Dec. 3, 1935. A. G. McKEE 2,023,025

INSULATED BLOWPIPE

Filed May 11, 1934 2 Sheets-Sheet 1

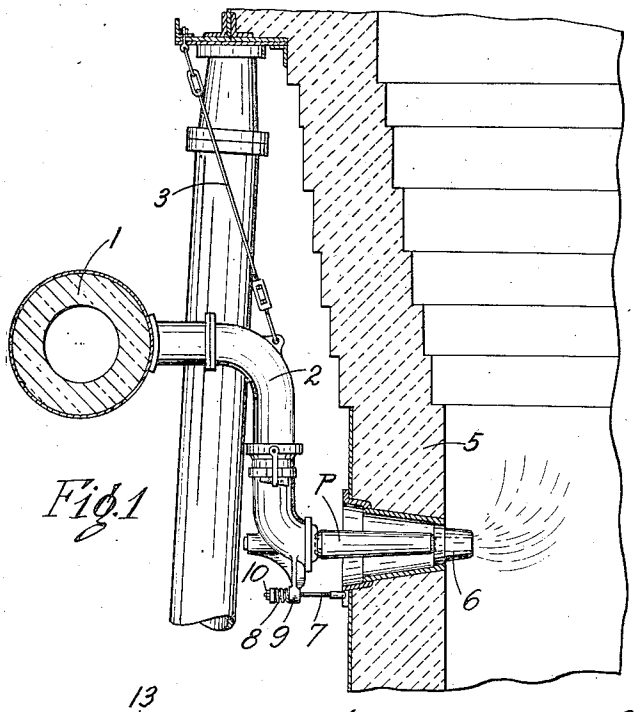


Fig. 1

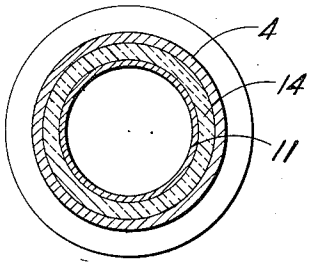


Fig. 3

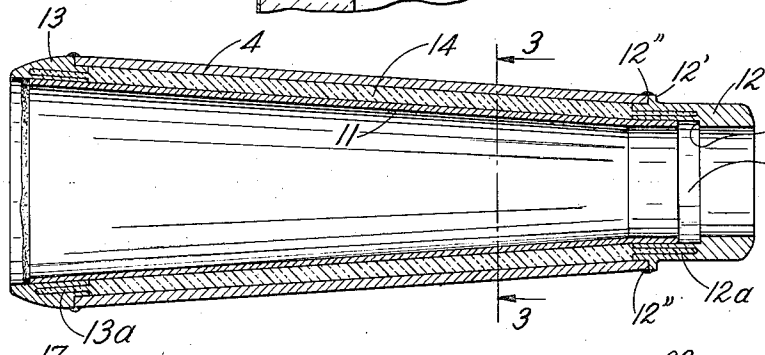


Fig. 2

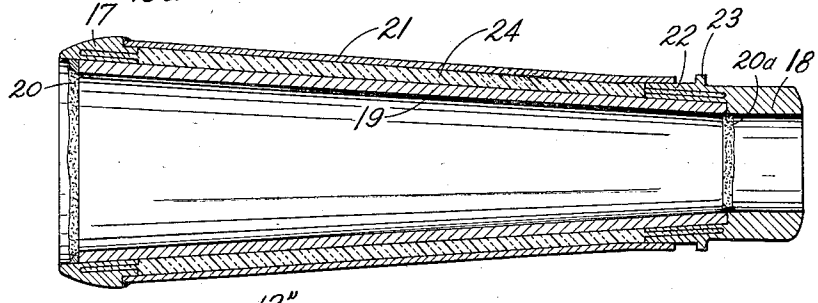


Fig. 4

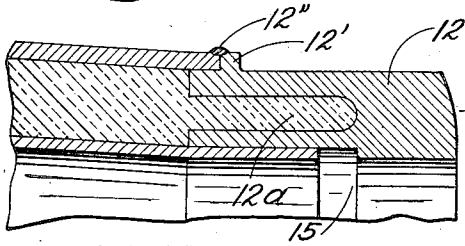


Fig. 5

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INSULATED BLOWPIPE

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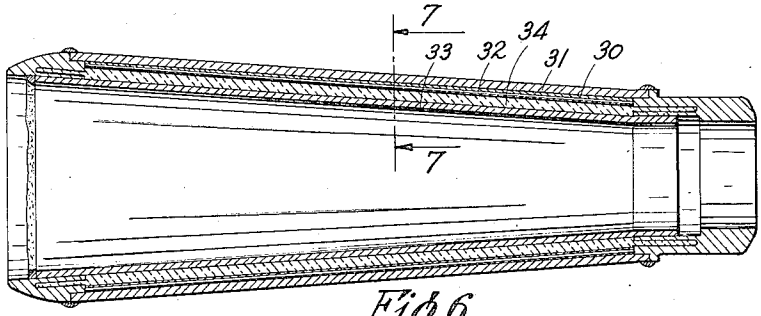


Fig. 6

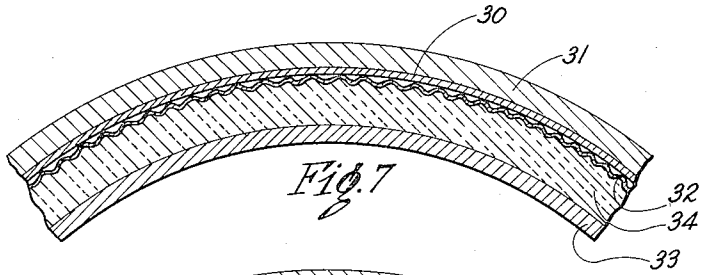


Fig. 7

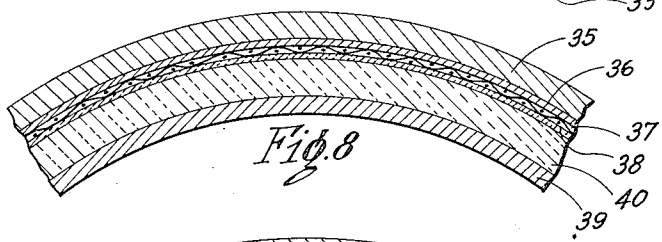


Fig. 8

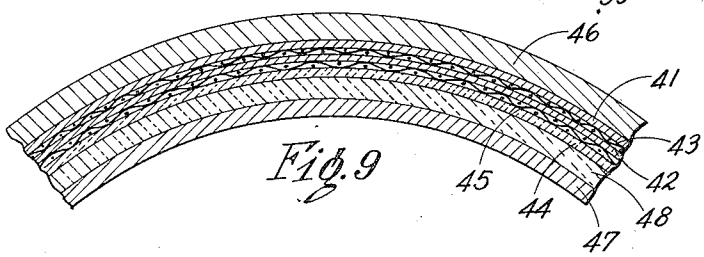


Fig. 9

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INSULATED BLOWPIPE

Arthur G. McKee, Cleveland, Ohio

Application May 11, 1934, Serial No. 725,154

3 Claims. (Cl. 266—41)

This invention relates to apparatus for conducting fluids at high temperatures and more particularly to an improved type of blow pipe for blast furnaces and the like in which heat insulating material is used to protect certain parts of the blow pipe, to reduce the loss of heat in the hot blast as it passes through the blow pipe into the furnace and to effect a corresponding saving in the loss of temperature in the blast.

I am aware that it has previously been proposed to provide an insulated blow pipe for a blast furnace. However, such insulated blow pipes as have been previously proposed and with which I am familiar have possessed certain defects which make them unsuitable for operation with present day methods of blast furnace operation. It is therefore an object of this invention to provide a durable and safe blow pipe construction, which, by protecting the heat insulating material from the destructive action of the hot blast, makes possible the use of readily available and inexpensive insulating materials. By protecting the insulating material by heat resisting alloy steel and utilizing the insulating material to protect the outer steel shell from heat so that it will retain its strength to resist the air pressure of the blast and other stresses, as will be fully described later, the object of providing a durable and safe insulated blow pipe is attained.

A further object of my invention is the provision of a blow pipe which may be economically manufactured and maintained in service by providing for the removal and replacement of the part or parts in direct contact with the hot gases and subjected to the deteriorating and abrasive action of the hot blast.

Another object is the provision of an improved fabricated blow pipe construction which can be readily made interchangeable with existing commercial blow pipes of various dimensions with a minimum range of sizes of cast parts, thus greatly reducing initial pattern costs. Owing to the wide variety of sizes and shapes of the blow pipes used in existing present day furnace installations this is an important feature of my invention. In recent years it has become more and more important to provide a safe blow pipe construction due to the tendency towards the use of higher hot blast temperatures in present furnace practices. As the hot blast temperature may run as high as 1700° F. it is not uncommon to find blow pipes operating at red heat so that the strength of the material in the pipes is reduced to a dangerous point. This excessive heat frequently causes the sagging of such pipes in service and occasionally complete collapse or bursting, endangering operators in the vicinity not only from the hot pipe itself and from the high temperature air blast but also from the incandescent material blown out by the blast in case of rupture. By protecting the outer load carrying tube of my blow pipe from the high temperature of the blast, as later explained, this portion of the tube operates at all times near the temperature at which the material possesses its maximum strength and thus the possibility of failure of the blow pipe is eliminated.

The above and other objects of my invention will appear from the following description of several embodiments thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a fragmentary vertical sectional view of the bottom portion of a blast furnace showing my improved blow pipe in position.

Figure 2 is a longitudinal cross section of a preferred form of my improved blow pipe.

Figure 3 is a cross section of my preferred form of blow pipe taken on line 3—3 of Figure 2.

Figure 4 is a cross sectional view, generally similar to Figure 2, but showing a modified form of my invention.

Figure 5 is an enlarged cross sectional view showing the recessed portion of my end pieces filled with insulating material.

Figure 6 is a cross sectional view of my improved blow pipe construction in which is embodied a heat reflecting surface.

Figure 7 is an enlarged cross sectional view taken on line 7—7 of the blow pipe illustrated in Figure 6, illustrating one arrangement of heat reflecting surface.

Figure 8 is a view generally similar to Figure 7 but illustrating a modified form of heat reflecting surface arrangement.

Figure 9 is a view generally similar to Figures 7 and 8 but illustrating a blow pipe having a plurality of heat reflecting surfaces.

Referring now to Figure 1 the usual blast furnace bustle pipe 1 is adapted to carry the hot blast from the hot blast stoves to the down leg 2 which is flexibly suspended by a rod 3. The blow pipe, generally indicated by the reference character P, engages the down leg 2 through a ball and socket connection and carries the hot blast through the furnace wall 5 to the tuyère 6. The down leg 2 is secured at its outer end by means of a rod 7 hinged to the furnace wall. This rod passes through an opening in the downwardly extending lug 9 on the down leg 2 and then through a coil spring 8. The outer end of

the rod 7 is threaded to receive the spring retaining nut 10. By tightening the nut 10 on the end of the rod 7 the spring 8 may be compressed thus forcing the down leg 2 toward the furnace and firmly holding the blow pipe P in position between the end of the down leg 2 and the tuyère 6 while at the same time this spring connection allows for expansion and contraction due to variations in temperature. The endwise compression exerted by the spring 8 on the blow pipe is considerable and must be taken into account in the choice of materials for the blow pipe, as will later appear.

In Figures 2 and 3 I have illustrated one form of my improved blow pipe construction. The outer tapered tubular member 4 of high carbon steel, or other material having sufficient strength, is fixed at one end, preferably by welding to the cast end piece 13 which, as is clearly seen from Figure 2, has a rounded outer surface designed to properly fit the various types of ball and socket connections on the down leg 2 of the hot blast pipe. At its opposite end the tubular member 4 engages the cast end member 12 as far as the thrust shoulder 12′ thereon and, as illustrated, is held in position by welding at 12″. The members 12 and 13 may be castings of either steel or suitable heat resisting alloy and preferably cored out as at 12a and 13a to provide additional space for heat insulating material. The outer end (the right hand end in Figure 2) of the end piece 12 is shaped to fit into the various types of commercial tuyères. The inner wall of my blow pipe is formed by a sheath or sleeve member 11, preferably of heat resisting alloy such as nickel chromium steel, and may be welded or otherwise rigidly secured to the member 13. The opposite end of the heat resisting sheath 11 is adapted to have a sliding fit upon the inner end of the end member 12. A space 15 is left between the end of the sheath 11 and the shoulder 12‴ to provide for the differences in expansion of the relatively cool outer tubular member 4 and the inner sheath 11. Insulating material 14, preferably in powdered or granular form, fills the annular space between the outer tube 4 and the sheath 11 and the recesses 12a and 13a of the end pieces. This insulating material may readily be placed in position after the members 4 and 11 have been secured to end piece 13 but before the end piece 12 is assembled.

In the blow pipe construction just described the end thrust on the blow pipe as a whole is taken through the relatively heavy tubular member 4 and the end pieces 12 and 13. The relatively light sheath member 11 acts merely to retain and protect the insulating material and is supported so that it may expand or contract independently of the rest of the blow pipe structure. This inner sleeve 11, inasmuch as it is not subject to end thrust, may be made of relatively light gauge alloy steel so as to minimize the cost of the unit. The safety features of my construction will be seen by those skilled in the art, it being understood that the outer tubular member 4 is protected from the heat of the hot gases so that it always remains at a relatively low temperature within the range of the maximum strength of the material used.

In Figure 4 I have illustrated a modified form of my improved blow pipe construction in which the end pieces 17 and 18 are connected by a relatively heavy inner tubular member 19, of suitable heat resisting alloy, which tubular member is preferably welded to the end pieces 17 and 18 at 20 and 20a. An outer insulating material retaining sleeve 21 is secured, as by welding, to the end member 17 and has a sliding fit at its opposite end on the portion 22 of the end piece 18. The end of the sleeve 21 which engages the end piece 18 is spaced from the flange 23 on the end piece 18 to permit relative movement, due to temperature variations, between the sleeve 21 and the other parts of the blow pipe structure. The space between the sleeve 21 and the inner tubular member 19 is filled with suitable insulating material 24 in the manner described above in relation to Figure 2.

In the embodiment of my invention illustrated in Figure 4 the end thrust upon the blow pipe structure is carried by the relatively heavy inner tubular member of heat resisting alloy. The outer sheath may be of relatively light gauge material and acts primarily as a retainer for the insulating material. It will be seen that in this construction the load on the blow pipe must be supported by the tubular member 19 which is subjected directly to the heat of the hot blast. Thus, this member must be made heavy enough and of suitable material to withstand the temperatures and forces encountered. Although this embodiment of my invention does not possess the features of protecting the load carrying portion of the blow pipe from the direct heat of the hot blast it does possess substantially the same advantages as the preferred form of my invention insofar as operating economy and production are concerned.

Figures 6 and 7 illustrate a blow pipe of the general type illustrated in Figure 2 but having a relatively thin sheet metal liner 30 disposed within the outer tubular member 31. The liner 30 has a polished heat reflecting inner surface and may be made of polished aluminum, chromium plated steel or the like. In some cases the inner surface of the outer tubular member may be finished to form a heat reflecting surface. Immediately inside of the heat reflecting member 30 is a corrugated tubular member 32 preferably of asbestos board or the like. This corrugated board engages the polished surface of the member 30 only at spaced points and provides a substantial air space adjacent the heat reflecting surface. The inner heat resisting alloy sheath 33 is similar to sheath 11 of Figure 2 and retains the heat insulating material 34 in position between its outer surface and the inner surface of the corrugated member 32. Thus, the heat insulating material is maintained out of contact with the reflecting surface and the heat reflecting and insulating value of the surface is obtained.

In Figure 8 I have illustrated another arrangement for maintaining the reflecting surface out of contact with the insulating material. In this embodiment of my invention the outer tubular member 35 is lined by the heat reflecting member 36 having a polished heat reflecting inner surface and a wire screen 37, preferably of relatively coarse mesh, is inserted between the member 36 and the asbestos board tube 38. The screen 37 serves to space the tube 38 from the reflecting surface and to provide the necessary space to render the reflecting surface effective. The inner alloy sheath 39 and the heat insulating material filler 40 are substantially the same as in Figure 7.

In Figure 9 a plurality of heat reflecting members 41 and 42 are employed. These members are spaced by the screen 43 and the reflecting

surface of the inner member **42** is spaced from the asbestos board tube **44** by a screen **45**. The outer load carrying tube **46**, the inner heat resisting alloy sheath **47** and the insulating material filler **48** are substantially the same as described above in connection with Figures 7 and 8.

By providing one or more polished reflecting surfaces, which surfaces are spaced from the adjacent insulating material, I am able to increase the heat insulating capacity of my blow pipe and to further protect the outer load carrying tube from the high temperatures of the blast.

Although I have described in considerable detail the illustrated embodiments of my invention, it will be understood by those skilled in the art that modifications and variations may be made in my blow pipe structure without departing from the spirit of my invention. I do not, therefore, wish to be limited to the specific forms of my invention herein shown and described but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In a blast furnace blow pipe, an outer load supporting tubular member, end members secured at the ends of said outer tubular member, one of said end members being adapted to engage a blast furnace tuyère and the other end member being adapted to engage a blast furnace hot air pipe, an inner tubular sheath of relatively thin heat resisting material within said outer tubular member, said inner tubular sheath being secured at one end to one of said end members and having a sliding fit between its opposite end and the other end member, and insulating material disposed in the space between said outer tubular member and said inner tubular sheath.

2. In a blast furnace blow pipe, an outer load supporting tubular member, end members secured at the ends of said outer tubular member, one of said end members being adapted to engage a blast furnace tuyère and the other end member being adapted to engage a blast furnace hot air pipe, an inner tubular sheath of heat resisting material within said outer tubular member, said inner tubular sheath being secured at one end to one of said end members and having a sliding fit between its opposite end and the other end member, and insulating material disposed in the space between said outer tubular member and said inner tubular sheath.

3. In a blast furnace blow pipe, an outer load supporting tubular member, end members secured at the ends of said outer tubular member, one of said end members being adapted to engage a blast furnace tuyère and the other end member being adapted to engage a blast furnace hot air pipe, an inner tubular sheath of heat resisting material within said outer tubular member, said inner tubular sheath being secured at one end to one of said end members and having a sliding fit between its opposite end and the other end member, means for providing a heat reflecting surface within said outer tubular member, and insulating material disposed in the space between said heat reflecting surface and said inner tubular sheath.

ARTHUR G. McKEE.