May 25, 1954 J. H. SPROW 2,679,390

TUYERE FOR BLAST FURNACES

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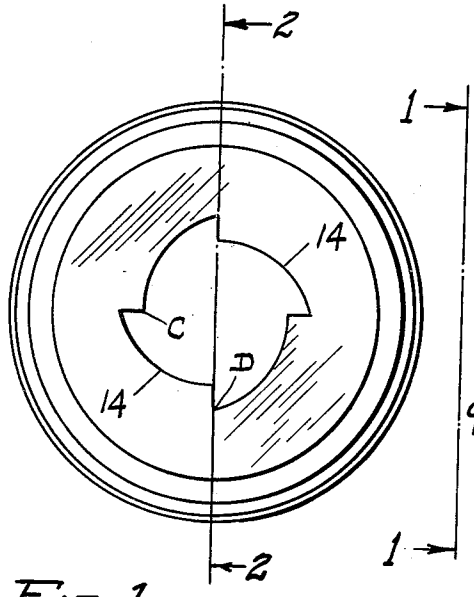


Fig. 1

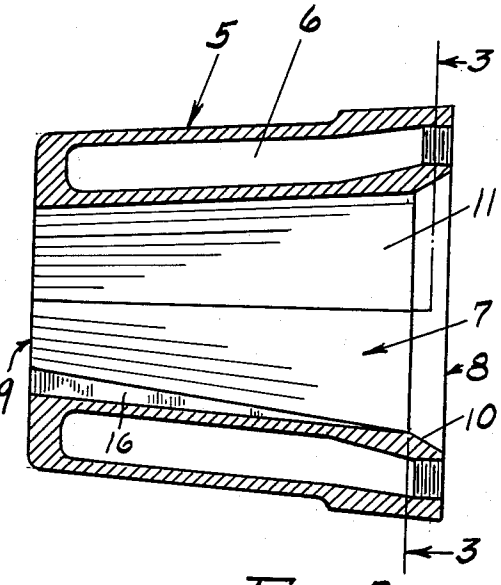


Fig. 2

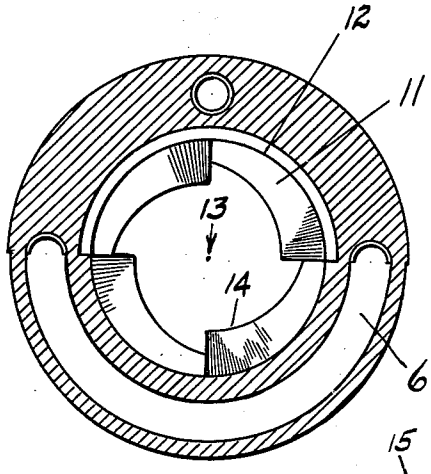


Fig. 3

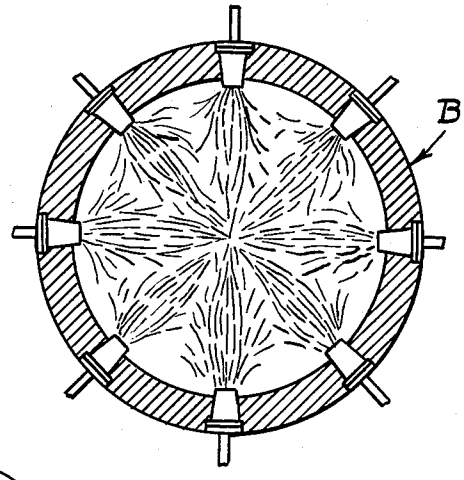


Fig. 4

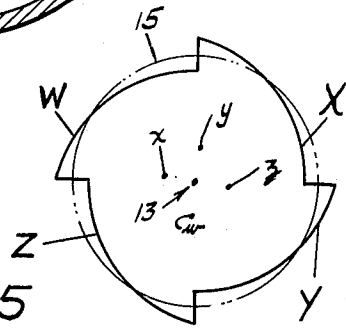


Fig. 5

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TUYÈRE FOR BLAST FURNACES

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1 Claim. (Cl. 266—41)

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My invention relates to a tuyère for blast furnaces.

It is the main object of my invention to provide a tuyère for blast furnaces which will produce both a penetrating and a spreading blast so as to ensure penetration of the blast into the center of the material adjacent the circumference of the furnace in both a horizontal and a vertical direction.

Another object of my invention is to provide a tuyère which will impart a whirling action to the blast so that it will be more penetrating but which is so designed that it can be cleaned without difficulty.

Another object of my invention is to provide a tuyère of the type indicated above which produces a whirling stream that penetrates in an axial direction but also spreads radially substantially uniformly in all directions.

The preferred embodiment of my invention is illustrated in the accompanying drawing wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a nose end view, taken along line 1—1 of Figure 2, of a tuyère made according to my invention.

Figure 2 is a longitudinal sectional view taken through the tuyère of Figure 1 along line 2—2.

Figure 3 is a sectional view taken along line 3—3 of Figure 2 at the inlet end of the tuyère.

Figure 4 is a top view showing several tuyères in place in the blast furnace and the action thereof.

Figure 5 is a diagram illustrating the formation of the bore in the tuyère at the nose end thereof.

With reference to the drawing, I have shown a tuyère comprising a substantially frusto-conical hollow body 5. This body is provided with a surrounding water jacket 6. An axial bore 7 is provided in the body 5 for receiving the air blast and directing it into the furnace. The bore 7 extends from the inlet end 8 to the nose or outlet end 9. The body 7 tapers or converges from the inlet end 8 to the outlet end 9 and the inlet end is provided with an inwardly angled surface 10 leading into the bore 7.

The inner wall surface of the body 5 of the tuyère, that is, the surface of the bore 7 is divided into blast-directing segments 11 which extend the full length thereof and which are disposed side-by-side around the complete circumference of the bore. These segments are provided in an equal number so that they are arranged in pairs, each pair consisting of two diametrically opposed segments. In the drawing, I have illustrated four segments 11 but it is to be understood that six, eight, or any desired even number of segments may be provided, depending somewhat upon the cross-sectional size of the tuyère.

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Each segment 11 has a taper from the inlet end of the bore to the outlet end of the bore. The curvature transversely of each segment 11 at the inlet end of the bore 7 is concentric with the curvature of the other segments so that the segments 11 merge with each other at such inlet end, as illustrated best in Figure 3, along a circle 12 which is at the inner surface of the bore 7 and which has its center at the axis 13 of the bore. However, on the other or nose end, the segments are not concentric, as shown best in Figure 3 and Figure 5 and their respective centers are not located on the bore axis 13.

It will be noted from Figure 5 that the centers w, x, y and z, of the respective curves 14 of the various segments, which are each designated W, X, Y, Z, are spaced from the axis 13 away from its curve in a uniform manner a distance less than half the radius of such curve at the inlet end. Also, the radius of curvature of each curve W, X, Y, Z is greater than that of the median circle 15 which has its center at axis 13. It will also be noted from Figure 5 that the radius of curvature of each segment 11 at the nose end W, X, Y and Z is displaced angularly in a clockwise direction from the radius of curvature of such segment at the inlet end. Thus, the radius of each curve 14 is such and its center is so located that for a portion of its extent it curves out beyond the circle 15, and for another portion of its extent, it curves inwardly within the circle 15. This relative arrangement of the curvature 14 of the various segments 11, at the nose end of the tuyère, results in the formation of a radial shoulder 16 between each pair of adjacent segments 11. This shoulder 16, as shown in Figure 2, is of maximum inward extent or height at the nose end of the bore 7 and gradually diminishes in extent until the inlet end of the bore is reached where it disappears and, as previously indicated, the adjacent segments 11 merge with each other. Thus, each segment 11 tapers from one end of the bore 7 to the other and, in effect, tapers transversely and inwardly towards the bore axis 13 in a counterclockwise direction as shown in Figure 1.

When the blast of air is forced into the inlet end of the bore 7, the segments 11 will gradually twist the stream about the axis of the bore so that when it is discharged from the outlet end

thereof the outer border thereof will have a whirling motion. This whirling motion will give a deeper penetration towards the vertical axis of the blast furnace B as shown in Figure 4. Because of the gradual taper in both the longitudinal and transverse directions, the bore will accept the blast with very little resistance. The air will not only penetrate towards the axis of the furnace, because of the whirling or twisting action, but will spread outwardly, as indicated in Figure 4, because of the diverging surfaces of the opposed segments 11 which, as previously indicated, are arranged in pairs. The transverse taper of the segments can be made left or right so that the whirling or twisting action of the stream or blast can be made clockwise or counterclockwise. As viewed in Figure 2, the twisting will be in a counterclockwise direction. This tuyère arrangement provides a concentrated stream of air at the four points C where the opposed segments 11 converge as well as a stream with a spreading effect at the four diverging points D which will be on the outer border of the air stream. Each segment 11 tends to concentrate and spread the air at the precise points indicated and the result is a stream or blast which has both a penetrating and a spreading effect, the spreading effect being uniform in all directions regardless of the position to which the tuyère body 5 is rotated about its axis as it is set in the furnace B. Although a twisting action is produced on the stream, this is accomplished without the use of helical ribs which would make cleaning more difficult.

Various other advantages will be apparent.

I claim:

A tuyère comprising a body portion having a bore extending therethrough and which tapers inwardly towards its axis from its inlet end to its nose end, a series of segmental surfaces arranged in pairs of diametrically opposed surfaces formed on the interior of the body and disposed side-by-side completely around the surface of the bore, said segmental surfaces being concentric at the inlet end on the axis of the bore but each surface having its center of curvature spaced uniformly outwardly from the axis away from the curve a distance less than half the radius of curvature of such surface at the inlet end of the bore and its radius of curvature being displaced angularly in a clockwise direction from the radius of curvature of said surface at the inlet end so that a radial shoulder is provided between adjacent segmental surfaces, said shoulder decreasing in radial extent from the nose end of the bore to the inlet end thereof.

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