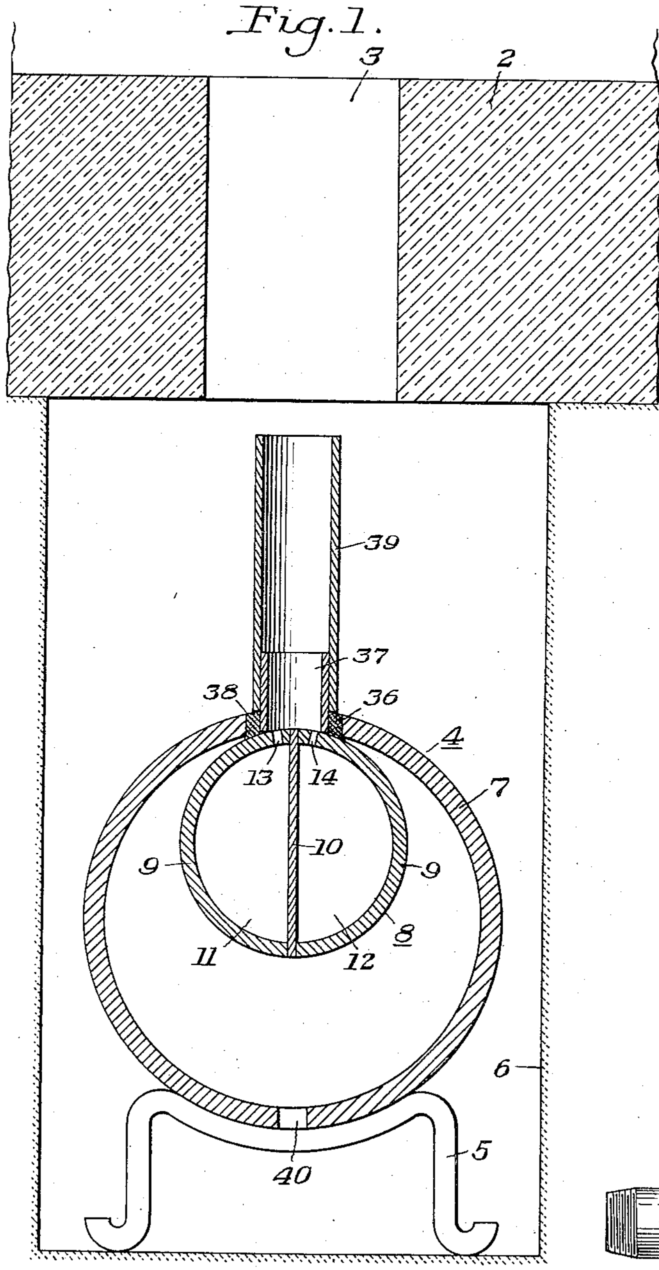
June 13, 1939. C. A. HOBSTETTER ET AL 2,161,865

BURNER CONSTRUCTION

Filed May 29, 1936 2 Sheets-Sheet 1



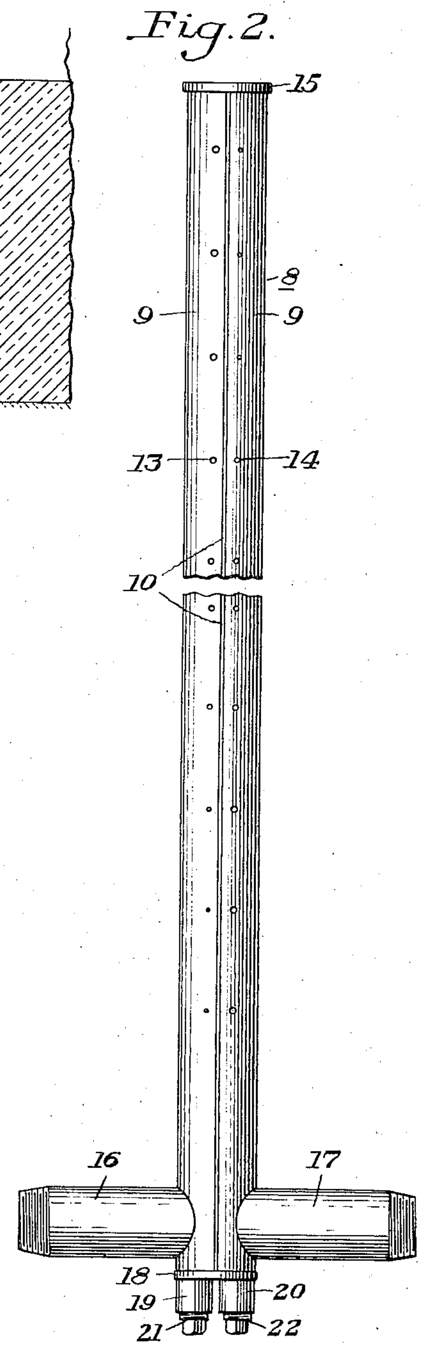


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Fig. 3.

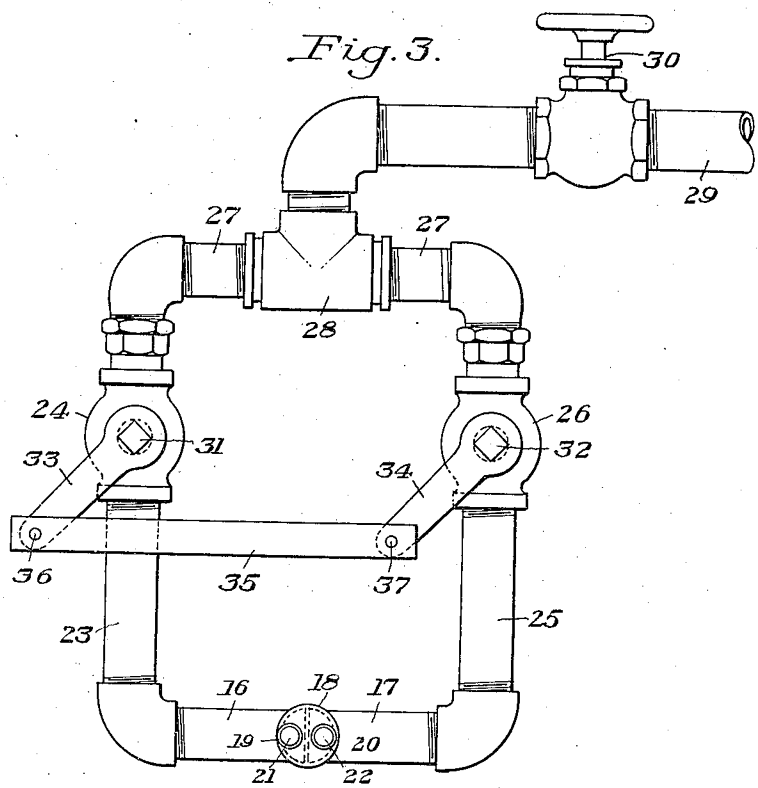


Fig. 4.

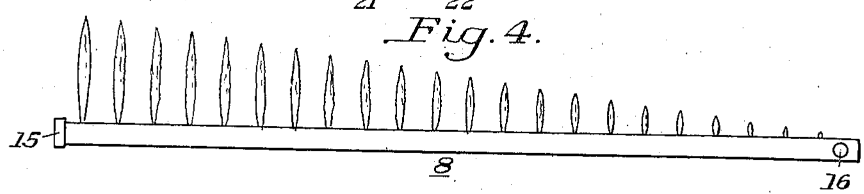


Fig. 5.

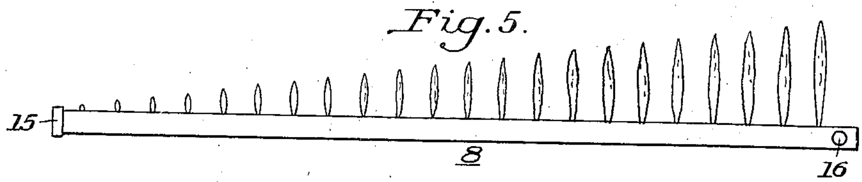
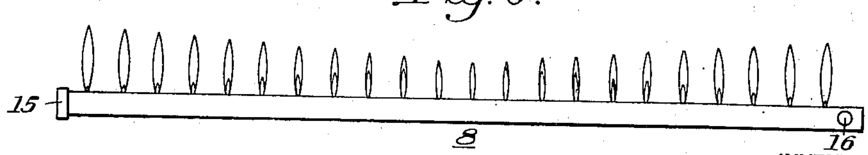


Fig. 6.



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BURNER CONSTRUCTION

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10 Claims. (Cl. 158—104)

This invention relates broadly to burner construction and more particularly to burners for fluid fuel such as are adapted for use in connection with ovens, furnaces and the like, and the invention is especially well adapted for use in connection with treating furnaces as for example furnaces for annealing metal. The invention provides for the control of the heat supplied by the burner so that the temperature in the furnace may be varied at different points therein whereby to enable close temperature control under various operating conditions.

While the invention is not so limited, it will hereinafter be described purely for purposes of explanation and illustration as embodied in a fluid fuel burner, as for example a gas burner particularly adapted and intended for use in connection with a metal treating furnace. Means are provided for admitting fuel to the burner, and for controlling from a convenient point, such as the end of the burner, the amount of fuel delivered to the combustion zone at points spaced along the burner. Thus a relatively great amount of heat may be supplied adjacent one end of the burner or adjacent the opposite end, and the heat differential may be controlled within wide limits, or the burner may be operated to supply an equal amount of heat throughout its entire length. The ability to control from a convenient point the amount of heat supplied at various points along the burner enables doing away with a multiplicity of control devices or valves such as have heretofore been provided in burners of the general type in question, and which have had to be individually manipulated to obtain the desired temperature differential in the furnace. In many instances the control valves, or some of them, have been difficulty accessible or a relatively great amount of piping has been required to enable location of the valves at a convenient control point. Our burner construction does away with these disadvantages.

We also provide for utilizing in a novel manner the air supplied to the burner for cooling the burner proper, the heat abstracted from the burner proper serving to raise the temperature of the air and promote greater efficiency in the burner, as well as to reduce the danger of damage to the burner through overheating. While this function broadly is not new, it is accomplished in an especially desirable way in our burner whereby advantages in operation and in economy of construction are obtained.

Other details, objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings we have shown a present preferred embodiment of the invention in which

Figure 1 is a transverse cross-sectional view through a burner construction and through a portion of the furnace to which it is applied,

Figure 2 is a plan view of the burner proper with a portion cut away,

Figure 3 is an elevational view showing the means for controlling the flow of fuel to the burner, and

Figures 4, 5 and 6 are diagrammatic views illustrating the manner of operation of the burner.

Referring now more particularly to the drawings, there is shown in Figure 1 a portion 2 of a furnace as, for example, the bottom of a metal annealing furnace having therein an upwardly extending elongated passage 3 through which the heat from the burner enters the furnace chamber. The burner as a whole is designated generally by reference numeral 4 and is carried on suitable supports 5 within a burner pit or casing 6. The burner 4 comprises an air duct or conduit 7 shown as being generally in the form of a pipe having disposed therein the burner proper or fuel conduit 8. The fuel conduit 8 is also generally in pipe form, being made up of opposed pipe segments 9 with a division wall 10 therebetween, the pipe segments and division wall being connected together in any suitable manner, as for example by welding. There are thus formed two separate fuel passages 11 and 12 through which fuel is introduced. In the upper portion of the fuel passage 11, adjacent the wall 10, as shown in Figures 1 and 2, is a longitudinally extending series of fuel openings or ports 13, and a similar longitudinally extending series of ports 14 is provided at a corresponding position in the fuel passage 12. As diagrammatically illustrated in Figure 2, the ports 13 in the fuel passage 11 are graduated in size, the port of greatest cross-sectional area being at one end of the burner and that of least cross-sectional area being at the opposite end. Preferably the intermediate ports are of gradually decreasing cross-sectional area from the first mentioned toward the last mentioned end of the burner. The ports 14 in the fuel passage 12 are similarly graduated in size, but the port of greatest cross-sectional area in such fuel passage is at the end of the burner opposite the end at which the port of greatest size in the fuel passage 11 is provided. The relative sizes and ar-

rangement of the respective ports is clearly illustrated diagrammatically in Figure 2, although no attempt is made in such figure to reproduce the ports in actual size.

We find it convenient to position each of the ports 13 opposite one of the ports 14 as shown in Figure 2, although this is not essential. One end of the fuel conduit 8 is preferably closed as indicated at 15. At the opposite end, fuel inlet pipes or conduits 16 and 17 are provided, the former opening into the fuel passage 11, and the latter into the fuel passage 12 as shown. The end of the fuel conduit 8 opposite the end which is closed at 15 may have applied thereto a cap 18 provided with a pair of internally threaded collars 19 and 20, which may be closed respectively by plugs 21 and 22, to enable cleaning of the fuel passages. Normally when the burner is in operation, the plugs 21 and 22 are in place and close the end of the fuel conduit.

The pipe 16 is connected through a pipe 23 with a valve 24, and the pipe 17 is connected through a pipe 25 with a valve 26. The respective valves 24 and 26 are connected through pipes 27 and a T 28 to the fuel supply line 29 which is provided with a valve 30. The valves 24 and 26 may be of the cylinder type, and may be so designed and adjusted that when one of them is fully closed the other will be fully open and vice versa. For example, the valves may be such that rotation of each through an angle of, say, 90° will move it from fully closed to fully open position. The valve 24 has a stem 31, and the valve 26 has a stem 32. An operating lever 33 is keyed to the stem 31, and an operating lever 34 is keyed to the stem 32. A link 35 is pivoted to the lever 33 at 36, and to the lever 34 at 37.

It will thus be seen that movement of the link 35 causes equal rotative movement of the valves 24 and 26, one of such valves being gradually opened, while the other is gradually closed. Figure 4 illustrates diagrammatically the condition obtaining when the valve 24 is fully open and the valve 26 is fully closed. Under such conditions, fuel is supplied only to the fuel passage 11 and hence emerges only through the ports 13. No fuel is supplied to the fuel passage 12 so that none emerges through the ports 14. Thus, as will be apparent upon inspection of Figure 4, a relatively great amount of heat may be supplied at the front of the burner and thus at the front of the furnace, the amount of heat supplied varying gradually from the front to the rear. In Figure 5 is diagrammatically illustrated the condition obtaining when the valve 26 is fully open and the valve 24 is fully closed. Under these circumstances, fuel is supplied only through the fuel passage 12 and the ports 14, and not through the fuel passage 11 and the ports 13, and consequently a greater amount of heat is supplied at the rear of the burner than at the front, the amount of heat gradually increasing along the burner from front to rear.

Figure 6 illustrates the condition obtaining when each of the valves 24 and 26 is half open. Under these circumstances an equal amount of fuel is delivered to each of the fuel passages 11 and 12, and consequently through the ports 13 taken collectively and the ports 14 taken collectively. The ports 13 and 14 are preferably so proportioned that when both valves 24 and 26 are half open a uniform amount of heat is supplied along the entire length of the burner. The oppositely disposed ports 13 and 14 at each of the spaced points along the burner augment each other so that the total amount of fuel supplied through each such set of ports is equal to the total amount of fuel supplied through each other set when both of valves 24 and 26 are half open.

The link 35 may, if desired, be removed, and each of the valves 24 and 26 operated independently whereby, as will be appreciated, an infinite number of conditions of heat intensity and heat gradation may be obtained in the burner. By proper control of the valves any desired temperature relation along the burner may be obtained.

While we have shown only two fuel passages 11 and 12, it will be appreciated that the invention is not limited to the use of only two fuel passages, but the number of fuel passages may be varied as desired. Likewise the relative sizes of the fuel ports in the various fuel passages may be varied so that provision may be made for any condition of heat supply which may be desired.

The air duct or conduit 7 is provided along its length with openings 36, one corresponding in position with each pair of ports 13 and 14. In constructing the burner the fuel conduit 8 is temporarily supported relative to the air duct 7 in the position shown in Figure 1 and a nipple 37 is introduced downwardly through each of the openings 36 so as to be positioned to conduct upwardly from the fuel conduit 8 fuel passing out through the ports 13 and 14. With the members 7, 8 and 37 thus assembled they are welded together by suitable welding material as shown at 38 in Figure 1. A burner extension 39 is provided about the upper portion of each of the nipples 37 to conduct the fuel upwardly to the combustion zone. The fuel then passes into the passage 3 where it mixes with the air for combustion. The burner extensions 39 are preferably not welded to the assembly of the members 7, 8 and 37 so that such burner extensions may easily be removed and replaced when desired.

The air may be admitted to the air duct 7 longitudinally thereof, and is preferably supplied under pressure, being discharged from the air duct through an opening or openings 40 in the bottom thereof, the air passing laterally and upwardly into the combustion zone and supporting combustion of the fuel delivered by the burner. The air is preheated in the air duct 7 by direct contact with the fuel conduit 8 which is in metal-to-metal contact with the extension 39 and the conduit 37 as well as the air duct 7. Thus heat is transmitted away from the fuel conduit 8 both by the air in the air duct and by conduction through the metal of the air duct itself, such metal being of relatively great mass as compared with the metal of the fuel conduit. This brings about an ideal condition in maintaining the fuel conduit sufficiently cool and, at the same time, desirably preheating the air.

While we have shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the same is not limited thereto, but may be otherwise variously embodied within the scope of the following claims.

We claim:

1. Burner construction, comprising a plurality of fuel ducts disposed generally in side-by-side relationship, means for admitting fuel thereinto, one of said ducts having fuel outlet means spaced therealong and of gradually increasing size in one direction, the other of said ducts having fuel outlet means spaced therealong and of gradually decreasing size in said direction, and means for

controlling the flow of fuel in each of said ducts.

2. Burner construction, comprising a plurality of fuel ducts having fuel outlet means therein, means for admitting fuel thereinto, valve means for controlling the quantity of fuel admitted to the respective fuel ducts, and means for operating said valve means to admit at all times a substantially constant total quantity of fuel to said ducts while proportioning the same at will between the respective ducts.

3. Burner construction, comprising a plurality of fuel ducts disposed generally in side-by-side relationship, means for admitting fuel thereinto, each of said ducts having at a location therealong fuel outlet means of different size from the correspondingly positioned fuel outlet means of the other duct and at another location therealong fuel outlet means of substantially the same size as the correspondingly positioned fuel outlet means of the other duct, and means for controlling the flow of fuel in each of said ducts.

4. Burner construction, comprising an air duct for supplying air to the burner, a fuel duct having fuel outlet means therein, means for admitting fuel to the fuel duct, the fuel duct being disposed within the air duct, the air duct having outlet means in registration with the fuel outlet means in the fuel duct to permit the outlet of fuel therethrough, the air duct being sealed to the fuel duct about said outlet means in the air duct which are in registration with the fuel outlet means in the fuel duct to prevent the outlet of air therethrough, the air duct having other outlet means through which the air in the air duct passes, and a casing disposed about the air duct and open at the top.

5. Burner construction, comprising a fuel duct having outlet means in its upper portion, means for admitting fuel to the fuel duct, an air duct in thermo-conductive relationship with the fuel duct and extending therebelow, air outlet means in the lower portion of the air duct, and a casing disposed about the air duct and open at the top.

6. Burner construction, comprising a fuel duct having outlet means in its upper portion, means for admitting fuel to the fuel duct, an air duct in thermo-conductive relationship with the fuel duct and extending therebelow, air outlet means in the air duct out of registration with the outlet means in the fuel duct, and a casing disposed about the air duct and open at the top.

7. Burner construction, comprising an air duct for supplying air to the burner, a fuel duct within the air duct, the fuel duct having fuel outlet means communicating through the air duct with the outside of the burner but out of direct communication with the interior of the air duct, the air duct having air outlet means offset generally circumferentially of the burner from the fuel outlet means, and a casing disposed about the air duct and open at the top.

8. Burner construction, comprising a plurality of fuel ducts, means for admitting fuel thereinto, each of said ducts having fuel outlet means spaced therealong and of gradually increasing size from an end portion toward the other end portion thereof, the area of said outlet means in said respective ducts increasing in different directions, and means for controlling the flow of fuel in each of said ducts.

9. Burner construction, comprising a pair of fuel ducts disposed generally in side-by-side relationship, means for admitting fuel thereinto, each of said ducts having fuel outlet means spaced therealong and of gradually increasing size from an end portion toward the other end portion thereof, the area of said outlet means in said respective ducts increasing in opposite directions, and means for controlling the flow of fuel in each of said ducts.

10. Burner construction, comprising a pair of fuel ducts disposed generally in side-by-side relationship, each of said ducts having fuel outlet means disposed therealong, said fuel outlet means in each duct being so constructed and arranged as to deliver a relatively great quantity of fuel at one portion of the duct and a relatively small quantity of fuel at another portion of the duct, the portion of each duct at which a relatively great quantity of fuel is delivered being disposed opposite the portion of the other duct at which a relatively small quantity of fuel is delivered, means for admitting fuel to the respective ducts, and means for controlling the quantity of fuel admitted to each duct.

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