March 28, 1944. H. A. REECE 2,345,503

TUYERE

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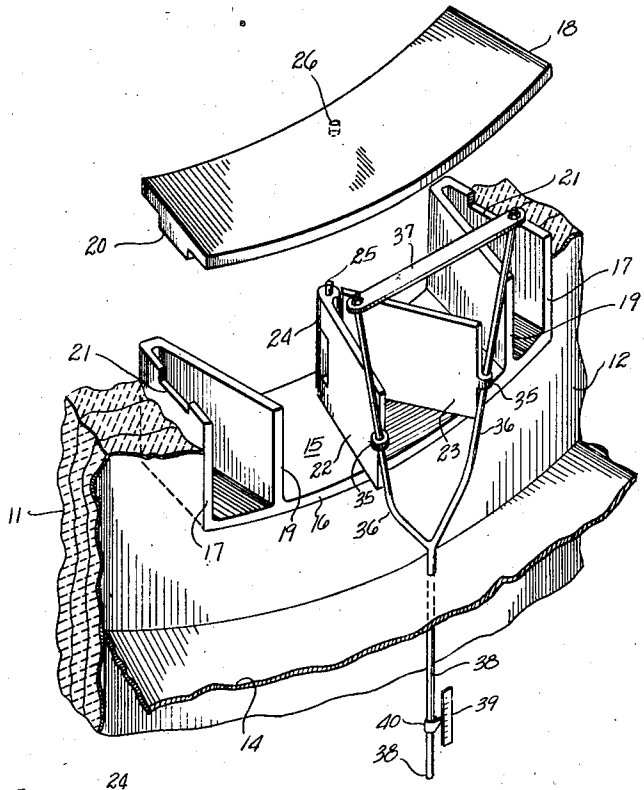

Fig. 1

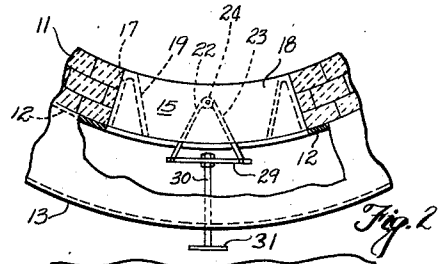

Fig. 2

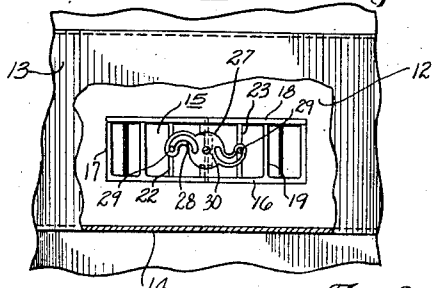

Fig. 3

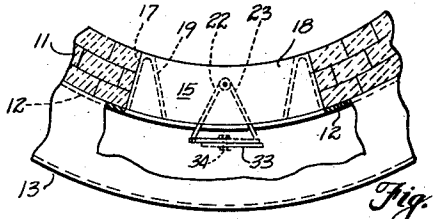

Fig. 4

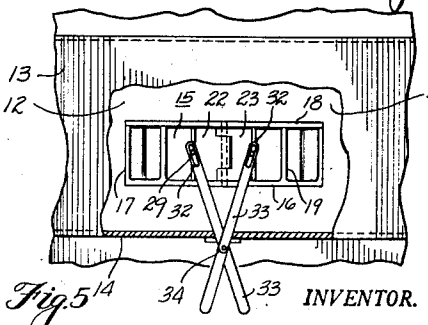

Fig. 5

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TUYÈRE

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14 Claims. (Cl. 266—42)

My invention relates to metallurgical furnaces and the like, such as cupolas for the melting of metal, and is directed to the tuyères entering the same for the supplying of a blast of air to the interior of the furnace at a plurality of positions around the furnace.

The principles of my invention are particularly directed to the form and construction of the tuyère boxes or casings mounted in the wall of the furnace and to the operating parts associated therewith. The tuyère boxes have openings extending therethrough for the passage of the air blast through the furnace wall, the walls of the tuyère boxes being mounted in the furnace wall.

It is an object of the present invention to provide improved means of controlling the flow of air through the tuyères into the furnace.

Another object is the provision for efficiently regulating the size of the opening through the tuyère.

Another object is the provision for efficiently regulating the angular disposition of walls of the opening to guide the air blast as desired.

Another object is the provision for adjustably changing the flare of the walls in the tuyère box guiding the air blast into the furnace.

Another object is the provision for dividing a tuyère box in two or more parts and to effectively make each part a separate tuyère by adjustably flaring a movable wall therein.

Another object is the provision for adjustably varying the shape of a wall of a tuyère box to guide the air blast through the box in a manner desired.

Another object is the provision for changing a tuyère box having opposite end walls flared out toward the interior of the furnace into two or more portions each having opposite end walls flared out toward the interior of the furnace and thereby effecting two or more separate flared tuyères.

Another object is the provision for adjusting the area of the opening through a tuyère, the degree of change in area being greater on the the outer side of the tuyère.

Another object is the provision for efficiently changing the effective area in a tuyère box through which an air blast passes and efficiently guiding the air blast through the box to control its distribution into the furnace.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a perspective view of a tuyère box embodying the preferred form of my invention with the top plate of the box raised up from its normal position to better show the interior of the box, the box being positioned in the wall of a furnace of which a partial view is shown;

Figure 2 is a plan view of a tuyère box embodying a modified form of my invention;

Figure 3 is an elevational view of the tuyère box shown in Figure 2;

Figure 4 is a plan view of a tuyère box embodying another modified form of my invention; and

Figure 5 is an elevational view of the tuyère box shown in Figure 4.

Referring to the views of the drawing, there is shown a tuyère box denoted generally by the reference character 15. The tuyère box 15 is mounted in the brick wall 11 of a cupola or other metallurgical furnace in such manner that the tuyère box provides an opening through the furnace wall from outside the furnace to inside the furnace. A plurality of the tuyère boxes are mounted in the furnace wall around the circumferential extent thereof in the usual manner, most often in one horizontal plane but sometimes in more than one horizontal plane or otherwise disposed. As all of the tuyère boxes in my improved furnace are of similar construction it has been considered necessary to illustrate only one tuyère box in the furnace wall and the adjacent portion of the furnace wall.

The furnace wall being cylindrical is of concave form on its inner surface and of convex form on its outer surface. The inner and outer outline of the tuyère box generally conforms to these surfaces as to be substantially flush therewith. There is an opening or open space extending through the tuyère box communicating with the interior of the furnace on one side and with a source of an air blast outside the furnace on the other side. The source of the air blast may be a wind box proper mounted to the side of the furnace, a boot-leg pipe or other conduit between the wind box proper and the individual tuyères, or other suitable source. For purposes of definition and simplicity in description the source of the air blast may be referred to in this description and the claims as a wind box. A shell 12 of iron, steel or other metal surrounds the brick wall 11 and the opening in the tuyère box 15 extends through this shell as well as

through the wall 11. The shell 12 forms the outer surface of the furnace wall and may form the inner surface of the wind box (or boot-leg pipe) adjacent the tuyère.

In Figure 1, wherein portions of the wall and surrounding wind box are cut away to illustrate the construction of the tuyère box, only a portion of the wind box is shown, the portion shown being the bottom wall 14 thereof. The wind box, however, may be assumed to have any of the usual forms now known. In Figures 2 to 5, inclusive, the outer wall 13 of the wind box is also shown.

My tuyère box 15 comprises a bottom plate 16, the outer end plates 17, the inner flared end plates 19 and the top plate 18. The tuyère box is made of suitable metal such as iron, steel or special heat resisting alloys. The bottom plate and end plates may conveniently be cast in one integral piece as illustrated in Figure 1. The top plate 18 rests upon and is secured to the top edges of the end plates to form contiguous walls. A tongue or projection 20 provided on the top plate 18 is adapted to fit into the groove or recess 21 in the end plates 17 and to secure the parts together.

It is to be noted that the end plates 19 are disposed at an angle and flare outwardly toward the interior of the furnace. It has been found that such a construction forms an efficient tuyère in guiding the air blast through the tuyère and distributing it fan-wise into the interior of the furnace.

In prior tuyère boxes there has sometimes been positioned in the tuyère box, intermediate of its flared ends, an upright or vertical strut or flat plate permanently fixed in position and disposed on a radial line extending from the axis of the furnace. Such a strut has however been nothing more than a support for the top of the tuyère box. Being relatively narrow, it did not effectively divide the opening through the tuyère box and was not angularly disposed in relationship to the end walls of the tuyère box to cooperate therewith in guiding and distributing the air blast in a manner required for a well-designed tuyère. The limitations, disadvantages and defects of such prior constructions become apparent from the disclosure of the present invention.

There is mounted in my improved tuyère box a pair of flat plates 22 and 23 hinged together at their forward edges disposed toward the interior of the furnace by means of a hinged mounting 24. The pivot pins 25 extend up and down into holes 26 in the top and bottom plates of the tuyère box, only the upper pin 25 and upper hole 26 being shown in Figure 1 of the drawing. The vertical plates 22 and 23 are free to rotate on the mounting 24 relative to each other and relative to the walls of the tuyère box. The free ends of the plates 22 and 23 extend back through the tuyère box at a variable angle to each other and generally toward the outside of the furnace.

It is to be observed that as the front edges of plates 22 and 23 are pivotally joined and the rear edges or free ends of the plates may swing in arcs, the effective area of the opening through the tuyère box is variably modified. Likewise, the angle of deflection or guidance of the air blast by the walls 22 and 23 is variably changed by adjusting the angular disposition of the plates.

The means provided for adjustably swinging the plates 22 and 23 in the embodiment shown in Figure 1 consists of a Y-shaped member having angularly disposed arms 36 slidably engaged in the slide rings 35 extending from, and carried by, the outer edges or free ends of the plates 22 and 23. A vertically disposed arm or rod 38 joining the arms 36 of the Y-shaped member extends down through a small opening in the bottom wall 14 of the wind box. The engagement of rod 38 in the opening through the wall is such that there is a hermetic seal against the loss of air from the wind box. To give strength and rigidity to the Y-shaped element the upper ends of the arms 36 are tied together by the element 37. The Y-shaped element is preferably made of metal or other strong and rigid material. A notched scale member 39 is secured to the side of the furnace wall and a pointer element 40 non-movably secured to the rod 38 is adapted to engage in notches in the member 39 and to indicate the relative elevation of rod 38 and hence the position of the arms 36 in the slide rings 35.

Upward movement of the rod 38 from outside the wind box is translated into a movement swinging the plates 22 and 23 toward each other and diminishing the angle between them. Downward movement of the rod 38 is translated into a movement swinging the plates 22 and 23 away from each other and increasing the angle between them. Therefore, the angular disposition of the plates 22 and 23 may be adjustably determined and fixed by means of the Y-shaped member and notched element 39. The angular disposition of the plates 22 and 23 determines the effective area of the opening through which an air blast passes and the deflecting or guiding of the air blast by the plates 22 and 23.

It is to be noted that by adjustment of the position of plates 22 and 23 the tuyère opening is, in effect, divided into two tuyère openings each having flared end walls for properly guiding and distributing the air blast into the furnace. The plates 22 and 23 are thus adapted to cooperate with the flared end walls 19 in the control of the air blast through the furnace wall and into the furnace. By adjustment of the angular disposition of the plates 22 and 23 the desired re-action between the plates 22 and 23 and flared end walls 19 may be obtained.

The inner open area of the tuyère box (that is, the size of the tuyère opening adjacent the inside of the furnace) is preferably of a fixed value which has been determined by calibration with regard to the diameter of the furnace and other factors. My tuyère box has the advantage of incorporating therein the flexible features of changing the effective area of the opening through which the air blast passes and of changing the deflecting or guiding action afforded to the air blast, and at the same time maintaining the fixed value for the inner open area of the tuyère box. This is possible by reason the convergence and joinder of the plates 22 and 23 on the side of the tuyère box toward the interior of the furnace to maintain a substantial constant width of the two plates at the region of their joinder.

In Figures 2 and 3 there is shown a modified arrangement for moving the plates 22 and 23. A cam guide member 27 has two annular slots or grooves 28 in which extend and slide pins or bosses 29 carried by the outer edges or free ends of the plates 22 and 23. A shaft 30 rigidly secured to the cam member 27 and extending out through the outer wall 13 of the wind box in a hermetic seal therewith is rotatable by the handle 31 to revolve the cam member through sub-

stantially 90°. The turning of the handle 31, from outside the wind box, swings the plates toward each other when turned in one direction and away from each other when turned in an opposite direction.

In Figures 4 and 5 there is shown another modified arrangement for moving the plates 22 and 23. Crossed levers 33 have slots 32 slidably engaging the pins or bosses 29 carried by the outer edges or free ends of plates 22 and 23. The levers 33 are pivotally mounted to the bottom wall 14 of the wind box by means of the mounting 34 and extend through the bottom of the wind box in a hermetic seal therewith. Movement of the lower ends of the levers is translated into movement of the plates 22 and 23.

The present disclosure includes the description contained in the following claims as well as in the foregoing specification. Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim as my invention:

1. A tuyère box for a metallurgical furnace, said box having an opening therethrough for providing communication for an air blast from outside the furnace through the furnace wall to the interior of the furnace, said opening being defined by a top plate, a bottom plate and opposite end plates, said end plates being flared out toward the interior of the furnace to direct said air blast fan-wise into the furnace from said opening, a pair of movable plates disposed in said opening intermediate of said end plates, said movable plates being pivotally mounted at their edges adjacent the interior of the furnace and swingable toward and away from each other in the tuyère box to vary the size of said opening adjacent the outside of the furnace wall, and operating means for swinging said movable plates to desired angular positions in said opening, the said movable plates being adapted to be flared outwardly toward the interior of the furnace by the angular disposition thereof to divide the tuyère into two openings having flared ends and directing the air blast through said two openings fan-wise into the furnace.

2. In a tuyère box mountable in the wall of a metallurgical furnace, said tuyère box having an opening extended therethrough to permit an air blast to pass through the box from the outside to the inside of the furnace, a pair of plates vertically positioned in said box intermediate the ends thereof, said plates being hinged together and to said box on their edges disposed toward the interior of the furnace and being swingable in said box relative to each other to vary the size of said opening on the side of the box toward the exterior of the furnace, and means for swinging said plates to adjust their angular disposition in said box, the angular disposition of the plates determining the effective area of said opening on the side of the box toward the exterior of the box and the degree of deflection of said air blast passing through the opening adjacent said plates into the furnace.

3. In a tuyère box having defining walls adapted to be mounted in the wall of a metallurgical furnace and having an open space extending therethrough from the exterior of the furnace to the interior of the furnace, the defining walls at the ends of the tuyère being angularly disposed to progressively increase the size of said open space toward the interior of said furnace, a pair of movable plates in said box dividing said open space into two parts, pivot mounting means connecting said plates and pivotally connecting the plates to said box adjacent the side of the box toward the interior of the furnace, said plates extending back through the open space in the box toward the exterior of the furnace, and operating means connecting said plates for swinging said plates relative to each other to change the angular disposition of the plates in said box, the adjustment of the angular disposition of said plates by said operating means adjustably determining the size of said two parts of said open space and fixing the degree of deflection by said plates of said air blast passing through said two parts of the open space in the tuyère box.

4. A tuyère box adapted to be mounted in the wall of a metallurgical furnace, the end walls of said box diverging from each other toward the interior of the furnace to spread the air blast passing through the box fan-wise into the furnace, a pair of movable plates vertically disposed in said box intermediate of said end walls, said movable plates being pivotally connected to said box and meeting each other at their forward edges adjacent the interior of the furnace, said movable plates extending back through the box and having their rearward edges disposed toward the exterior of the furnace, and means connected to said rearward edges for swinging said plates in said box to adjustably fix the angular disposition of the plates in the box, the angular disposition of said plates relative to each other determining the effective area of the box through which said air blast may pass and fixing the relative divergence between said end walls of the box and said plates to control the spread of said air blast moving through the box on opposite sides of said plates.

5. In a tuyère box for a metallurgical furnace, a pair of hinged plates mounted in the box, the hinged portion of the plates being disposed toward the interior of the furnace and the free portion of the plates being disposed toward the exterior of the furnace, an operating member having angle portions disposed at an angle to each other, and slide means connecting the free portion of the plates to said angle portion of the operating member, the arrangement of the plates, operating member and slide means being such that movement of the operating member toward and away from said plates swings the plates about said hinged portion to vary the effective opening through the tuyère box and the angle of the plates relative to the walls of the tuyère box.

6. In a tuyère box for a metallurgical furnace, a pair of hinged plates pivotally mounted in the box, the hinged portion of the plates being disposed toward the interior of the furnace and the free portion of the plates being disposed toward the exterior of the furnace, a revolvable cam member connecting the free ends of said plates and adapted to swing said plates toward and away from each other in said box, and a shaft for revolving said cam member, the swinging of said plates into desired angular position by said cam member and said shaft providing for the adjustment of the effective area of the opening through said box for the air blast and

the inclination of said plates for the degree of deflection of the air blast passing through the box.

7. In a tuyère box for a metallurgical furnace, a pair of hinged plates pivotally mounted in the box, the hinged portion of the plates being disposed toward the interior of the furnace and the free portion of the plates being disposed toward the exterior of the furnace, a pair of slotted levers slidably engaging the free ends of said plates, said slotted levers being pivotally mounted to move at an angle to said plates and to swing said plates toward and away from each other, whereby the angular disposition of said plates in the box may be adjustably fixed.

8. In a tuyère box having an entrance up-stream opening and an exit down-stream opening larger than the up-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without materially restricting the down-stream opening, and adjustable means for positioning the closure means.

9. In a tuyère box having an entrance up-stream opening and an exit down-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without materially restricting the down-stream opening, and adjustable means for positioning the closure means, said closure means comprising a member having a side disposed at an angle to a side of the tuyère box.

10. In a tuyère box having an entrance up-stream opening and an exit down-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without restricting the down-stream opening, locking means for positioning the closure means, said closure means comprising two parts having their down-stream ends converging toward each other and having their up-stream ends separated to restrict the up-stream opening.

11. In a tuyère box having an entrance up-stream opening and an exit down-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without materially restricting the down-stream opening, and adjustable means for positioning the closure means, said closure means comprising two swingable vane members substantially dividing the tuyère box with their down-stream ends converging toward each other and pivotally connected to said box and with their up-stream ends being swingable with reference to each other to restrict the up-stream opening.

12. A tuyère box having an entrance up-stream opening and an exit down-stream opening for a metallurgical furnace having an air duct, said tuyère box having a center strut having two parts foldable laterally with respect to each other, actuating means for expanding the foldable parts to close the tuyère and for contracting the foldable parts to open the tuyère, and locking means engaging the actuating means to adjustably position the two foldable parts at any point between their open and closed positions, said two foldable parts restricting the up-stream opening more than the down-stream opening.

13. In a tuyère box having an entrance up-stream opening and an exit down-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without materially restricting the down-stream opening, and adjustable means for positioning the closure means.

14. In a tuyère box having an entrance up-stream opening and an exit down-stream opening for admitting air to a metallurgical furnace, closure means extending into the tuyère box for restricting the up-stream opening without materially restricting the down-stream opening, and adjustable means for positioning the closure means, said closure means comprising a swingable vane member adjustably positioned at variable angles with respect to a side of the tuyère box.

HERBERT A. REECE.