

[54] **EQUIPMENT FOR CONVEYING SMOKES AND PRODUCTS OF THE COMBUSTION IN A SMELTING FURNACE**

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[51] Int. Cl. .... **F24f 9/00**

[58] Field of Search .... **432/64; 98/36, 115 LH; 266/15, 16, 19**

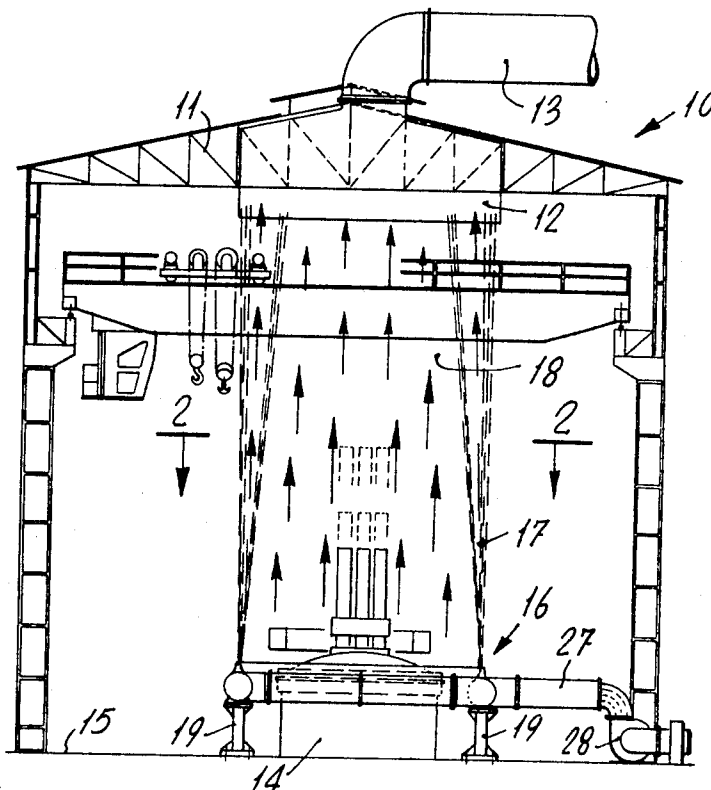
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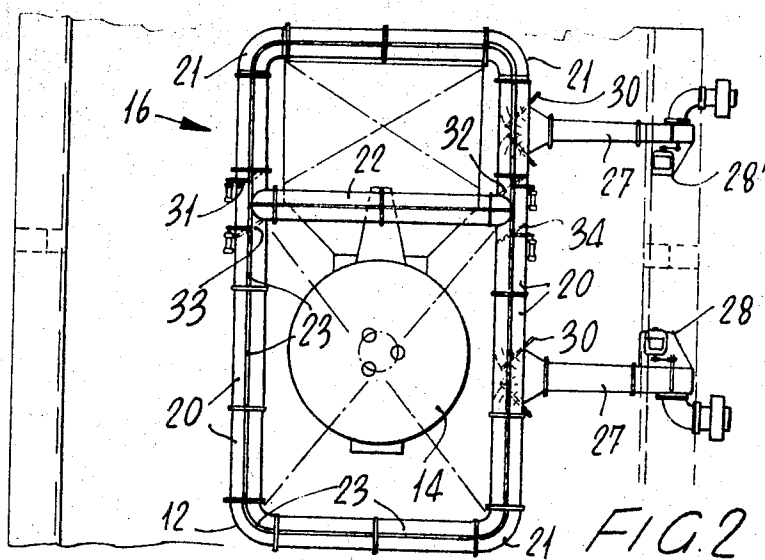
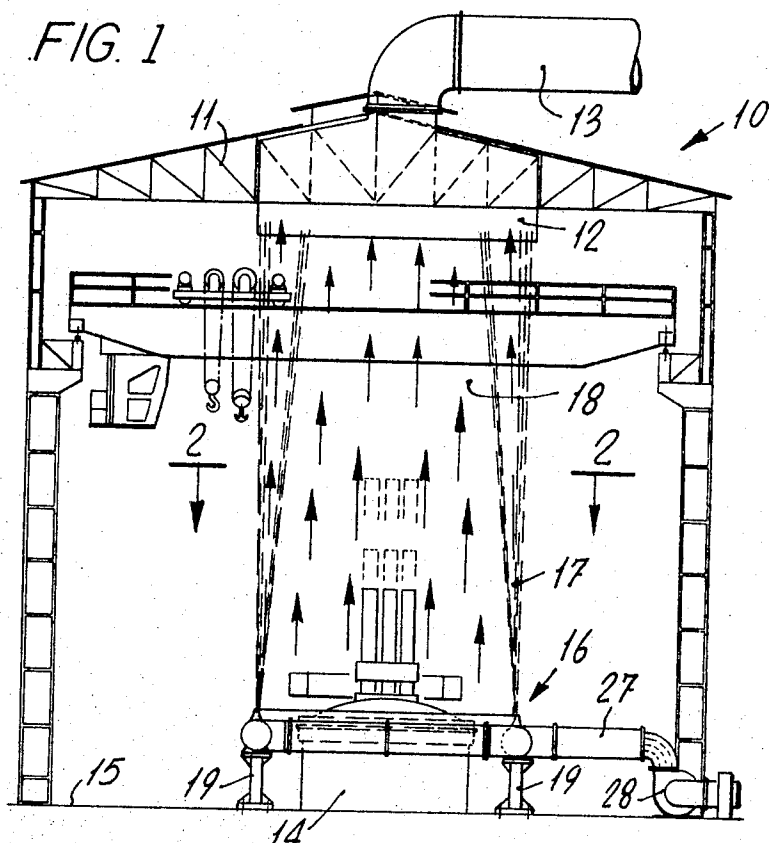
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### [57] **ABSTRACT**

An equipment for the collecting and conveying smokes and combustion products of a smelting furnace. Such equipment comprises blowing means generating a screen of compressed air around the furnace, the said air screen forming a vertical closed chamber conveying the smokes leaving the furnace to a hood located above.

**5 Claims, 5 Drawing Figures**





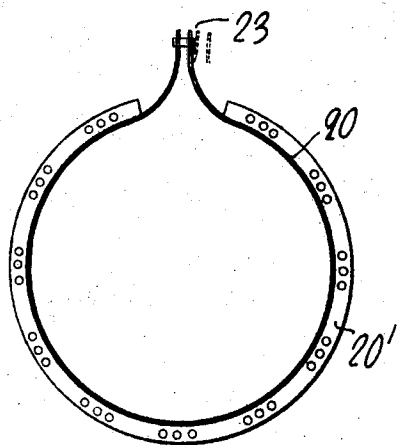


FIG. 3

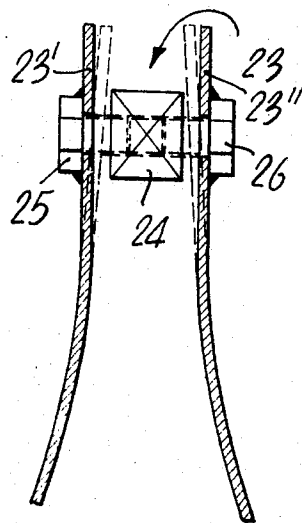


FIG. 4

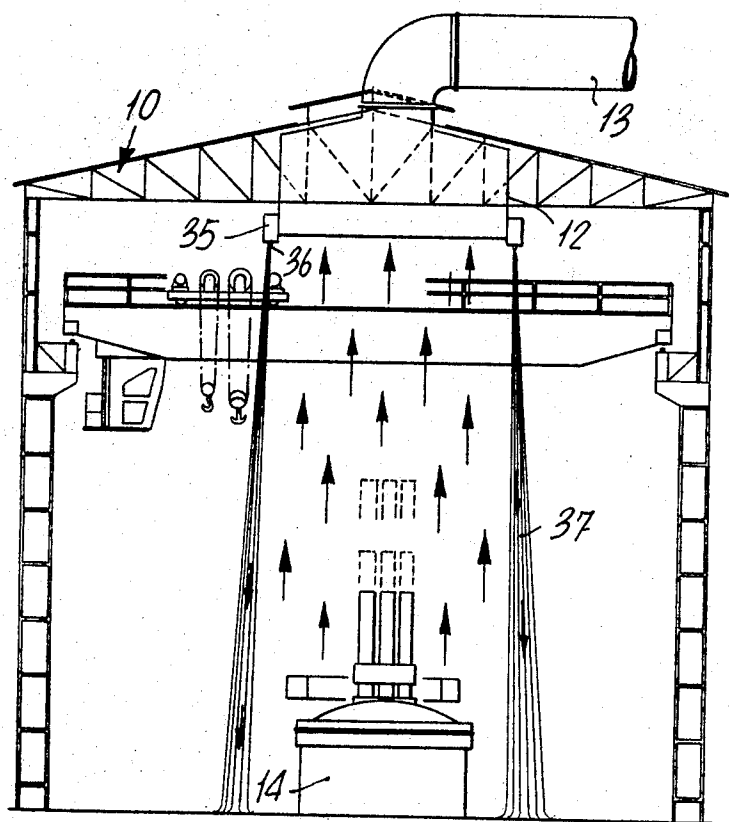


FIG. 5

## EQUIPMENT FOR CONVEYING SMOKES AND PRODUCTS OF THE COMBUSTION IN A SMELTING FURNACE

This present invention relates to an equipment designed for collecting and conveying the smokes released by a combustion in a smelting furnace and delivering them to a hood.

Purpose of this present invention is to provide an equipment of simple construction, efficient and economical and which allows the elimination of the use of costly heat-exchangers as it is used presently, in that the smokes can reach the hood, under a reasonably low temperature. With the use of the equipment provided by this invention, the spaces taken by the equipments generally used for partially collecting the smokes released through the furnace are eliminated.

In general, an equipment for the complete collecting of the smokes and products of combustion released through the furnace, comprises blowing means suitable for creating a screen of compressed air all around the smelting furnace, thus creating a chamber or an insulated vertical conduit which will lead, inside it, the smokes leaving the furnace, thus delivering them to a hood positioned above.

According to a first embodiment of this equipment for collecting smokes, and according to the present invention, the blowing means are arranged peripherally around the furnace and they comprise a plurality of nozzles directed upwardly, thus creating a tubular screen of compressed air directed upwardly to a suction hood. In general, the said air screen has a speed higher than the speed of the smokes and it is directed to the said hood for being delivered externally the factory, together with the smokes and the combustion products of the said furnace. To this scope, the blowing means are provided with a device to orientate the jets of air, along with a device to permit the change of the section of said jets a manner as to ensure that the speed of air released is always higher, than the speed of the smokes released by the furnace according to a ratio desired.

Moreover, it is well known that during the loading of a scrap into an electric furnace, during the melting of the said scrap and during the scoring and the blowing in of oxygen, the smokes will develop only with an established area while during the phase wherein the cast metal is tapped into the ladle, the smokes will develop within an area differing from the above one. Therefore, the equipment according to this invention is provided with a device for choking in a manner as to use and to strengthen the jets of compressed air within one of the said working areas.

According to another form of execution, the manifold for the distribution of the compressed air suitable for generating the screen is located above the furnace along the periphery of the hood for creating a screen of air directed in countercurrent to the smokes or directed downward.

The equipment to this invention will be now described in detail to be read in connection with the attached drawings, and wherein:

FIG. 1 shows a view of the assembly of a smelting furnace provided with the equipment according to the invention;

FIG. 2 is a plan view of the furnace taken substantially according to line 2—2 of FIG. 1;

FIG. 3 is a cross-section of the manifold for the compressed air encircling the smelting furnace;

FIG. 4 is a section of an enlarged detail of the manifold of FIG. 3, in correspondence of a nozzle for delivering the compressed air;

FIG. 5 shows a modification of the said equipment.

Now, referring to FIG. 1, reference 10 indicates the structure of a shed in general, wherein its trusses 11 support a suction hood 12 for delivering outwardly, through a piping 13, the smokes and the products of combustion released by a smelting furnace 14, for example an electric arc furnace, above which the said hood 12 is located. Close to the base of the hood and inside it with auxiliary means for suctioning (not shown) may be provided.

The piping 13 for delivering the smokes outwardly can be connected with a suctioning and purifying unit (not shown) which, in its turn, is connected with a vent stack.

As shown in FIG. 1, the said smelting furnace 14 is encircled to a certain elevation from the ground 15 of the factory, by a manifold for distributing the compressed air, in general indicated by 16, wherein the latter shows a plurality of nozzles directed upwardly to form a fluid wall or a screen of compressed air 17 which latter will form an insulated chamber or vertical conduit 18 directed from the smelting furnace 14 to the hood 12 for delivering the smokes and the combustion products.

The said manifold 16 is located at an elevation, as regards the ground 15, of about 2–2.5 meters and therefore it is supported by pillars or by a carrying structure 19.

The execution of the said manifold 16 will now be described in detail, as shown in FIGS. 2, 3, 4 of the drawings attached herewith.

As indicated in FIG. 2, the said manifold 16 has a rectangular configuration, (however, not essential for this present invention), and it consists mainly of a plurality of straight tubular sections 20 of manifold which are connected with one another through end flanges, and of curved manifold sections 21 at the corners of the said manifold.

As shown in FIG. 2, also the formation of an intermediate tubular length 22 of manifold is provided, which latter is also formed by straight tubular sections reserved for dividing the area around the furnace into two separated areas indicated by A, B, namely, and which will be described further on.

Each of the said sections 20, 21 and 22 of the manifold 16 for the distribution of the compressed air comprises, at its upper portion, the formation of one or a plurality of nozzles 23 for venting the compressed air. This characteristic is illustrated more clearly in FIGS. 3, 4 of the drawings attached herewith.

As shown in FIG. 3, which is a cross-section of a general tubular section of the said manifold, for example the one indicated by 20, each nozzle 23 for the compressed air is extended longitudinally, substantially for the entire length of each tubular section of the manifold, thus affording a continuity to the air screen 17 built therein.

As shown in the enlarged view of FIG. 4, each single nozzle 23 consists of two opposite edges 23' and 23'' formed by the longitudinal slot of each section of manifold, between the said opposite edges some sleeve spac-

ers 24 are provided which engaged with proper bolts 25, 26 having right-hand threading and left-hand threading, namely, with the purpose of permitting the adjusting of the outlet section of the jet of compressed air to obtain a constant speed of compressed air which is higher than the speed of the smokes, according to an established ratio.

For example, it can be said that satisfactory operating conditions are attained with a ratio between the speed of the compressed air of the screen 17 and that of the smokes, equal to or higher than three.

However, under normal operating conditions, it is preferred to have said ratio equal to five, to obtain a regular operation of the said equipment.

The adjustment of the outlet section of the said jets is carried out during the starting of the furnace by actuating the said spacing elements 24 with the purpose of approaching to or moving away of the edge 23' from the edge 23'' of each nozzle, as schematically shown with dash-lines in FIG. 4. For a good operation of the said equipment, the range of adjustment of the jets, that is the minimum and the maximum distance between the matching edges of a nozzle, can be included within 20-30 mm approx.

However, this distance is given only as an example of execution.

Said manifold 16 for distributing the jets of the compressed air, as shown in FIGS. 1, 2 of the drawings attached herewith, is connected, through one or more pipings 27 for delivering the compressed air, to one or some fan for blowing units 28, 28' for the compressed air, which fans suction the air externally the factory for preventing a probable motion of dust within the smoke suctioning area.

Of course, the capacity of the said fan or fans for supplying the air, will depend on the suction of the said nozzles 23, and moreover on the speed of the jets of air leaving the unit, as well as on the development of the ring of the said manifold 16 which in turns will depend on the diameter of the smelting furnace 14 and the requirements of installation.

Each single fan 28 for supplying the compressed air is provided with a suction control gate, (not shown), for adjusting the air suction, with the purpose of minimizing the power absorbed. In tropical zones, the air supplied by the fan or fans shall be properly cooled by means of a refrigerator, thus increasing the efficiency of the said jets.

To obtain an optimal delivery of air flow, thus minimizing the loss of load just at the point of connection between a delivery piping 27 and the manifold 16, some hinged baffles 30 driven externally through a lever system are provided, which will divide and direct the flow of air longitudinally the manifold.

It has been stated that the products of combustion leaving the furnace and the tubular screen of air 17, are delivered outward through the said hood 12. Therefore, for reducing the dimension of the said hood and consequently the delivery and the capacity of the exhaustor installed, the use of a device for orientating the jets of air forming the screen 17 has been provided, with the purpose to deliver them to the said hood 12.

The said orientation is carried out when the furnace is started by rotating-inwardly on its own flanges and according to its own axis the straight tubular sections of the said manifold, thus obtaining the conveyance of

the smokes to the hood as established. To this purpose, the said flanges 20' of each tubular section of the manifold, as shown in FIG. 3, are provided with plurality of through holes for the tightening bolts. On the basis of tests carried out, it has been observed that the adjustment of the inclination of said jets can be carried out within a range included between 2° and 3° as regards the vertical direction.

The equipment according to this invention operates as follows.

When the furnace is started, during the loading of the scrapes the melting of the scrapes, the slagging and the blowing in of oxygen, the smokes and the combustion products will mainly develop within the area indicated by A. Therefore, the hinge-valves 31, 32 which are controlled by their pneumatic actuators, are closed for impeding the air circulation supplied by ventilator 28, through the peripheral portion of the manifold delimiting the said area B.

The compressed air fed through the ventilator 28' will therefore form, a fluid wall around the area A of the furnace, that is a screen of compressed air all along the periphery of the smelting furnace 14. The manifold 14 distributes the compressed air to the blowing nozzles 23 thus forming an insulated chamber within which the smokes or products of the combustion flowing from the furnace are conveyed upward to the said hood 12. From the said hood 12, the smokes and the combustion products are then conveyed to a suctioning and depuration unit, and finally they will leave the stake.

On the other hand, during the tapping of the melt metal into the ladle, since the smoke develops only within the zone indicated by B, the portion of the manifold 16 related with the area A is insulated through the hinge-valves 33, 34, in such a manner that the compressed air delivered by the fans 28 will circulate only within the portion of the manifold which delimitates this zone, thus forming an insulated chamber which conveys the smokes produced within the cast steel outlet area to the said hood 12.

FIG. 5 shows a modification of this invention.

In this figure, the parts unchanged are indicated by the same reference numbers.

FIG. 5 shows that the manifold for the distribution of the compressed air, indicated by 35, is located peripherally around the suction hood 12, and it is provided with nozzles 36 downwardly directed, releasing the compressed air to generate a screen or tubular wall of compressed air 37 around the furnace, directed downward, differently from the previous case. One or more fans will feed, through especial piping, the compressed air to the distribution manifold 35. In the execution shown, the jets are inclined outwardly for creating a chamber with a frusto-conical configuration with its larger base at the bottom; this will permit the use of a hood 12 with reduced sizes.

The equipment according to the present invention can be used with any type of smelting furnace for steel, cast-iron, and processes for the preparation of ferroalloys.

What we claim is:

1. An equipment for the collecting and conveying smokes and combustion products of a smelting furnace, characterized in that it comprises blowing means comprising manifold sections generating a screen of compressed air around the furnace, the said air screen forming a vertical closed chamber conveying the

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smokes leaving the furnace to a single hood located above, the said blowing means being arranged peripherally around the furnace and comprising manifold provided with a plurality of inward nozzles to form a chamber delimited by a wall of upward compressed air within which the smokes go directly upward to the said suction hood, the manifold for distributing the compressed air comprising a first manifold portion arranged around the furnace and suitable to form a screen of air around the furnace itself during the starting up and running of the latter, and a second manifold portion separable from the former, suitable for generating an air screen around the area wherein the melt metal leaves the furnace.

2. An equipment according to claim 1, characterized in that each one of the manifold portions for the distribution of the compressed air is fed through a proper fan unit.

3. An equipment according to claim 2, characterized in that at least some of the manifold nozzles can be oriented inward.

4. An apparatus for collecting and conveying smoke and products of combustion of a smelting furnace in-

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cluding the secondary smoke produced during the casting of melted steel into a ladle, comprising hood means positioned above the furnace, blowing means for generating a compressed air screen means around the furnace so that the air screen means forms a vertical closed chamber surrounding the smoke and products of combustion leaving the furnace to said hood means, said air screen means being arranged so that direct collision of the air screen means with the smoke and combustion products is prevented, the hood means comprising a single fixed hood, the compressed air screen means comprising two different screens of air that are always firm and vertical which are directed towards the single upper hood during the melting process of steel during the casting phase of the melted steel.

5. The structure as defined in claim 4, wherein the blowing means comprises a pair of manifold sections, one of said manifold sections surrounding the furnace during the melting of steel, and the other manifold section working during the casting phase and surrounding the specific part of the furnace where the casting takes place.

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