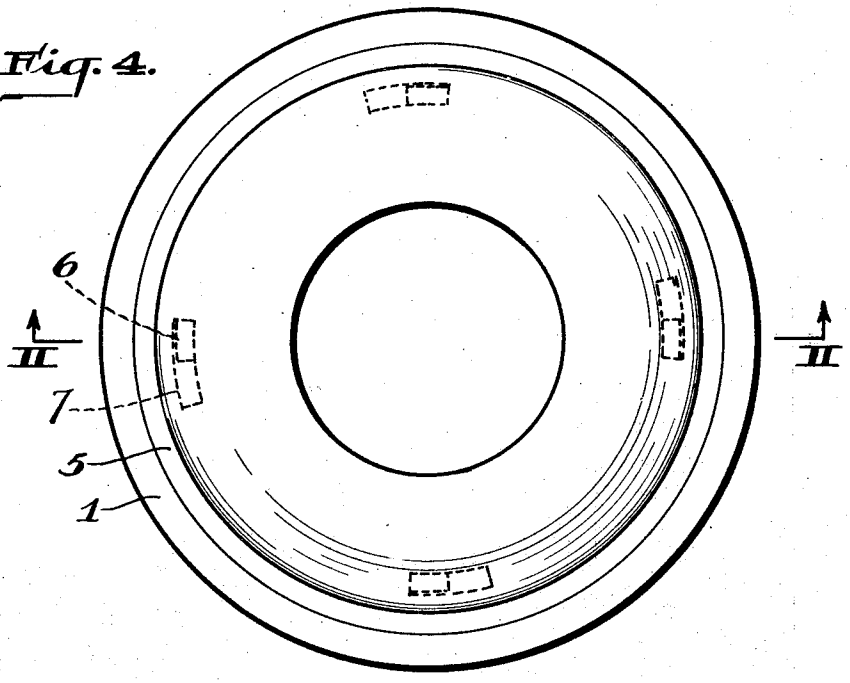
July 19, 1932. J. A. BOLAND 1,868,306

BLAST FURNACE TUYÈRE

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Fig. 4.



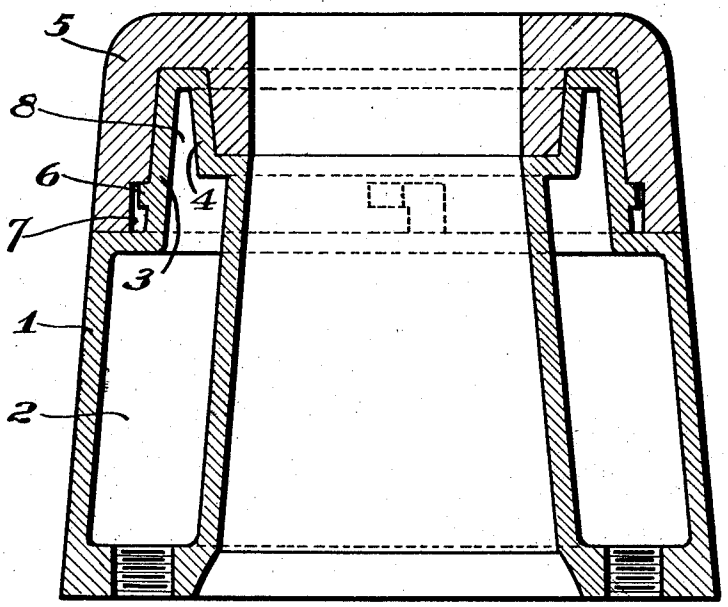


Fig. 1

WITNESS

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Fig. 2.

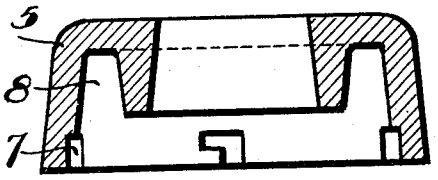


Fig. 3.

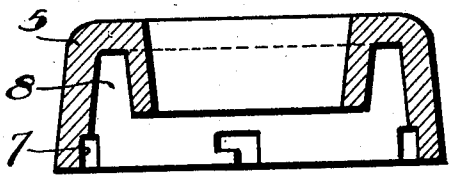


Fig. 5.

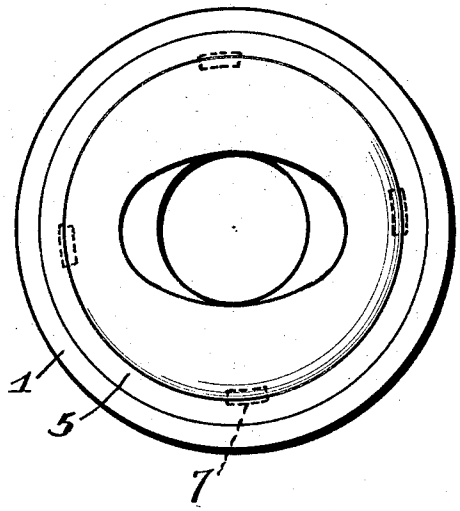
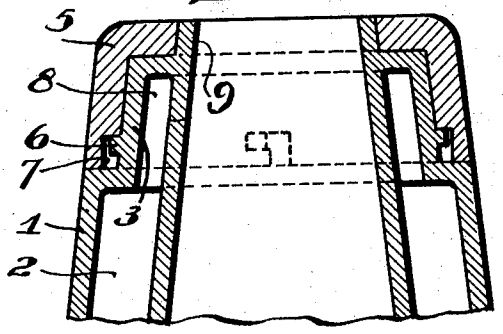


Fig. 6.



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UNITED STATES PATENT OFFICE

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BLAST FURNACE TUYÈRE

Application filed August 23, 1930. Serial No. 477,197.

This invention pertains to improvements in tuyères of the type used for supplying blast furnaces with heated air, fuel gas, or both. Particularly it pertains to a tuyère that is alterable with respect to its orifice without requiring changes in the base.

In blast furnace operation the tuyères are subjected to extreme conditions of temperature, of chemical reaction and of abrasion. Since they are located as conduits near the base of the furnace where a maximum rate of combustion is obtained, considerable corrosion of the tuyère orifice results. This corrosion is augmented by abrasion, particularly from the mechanical action of the charge as its weight is imposed against the tuyère section. Under such destructive influences the operation of the orifice becomes impaired.

Previously also considerable damage has resulted from the use of tuyères constructed to be cooled by the passage of fluid therethrough for, when a water cooled tuyère becomes broken, the presence of water in the furnace seriously impairs its operation. In the past it then has been necessary to replace the whole tuyère from time to time.

Also, in blast furnaces the conformation of the charge and the conditions under which the furnace must be operated frequently require modification of the point of application of the blast or of the shape of the introducing orifice, or of both. This, too, has required the substitution of entirely different tuyères. In some instances it has been necessary to replace a tuyère having a certain size round orifice by a tuyère having a different size or by an oval orifice, for example, or at some period to employ a tuyère extending into the charge a different distance than required at some other period.

This invention is directed to overcoming such defects and also to providing substantial economies by providing replaceable or alterable tips or orifices for a given tuyère base. Thus, it will be possible to modify the operation of a tuyère simply by substituting suitably different orifices. The benefits of this invention further will become more apparent by referring to the drawings.

In the drawings, Fig. 1 represents an assembled tuyère and removable orifice tip in longitudinal section; Figs. 2 and 3 represent in longitudinal section modified forms of orifice tips; Fig. 4 represents an end view of a tip with a circular orifice; and Fig. 5 similarly a tip with an oval orifice. Fig. 6 represents a modified form of assembled tuyère and orifice tip.

In the drawings a tuyère generally is designated by the numeral 1. It comprises a hollow cylindrical body or base provided in the walls of the base with suitable means to cool the tuyère by fluid circulation. In the illustrative form shown such means simply comprises a jacket 2 in the walls suitably provided with inlet and outlet for the circulation of a fluid, for example water, through the walls of the base.

The conformation of the base at its orifice outlet end 2 in the form illustrated in Figs. 1 and 6 is such as to engage a replaceable tip. As shown, a suitable length of the tuyère base at the orifice end is reduced in external diameter and likewise the annular water jacket is reduced in diameter as shown in the portion 3 of the base. Thus engagement is provided for an orifice tip to fit over the tip of the tuyère, with the orifice tip in the nature of a cap in the form illustrated in Fig. 1. Preferably a corresponding and suitable length of the tuyère base is enlarged in internal diameter so that the orifice cap may extend inwardly a suitable distance along the base wall. This portion of the internal wall of the tuyère base is designated as 4 in Fig. 1. In this latter form the tip of the tuyère base extends as a tongue somewhat into the body of the orifice member. The orifice member is designated by the numeral 5.

In the form illustrated by Fig. 6, the inner wall of the tuyère base is extended practically to the terminal face of the replaceable tip.

Suitable engagement will be had to secure the orifice tip to the base. In some instances it may be sufficient to machine the engaging surfaces of the base and of the tip, particularly so where both members are of metallic material. The use of corrosion resistant metal tips will be of considerable advantage

in many instances, and these advantages will be enhanced by providing appropriate fitting of the surfaces. It is proposed to form the orifice member of refractory material for some purposes and in such cases the engagement may result from the plasticity either of the body of the orifice member or of such material as may be applied to the engaging surface thereof as a suitable bond. In any of these cases it is of added advantage to unite the base and the tip members of the tuyère by distinct locking means. For example, a bayonet joint is a preferred form. Such bayonet lock is illustrated in the drawings by a lug 6 on the base and complementary recess 7 in the orifice member. Other engagements would include threading or cementing the tip to the base.

The effects of these improvements will be reflected not only in the structure as a whole, but with respect to its parts. It will permit using a standard tuyère base for a variety of orifice characteristics, since the only requirement will be to alter the orifice itself. Further, it becomes possible to protect the tip of the tuyère, particularly against its breaking and against leakage of the cooling fluid. With respect to the orifice tip itself this invention contemplates a wide range of characteristics.

More particularly to describe these orifice tips, of which it is proposed that a suitable assortment the available for a given tuyère, a variety of materials may be utilized. They should be adapted to the conditions in the furnace with a minimum of dependence on the tuyère base. It will be particularly useful to construct the orifice member of refractory material, for thus a wide range of characteristics is available. The refractory may be modified as to its acidity or basicity or as to its softening point or as to its influence on the combustion, and in other respects known to the refractory art of itself. It may be molded on the base and then baked, either before or after the tuyère is replaced in the furnace. Or, baked forms may be prepared for replacement as a whole. These orifice tips may derive some degree of cooling from the tuyère base, particularly where the cooling conduit of the base extends materially into the orifice member as in the case illustrated by the portion 8 in the drawings, or where a heat conducting portion of the base extends into heat transferring relation to the orifice member. In some cases it will be sufficient for the inner wall of the base to be extended along the orifice, as illustrated by element 9, Fig. 6.

A particular advantage of this invention is the adaptation of the contour of the orifice to meet conditions in the furnace. The orifice may be made circular or oval, as shown respectively in Figs. 4 and 5, or may be given any desired contour. Further, the blast conduit through the orifice member may be given parallel walls, or converging, or diverging walls, as is illustrated respectively in Figs. 1, 2 and 3, or given any desired combination of shapes. Also the point of application of the blast may be controlled, not only by the configuration of the blast conduit, but also by changes in the length of the orfice member. This flexibility is of extreme importance in combating the tendency of the charge to pillar in a blast furnace.

The disclosure of this invention has been presented to comply with the patent statutes. Resort has been had to specific illustrations, but such are not intended to imply any limitations beyond the necessary restrictions imposed by the prior art within the terms of the appended claims.

I claim as my invention:

1. A blast furnace tuyère comprising a base of hollow-wall structure to contain an annular cooling chamber, and a refractory orifice tip demountably attached to the base, the base at the tip end being of reduced exterior diameter to provide an extension of the cooling chamber, and the tip being recessed to fit as a hood over the cooling chamber extension of the base for cooling the body of the separable refractory tip.

2. A blast furnace tuyère comprising a metal base of hollow-wall structure to contain an annular cooling chamber, and a refractory orifice tip demountably attached to the base, the base at its tip end being of reduced exterior diameter to provide an extension of the cooling chamber, and having a locking lug extending laterally from the exterior cooling chamber wall, and the tip being recessed to interlock with the lug and to fit as a hood over the cooling chamber extension of the base, for cooling the body of the separable refractory tip.

In testimony whereof, I sign my name.

JEROME A. BOLAND.