Nov. 7, 1939. K. STEINBACHER 2,178,654

TUYÈRE

Filed July 30, 1938 2 Sheets-Sheet 1

Fig. 1

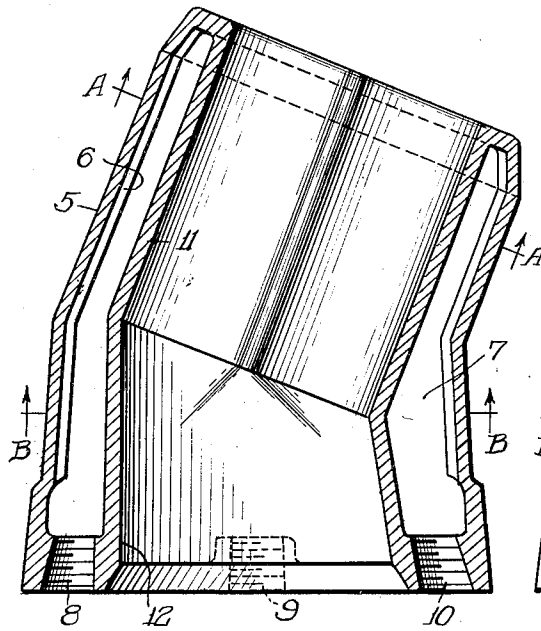


Fig. 2

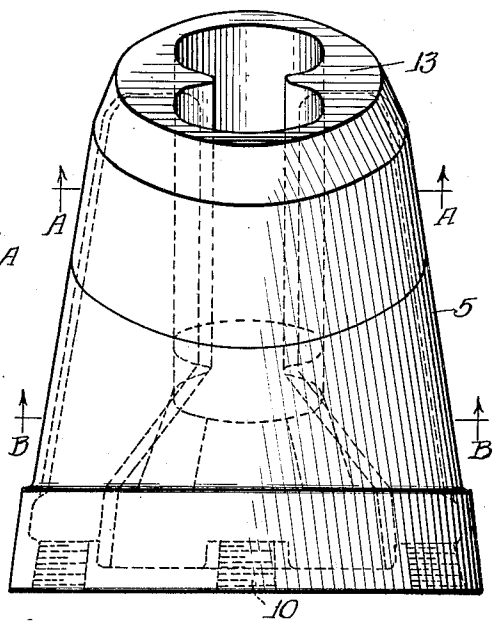


Fig. 3

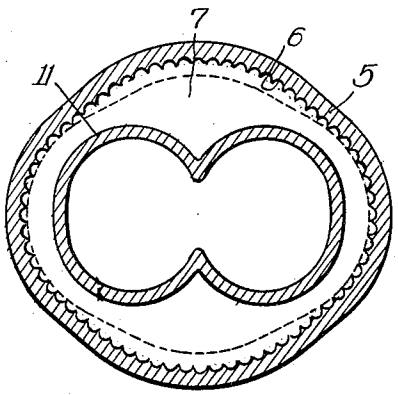
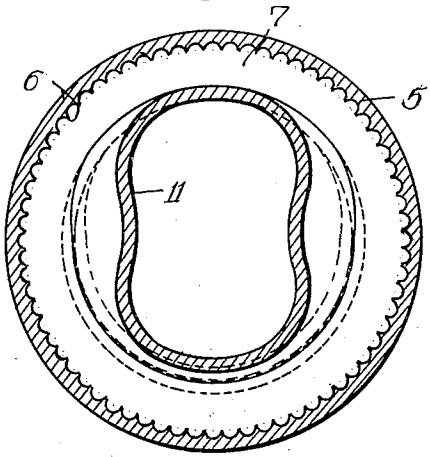


Fig. 4



INVENTOR.
Karl Steinbacher,
BY Wilkinson, Huxley, Byron & Knight
ATTORNEYS.

Nov. 7, 1939. K. STEINBACHER 2,178,654

TUYÈRE

Filed July 30, 1938 2 Sheets-Sheet 2

Fig. 5

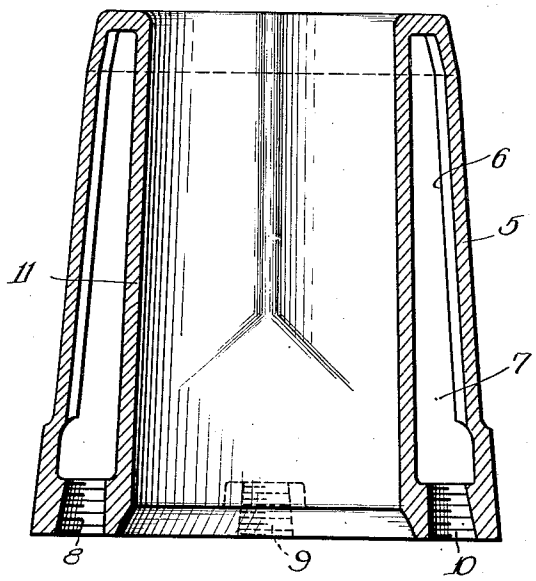
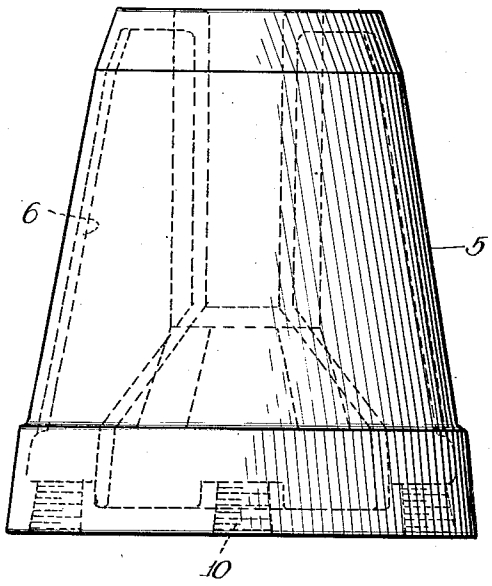


Fig. 6



INVENTOR.
Karl Steinbacher,
BY Wilkinson, Huxley, Byron & Knight
ATTORNEYS.

Patented Nov. 7, 1939 2,178,654

UNITED STATES PATENT OFFICE

2,178,654

TUYÈRE

Karl Steinbacher, Portsmouth, Ohio

Application July 30, 1938, Serial No. 222,103

1 Claim. (Cl. 266—41)

This invention relates to a new and improved tuyère and more particularly to a water-cooled tuyère of the type used in blast furnaces or the like.

The iron blast furnace is a vertical shaft, generally circular in a horizontal cross-section, and provided at the top with means for receiving a charge of ore, coke and limestone; provided at the bottom with apertures for the withdrawal of slag and iron, and also provided at a point above the slag line with a plurality of openings into which are fitted watercooled nozzles known as tuyères. These tuyères are spaced at equal intervals around the furnace, and form the points of entry of the wind or hot air blast blown into the furnace for the combustion of coke. Researches of various investigators have demonstrated that the combustion of coke occurs relatively close to the nose of the tuyère, generally speaking, within a distance of about forty inches, the horizontal cross-section of the area within which combustion takes place being approximately circular or slightly elliptical, with the long axis in the direction of the flow of the blast in a horizontal plane.

Into the void created by the gasification of coke in front of the tuyères fall the coke and molten material immediately above, and this process causes the descent of stock in the furnace from the top to the bottom.

It is an object of the present invention to provide a new and improved tuyère for blast furnaces or the like.

It is a further object to provide a tuyère which discharges the blast in such manner as to enlarge the horizontal cross-section of the effective combustion space in front of the tuyère.

It is also an object to provide a tuyère having a horizontally elongated discharge opening with a restricted portion intermediate the ends of the opening.

It is an additional object to provide a tuyère which will cause a combustion zone such as will facilitate the descent of material in the furnace and minimize or prevent the bridging of material which results in the condition known as "hanging."

Other and further objects will appear as the description proceeds.

I have shown a preferred embodiment of my invention in the accompanying drawings, in which—

Figure 1 is a horizontal section through one form of my improved tuyère, the section being taken through the long dimension of the tuyère passage;

Figure 2 is an elevation of the tuyère as seen from the right of Figure 1;

Figure 3 is a cross-section taken on line A—A of Figures 1 and 2;

Figure 4 is a second cross-section taken on line B—B of Figures 1 and 2;

Figure 5 is a sectional view similar to Figure 1 but showing a straight tuyère; and

Figure 6 is an elevation of the tuyère shown in Figure 5, as viewed from the right or left.

The tuyère is preferably formed by means of a casting operation, and may be made of copper or of suitable metallic alloys commonly used for tuyères of this character. The outer tuyère wall 5 is circular in cross-section on line B—B as shown in Figure 4, while it is oval in cross-section on line A—A as shown in Figure 3. This wall 5 is shown as carrying the inner corrugations or fins 6 which serve to facilitate heat transfer between the cooling fluid and the outer wall of the tuyère. The tuyère is provided with a cavity 7 for carrying this cooling fluid, the cavity being provided with ports 8, 9 and 10 to which suitable inlet and outlet pipes may be connected for introducing and withdrawing the cooling fluid.

The inner wall 11 of the tuyère is circular in cross-section at its lower end 12. This wall 11 is generally oval in shape on the plane B—B as shown in Figure 4. When it reaches the plane A—A it is approximately the form of a figure 8 in cross-section, as shown clearly in Figure 3. The form of passage shown in Figure 3 also continues to the discharge face 13 of the tuyère as shown in Figure 2.

It will be apparent from the figure of the drawings that the passage through the tuyère for the hot blast or wind gradually changes from a circular cross-section to an elongated or oval cross-section and from such cross-section to the figure 8 of the discharge end. A substantial portion of the passage is of figure 8 cross-section, as will be apparent from Figure 2, so that by the time the blast leaves the discharge face of the tuyère the turbulence caused by the variation in cross-sectional area and form will be substantially reduced and the blast issues as a pair of interconnecting and slightly overlapping columns of air under pressure. The restriction intermediate the ends of the cross-section of the passage, which serves to give it the figure 8 form in cross-section, is thus effective in producing a discharge column which is distinctly different from the

column discharged merely from a flattened elongated orifice.

The discharge area of the tuyère is substantially identical in area with the circular opening which has heretofore been in general use in such tuyères. It therefore serves to discharge the same quantity of air as the usual tuyère at the same velocity. I have found that the improved figure 8 form of passage is very materially more effective than merely an oval or flattened passage. I have found that with such oval or flattened passages a preponderance of air passes along the central axis of such passage and the objects of my invention are not attained. In order to prevent the preponderance of air passing along the central axis of the tuyère, I reduce the vertical heighth of the central portion of the tuyère by the restrictions shown, which serve to produce the figure 8 form of discharge orifice. The outer shell of the tuyère is substantially unchanged in shape, the water space being increased at the top and bottom of the tuyère and decreased at the sides of the tuyère. This maintenance of the external shape is desirable in order to avoid a flat upper surface which might render the tuyère likely to be punctured by globules of molten iron coming in contact therewith.

The invention has been described both in connection with an angular type of tuyère, such as shown in Figures 1 to 4, and also in connection with a standard straight tuyère as shown in Figures 5 and 6. It will be understood that the invention is independent of the particular form of tuyère and may be applied to these or other forms of tuyères.

While I have shown one preferred form of my invention this is capable of change and modification to meet varying conditions and requirements and I contemplate such variations as come within the spirit and scope of the appended claim.

I claim:

A water-cooled tuyère having a passage therethrough, the inlet end of the passage being substantially circular in cross-section and the discharge end of the passage being substantially figure 8 shaped in cross-section, the inlet circular cross-section gradually merging with the figure 8 shaped cross-section of the discharge portion of the passage.

KARL STEINBACHER.