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2,507,260

AIR-COOLED BURNER FOR FURNACES

Filed Jan. 29, 1947

2 Sheets-Sheet 1

Fig. 2.

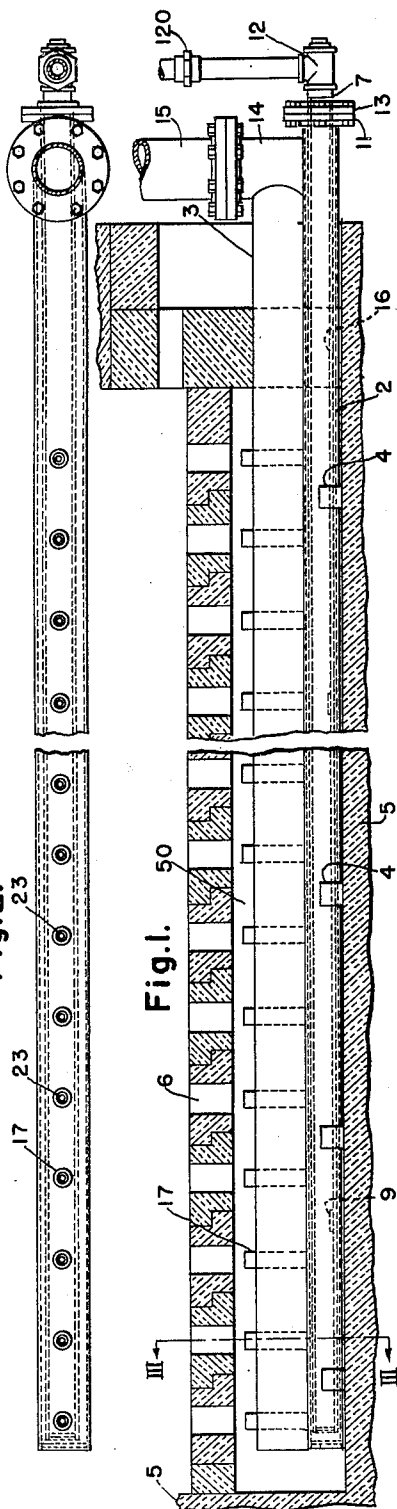


Fig. 1.

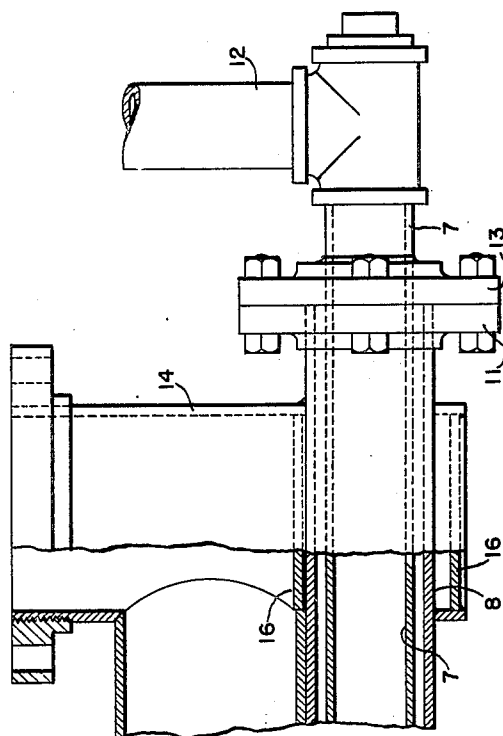
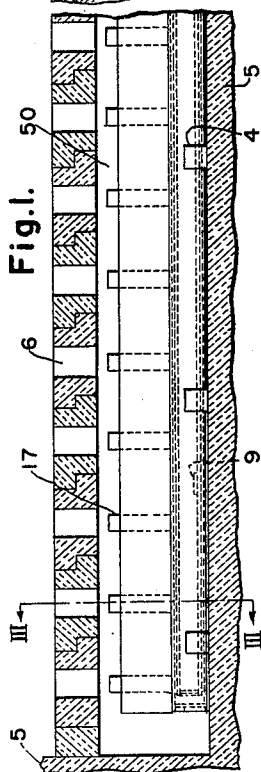
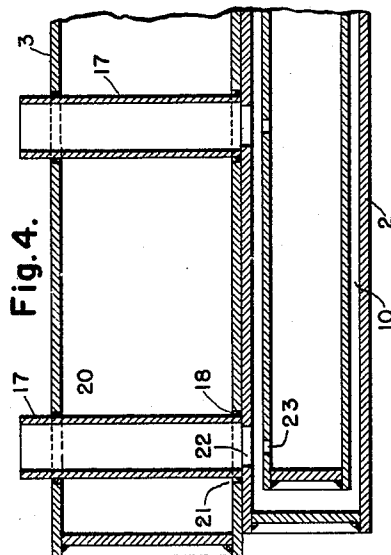


Fig. 4.



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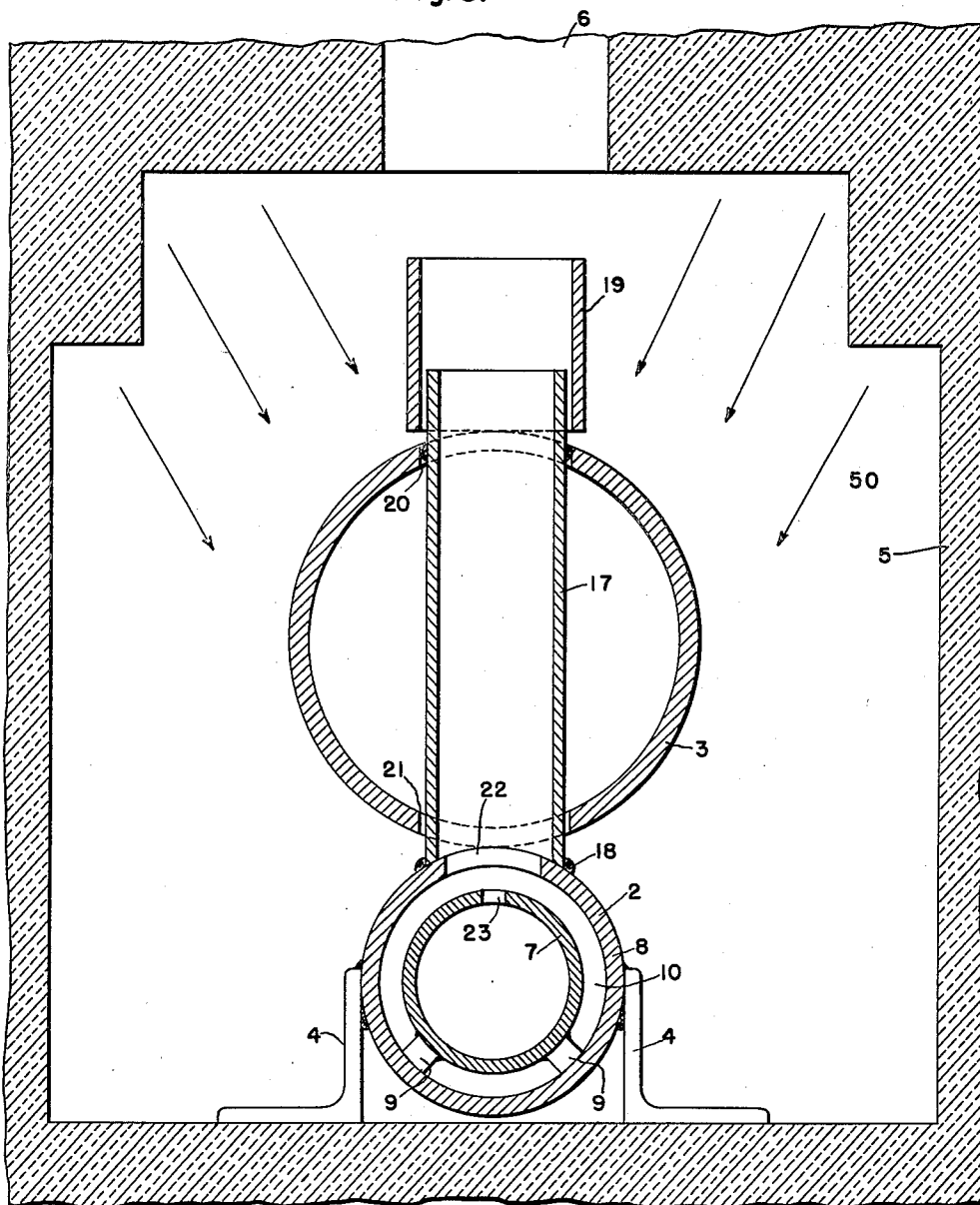
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Fig. 3.



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AIR-COOLED BURNER FOR FURNACES

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3 Claims. (Cl. 158—7)

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This invention relates to the construction of burners, particularly to burners for the combustion of fluid fuel in industrial furnaces. The burner of this invention is more particularly, though not exclusively, adapted for firing furnaces used in the heat treatment and/or annealing of metal products, such, for example, as sheet steel which is ordinarily treated in box-type or cover-type furnaces.

A burner of the sort to which this invention is especially directed comprises an elongate duct having a plurality of outlets for the release of jets of fuel at points spaced apart longitudinally on the burner body.

The fluid fuel used with burners of the type in mind is a hydrocarbonaceous gaseous or vaporous fuel, which, under the effect of the heat to which the burner is subjected to in service, deposits carbon upon the surfaces of the burner body, and tends to plug the orifices or passages through which the fuel flows. With this circumstance in mind, it will be understood that this invention consists in certain new and useful improvements in burner construction, whereby the fuel-conducting portions of the burner body are screened from extreme furnace temperatures. Additionally, the burner structure is such that the portion or portions thereof which tend to become fouled with accumulations of carbon may be readily removed from the burner structure, and a spare portion substituted. In consequence, it becomes possible to maintain the burner, and the furnace in which it is used, in substantially continuous operation; that is to say, it is no longer necessary to withhold the furnace from service in order to permit the removal of accumulated carbon from the burner or burners of the furnace.

The invention will be understood upon reference to the accompanying drawing, in which:

Fig. 1 is a fragmentary view showing a burner embodying the invention in side elevation. By way of example, this view shows the burner in position of service within the burner chamber of a box-type annealing furnace, the refractory walls of the chamber in the furnace structure being indicated fragmentarily in vertical section;

Fig. 2 is a fragmentary view of the burner structure as seen in plan from above;

Fig. 3 is a fragmentary sectional view of the burner installation to larger scale, as seen on the plane III—III of Fig. 1; and

Fig. 4 is a fragmentary view of the burner, partly in longitudinal vertical section and partly

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in side elevation. This view shows the burner on larger scale than Figs. 1 and 2, but on smaller scale than Fig. 3.

Referring to the drawings the burner comprises an elongate fuel duct 2 and an air duct 3. The air duct is positioned immediately above the fuel duct, and is substantially coextensive in length therewith. In service the burner is usually arranged within an elongate tunnel-like chamber, such as the chamber 50 within refractory body 5 of the furnace fragmentarily indicated in Figs. 1 and 3. Angle members 4 are welded to the fuel duct, providing feet upon which the burner structure is supported upon the floor of the chamber 50. The roof of the chamber 50 is provided with a series of ports 6 through which the burner is adapted to deliver burning jets of fuel and air into the combustion chamber or zone located in the furnace above the roof or top wall 5 of the burner chamber 50.

The fuel duct 2 of the burner is advantageously formed of an inner tube 7 telescopically assembled within and encased by an outer tube 8; the inner tube 7 is substantially smaller in diameter than the tube 8 and is provided with lugs 9 which support the inner tube in concentric relation with respect to the outer tube 8, with a substantial thermal insulating space 10 provided between the walls of the inner and outer tubes. The burner structure at one end (the right-hand end, Fig. 1) extends beyond the walls of the furnace structure, where an inlet is provided for delivering fuel to the inner tube of the fuel duct 2, and an inlet for delivery of combustion air to the air duct 3.

More particularly, the outer tube 8 of the fuel duct is equipped with a flange 11 through which the inner tube 7 extends to a threaded terminal, by means of which connection is made to a fuel supply pipe 12. The inner tube 7 carries a flange 13. The flanges 11 and 13 are bolted together, detachably securing the tubes 7 and 8 in assembly.

The air duct 3 is positioned immediately above the fuel duct 2, with the axes of the two ducts located in the same vertical plane. The air duct is of substantially larger diameter than the fuel duct, and in this case rests upon the top of the fuel duct. An inlet for air is provided at the end of the burner where the fuel inlet is located. The air inlet is formed by a vertical pipe section 14 welded upon the end of air duct 3, and the pipe section 14 is flanged at its upper end, whereby it may be detachably bolted to the flanged end of a pipe 15 which supplies the combustion

air to the burner. Preferably the inlet pipe section 14 extends downward below the air duct 3, and is ported for the passage of the fuel duct 2 through it, the lower end of the section 14 thus forming an additional supporting member for the burner structure. Blanking plates or bulkheads 16 are welded across the bore of pipe section 14 above and below the fuel duct, as shown in Fig. 4.

At points spaced apart longitudinally of the fuel duct radially extending jet pipes 17 are provided. These jet pipes are welded in hermetic seams 18 to the outer tube 8 of the fuel duct, and in the burner shown the jet pipes rise in a vertical line, projecting upwardly through the air duct 3. The wall of the air duct is orificed, as at 20 and 21, to permit the passage through of the jet pipes. The jet pipes are united to the wall of the air duct by continuous hermetic welds in the upper orifices 20, and, if desired, by intermittent tack welds in the lower orifices 21. Removable nozzle sleeves 19 (Fig. 3) are positioned upon the projecting upper ends of the jet pipes. As shown, these jet pipes are severally aligned with the ports 6 in the top wall of the burner chamber 50. Passages 23 and 22 are formed in the walls of the inner and outer tubes 7 and 8, respectively, of the fuel duct, and through such passages communication is established between the fuel-delivering tube 7 and the jet pipes severally. Each of the passages 23 in the inner tube comprises a relatively small orifice, whose size is determined to give the desired flow of fuel into the associate jet pipe, while the corresponding passage 22 in the outer tube 8 is comparatively large. The function of the passage 22 is primarily to provide unrestricted passage of the fuel jet delivered by the associate orifice 23 into the jet pipe above.

The jets of fuel are directed upwardly from the jet pipes and nozzles through the ports 6, and air is released from the air duct 3 to furnish combustion air for the fuel jets projected into the furnace chamber or combustion zones above the top wall of the burner chamber. This combustion air is released by the fuel duct at distributed points in the extent of the burner, and advantageously the air release is effected by forming the orifices 21 in the wall of the air duct larger than the bodies of the jet pipes, as may be understood upon reference to Fig. 3. Around each of the jet pipes, therefore, a clearance is provided, through which air is delivered into the burner chamber 50, and from this chamber the air is aspirated by the action of the fuel jets flowing upwardly through ports 6. A combustible mixture of fuel and air is thus delivered upwardly from each of the ports 6.

As noted in the introduction to this specification a problem in the operation of burners firing fluid hydrocarbon fuels has heretofore been caused by the deposition of carbon upon the body and in the passages of the burner, this deposition of carbon being created by the heat to which the body of the burner is subjected in service. In Fig. 3 the arrows indicate the directions in which the greatest quantity of heat flows or radiates into the chamber. It will be understood, of course, that when the furnace is in service all of the refractory walls 5 which define the burner chamber 50 heat up, but the highest temperatures are developed in the upper wall portions of the chamber, and greatest heat is radiated downwardly in the direction of the arrows.

If the portion of any burner carrying a hy-

drocarbon fuel is prevented from becoming excessively hot, the problem in question is practically solved. The structure of the burner of this invention is particularly effective to this end.

The inner tube 7 of the fuel duct is the more critical element of the burner structure, since it is this tube which carries the fuel, and it is this tube which includes the relatively small orifices (23) which tend to become clogged with accumulations of carbon. It will be noted that the tube 7 is housed or encased within the outer tube 8, and thus receives primary protection against excessive heat. Additionally, the dead space 10, while filled with the gaseous fuel, provides a thermal screen for the fuel-conducting tube 7. The position and the relatively large diameter of the air duct 3 are important, since the air duct "shades" the fuel duct from the most acute heat radiated in the directions of the arrows. Furthermore, the duct 3, confining a continuously flowing stream of relatively cool air, exerts a cooling as well as a "shading" effect upon the fuel duct. Also, it is important to note that the currents of air delivered downwardly through the clearances between the bodies of the jet pipes 17 and the edges of the openings 21 play upon the outer surface of the fuel duct, and operate with a thermal screening, as well as a heat-removing effect. Thus, it will be understood that the burner structure of this invention is effective to protect the fuel duct from the objectionable influence of heat.

From time to time, it may be desirable to clean the relatively small orifices 23 of the burner, irrespective of the degree to which the deposition of carbon is inhibited. Hitherto, burners of the class herein under consideration had to be removed from the furnace to permit cleaning, or in some cases the furnace has been removed from service and the burner cleaned, after the furnace has been cooled down to the point where workmen could enter. In the burner structure of this invention, such furnace shutdowns are avoided. It is merely necessary to remove the bolts which secure the flanges 11 and 13 together, disconnect the coupling 120 in the fuel supply line, and then withdraw the inner tube 7 of the fuel duct from the burner structure. A spare inner tube 7 is then quickly assembled in place of the inner tube removed, and furnace operation can proceed without undue interruption. The removed inner tube can be cleaned at leisure, and held in readiness as a spare.

The appended claims define the invention with the understanding that many variations or modifications may be made in the structure described without departing from the spirit of the invention.

I claim:

1. A burner structure comprising an elongate fuel duct in the form of an outer cylindrical tube having an inner cylindrical tube removably positioned therein, an inlet for the introduction of fuel to said inner tube, an elongate cylindrical air duct of greater diameter than the fuel duct, said air duct being superimposed upon said fuel duct in position to screen the fuel duct from heat radiated downwardly from points above the burner structure, an inlet for the introduction of air to said air duct, and a plurality of jet pipes extending from said fuel duct at spaced-apart points longitudinally thereof and projecting transversely through said air duct, the walls of said inner and outer tubes of the fuel duct in-

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cluding passages for the flow of fuel from said inner tube into said jet pipes severally, and the wall of said air duct including in its bottom wall portion a plurality of outlet passages spaced apart longitudinally of the air duct for the delivery of air over the external wall of the outer tube of said fuel duct.

2. A burner structure comprising an elongate fuel duct in the form of an outer cylindrical tube having an inner cylindrical tube removably positioned therein, an inlet for the introduction of fuel to said inner tube, an elongate cylindrical air duct of greater diameter than the fuel duct, said air duct being superimposed upon said fuel duct in position to screen the fuel duct from heat radiated downwardly from points above the burner structure, an inlet for the introduction of air to said air duct, and a plurality of jet pipes extending from said fuel duct at spaced apart points longitudinally thereof and projecting transversely through said air duct, the walls of said inner and outer tubes of the fuel duct including passages for the flow of fuel from said inner tube into said jet pipes severally, and the wall of said air duct including in its bottom wall portion at the points where said jet pipes project therethrough passages for the delivery of air over the external wall of the outer tube of said fuel duct.

3. In combination, a tunnel-like chamber provided with openings at its top for upwardly directed jets of burning fuel, a burner structure mounted to extend longitudinally of said chamber, said burner structure comprising an elongate fuel duct in the form of an outer cylindrical tube

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having an inner cylindrical tube removably positioned therein, an inlet for the introduction of fuel to said inner tube, an elongate cylindrical air duct of greater diameter than the fuel duct, said air duct being superimposed upon said fuel duct in position to screen the fuel duct from heat radiated downwardly through said openings and from the upper wall portions of said chamber, an inlet for the introduction of air to said air duct, and a plurality of jet pipes extending from said fuel duct at spaced-apart points longitudinally thereof and projecting transversely through said air duct in line with said openings at the top of said burner chamber, the walls of said inner and outer tubes of the fuel duct including passages for the flow of fuel from said inner tube into said jet pipes severally, and the wall of said air duct including in its bottom wall portion a plurality of outlet passages spaced apart longitudinally of the air duct for the delivery of air over the external wall of the outer tube of said fuel duct.

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