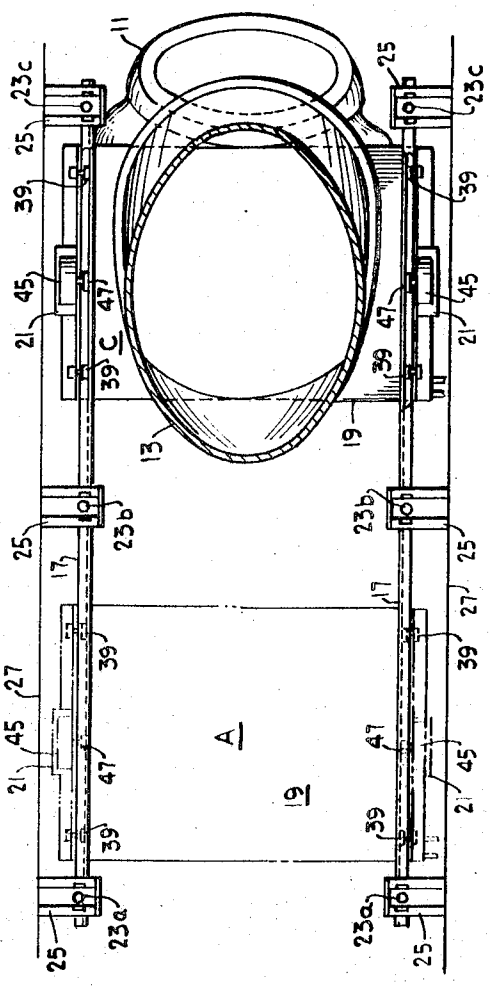

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35a
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Fig. 5.


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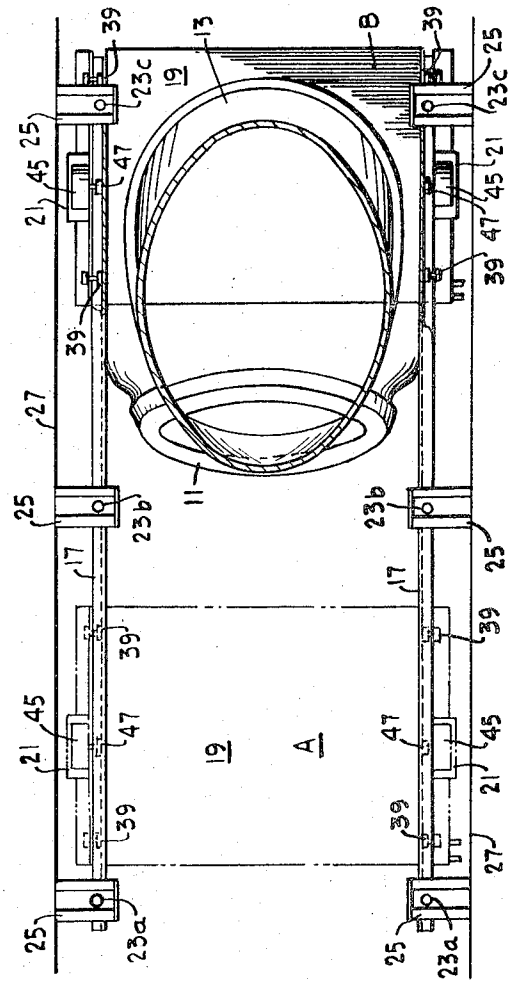

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Fig. 4.

Fig. 7.

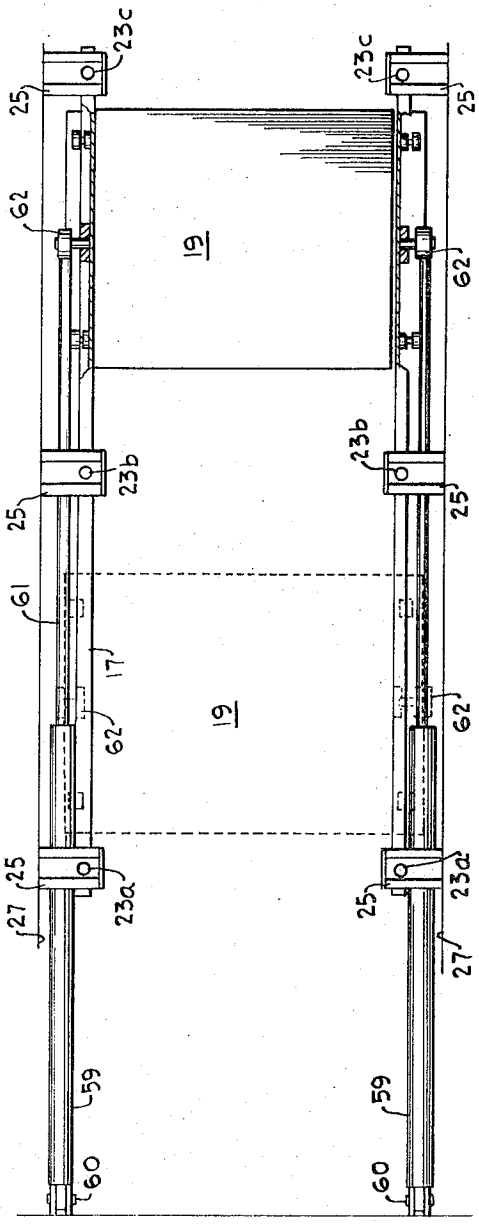
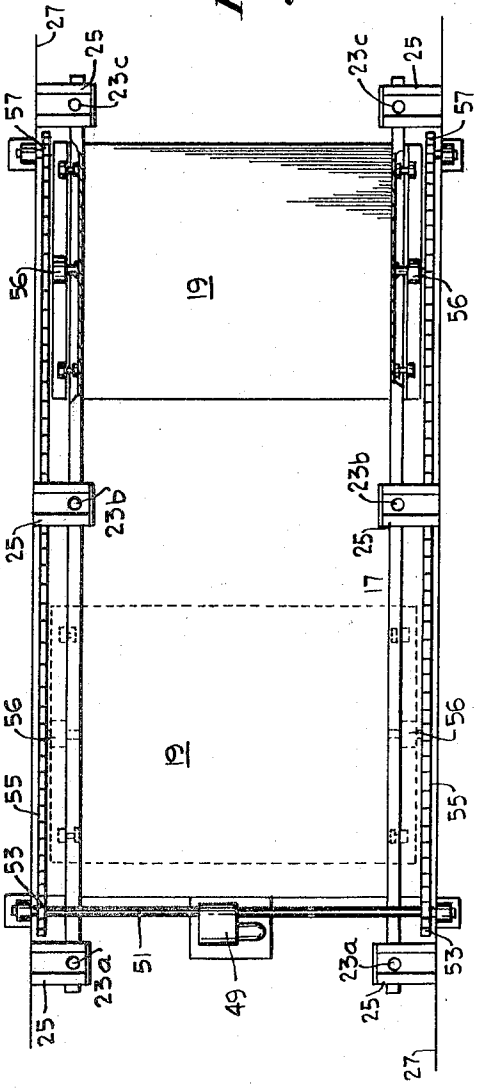

23c
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Fig. 6.


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CONTAINMENT OF DUST AND FUMES FROM A METALLURGICAL VESSEL

BACKGROUND OF THE INVENTION

A. Field of the Invention

This invention relates to the containment of waste gas effluent from a metallurgical furnace and to the exhaust hoods of such furnaces and, more particularly, to a device to capture fugitive plume escaping from such furnace especially when the mouth of the furnace is rotated from the mouth of the hood so that other metallurgical operations can be performed on the furnace, such as, for example, the charging of raw materials into the furnace or the tapping of molten metal from the furnace.

The exhaust hood for metallurgical furnaces particularly for the basic oxygen furnace (BOF) receives and conducts the waste gas effluent generated in the furnace away from the furnace to a gas cleaning apparatus remote from the furnace. When oxygen is introduced into a basic oxygen furnace during the steel refining process or blowing period, large quantities of waste gas effluent are produced by the chemical reaction of gaseous oxygen with the hot molten metal in the furnace; it is not at all unusual for the effluent to reach temperatures of 3,500°F or even higher. The duration of the steel refining process or the duration of the blowing period the gaseous oxygen into the molten metal is usually from twenty to twenty-two minutes and the quantity of waste gas effluent discharged during that period of time is of the order of 50 cubic feet per minute or more per cubic foot of oxygen blown.

Accordingly, the exhaust hood of BOF furnaces while they may be simple in concept are rather complicated pieces of equipment requiring considerable protective measures such as water cooling and/or refractory brick to protect the hood and its structure from the hot, abrasive waste gas effluent from such furnaces. Most hood systems efficiently and effectively contain the effluent from the furnace during the steel refining period which are subsequently treated so that there is no appreciable pollution of the surrounding environment during that period of time.

In the case of BOF furnaces, the furnace is usually in its vertical position during the steel refining process but is rotated from this vertical position to receive scrap and hot metal ingredients on one side for charging and rotated in the opposite direction from this position to discharge molten metal for tapping after the steel refining period. At these out-of-vertical positions, there is considerable misalignment of the mouths of the furnace and the hood, thus, reducing the effectiveness of the hood in capturing the effluent.

B. Description of the Prior Art

Heretofore, the primary concern has been with the containment of the waste gas effluent generated during the steel refining period or the blowing period of the BOF while the waste gas effluent generated during the tapping and charging periods has been merely ignored and tolerated. However, with the advent of stricter air pollution emission standards, it has been necessary to devise and consider supplementary and auxilliary devices to contain and recover the waste gas effluent during these periods of operation.

Several proposals have been made, many of which are inefficient, uneconomical and unsuitable for the task. For example, it has been suggested to operate the hood system at its capacity to contain the waste gas effluent generated during charging and tapping periods. The difficulty with this proposal is that ambient air would be evacuated in preference to the waste gas effluents by the hood and, accordingly, the effluents would be liberated into the surrounding environment.

It has been suggested to use supplementary devices installing them at existing operations. Such supplementary devices usually comprise auxilliary hoods that are mounted adjacent to existing hoods to contain the effluent generated during charging and tapping. In some cases such auxilliary hoods include their own evacuating and gas cleaning equipment separate from the regular hood evacuation system. Obviously, such alternatives are an economic burden to the process. In some plants, the physical layout of the plant precludes the use of supplementary devices and, accordingly, other impractical alternatives must be sought.

None of the foregoing solutions proposed to the art have been satisfactory and, accordingly, there has been a long-felt need for a device that utilizes existing hood systems and gas cleaning systems to capture and clean the fugitive waste gas effluent generated during the tapping or charging operations of the process without becoming an economic burden to the process.

SUMMARY OF THE INVENTION

In accordance with the invention, a device for use with the exhaust hood of a metallurgical furnace to improve the waste gas effluent capture efficiency of the hood in exhausting effluent from the furnace comprises closure means for partially restricting the cross-sectional area of the mouth of the hood to increase the face velocity of gas effluent passing through the mouth thereof, support means fixed adjacent to the hood for carrying the closure means and drive means for moving the closure means from a position that is remote from the mouth of the hood to a position that is adjacent to the mouth of the hood to restrict the cross-sectional area of the mouth of the hood so that fugitive waste gas effluent is captured by and passes through the unrestricted cross-sectional area of the mouth of the hood.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view illustrating an embodiment of the invention in conjunction with a basic oxygen furnace and its cooperating hood wherein the basic oxygen furnace is illustrated in phantom lines in an upright position and in solid lines in a tapping position from the upright position;

FIG. 2 is a side elevational view illustrating the embodiment of FIG. 1 wherein the basic oxygen furnace is illustrated in phantom lines in an upright position and in solid lines in a charging position from the vertical;

FIG. 3 is a front elevational view of the embodiment of FIG. 1 taken at line III—III of FIG. 1;

FIG. 4 is a top plan view of the embodiment of FIG. 1 taken at line IV—IV at FIG. 1;

FIG. 5 is a top plan view of the embodiment of FIG. 2 taken at line V—V of FIG. 2;

FIG. 6 is a top plan view of another embodiment of the invention; and

FIG. 7 is a top plan view of still another embodiment of the invention.

DETAILED DESCRIPTION

In FIG. 1 there is illustrated a basic oxygen furnace 11 and its cooperating hood 13 with an embodiment of the invention generally indicated at 15. The furnace 11 is illustrated in phantom lines in its upright position, the normal position in which the furnace resides during the steel refining process or the oxygen blowing period, and the furnace is also illustrated in solid lines in its tapping position, being rotated from the vertical position. In contrast, the furnace 11 in FIG. 2 is also illustrated in phantom lines in an upright position and is illustrated in solid lines in its charging position, being rotated from a vertical position opposite the furnace tapping position shown in FIG. 1.

The embodiment of the invention generally indicated at 15 includes a pair of parallel tracks 17 lying in a common plane, a movable closure plate 19 carried by the tracks and driving means 21 for moving the closure plate from a position remote from the hood to a position partially restricting the cross-sectional area of the mouth of the hood.

The furnace 11 illustrated in the drawings is a typical basic oxygen furnace although the particulars of its design and construction are not illustrated in the drawings and are not critical to the invention.

The hood 13 illustrated in the drawings is a typical water-cooled hood although the particulars of its design and construction are not illustrated in the drawings and are not critical to the invention.

The tracks 17 are mounted on or adjacent to the hood 13. As illustrated in FIG. 3, there are two tracks straddling the hood 13 being substantially parallel to each other and lying in a common plane. As shown in FIGS. 1 and 2 each track extends beyond the hood so that the closure plate 19 may reside in a remote position from the hood (Position A in the drawings) during the steel refining process but in an engaged position (Position B in FIG. 1 for tapping) and (Position C in FIG. 2 for charging). Each track 17 is secured adjacent to the hood 13 by expansion mechanisms 23 which, in turn, are secured to frame 25, a part of the building structure 27 independent of the hood. Each track is illustrated as being secured to three expansion mechanisms 23(*a*), (*b*) and (*c*); although more or less of such mechanisms may be used.

Each expansion mechanism 23 comprises a hydraulically driven, pneumatically-driven or screw-driven cylinder that is capable of moving in a vertical direction so that the tracks 17 and the closure plate 19 may be raised or lowered with respect to the mouth 29 of the hood 13. Each expansion mechanism 23 is synchronized for movement with each other so that both tracks may be uniformly raised or lowered as desired. The purpose of the expansion mechanism is to adjust the position of the tracks with respect to the hood and in turn the position of the closure plate with respect to the mouth 29 of the hood as thermal expansion and contraction of the hood is experienced. The maximum expansion and contraction experienced in the hood is about seven inches depending upon thermal conditions.

Expansion mechanisms 23 are only necessary on those hoods 13 that are supported from the top and that are permitted to hang in suspension and expand thermally from this fixed point, the type intended to be illustrated in the drawings herein. Expansion mechanisms 23 would not be necessary were the hood supported at the mouth level and permitted to expand thermally upwardly from the mouth level. The use of the expansion mechanism is a desirable feature of the invention since the closure plate 19 must be in close proximity to the mouth 29 of the hood so as to reduce the volume of ambient air drawn into the hood system when the closure plate is in the partially closed position restricting the cross-sectional area of the hood.

Each track 17 has generally a closed face 33 facing the mouth of the hood to protect the tracks from the accumulation of molten metal and the like and is further protected with a heat shield 31 as best illustrated in FIG. 3. The purpose of the heat shield is to protect the track from exposure to the high temperatures that occur near and about the mouth of the hood and further to protect the tracks from amounts of molten metal that might inadvertently splash onto the tracks from the furnace 11 and thus interfere with the travel of the closure plate along the tracks.

The closure plate 19 as illustrated in the drawings is cooled with a fluid, such as, for example, water. In the drawings, the hood has water inlet and outlet means 35(*a*) and (*b*) that are connected to flexible hoses (not shown) and in turn to a source of water (not shown) for the purpose of cooling the plate from the high temperatures generated near and about the mouth of the hood. The manner of construction of the closure plate 19 is not essential to the invention so long as it is capable of withstanding high temperatures generated near and about the mouth of the hood. Alternatively, the closure plate may be protected with refractory bricks.

The closure plate 19 is generally rectangular having a planer construction and is secured to brackets 37 that are mounted near the edge of the plate as shown in FIG. 3. The brackets 37 are journalled to wheels 39 that are adapted to freely rotate on the tracks 17 as illustrated. Each wheel 39 has a peripheral groove 41 in the center of its periphery cooperating with the lips 43 of the track thereby securely holding the closure plate and the wheel with respect to the track. It will be recognized that while this embodiment of the wheels 39 is preferred, other embodiments may be used in accordance with the invention. Accordingly, the closure plate 19 is capable of free movement to and along the track 17 from a remote position (Position A) to a position in partial closure of the mouth 29 of the hood (Position B or Position C as illustrated in the drawings).

In all of the drawings except FIGS. 6 and 7, one embodiment of the driving means 21 is illustrated. As best observed in FIG. 3 there are two driving means, one mounted on each side of the closure plate. The closure plate 19 acts as a heat shield to protect the driving means from the intense heat resulting from the tapping and charging of the furnace when the closure plate is in either one of the two engaged positions. In FIGS. 1 through 5 each driving means 21 comprises a motor 45 driving a drive wheel 47. Drive wheel 47 engages the tracks 17 as illustrated in FIG. 1. The motor 45 is capable of forward and reverse drive and appropriate controls for the motor 45 and its directionality are mounted in the operator's station (not shown). The movement of each motor is synchronized with the other motor so that the closure plate smoothly moves from its remote position to either one of its engaged po-

sitions. Preferably, electrical motors are used but it is apparent that other kinds of motors may be used in the practice of the invention without limitation.

In FIG. **6**, on the other hand, there is illustrated another embodiment of the driving means that may be used in accordance with the invention. The driving means comprises one motor **49** mounted to the frame at the remote end of and between the tracks **17**. Drive axle **51** extends between the tracks and is driven by the motor; the drive axle is journalled at both of its ends to a drive sprocket wheel **53**. Each sprocket wheel **53** drives a chain **55**, one on each side in alignment with the tracks, that extends along the length of the tracks from the remote end to the opposite end of the tracks. At the other end of the tracks, there is a second sprocket wheel **57** for carrying the chain **55**. On each side of the closure plate **19** there is mounted a cog wheel **56** engaging the chain **55** so that as the chain is advanced the closure plate is moved. Motor **49** is capable of forward and reverse drive and appropriate controls for the motor are mounted in the operator's station (not illustrated in the drawings). Preferably, an electrical motor is used but it is apparent that other kinds of motors might be used in the practice of the embodiment of this invention without limitation.

In FIG. **7**, there is illustrated still another embodiment of the driving means that may be used in accordance with the invention. The driving means comprises two hydraulically or pneumatically driven cylinders **59** that are pivotedly mounted to the frame at **60** at the remote end of the tracks **17**. The pivotal mount at **60** is necessary to accommodate the vertical movement of the tracks by the expansion mechanisms **23**. Each cylinder **59** carries a plunger rod **61** that is pivotedly mounted at **62** to the closure plate **19** as illustrated in FIG. **7**. Again, the pivotal mount at **62** is necessary to accommodate the vertical movement of the tracks by the expansion mechanisms **23**. When the plunger rod **61** of each cylinder is extended, the closure plate is moved from the remote position (Position A) to either position adjacent the hood of the mouth as shown in FIG. **7**; When the plunger rod is retracted, the closure plate is returned to its remote position. Appropriate controls for the cylinders are mounted in the operator's station (not shown in the drawings). It will be observed that in applications where there is a long travel distance, compound plunger rods may be necessary.

As illustrated most clearly in FIGS. **4** and **5**, the closure plate **19** has three basic positions with respect to the hood that are coordinated with the three basic positions of the furnace. The three basic positions of the closure plate are (*a*) a retracted or remote position where the furnace is in a vertical position for the steel refining process and where the closure plate is remote from the hood (Position A); (*b*) a tapping position where the furnace is rotated from its vertical position to the left in FIGS. **1** and **4** and where the closure plate is positioned so that the unrestricted cross-sectional area of the hood is also to the left in FIGS. **1** and **4** (Position B); (c) a charging position where the furnace is rotated from its vertical position to the right in FIGS. **2** and **5** and where the closure plate is positioned so that the unrestricted cross-sectional area of the hood is also to the right in FIGS. **2** and **5** (Position C). The closure of the mouth **29** of the hood is partial when the closure plate is in a position for tapping (Position B) or for charging (Position C). The amount of closure of the cross-sectional area of the mouth of the hood is proportional to the distance between the mouths of the hood and furnace or, in other words, proportional to the zero velocity point of the plume escaping from the furnace as will be explained later. The percentage of closure for any given circumstance will depend on the above-stated variables and in each installation, it will be necessary to calculate and determine the optimum conditions for the containment of the effluent when the furnace is either being tapped or charged. Preferably, the movement of the closure plate is synchronized with the movement of the furnace as it is rotated to either a tapping or charging position.

In use, the closure plate is normally maintained at its remote position (PositionA) during the steel refining period when the furnace is maintained in an upright position (illustrated in phantom lines in the drawings). Prior to tapping or charging of the furnace, the closure plate **19** is moved to either one of its two engaged positions (Position B or C). Preferably, the movement of the closure plate is coordinated with the movement of the furnace, while the closure plate is being moved the available draft of the hood is maintained at its normal operating condition. As the cross-sectional area of the mouth of the hood is restricted, the face velocity of effluent entering the hood through the unrestricted cross-sectional area is increased in proportion to the amount of closure. Once the closure plate reaches its engaged position (either Position B or C), the expansion mechanisms **23** are activated to bring the closure plate into close proximity with the mouth of the hood to restrict the volume of ambient air that otherwise might be exhausted into the hood. With this increased face velocity, the hood is now capable of more effectively capturing the effluent escaping from the furnace and its surroundings. As the furnace is rotated further from the upright position the more face velocity would be needed and accordingly, a greater restriction of the mouth of the hood would be required. When the furnace is to be returned to its upright position, the expansion mechanisms **23** are deactivated lowering the closure plate **19** from the mouth of the hood so that the closure plate may easily be returned to its remote position (Position A).

One of the desirable features of the present invention is that it can easily be installed on present hood systems throughout the industry and their existing exhaust systems need not be altered materially. Most of the existing exhaust capabilities now existing in the industry are satisfactory for the successful utilization of the invention. For example, many hood systems presently in use have a draft capacity of one million cubic feet per minute. Assuming that the diameter of the mouth of the hood is approximately 17 feet, a face velocity at the mouth of the hood of 60 feet per second can be achieved. Such a face velocity is not sufficient to effectively capture effluent when the furnace is misaligned from the hood. It is generally believed that for a hood to effectively capture effluent from a furnace that is not aligned with the hood requires a face velocity of 200 feet per minute at the "zero velocity point" of the escaping plume.

The "zero velocity point" of a plume comprises a locus of points within the plume where there is no movement of gases. It exists where the gases have a temperature that is no greater than a temperature that is equal to ambient temperature plus ten percent (10

percent) of the difference between the temperature at the center of the plume and ambient temperature. Thus, if ambient temperature were 100°F and the temperature at the center of the plume were 800°F, then the "zero velocity point" would be that locus of points within the plume where the temperature is no greater than 100°F plus 10 percent (10 percent) of (800°F–100°F) or 170°F.

For a hood to capture such a plume, the face velocity at the zero velocity point of the plume should be about 200 feet per minute meaning that the face velocity at the mouth of the hood must be greater than 200 feet per minute, the actual value of which will depend on the physical location of the zero velocity point in the plume.

While the present invention has been described with particular reference to basic oxygen furnaces, it will be recognized that the invention is applicable to other types of metallurgical furnaces with but minor modifications.

What is claimed is:

1. A device comprising:

a. a rotatable metallurgical furnace having a furnace mouth disposed at its top; said furnace being disposed in an upright position for oxygen blowing operations and being adapted to rotate about an axis to the left and to the right of said upright position for operations other than oxygen blowing operations;

b. an exhaust hood positioned above said furnace for the capture of gas effluent; said hood having a hood mouth that is aligned with said furnace mouth when said furnace is disposed in said upright position; and

c. means for use at said hood mouth that is capable of variably and partially restricting selected portions of the cross-sectional area of said hood mouth to provide a reduced, unrestricted portion and a restricted portion at said hood mouth; said means being cooperatively associated with the rotation of said furnace from its upright position so that said reduced unrestricted portion is disposed to the left of said restricted portion when said furnace is rotated to the left of said upright position and said reduced unrestricted portion is disposed to the right of said restricted portion when said furnace is rotated to the right of said upright position whereby the face velocity of gas effluents entering said hood through said reduced unrestricted portion is increased to improve the capacity of said hood to capture gas effluents.

2. The device of claim **1** including means for synchronizing the partial restriction of said hood mouth with the rotation of said furnace from its upright position.

3. The device of claim **1** wherein said means comprises a plate.

4. The device of claim **3** wherein said plate is protected from heat.

5. The device of claim **3** wherein said plate is cooled with a fluid.

6. The device of claim **3** wherein said plate is cooled with water.

7. The device of claim **1** wherein said means is external of said hood.

8. The device of claim **1** wherein said means is capable of moving with respect to the thermal movement of said hood so that the distance between said means and said hood is constantly maintained.

9. The device of claim **1** wherein said metallurgical furnace is a basic oxygen furnace.

10. The device of claim **1** wherein said means is capable of partially restricting the cross-sectional area of said hood mouth in proportion to the degree of rotation of said furnace from its upright position.

11. A device comprising:

a. a rotatable metallurgical furnace having a furnace mouth disposed at its top; said furnace capable of being disposed in an upright position for oxygen blowing operations and capable of being rotated about an axis in a plane of rotation in two opposed directions;

b. an exhaust hood positioned above said furnace having a hood mouth that is aligned with said plane of rotation of said furnace;

c. means for use at said hood mouth when said furnace is rotated from its upright position that is capable of variably and partially restricting selected portions of the cross-sectional area of said hood mouth to provide a reduced unrestricted portion and a restricted portion at said hood mouth; said reduced unrestricted portion being disposed in the same direction to which said furnace mouth is rotated and said restricted portion being disposed in the opposite direction to which said furnace mouth is rotated, whereby the face velocity of gas effluents entering said hood through said reduced unrestricted portion is increased to improve the capacity of said hood to capture gas effluents.

12. A device for improving the gas effluent capture efficiency of an exhaust hood having a hood mouth through which gas effluent is captured that is cooperatively associated with a rotatable metallurgical furnace having a furnace mouth; said hood mouth and said furnace mouth being capable of alignment with each other and being capable of misalignment with each other in two opposed directions of misalignment; said device comprising;

Means for use at said hood mouth that is capable of variably and partially restricting selected portions of the cross-sectional area of said hood mouth to provide a reduced unrestricted portion and a restricted portion at said hood mouth and that is capable of providing said reduced unrestricted portion nearer said furnace mouth than said restricted portion when said furnace mouth is misaligned in either direction if misalignment with said hood mouth whereby the face velocity of gas effluents passing through said reduced unrestricted portion is increased to improve the gas effluent capture efficiency of said hood.

13. The device of claim **12** including means for synchronizing the partial restriction of said hood mouth with the degree of misalignment of said furnace mouth and said hood mouth.

14. The device of claim **12** wherein said means comprises:

a. a pair of parallel tracks fixed adjacent to said hood lying in a common plane that extends adjacent to and beyond said hood mouth;

b. a movable plate that is carried by said tracks; and

c. means for moving said plate from a position remote from said hood mouth to a position adjacent to said hood mouth in partial restriction thereof.

15. The device of claim **14** wherein said tracks carry means for protecting said tracks from heat and molten metal.

16. The device of claim **14** wherein said moving means comprises:

a. a pair of motors each of which is mounted on said plate at the sides thereof; and

b. a drive wheel being carried by each of said tracks being rotatably fixed to each of said motors for moving said closure plate along said tracks; each of said motors being synchronized with each other.

17. The device of claim **14** wherein said driving means comprises:

a. a motor situated at the remote end of and between said tracks;

b. a drive axle cooperatively associated with said motor and extending between said tracks;

c. a pair of first sprocket wheels one of which is mounted to one end of said drive axle and the other of which is mounted to the other end of said drive axle;

d. a pair of second sprocket wheels disposed at the other opposite end of said tracks, one of which is cooperatively associated with one of said first sprocket wheels and the other of which is cooperatively associated with the other of said first sprocket wheels.

e. a pair of continuous chains engaging each pair of cooperating first and second sprocket wheels; and,

f. a pair of cog wheels fixed to each side of said plate, one of which is cooperatively associated with one of said continuous chains and the other of which is cooperatively associated with the other of said continuous chains.

18. The device of claim **14** wherein said driving means comprises:

a. two cylinders each of which is pivotedly mounted to a frame at the remote end of said tracks;

b. each cylinder carrying a plunger rod having its free end pivotedly mounted to said plate; and,

c. means for activating said plunger rods for extension and retraction.

19. The device of claim **14** including expansion mechanisms for moving said tracks with respect to said hood mouth to accommodate the thermal expansion of said hood so that the distance between said plate and said hood mouth is constantly maintained.

20. The device of claim **19** wherein said expansion mechanisms comprises:

a. a cylinder secured to a frame;

b. each cylinder having a plunger rod that is secured to said tracks; and

c. means for activating said plunger rods for extension and retraction.

21. In an exhaust hood having a hood mouth that cooperates with a rotatable metallurgical furnace having a furnace mouth and being adapted to rotate about an axis in a clockwise and a counter-clockwise direction; said hood mouth having a centerline perpendicular to the plane in which said hood mouth lies and said furnace mouth having a centerline perpendicular to the plane in which said furnace mouth lies; said centerlines being coaxial when said furnace is disposed in a position for oxygen blowing operations and said centerlines intersecting each other at an angle when said furnace is rotated clockwise or counterclockwise, wherein the improvement comprises:

Means for use at said hood mouth that is capable of moving into a position adjacent to said hood mouth that partially restricts the cross-sectional area of said hood mouth to provide a reduced unrestricted portion having a centerline that is perpendicular to the plane in which said reduced unrestricted portion lies and that is substantially parallel to said centerline of said hood mouth; said centerline of said reduced unrestricted portion being displaced from the centerline of said hood mouth in the same direction as the centerline of said furnace mouth when said furnace is rotated, the displacement of said centerline of said reduced unrestricted portion being proportional to the said angle whereby the face velocity of gas effluents entering said hood through said reduced unrestricted portion is increased to improve the gas effluent capture efficiency of said hood.

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