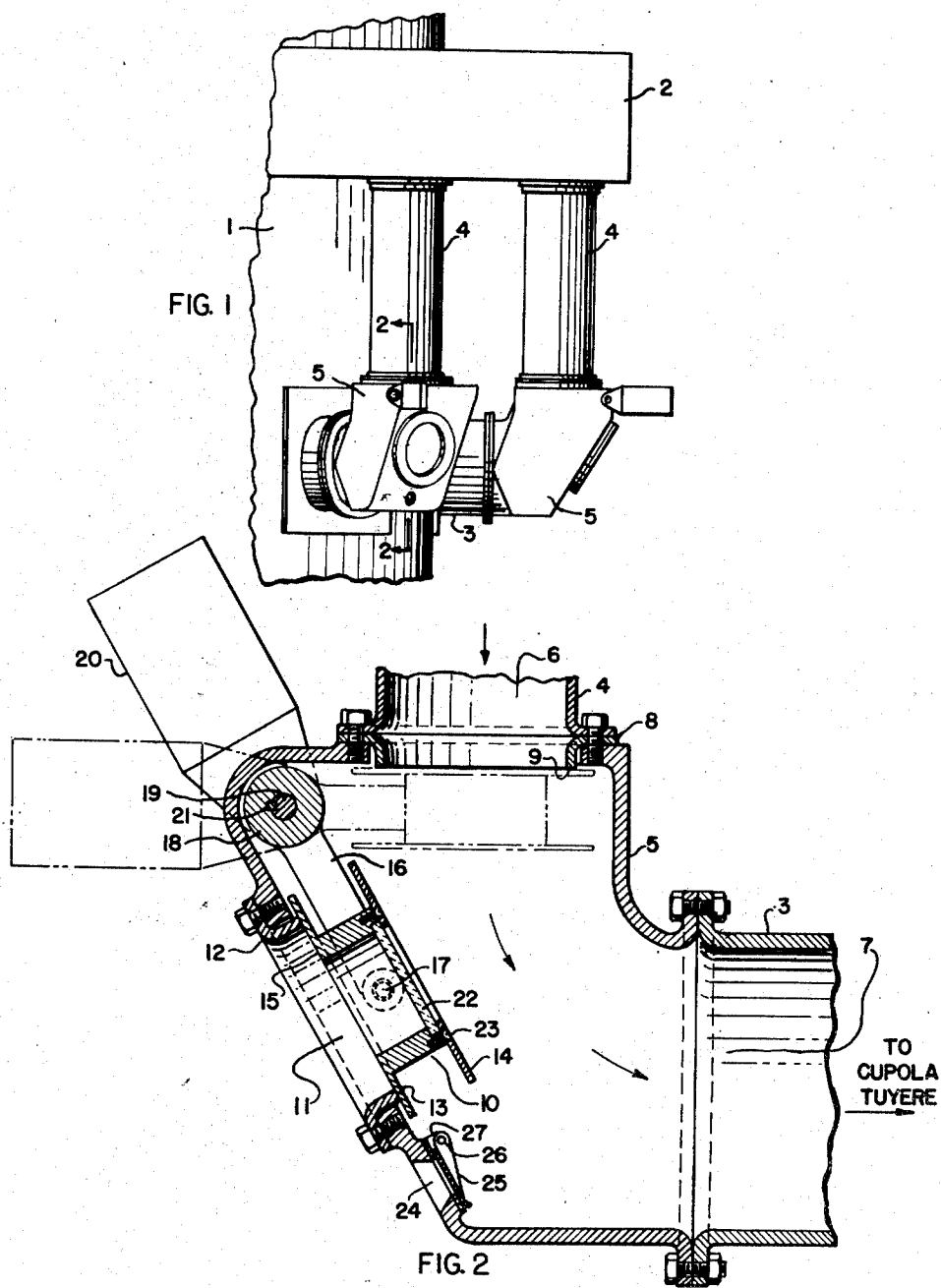


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IMPROVED TUYERE ELBOW

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IMPROVED TUYÈRE ELBOW

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1 Claim. (Cl. 137—112)

This invention relates to an improved type of tuyère elbow for use with a cupola or like type of furnace, and more particularly to an elbow providing an automatic gas check valve and auxiliary air inlet means for use between a wind box and a tuyère.

In furnaces and heaters of various types and particularly in connection with the cupola form of construction, as utilized in the steel and foundry industry, where metals or metallic ores, etc. are subjected to high temperature heating, it is customary to have an air distributing chamber, or wind box effect the distribution of air to the various tuyères within the cupola or furnace chamber. Also with cupolas, it is general practice to have a circular wind box which circumscribes the cupola chamber and utilize a plurality of tuyère elbows which independently connect each of a plurality of tuyère inlets to the wind box.

The tuyère, or tuyères, inside the cupola are provided with a plurality of tuyère inlet means which extend radially through the wall of the cupola to separately connect with each tuyère elbow. It is however, a particular problem in this arrangement to prevent hot cupola gases from backing up through the tuyère inlet means to the windbox or even to the blower or heat-exchanger means when the forced air supply is shut off. Hot gases flowing in a back draft can be harmful to the auxiliary equipment and it is thus important to provide means for stopping the back flow. In the past, check dampers and gas vents have been provided in the blast pipe and at the wind box and manually operated tuyère doors are provided at each elbow which must be opened when the forced air supply is shut down. However, this arrangement has not been satisfactory, because when all tuyère doors are not properly opened, the hot gases, which may be 1200° F. or more, may cause an explosive mixture in the wind box and blower, or can warp and buckle downpipes from the wind box to the tuyère elbow, when utilized in up to date cupola design. The apparatus of the present invention is of particular advantage in that both an automatic gas check valve or damper and auxiliary air inlet means are provided at points directly adjacent the inlets to the cupola tuyères.

It is thus a principal object of the present invention to provide an improved tuyère elbow which has automatic gas check damper and auxiliary air inlet means, so that damaging hot or explosive gases are prevented from backing up and reaching equipment which may be harmed, and auxiliary air is allowed to enter automatically into the tuyère elbow.

It is a further object of the invention to provide a single pivoted and counterweighted check valve member to move alternatively between an air stream inlet and an auxiliary air inlet opening within a tuyère elbow.

It is a still further object of the present invention to provide a novel swinging or pivoted type of check valve member having a sight glass therein, and a location within an air inlet tuyère elbow which permits visual inspection into each of the cupola tuyères.

Briefly, the present invention provides an improved type of tuyère elbow adapted for connection between a cupola wind box and a cupola tuyère and comprising in combination, a tuyère elbow housing having forced air stream inlet and outlet ports and an auxiliary air inlet opening a movable valve member within the interior of said housing, said valve member positioned intermediately between the interior portions of the forced air inlet port and the auxiliary air opening, whereby the check

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valve member may seat alternatively against the interior of the forced air and auxiliary air inlet port, and counterweight means connecting with the valve member operating to raise the latter against the forced air inlet port when a forced air stream through the elbow is stopped.

The construction of the tuyère elbow and the automatically operating check valve means therein is preferably such that the forced air inlet is at the top end portion of the elbow while the natural draft or auxiliary air inlet port or vent opening is in a side or lower portion of the elbow so that the valve member may normally rest against the inside face of the vent opening by virtue of the downward pressure of the air inlet stream. However, the counterweight means is connected with the valve member so that the latter is raised upwardly against the inside face of the forced air inlet opening, when there is no pressure or air flow down through the elbow. This feature permits the automatic checking of any back flow of hot or explosive gases from the cupola by way of the tuyères and tuyère inlet means and a direct natural draft inlet for air to be introduced through the elbow to the tuyère. By maintaining the auxiliary opening in the back portion of the elbow with a central axis in substantially the same plane as the air inlet port and the air outlet port, then the auxiliary opening may be located substantially opposite the air outlet port which connects with and faces directly towards the cupola. The opposing arrangement provides access to and inspection through the elbow into the cupola tuyère. As a particular feature of a preferred embodiment of the present tuyère elbow, the check valve member is provided with a transparent lens portion, such as of Pyrex glass or mica, so that an operator can look through the check valve member directly into the cupola tuyères during the melting operation of the cupola. A preferred embodiment of the elbow also utilizes a pivoted connection between the counterweight arm and the valve member itself so that the member may adjust itself to provide proper alignment and good seating against the inside portions or faces of either the forced air inlet opening or the auxiliary opening.

Reference to the accompanying drawing and following description thereof will serve to better illustrate the construction and arrangement of the improved tuyère elbow, as well as set forth additional advantageous features in connection therewith.

Figure 1 of the drawing is an elevational view of a portion of a vertical furnace or cupola showing the location and use of the improved tuyère elbows between the wind box and the tuyère inlets.

Figure 2 of the drawing is a sectional view through an improved tuyère elbow as provided by this invention and as indicated by the line 2—2 in Figure 1 of the drawing.

Referring now more specifically to Figure 1 of the drawing, there is shown a portion of a cupola 1 having a circular type of wind box 2, which surrounds the cupola and provides for the substantially uniform distribution of air to a plurality of tuyère inlets 3. The tuyère inlets 3 are spaced circumferentially around the cupola and provide a multiple number of air inlets to the internal tuyères of the furnace or cupola. Depending from the wind box 2 are a plurality of downpipes 4 which connect at their lower ends with the upper portion of the tuyère elbow housing or body portion 5. In other words, a tuyère elbow is provided between each wind box downpipe and each tuyère inlet to provide for the transmission of the air streams into the cupola. However, it is not necessary in all cases to use downpipes and the tuyère elbows may be connected directly to the lower portion of the wind box.

Referring now also to Figure 2 of the drawing, the tuyère elbow housing 5 is provided with an upper air inlet port or opening 6 and a side air outlet opening or port 7. The latter is indicated as being flanged and bolted directly to the tuyère inlet portion 3. The air inlet opening 6, in the present embodiment, is provided with a flanged insert member 8, which is adapted for bolting between the lower end of the downpipe member 4 and the upper face of the housing 5. The interior portion or face of the insert member 8 is provided with a

flat substantially smooth periphery 9 which provides a seating surface for an internally positioned movable and pivotally connected damper or check valve member 10.

In the back sloping side portion of the elbow body 5 there is provided an auxiliary air opening 11 which also has an insert member 12, similar to member 8, and having an outer flange permitting it to be bolted to the housing member 5. Insert member 12 has an internal smooth edge or periphery 13 adapted for providing a second seating surface for the check valve member 10. The opening 11, and its insert member 12, is positioned within the back portion of the body or housing member 5 such that a line projecting normal to its center is in substantially the same plane as a line projecting normal to the center of the air inlet port 6 and its insert member 9 whereby the movable check valve member 10 may swing in a fixed vertical arc between the inside faces or seating surfaces of the two openings. The auxiliary opening 11 also preferably is in the back portion of the housing 5, opposing the air outlet port 7 so that there may be direct access and observation into the tuyères of the cupola.

The check valve member 10 is constructed in a special manner providing two seating faces or flanges 14 and 15, inasmuch as the member is pivoted in a manner to move between the auxiliary opening 11 and the forced air inlet port 6 and seats alternatively against the face 9 of insert member 8 or the face 13 of the insert member 12. The damper or check valve member 10 preferably has two damper arms, one of which is indicated as 16, and which connect with each side of the member 10 in a pivoted connection. The present drawing shows in broken lines the end of the damper arm 16 connecting with a pin member 17. This type of connection permits the seating flanges 14 and 15 of the damper member to obtain good seating with the respective seats of the insert members at each opening. The damper arms 16, in turn extend from a shaft member 18 which in turn pivots about a rod or pin member 19. The pin member 19 extends across the housing or body portion of the elbow 5 between opposing holes or bearing portions, not shown in the present drawing. However, at one end, the pin member 19 extends through the body 5 and connects with an external counterweight member 20. The hollow shaft member 18 is fixed to the pin member 19 by a key member 21, or other suitable means. Thus, there is a rigid connection between the damper member 10 and the external counterweight 20, with pivoting taking place between the two end portions of the pin member 19.

When the cupola is in operation, an air stream is continuously fed downwardly through each downpipe 4 and through each tuyère elbow into the multiplicity of tuyère inlets 3 and into the interior of the cupola. The damper member 10 is counterbalanced so that air pressure maintains it against the inside face of the auxiliary opening 11. However, when the air supply to the windbox 2 and through the plurality of downpipes 4 is stopped, the pressure is taken off of the interior face of the check valve member 10, then the counterweight pivots the latter so that it raises and seats against the seating surface 9 at the air inlet port 6. In other words, the counterweight 20 exerts a slightly greater rotating movement around pivot pin 19 than is exerted by the check valve member 10 and its accompanying parts at the end of arms 16, so that without the influence of the pressure of the forced air stream the weight 20 exerts its gravity action and lifts the valve member 10 against seating surface 9. Suitable spring type of counterweight means may of course be attached to the damper or valve member 10 or shaft 18 in lieu of the weight 20, to provide for its lifting.

As set forth briefly hereinbefore, upon the check valve member raising and moving into a horizontal position, as shown by the dotted lines in Figure 2, any back draft of damaging gases from the cupola tuyères are prevented from passing upwardly through the elbow and through the downpipe members 4 into windbox 2 or cupola blower. At the same time, the auxiliary air inlet 11 is automatically opened and there is a flow of air, by natural draft, through the tuyère elbow to the tuyère inlets. Thus the elbow is maintained cool and there is no damage to the downpipes from excessive heating or explosive gases in the air ducts, wind box, or blower.

A desirable embodiment of the check valve member, as illustrated, provides a transparent lens member 22 so that there may be visual inspection means directly through the damper member into the tuyères of the cupola, during its normal operation. The lens member 22 is seated within the check valve member 10 and retained in place by the flange portion 14. The latter is indicated as being removably attached to the body of the damper member 10 by a plurality of countersunk head stud bolts 23, although rivets or other equivalent means may be provided for maintaining the lens member removably in place within the body of the check valve member. The lens member must, of course, be formed from a high temperature resistant material, such as Pyrex glass, mica, or the like. It is also a feature of the present improved tuyère elbow to maintain a small diameter poke hole in the body of the elbow substantially opposite the air outlet to the cupola tuyère. An opening 24 is provided below the auxiliary opening and provides means for inserting a rod or suitable poking member through the tuyère inlet 3 and to the interior of the cupola, where such operation may be necessary without the escape of an excessive amount of air. A top hinged flapper or cover member 25 is provided inside of the housing 5 and over the poke opening 24. The flapper 25 is pivoted on a suitable pin or bolt 26, which in turn connects with a suitable boss or raised portion 27, at the inside top portion of the opening 24. Thus the gravity weight of the flapper member maintains the latter in a normally closed position over the opening 24, while at the same time the insertion of a poker or rod means through the opening readily causes the flapper member 25 to be raised and temporarily uncover the opening.

We claim as our invention:

35 A tuyère elbow adapted for connection between a cupola wind box and a cupola tuyère and comprising in combination, an elbow shaped housing having an upper air stream inlet port and a side outlet port, with said elbow shaped housing having an auxiliary air inlet opening positioned in a side portion of said housing substantially opposite that of said air outlet port and having a line normal to its center lying the same plane as a line normal to the center of said air stream inlet port, a movable and pivotally mounted check valve member positioned within said housing between said air inlet port and said auxiliary inlet opening, said valve member having flange like seating surfaces on each face thereof and a centrally positioned removable transparent high temperature resistant lens portion, the latter permitting visual inspection through said elbow shaped housing and through said air stream outlet port thereof when said check valve member rests against said auxiliary inlet opening, with said valve member connecting to and pivoting on extended spaced arm means from a shaft member extending across the interior of said housing, said shaft member extending through said housing at a position between adjacent interior portions of said air inlet port and said auxiliary air inlet opening, and said shaft position in said housing permitting said valve member to swing in an arc and seat alternatively against the inside of said air stream inlet port and the inside of said auxiliary inlet opening, and counterweight means connecting with said shaft externally of said housing and opposing said valve member in a manner operating to raise the latter against the inside face of said air stream inlet port upon the discontinuance of the introduction of air downwardly through said air stream inlet port.

References Cited in the file of this patent

UNITED STATES PATENTS

396,765	Power	Jan. 29, 1889
663,177	Klink	Dec. 4, 1900
742,919	Smith	Nov. 3, 1903
845,213	Bazin	Feb. 26, 1907
849,539	Garred	Apr. 9, 1907
875,101	Peregrine	Dec. 31, 1907
1,713,313	Willcox	May 14, 1929
2,438,769	Thomas	Mar. 30, 1948
2,461,392	Parry	Feb. 8, 1949
2,654,388	Glass	Oct. 6, 1953