

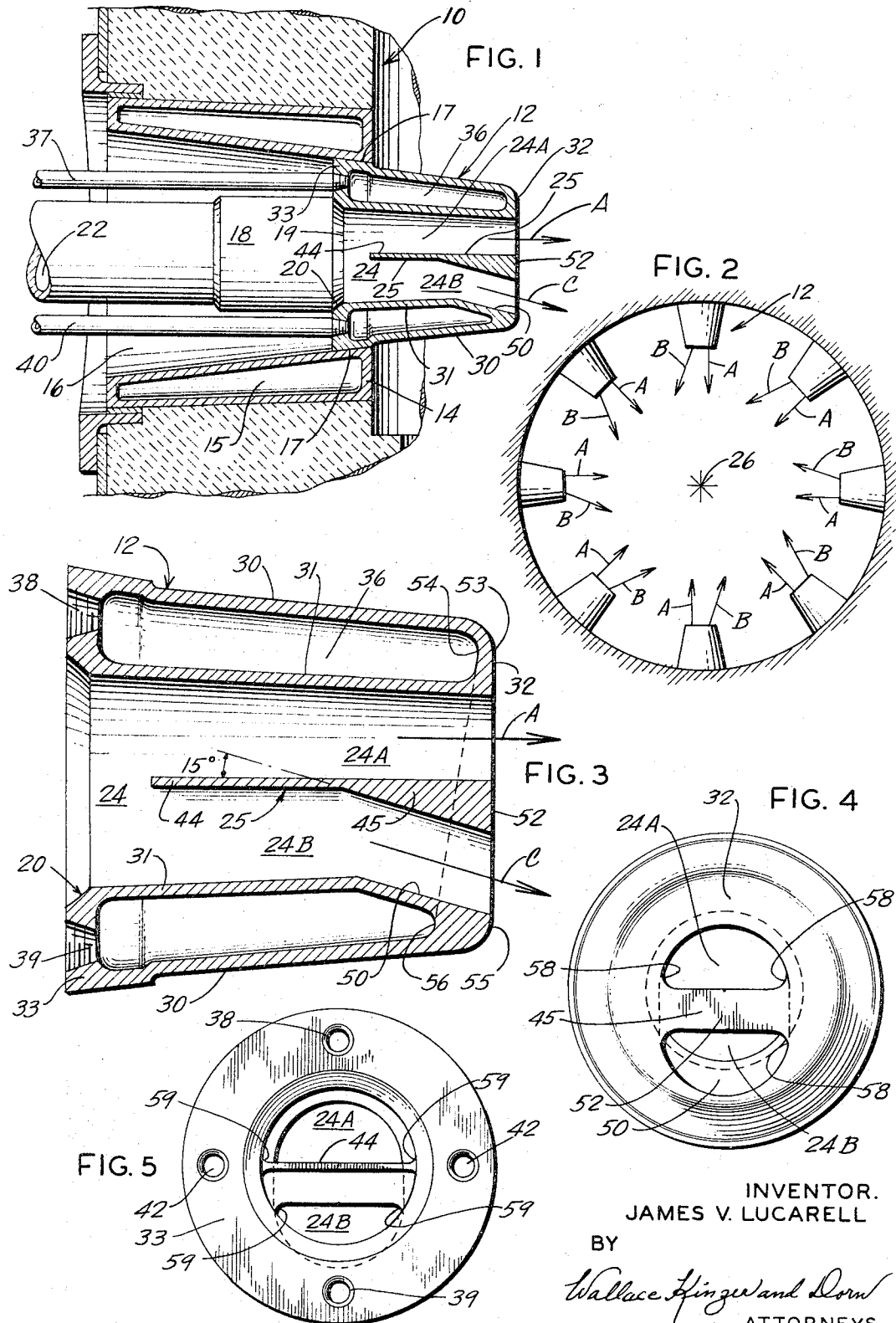
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TUYERE WITH DIVIDED PASSAGEWAY

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TUYERE WITH DIVIDED PASSAGEWAY
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This invention relates to blast furnaces, and more particularly to the method of and structure for controlling the introduction of gaseous blasts therein.

Typically, a blast furnace has a generally cylindrical interior encompassed within a furnace wall and a plurality of circumferentially spaced tuyeres disposed in the furnace wall through which gaseous blasts are introduced into the center of the furnace. In most blast furnaces, the tuyeres direct the gaseous blasts directly along radial lines toward the axis at the center of the furnace. In some blast furnaces, as disclosed in United States Patent No. 2,124,437, the flow of gaseous blasts is directed eccentrically of the axis of the furnace to produce a swirling effect to the blast. In still other blast furnace installations, as disclosed in United States Patent No. 2,781,190, the gaseous blasts are directed downwardly at an angle from the generally horizontal planes of tuyere locations in the furnace wall against the pool of molten metal therein. The more conventional radial blasts have the advantage of achieving greater penetration of the burden; however directing the air eccentrically or downwardly has advantages as set forth in more detail in the above cited patents. A primary object of the present invention is to control the blast in a blast furnace by directing one portion thereof at a radial path and directing another portion at an angle to the radially directed blast.

A more specific object of the invention is to provide for a novel flow of air into a blast furnace by dividing a blast of air in the tuyere into two portions while directing one portion along radial line toward the center of the furnace and the other portion at a predetermined angle to the radially directed blast of air.

Another object of the invention is a new and improved tuyere having the capability of dividing a blast of gaseous medium such as air into at least two portions, and directing a first portion thereof along a radial direction toward the center of the blast furnace and directing a second portion of the gaseous blast at a predetermined angle to the radially directed blast.

Another object of the invention is a tuyere having the foregoing capabilities and which can be positioned in the furnace wall so as to direct the second portion of the blast either downwardly or eccentrically of the radial blast.

A further object of the invention is the provision of a baffle within the bore of a tuyere to divide the blast of air or other gaseous body moving through the tuyere into two portions and to direct one portion of the blast of air at an angle relative to the other portion of air.

A general object of the invention is a tuyere of the foregoing type which is simple in construction and inexpensive to manufacture.

Other and further objects of the invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in

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the art without departing from the present invention and the purview of the appended claims.

In the drawings:

FIG. 1 is a sectional view showing a typical furnace wall having a tuyere constructed in accordance with the invention;

FIG. 2 is a diagrammatic view showing one orientation of a plurality of tuyeres and the direction of the air blast exiting each of the tuyeres under the present invention;

FIG. 3 is a sectional view of a tuyere constructed in accordance with the present invention;

FIG. 4 is an end view of the nose portion of the tuyere of FIG. 3; and

FIG. 5 is a rear view of the rear plate of the tuyere of FIG. 3.

Referring now to the drawings, and more particularly to FIG. 1, there is illustrated a typical installation within a blast furnace wall 10 of a tuyere 12 constructed in accordance with the preferred embodiment of the invention. The tuyere 12 is held in the furnace wall 10 by a tuyere cooler or holder 14 which has an annular cooling space 15 for receiving a cooling medium such as water. The tuyere cooler has a central conical opening 16, which at the narrowing forward end thereof, has a wedging fit at 17 to hold the tuyere 12 in place. A blow pipe 18 extends into and through the center of opening 16 of the tuyere cooler 14 and has a forward end 19 fitted into recess area 20 complementary in shape to the end 19 of the blowpipe 18. Preheated gaseous blasts, usually air blasts, flow through the interior bore 22 of the blowpipe 18 into the central opening or bore 24 at the rear of the tuyere 12.

Among the important aspects of the present invention are the dividing of the air blast within each tuyere 12 by a divider and baffle means 25 and the controlling of the directions of the divided streams of blast within the interior of the furnace. The divider and baffle means 25 forms two separate and distinct passageways 24A and 24B for directing the gaseous blast to exit from the tuyere 12 along diverging paths as will be explained hereinafter in detail.

FIG. 2 illustrates diagrammatically a conventional blast furnace installation having a plurality of circumferentially spaced tuyeres usually numbering eight to sixteen tuyeres. The tuyeres 12 extend into the central and cylindrical area, FIG. 2, of the blast furnace wherein the burden is being reduced. The more conventional type of tuyere arrangement has the bores of the tuyeres arranged in the same horizontal plane with each of the tuyeres oriented to direct the air of gaseous blast exiting therefrom toward the center of the furnace, defined by a generally vertical axis such as 26, FIG. 2. The direction of the blast from the tuyeres along radial lines toward this central axis 26 affords good penetration of the burden by the gas blasts from the tuyeres. However, advantages of air flow have been advanced for a tuyere arrangement such as that illustrated in United States Patent No. 2,124,437, wherein the nose of the tuyere is curved at an angle to the radial direction so that the air blasts exiting therefrom are directed eccentrically of the furnace so as to create a swirling draft. The swirling draft decreases the interference of the blasts with each other as they intersect adjacent the axis 26. The tuyere of United States Patent No. 2,781,190, has the blasts directed downwardly rather than straight outwardly along a horizontal plane toward the central axis of the furnace.

Of primary importance to the present invention is the method of controlling the air blasts in a blast furnace so

as to direct a portion of each of the air blasts from each of the tuyeres radially toward the center of the furnace and to direct another portion of each of the blasts exiting from a tuyere at an angle to the radially directed blasts so as to achieve an eccentrically directed blast, or alternatively, downward blast.

More specifically, an arrangement of air blasts according to the present invention has radially directed portions of the blasts, indicated by arrows A, to afford good penetration of the burden while simultaneously affording either eccentric blasts or downwardly directed blasts. In FIG. 2, the tuyeres 12 are disposed in the furnace wall with the passageways 24A and 24B both in the same horizontal plane. Thus, portions of the blasts exiting the passageways 24B are directed eccentrically as indicated by the directional arrows B, in FIG. 2, to create a swirling draft while that other portions of the blasts are directed radially as indicated by the arrows A to afford direct penetration type of blast from each of the tuyeres.

With the tuyeres 12 disposed in their holders 14 as shown in FIG. 1, a first portion of a blast is directed toward the axis 26 of the furnace while another portion of the blast is exiting at an angle to the radial blast A and is directed downwardly as shown by the directional arrows C, FIGS. 1 and 3. Thus, each of the tuyeres 12 will have a portion of a blast directed in the same horizontal and radial direction as indicated by the directional arrows A; and each of the tuyeres 12 will have a portion of the blast directed downwardly. Preferably, all of the tuyeres 12 will have the same orientation within the furnace. Thus, if the tuyeres 12 are oriented to effect an eccentric blast, then the tuyeres are aligned in the same direction of exhaust; for example, to afford a counter-clockwise swirling draft, as illustrated in FIG. 2. Alternatively, rotating the tuyeres 180° from the position of FIG. 2 would afford a clockwise swirling draft from the passageways 24B.

Similarly, when one of the tuyeres 12 is disposed in the manner illustrated in FIG. 1, it is preferred that all the remaining tuyeres 12 be similarly oriented with their respective blasts C pointed downwardly. It is to be understood from the foregoing that rotation of the tuyere 12 through 90° from the position shown in FIGS. 1 and 3 disposes a tuyere 12 to afford the eccentric directional blast B rather than the downwardly directed blast C. Thus, the same construction of tuyere 12 can be employed to afford either an eccentric or downwardly directed blast in combination with a radial blast.

Preferably, the tuyere 12 is a one piece casting of a copper alloy or other suitable material having an integrally formed outer circumferential wall 30, an inner circumferential wall 31, an inner or nose wall 32, a rear or butt wall 33 and a divider and baffle wall 25. In the space between the inner and outer circumferential walls 30, there are a series of cooling passages 36 for receiving cooling water from an inlet pipe 37 threaded into a tapped opening 38 in the rear wall 33 of the tuyere. In a conventional manner, one or more baffles (not shown) extend between outer wall 30 and inner wall 31 to form the passages 36 for directing forward and reverse longitudinal flow of the water which exits from the tuyere through a tapped opening 39 and an outlet pipe 40. Typically, the tuyere 12 has one or more tapped openings 42 in the rear plate 33 to permit cleaning of the interior passages 36. These tapped openings 42 are closed by tightly fitting plugs thereby preventing the loss of any water from a tuyere 12.

The divider and baffle wall means 25 is preferably formed with a rearward or divider portion 44 which is of relatively narrow cross-section and divides the bore into equal areas so as to afford the equal passageways 24A and 24B on opposite sides of the divider portion 44. This divider portion 44 is joined at a forward portion to a baffle portion 45 which is of increasing cross-sectional thickness in the direction toward the nose wall 32. The baffle portion 45 has a 15° inclination to the center line of the

tuyere 12 so that the portion of the gaseous blast moving through the passageway 24B exits at an angle of 15° relative to the portion of the gaseous blast exiting the passageway 24A. The angle of inclination of the passageway 24B, however, is subject to change with different designs and the 15° angle of inclination is exemplary. It is to be noted that the passage 24B is unrestricted in size because the inner wall 31 is tapered at 50 along a 15° angle so as to maintain the cross-sectional area of the passageway 24B equal to the cross-sectional area of the passageway in order not to restrict the flow of the gaseous blast therefrom.

While the baffle and divider means 25 may take different forms and shapes, it is preferred that the end of the baffle 52 at the nose wall 32 be of substantial thickness so as to better withstand the high thermal temperature and abuse. Preferably, the nose wall 32 is also of increasing thickness in a downward direction when the tuyere 12 is oriented with the passageway 24B to direct a gaseous blast downwardly. The wall 32 is of first thickness between the outer surface 53 and inner surface 54 at the top of the tuyere and is of a greater thickness between the surfaces 55 and 56 at the lower portion of the tuyere, when oriented in the position of FIG. 3. Also, it is preferred practice to generally round the interconnection of the divider and baffle plate 25 as shown by the rounded corners 58, FIG. 4, and rounded corners 59, FIG. 5.

From the foregoing, it will be seen that the present invention is directed to a novel manner of controlling the air blasts for a blast furnace; and to a novel tuyere having a baffle or divider for dividing an air blast into two portions and for directing one portion of an air blast at an angle to another portion of the air blast. Also with the novel tuyere of the invention, it is possible to employ the same tuyere to afford either an eccentric or downward blast in combination with a radial blast.

It is understood that the tuyere may be divided solely by baffles such as the baffle 45 without employing a divider 44 and that the divider and baffle may be of different lengths and shapes and still be within the purview of the present invention. Also, the baffles and divider shown to be integrally cast with the tuyere may be made separately and secured within a bore of the tuyere by welding or mechanical type fasteners.

Hence, while I have illustrated and described preferred embodiments of my invention, it is to be understood that these are capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. In a tuyere or like furnace part having an outer wall, an inner wall, a nose wall joining said outer and inner at the end of the tuyere to be inserted farthest into the furnace, a butt wall joining said outer and inner wall at the other end of the tuyere, said inner wall defining a bore for the flow of gases therethrough from the butt and to the nose end of the tuyere, and baffle means in said passageway for directing a first portion of said gas to exit from said bore at an angle to a second portion of said blast exiting from said bore, said baffle means extending rearwardly from said nose wall towards said butt wall and is of tapered decreasing thickness; said inner wall being tapered opposite said baffle means to maintain equal cross-sectional areas opposite one another between said baffle means and said inner wall.

2. In a one-piece, integrally cast tuyere or like furnace part having an outer integrally cast wall, an inner integrally cast wall, an integrally cast nose wall joining said outer and inner wall at the end of the tuyere to be inserted furthest into the furnace, an integrally cast butt wall joining said outer and inner wall at the other end of the tuyere, said inner wall defining a bore for the flow of gases therethrough from the butt end to the

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nose end of the tuyere, and an integrally cast baffle means located substantially in its entirety within said bore for dividing said bore and gas introduced therein into first and second streams flowing through said bore, said baffle means including an integral web portion extending across said bore to divide said bore into two separate passages, and an inclined portion for directing the gas at an angle to said integral web portion.

3. The tuyere of claim 2 wherein said inner wall is inclined at the same inclination as said inclined portion opposite said inclined portion to afford equal area passageways at the nose wall.

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References Cited

UNITED STATES PATENTS

157,256	11/1874	Wiard	-----	239—553 X
1,017,638	2/1912	McCoole	-----	239—553
1,994,115	3/1935	Stoecker	-----	266—41
2,781,190	2/1957	Weir	-----	266—41

FOREIGN PATENTS

976,068	3/1951	France.
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