Feb. 16, 1954 J. LUSKY, JR., ET AL 2,669,484

FUEL BURNER

Filed Dec. 13, 1951 2 Sheets-Sheet 1

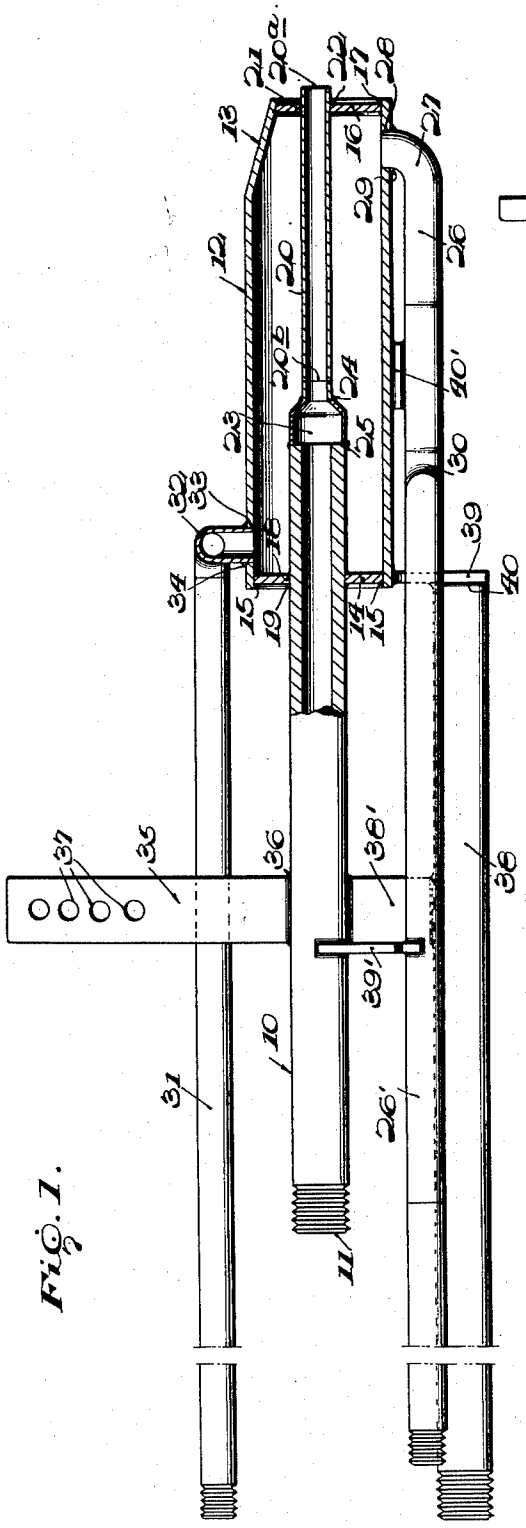


Fig. 1.

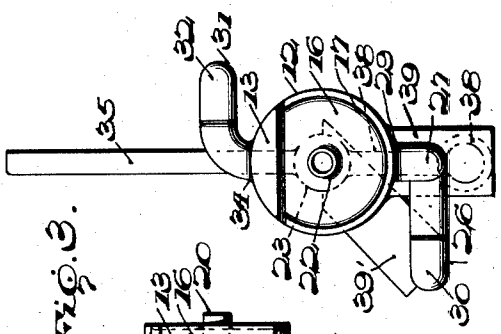


Fig. 3.

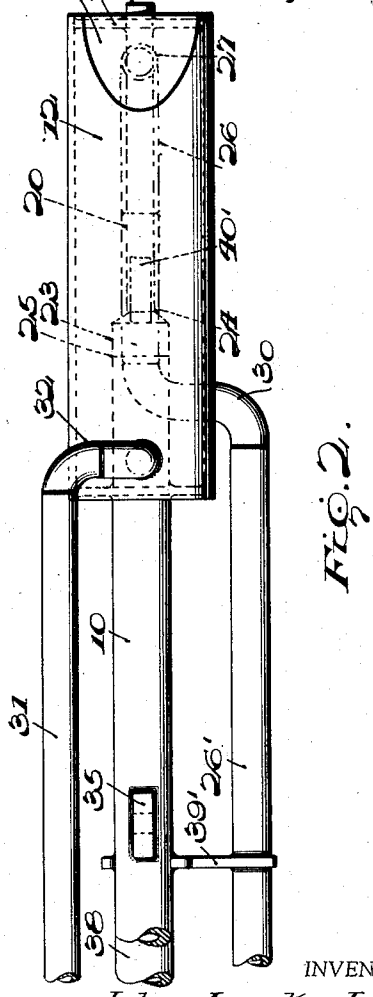


Fig. 2.

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FUEL BURNER

Filed Dec. 13, 1951 2 Sheets-Sheet 2

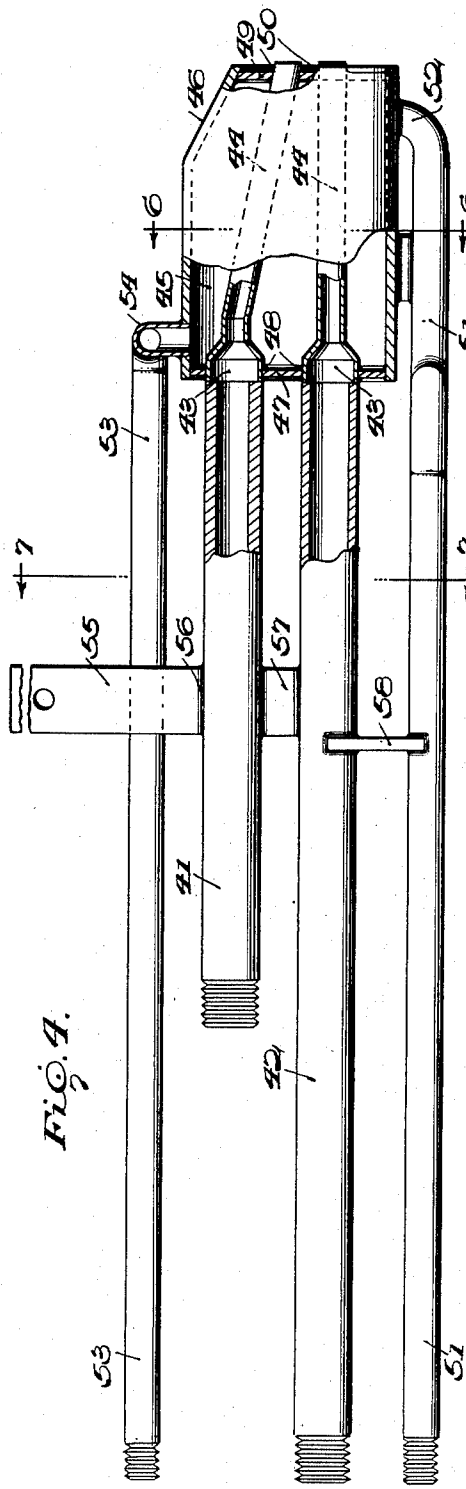


Fig. 4.

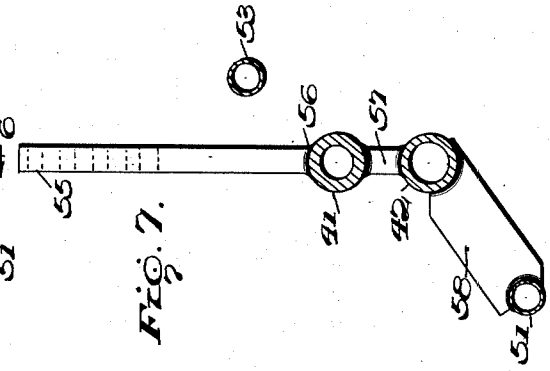


Fig. 7.

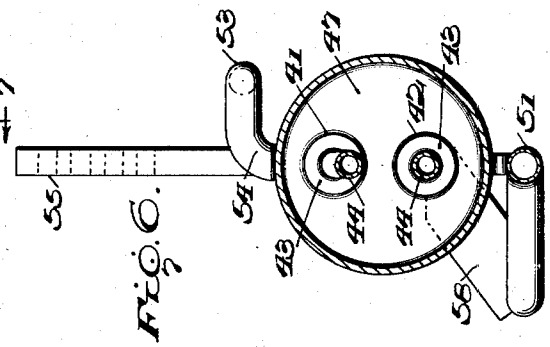


Fig. 6.

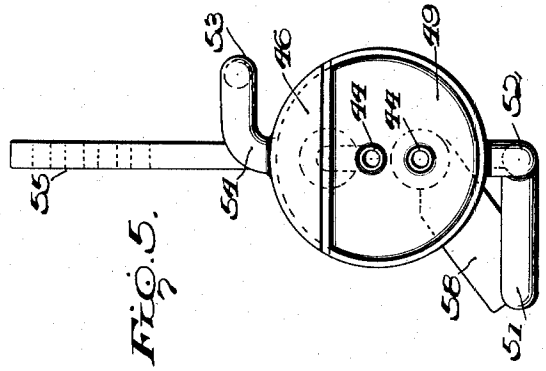


Fig. 5.

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Patented Feb. 16, 1954

2,669,484

UNITED STATES PATENT OFFICE

2,669,484

FUEL BURNER

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Application December 13, 1951, Serial No. 261,472

6 Claims. (Cl. 299—143)

1

The present invention relates to fuel burners and more particularly relates to burners which are adapted to handle both liquid and gaseous fuels. Although not limited thereto, the burner comprising this present invention is peculiarly well suited for use in open hearth steel making furnaces fired with liquid fuel, such as fuel oil, mixed with a gaseous fuel and/or steam. The burner also may burn straight liquid fuel or liquid fuel in combination with gaseous fuel in any desired ratio, depending upon availability and suitability of the particular fuel or fuels.

It has long been the practice in the operation of open hearth steel making furnaces to utilize a mixture of liquid and gaseous fuels with or without the use of steam therewith. It is well known in the art that prior burners have presented serious burner problems heretofore unsolved. Open hearth burners presently in use exhibit very undesirable characteristics. These burners become readily carbonized which results in greatly decreased efficiency in that the burner flame is shortened and distorted so as to ineffectively heat the open hearth to its proper temperature. In addition the said carbonization results in burner flame deflection and distortion so that in most cases the flame is deflected upward thereby causing early destruction or burning out of the furnace roof or other parts of the furnace.

Open hearth burners currently in use and utilizing a liquid or gaseous or a combination of such fuels are water jacketed in order to effectuate cooling and to prevent the burner from "burning out" due to exposure to relatively high temperatures of open hearth furnace operation. The aforesaid cooling jackets must withstand temperatures sometimes as high as 3200° F. and due to their size, which sometimes may reach a length of 10 to 12 feet and a diameter of 16 to 24 inches, and also due to the sometime complicated construction, it has in the past been extremely difficult to prevent said "burning out" or cracking up of these water cooled jackets.

As most burners of the type used in the smelting of iron are equipped with a complicated water cooling system, there is presented a problem of keeping the burner constituents from separating from one another due to unequal expansion and contraction of the parts. This problem has been met and eliminated in the burner structure of the present invention.

An object of this invention is to provide a highly effective burner of the class referred to above.

Another object of this invention is to provide new and improved structural features in a burner

2

of the class described, which reduce the cost of materials and labor in assembly, so that the burner may be substituted for other and less efficient equipment without prohibitive cost and expense.

A further object is to provide a burner of the character described, which is structurally improved to gain maximum durability, efficiency and economy in the operation thereof; so that in the manufacture of commodities such as steel in various forms, use of the improved burner of this invention reduces heat time substantially with a resultant reduction of cost in labor, fuel and furnace maintenance.

Still another object of this invention is to provide a burner of the type described which gives a better flexibility for the distribution of the flame across the hearth of the furnace and lowers the flame with relation to the roof as well as providing a more complete and efficient atomization of the fuel utilized.

Other important objects of the invention are to provide a burner of the above-mentioned character which is of simple construction, strong and durable; which is relatively light and well balanced and is easy to manipulate; which has a water jacket for directly receiving the cooling water, eliminating pipes therein, and shaped to prevent the formation of air pockets; and which has supporting and connecting means for ready adjustment of the burner to vertical, horizontal and angular positions.

Other objects and advantages of the invention will be apparent during the course of the following description.

This invention, then, comprises the features hereinafter described and as particularly pointed out and described in the claims. The following disclosure and the annexed drawings set forth in detail certain illustrative embodiments of the invention hereinafter described.

In the accompanying drawings, forming a part of this appliaction, and in which like numerals are employed to designate like parts throughout same,

Figure 1 is a side elevation of a burner device embodying my invention and having a single tubular burner head, parts in central vertical longitudinal section,

Figure 2 is a plan view of the same,

Figure 3 is an end elevation of the same,

Figure 4 is a side elevation of a burner device embodying a second form of the invention and having two tubular burner heads, parts in central vertical longitudinal section,

Figure 5 is an end elevation of the same,

Figure 6 is a transverse vertical section taken on line 6—6 of Figure 4, and,

Figure 7 is a similar view taken on line 7—7 of Figure 4.

In Figures 1 to 3 inclusive, the numeral 10 designates a main fluid fuel supply pipe, the rear end 11 of which is screw-threaded for connection with a steam and oil atomizer. This connection may be flexible.

The atomized oil and steam is supplied under suitable pressure through the pipe 10. The pipe 10 preferably has an outside diameter of 1¼ inches and an inside diameter of .89 inch. The body portion of the burner comprises a water jacket 12 formed from a pipe having a 4-inch exterior diameter and this pipe is 15 inches long. The pipe 12 is circular in cross-section throughout the major portion of its length, but is provided with an inclined flat 13, at its top and forward end. This flat is three inches long. This flat is transversely horizontal, as shown. Arranged within the rear end of the water jacket 12 is a circular plate 14, to fit therein and secured to the water jacket by welding 15, forming a water-tight joint. A second plate 16 is mounted in the reduced forward end of the water jacket 12 and is shaped to fit therein and is held in place by welding 17 for forming a water-tight joint. The pipe 10 extends through an opening 18 in the plate 14 and is welded to the plate 14 at 19 to form a water-tight joint. The pipe 10 projects forwardly into the water jacket 12 for a substantial distance, as shown. The pipe 10 is concentric with the water jacket 12.

A tubular burner head 20 is provided, which is mounted within the water jacket 12 and is concentric with relation thereto and in alignment with the main pipe 10.

This tubular burner head has an exterior diameter of 1 inch and an internal diameter of .62 inch, and the tubular burner head is 9 inches long, measured from the points 20*a* to 20*b*. This length is important as such length assures the proper flame characteristics. Shortening the length of the burner head 20 under similar conditions of steam and oil pressure would shorten the flame and cause it to fan out much sooner than desired. Lengthening the burner head 20 would tend to cause late combustion and therefore not develop proper combustion characteristics. This tubular burner head 20 extends through an opening 21 in the plate 16, and is secured thereto by welding 22, forming a water-tight joint. The burner head 20 may project for a short distance beyond the plate 16 or may be flush with the outer face of the plate. At its rear end the tubular burner head 20 is welded to a reducing coupling 23, as indicated at 24. The large rear end of the reducing coupling 23 is welded to the pipe 10 at 25.

Arranged beneath the water jacket 12, at the transverse center of the water jacket, is a horizontal longitudinal water supply pipe 26 having an elbow 27 extending through an opening 28 in the bottom of the water jacket inwardly of and adjacent the forward plate 16, and welded thereto as shown at 29 to form a water-tight joint. This pipe 26 is provided with an intermediate laterally extending portion 30, which is horizontally arranged, and is secured to the rear end 26′ of the pipe. The numeral 31 designates a water outlet pipe provided at its forward end with an elbow 32 extending into an opening 33 formed in the water jacket and secured to the water jacket by welding 34. The elbow of 32 is also at the vertical transverse center of the water jacket, and at the top thereof, and inwardly of and adjacent the rear plate 14. The pipes 26 and 31 and their elbows are ¾ inch pipes. It is thus seen that the water supply and outlet pipes are arranged exteriorly of the water jacket 12, and the inlets and outlets are arranged to assure a free constant flow of cooling water from the forward end to the rear end of the water jacket, without liability of clogging, as might occur where the inlet and outlet pipes are arranged within the water jacket. Since the water is introduced into the water jacket at its bottom, there is no tendency for an air pocket to develop at the bottom, and the inclined flat 13 being in alignment with the elbow prevents the formation of an air pocket at the forward end and top of the water jacket, since it properly directs the water rearwardly as it contacts therewith.

The burner is adjustably supported for horizontal, vertical and angular adjustments. To accomplish this a vertical support bar or hanger 35 has its lower end welded to the pipe 10, as shown at 36 and this bar is arranged in alignment with the transverse center of the water jacket. The vertical support bar has vertically spaced openings 37 for receiving bolts carried by a suitable support. Arranged beneath the pipe 10 is a supporting pipe 38, in vertical alignment with the pipe 10. The supporting pipe 38 is horizontal and extends longitudinally of the water jacket 12, and is arranged at an elevation beneath this water jacket and is welded at its forward end to a bracket or projection 39, as shown at 40, and this bracket or projection is welded to the bottom of the water jacket 12 at its transverse center and at its rear end. The supporting pipe 38 has a length of approximately 38½ inches and the supporting bar 35 is spaced from the water jacket for a distance of 9 inches. A vertical web 38′ is arranged between and is welded to the pipes 10 and 38, to rigidly connect them, and the web 38′ is in alignment with the bar 35.

The supporting pipe 38 is attached at its rear end to a suitable support and the attachment may be flexible and the support may be vertically and horizontally adjusted, and the supporting bar 35 may be vertically, horizontally and angularly adjusted, and these two spaced points of support render it possible to quickly and easily shift the burner for adjustment. Further, the burner may be angularly adjusted by moving the support bar 35 for a different distance than the support for the supporting pipe 38. A cable or the like may be secured to or brought into engagement with the supporting pipe 38 and this cable may be manipulated by a hoist to raise or shift the entire burner. The pipes 10 and 38 are disposed between the pipe 31 and pipe end 26′, and spaced therefrom for approximately equal distances, whereby the parts are well balanced. The proper balancing, supporting and ease of adjustment of the burner is an important feature of the invention.

The entire device is rendered more rigid by providing a diagonal bar 39′, one end of which is welded to the main pipe 10 and the other end to the rear pipe end 26′ and a web 40 is arranged between the pipe 26 and the water jacket 12 and is welded to these parts.

The burner device is assembled upon an open hearth steel furnace, in the conventional manner. The burner may be arranged in the manner shown in connection with the burner 7 of

Patent #2,344,203, and the tubular burner head 20 will project the flame into the chamber of the furnace above the hearth. The water entering through the pipe 26 is led directly into the forward end of the water jacket, producing the maximum cooling effect at the forward end, and travels rearwardly through the water jacket without producing air pockets and discharges through the outlet pipe 31. The flat 13 being located directly over the elbow 27, and due to its inclination, prevents the formation of an air pocket. The fuel which is a gaseous mixture of oil and steam is fed under suitable pressure through the main pipe 10 and discharges into the reducing coupling 23, and additional atomizing of the oil occurs within this reducing coupling, over what has previously occurred in the atomizing device connected with the rear end of the main pipe 10. The atomized gaseous fuel then discharges through the tubular burner head 20 into the combustion chamber of the furnace. As previously explained, the length of the tubular combustion head 20 is critical with respect to producing a flame of the desired shape.

An important feature of the device is that it is made entirely of simple standard parts, all of which are secured together by welding, eliminating the use of bolts, packing, etc. and providing an exceedingly strong, simple, and cheap construction. The construction is also light and the manner of supporting the device renders it convenient to adjust the burner.

In Figures 4 to 7 inclusive, we have shown a modification of the invention. In this form of the invention two tubular burner heads are used.

In these figures, the numeral 41 designates a main fuel supply pipe of the same size as the pipe 10. The numeral 42 designates a companion fuel supply pipe having the same diameter as the pipe 41. The rear ends of these pipes 41 and 42 are connected with conventional oil and steam atomizers. At their forward ends, the pipes 41 and 42 are connected with reducing couplings 43, corresponding to the coupling 23, by means of welding. The couplings 43 are connected with tubular burner heads 44, corresponding to the burner head 20 and of the same length and size. Each burner head 44 is substantially 9 inches long, the upper burner head being slightly longer than the lower burner head as shown in Figure 4.

The tubular burner heads 44 are arranged within a water jacket 45, corresponding to the water jacket 12, and the water jacket has an outside diameter of 6 inches. At its top the water jacket has a flat 46 corresponding to the flat 13. The rear end of the water jacket receives a plate 47, welded thereto, and this plate has openings 48 to receive the reducing couplings 43, which are welded to the plate 47. The forward end of the water jacket 45 receives a plate 49, welded to the water jacket and this plate has openings 50 to receive the tubular burner heads 44 which are welded to the plate.

The numeral 51 designates a water inlet pipe, having an elbow 52 extending through an opening in the bottom of the water jacket 45 and welded thereto. This elbow is adjacent to the forward end of the water jacket and is in alignment with the flat 46. An outlet pipe 53 is provided, having an elbow 54, extending through an opening in the top of the water jacket 45 adjacent to the rear plate 47, and secured thereto by welding. The pipes 51 and 53 are arranged upon opposite sides of the horizontal transverse center of the water jacket.

A supporting bar 55, corresponding to the bar 35, is provided and this bar is welded to the upper pipe 41 at 56 and a vertical web 57 is arranged between the pipes 41 and 42 and is welded to the same. A diagonal web 58 corresponding to the web 39, is welded to the lower pipe 42 and the inlet pipe 51, as shown. The lower pipe 42 corresponds to the pipe 38, and the pipes 51 and 53 are spaced laterally from the vertically aligned pipes 41 and 42, for approximately equal distances so that the parts are well balanced.

The operation of the second form of the invention is similar to that given in connection with the first form. The tubular burner heads 44 will provide two flames, having the desired shape and characteristics as explained in connection with the first form of the invention. The water will enter the forward end of the water jacket to properly cool the burner heads and discharge from the rear end of the water jacket without forming air pockets. The second form of the invention has the advantages of construction as explained in connection with the first form.

It is to be understood that the forms of our invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention or the scope of the subjoined claims.

Having thus described our invention, we claim:

1. A burner unit for an open hearth furnace, comprising a water jacket, a main fluid fuel supply pipe extending longitudinally of the water jacket and connected with the rear end of the water jacket, a tubular burner head arranged within the water jacket and having its rear end connected with the main fuel supply pipe and its forward end discharging beyond the forward end of the water jacket, a water supply pipe arranged exteriorly of the water jacket and leading into the water jacket adjacent to its forward end, and a water outlet pipe disposed exteriorly of the water jacket and leading into the water jacket adjacent to its rear end, said fluid fuel supply pipe, water supply pipe and water outlet pipe extending rearwardly of said water jacket with the water supply pipe and water outlet pipe extending on opposite sides of a vertical plane passing through said main fuel supply pipe, and means rigidly connecting said pipes.

2. A burner unit for an open hearth furnace comprising a water jacket provided in its top at its forward end with an inclined flat, a main fuel supply pipe extending longitudinally of the water jacket and connected with the rear end of the water jacket, a tubular burner head arranged within the water jacket and having its rear end connected with the main fuel supply pipe and its forward end discharging beyond the forward end of the water jacket, a water supply pipe arranged exteriorly of the water jacket and leading into the bottom of the water jacket adjacent to its forward end and in substantial alignment with said flat, and a water outlet pipe disposed exteriorly of the water jacket and leading into the top of the water jacket adjacent to its rear end, said fluid fuel supply pipe, water supply pipe and water outlet pipe extending rearwardly of said water jacket with the water supply pipe and water outlet pipe extending on opposite sides of a vertical plane passing through said main fuel supply pipe, and means rigidly connecting said pipes.

3. A burner unit for an open hearth furnace, comprising a water jacket including forward and rear ends, a main fuel supply pipe extending through the rear end and connected therewith and extending longitudinally of the water jacket, said main fuel supply pipe having its rear end adapted for connection with a steam and oil atomizer, a tubular burner head extending longitudinally within the water jacket and having its forward end extending through the forward head and connected therewith, a reducing coupling connecting the forward end of the main fuel supply pipe and the rear end of the tubular burner head and serving as a secondary atomizing chamber, a water inlet pipe arranged exteriorly of the water jacket and discharging into the water jacket near its forward end, and a water outlet pipe leading into the water jacket near its rear end and disposed exteriorly of the water jacket, said fluid fuel supply pipe, water supply pipe and water outlet pipe extending rearwardly of said water jacket with the water supply pipe and water outlet pipe extending on opposite sides of a vertical plane passing through said main fuel supply pipe, and means rigidly connecting said pipes.

4. A burner unit for an open hearth furnace, comprising a water jacket including a tubular body portion having an inclined top portion at its forward end, forward and rear plates mounted in the opposite ends of the tubular body portion and welded thereto and having openings formed therein, a main fuel supply pipe extending longitudinally of the water jacket and passing through the opening of the rear plate and welded thereto, a tubular burner head extending longitudinally within the water jacket and having its forward end extending through the opening in the forward plate, a reducing coupling connecting the forward end of the main pipe and the rear end of the tubular burner head and serving as a secondary atomizing chamber, a water supply pipe leading into the bottom of the water jacket adjacent to its forward end and in alignment with the inclined top portion, a water outlet pipe leading into the top of the water jacket adjacent to the rear plate, a supporting bar attached to the main pipe and spaced from the water jacket, a substantially horizontal supporting pipe, a bracket rigidly secured to the forward end of the supporting pipe and the rear end of the water jacket, the rear end of the supporting pipe extending for a substantial distance rearwardly beyond the supporting bar, and means rigidly connecting the supporting pipe and main pipe adjacent to the supporting bar.

5. A burner unit for an open hearth furnace, comprising a water jacket including a tubular body portion and forward and rear plates welded to the opposite ends of the tubular body portion, a main fuel supply pipe extending longitudinally

of the water jacket and passing through an opening in the rear plate and welded thereto, a tubular burner head extending longitudinally within the water jacket and having its forward end extending through an opening in the forward plate and having its rear end connected with the forward end of the main pipe, a water supply pipe leading into the bottom of the water jacket adjacent to its forward end, a water outlet pipe leading into the top of the water jacket adjacent to the rear plate, an upstanding supporting bar rigidly attached to the main pipe and spaced from the water jacket, a substantially horizontal supporting pipe arranged beneath and in alignment with the main pipe, a bracket rigidly secured to the forward end of the supporting pipe and the rear end of the water jacket, the rear end of the supporting pipe extending for a substantial distance rearwardly beyond the supporting bar, an upstanding web arranged between the main pipe and the supporting pipe in substantial alignment with the supporting bar and rigidly secured to said pipes, the water supply pipe and water outlet pipe being disposed upon opposite sides of the main pipe and spaced therefrom to produce a balanced structure.

6. A burner unit for an open hearth furnace, comprising a water jacket, upper and lower main fuel supply pipes connected with the rear end of a water jacket, a corresponding number of tubular burner heads extending longitudinally within the water jacket and having their rear ends connected with the forward ends of the main pipes and their forward ends discharging exteriorly of the forward end of the water jacket, a water supply pipe leading into the water jacket near its bottom and forward end, a water outlet pipe leading into the water jacket near its top and rear end, a supporting bar rigidly secured to the upper main pipe and spaced rearwardly from the water jacket, and an upstanding web rigidly connecting the upper and lower main pipes and in substantial alignment with the supporting bar, the water supply pipe and water outlet pipe being disposed on opposite sides of the main pipe and spaced therefrom to produce a balanced structure.

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