Nov. 20, 1934. C. J. LEVEY ET AL 1,981,602

BURNER ASSEMBLY

Filed Oct. 15, 1930 2 Sheets-Sheet 1

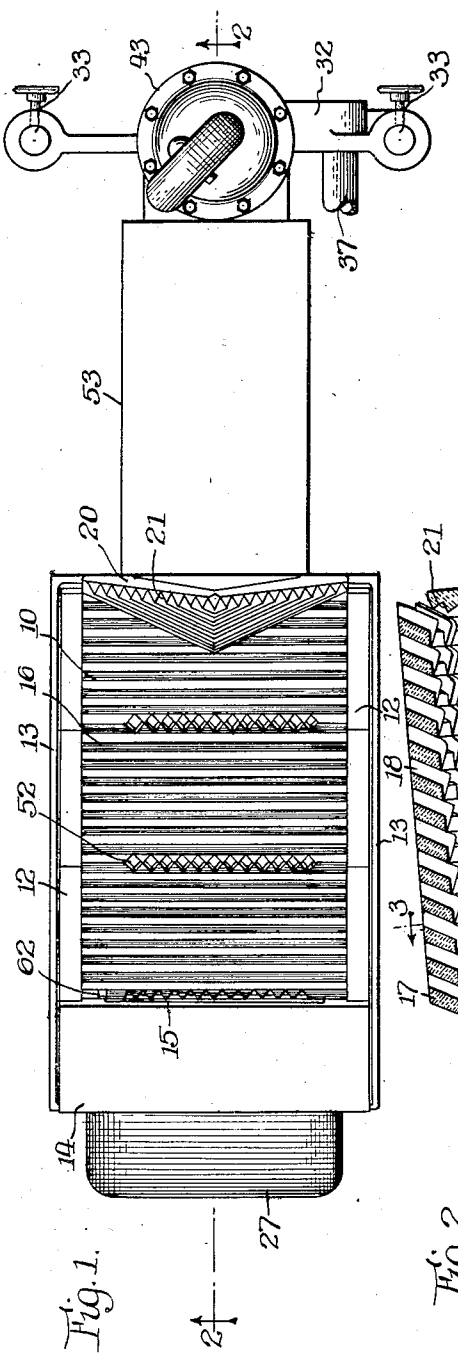

Fig. 1.

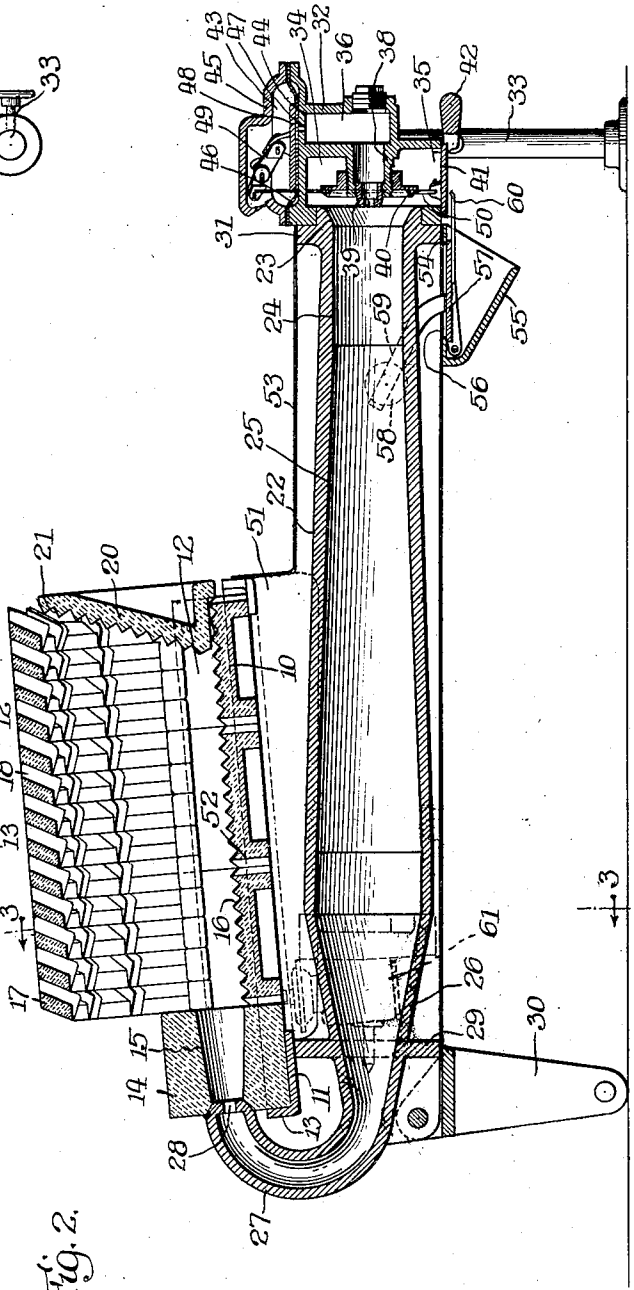

Fig. 2.

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BURNER ASSEMBLY

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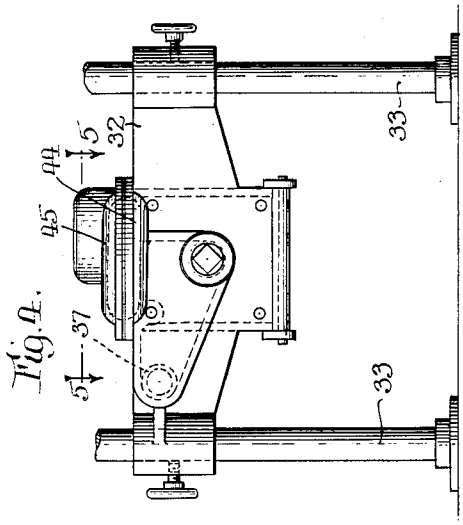


Fig. 4.

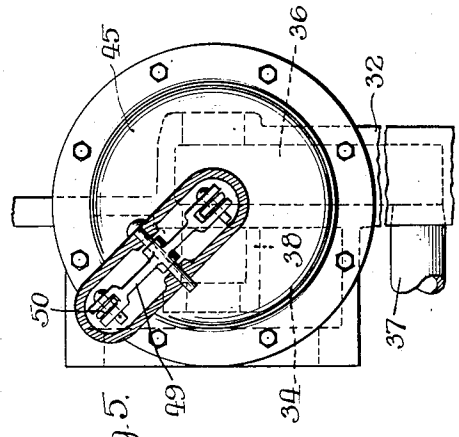


Fig. 5.

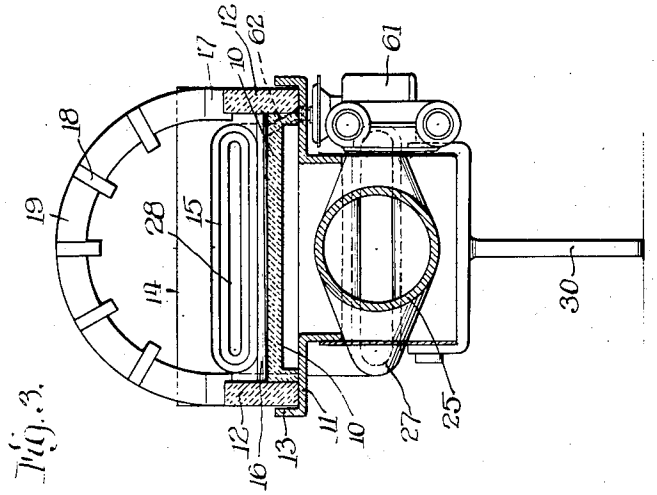


Fig. 3.

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# UNITED STATES PATENT OFFICE

1,981,602

## BURNER ASSEMBLY

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16 Claims. (Cl. 158—99)

The present invention relates to improvements in burner assemblies adapted particularly for the combustion of gas.

Various objects of the invention reside in the provision of a novel gas burner assembly which is simple, inexpensive and compact in construction, which is efficient in operation, which is not subject to back-firing, and which is adapted for either industrial or natural gas.

Another object is to provide a new and improved gas burner assembly so designed that it may be located on the furnace in an out-of-the-way position, and still will be readily accessible.

Another object resides in the provision of novel means for supplying primary and secondary air of combustion, and controlling said supply to prevent circulation of air through the furnace and thereby cooling off of the furnace during off periods, thus improving the efficiency of the furnace.

A further object resides in the provision of novel means for supplying secondary air at a point where it is all utilized in direct combustion, and in direct contact with the flame in the high temperature zone.

An important object of the invention resides in the provision of a novel combustion chamber which comprises a refractory pan provided with the only secondary air inlets and formed to present a large radiating surface and to induce a high state of turbulence, and which permits radiant heat to pass directly from the pan to the absorbent surfaces.

Other objects and advantages will become apparent as the description proceeds.

In the accompanying drawings, Figure 1 is a plan view of a burner assembly embodying the features of the invention with the refractory arches removed.

Fig. 2 is a vertical sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is an end view of the mixing device.

Figfl 5 is a fragmentary sectional view taken along line 5—5 of Fig. 4.

While the invention is susceptible of various modifications and alternative constructions, we have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that we do not thereby intend to limit the invention to the specific form diclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, the burner assembly constituting the exemplary embodiment of the invention comprises generally a combustion chamber, a mixing device for supplying a mixture of air and gas to the combustion chamber, and means for supplying secondary air of combustion.

The combustion chamber is adapted to be mounted in a suitable furnace in position, preferably at the bottom, to supply heat by radiation and convection to the heat absorbent surfaces. The furnace with its heat absorbent surfaces is not shown or described herein since the details thereof per se constitute no part of the present invention.

The combustion chamber, in its preferred form comprises a pan 10 of radiant refractory material which preferably is rectangular in shape, and which is disposed in a substantially horizontal position. The pan 10 is suitably mounted on a supporting base plate 11. Also mounted on the plate 11 are two vertical side walls 12 of refractory material which extend respectively along the sides of the pan 10. An upstanding peripheral flange 13 on the plate 11 serves to confine the pan 10 and the side walls 12 in assembled relation.

Mounted on the base plate 11, preferably at the rear end of the pan 10, is a suitable laterally elongated refractory burner block 14 which is formed with an expanding burner orifice 15 opening directly over the base and almost coextensive in width therewith. Preferably, the pan 10 is slightly inclined upwardly from the orifice 15 so that the fuel mixture will impinge against and sweep over the upper surface of the pan and the inner surfaces of the side walls 12. The top of the pan 10 also is formed from end to end with a series of transverse serrations 16 which serve to increase the radiant area, and to produce a retarding or abrasive action on the fuel mixture, thus effecting a high degree of turbulence. Thus, the fuel mixture is burned directly over and against the pan 10, and the latter is heated to an extremely high state of incandescence. This incandescence together with the large radiant surface of the pan 10 and the turbulence of the fuel and gases serves to establish an extremely high temperature zone directly over the pan, thereby insuring efficient combustion.

A suitable refractory arch is mounted over the pan 10, and is substantially coextensive in length therewith. In the present instance, the arch

comprises a series of semi-circular or curved radiant refractory arch members 17 which rest at their ends on the upper edges of the side walls 12, and which are in closely abutting relation. Preferably, each of the arch members 17 is inclined in cross-section outwardly and forwardly from the burner block 14, and is formed on its front surface with a plurality of radial peripherally spaced lugs or ribs 18. With the arch members 17 in assembled relation, the ribs 18 serve with the members to define a plurality of peripherally spaced apertures 19, thus producing a lattice effect. The apertures 19 are inclined outwardly and forwardly from the vertical, and serve to permit radiant heat from the interior of the combustion chamber to strike directly against the absorbent surfaces (not shown) of the furnace.

Mounted on the upper forward end of the pan 10 is a substantially vertical, radiant refractory front wall 20 which serves to substantially close the front end of the arch. In the present instance, the front wall 20 is wedge shaped, the inner surface being substantially parallel to the apertures 19, and preferably being formed from top to bottom with a series of transverse serrations 21 similar to the serrations 16.

The mixing device preferably is in the form of a proportional mixer comprising a Venturi mixing tube 22 having an inlet cone 23, a throat 24 and an elongated expanding cone 25. The discharge end of the tube 22 is connected through a converging sleeve 26 to a flattened burner supply conduit 27 connected to the block 14. Preferably, the tube 22, the sleeve 26 and the conduit 27 are formed integral. The conduit 27 opens through an elongated burner port 28 to the burner orifice 15, the port and the orifice being substantially coextensive in width.

Preferably, the mixing tube 22 extends along the underside of the refractory pan 10, and the supply conduit 27 is curved upwardly and then forwardly to establish its connection with the burner block 14. As a result, a compact construction, in which the mixing device is positioned out of the way under the furnace with attendant convenience and saving in floor space is obtained.

A peripheral flange 29 is formed about the discharge end of the sleeve 26, and serves to support the adjacent end of the base plate 11. A rear leg 30 is suitably secured to the sleeve 26 to support the rear end of the burner structure. The front end of the tube 22 is formed with a peripheral flange 31 against which a housing 32 is rigidly secured. Two adjustable legs 33 suitably secured to the housing 32 serve to support the front end of the burner structure.

The housing 32 is formed with a chamber 34 in direct communication with the mixing tube 22 and adapted to receive one of the constituents of the air-gas mixture. In the present instance, the chamber 34 serves as the primary air chamber, and to this end may be connected to a suitable source of air, as for example through an inlet opening 35 in the bottom to the atmosphere. The housing 32 is formed with a second chamber 36 for supplying the other constituent, namely gas, to the mixing tube 22. Gas under pressure is adapted to be supplied from a suitable source (not shown) to the chamber 36 through a pipe 37. Opening from the chamber 36 is an externally threaded tubular fitting 38 extending into the air chamber 34 in axial alignment with the tube 22. A restricted nozzle 39 is adjustably threaded into the free end of the fitting 38, and preferably terminates substantially in the plane of the inlet end of the entrance cone 23. Mounted on the fitting 38 for adjustment toward and from the inlet end of the cone 23 to regulate the size of the inlet air passage is a primary air shutter or valve 40.

In operation, a jet of gas under pressure will be discharged from the nozzle 39 axially into the entrance cone 23, and a proportionate flow of air from the chamber 34 past the shutter 40 will thereupon be induced. The air-gas ratio may be varied by adjusting the shutter 40, and the volume of fuel mixture supplied may be adjusted by adjusting the amount of gas supplied to the gas chamber 36.

Provision is made for controlling the supply of primary air in dependence on the supply of gas. To this end, an air damper 41 having a counterbalance 42 is pivotally mounted on the underside of the housing 32 for opening and closing the inlet air opening 35 to the air chamber 34. Mounted on the housing 32 is a casing 43 comprising a bottom wall 44 preferably formed integral with the housing 32, and a removable top wall 45. A pressure responsive member in the form of a flexible diaphragm 46 is mounted in the casing 43 with its peripheral margin tightly secured between the walls 44 and 45.

A bleeder port or vent 47 opens from the gas chamber 34 into the lower section of the diaphragm casing 43 to transmit the pressure of the gas against the underside of the diaphragm 46. Resting on the diaphragm 46 is a suitable weight 48. A lever 49 pivotally mounted intermediate its ends in the wall 45 is pivotally connected at one end to the weight 48 and at the other end through a vertical link 50 to the air damper 41. It will be evident that during off periods, the damper 41 will be closed, thus preventing the circulation of primary air through the combustion chamber and the furnace. In starting up the operation, the gas is turned on and is discharged through the nozzle 39 into the mixing tube 22. Due to the restricted character of the bleeder port 47, the gas pressure builds up gradually under the diaphragm 46 to effect a retarded opening of the damper 41, and hence in the initial period, gas is first supplied to the combustion chamber, thus preventing back-firing.

Another feature of the invention resides in supplying secondary air at a point where it is utilized in direct combustion, and is in direct contact with the flame in the high temperature zone. To this end, the base plate 11 is formed with a secondary air chamber 51 directly below the refractory pan 10, and the latter is formed with a plurality of transverse rows, three in the present instance, of small secondary air inlet openings 52. An external wall 53 secured at its ends to the flanges 29 and 31 and connected to the base plate 11 encloses the mixing tube 22 and the sleeve 26 and defines therewith a continuation of the secondary air chamber 51. Air from any suitable source may be supplied to the chamber 51, and in the present instance the chamber is adapted to communicate with the atmosphere through an inlet opening 54 formed in the underside of the wall 53 adjacent the flange 31.

Means is provided for controlling the supply of secondary air in dependence on the supply of primary air. Preferably, this means comprises a housing 55 mounted on the underside of the wall 53 over the opening 54, and formed with an opening 56 in registration therewith. A damper

57 is pivotally mounted at one end in the housing 55 for movement to open and close the opening 56. A weight 58 secured to the free end of an arm 59 extending upwardly from the damper 57 and rearwardly across its pivotal axis tends to hold the damper in closed position.

Secured to the free end of the damper 57 is a finger 60 extending out of the housing 55 into underlying relation to the primary air damper 41. It will be evident that when the damper 41 is opened it will open the secondary air damper 57, and that when the damper 41 is closed, the weight 58 will close the damper 57. Thus, secondary air is supplied only when primary air is supplied, and is supplied only to the high temperature zone directly over the pan 10, thereby further insuring efficient combustion, and preventing a cooling draft through the combustion chamber and the furnace during off periods.

Mounted on the underside and adjacent one side edge of the base plate 11 is a suitable safety pilot burner 61 communicating through a pilot port 62 formed in the refractory pan 10 with the combustion chamber at a point adjacent one end of the main burner orifice 15. Suitable automatic means (not shown) may be provided for cutting off the supply of gas to the pipe 37 in the event that the pilot flame becomes extinguished.

We claim as our invention:

1. In a burner assembly, in combination, a combustion chamber comprising a refractory base wall, and a burner block abutting against one end of said base wall and defining an end wall of said chamber, said block having a narrow elongated discharge orifice opening along the edge of said end of said base wall and being substantially coextensive in length therewith, one longitudinal edge of said orifice being substantially in the plane of the fire surface of said base wall.

2. In a burner assembly, in combination, a combustion chamber comprising a flat refractory pan, the fire surface of said pan being formed with a series of parallel serrations, and a burner having a narrow elongated orifice located along one edge and closely to the plane of said pan for discharging a fuel mixture thereover across said serrations, said orifice being substantially coextensive in width with said pan.

3. In a burner assembly, in combination, a combustion chamber comprising a flat refractory pan rectangular in form, a burner block at one end of said pan, said block having a laterally elongated orifice for discharging a fuel mixture over the upper surface of said pan, said pan being inclined upwardly from said orifice and being formed with a plurality of transverse serrations in its upper surface, a plurality of abutting arch members mounted over said pan, said arch members defining a plurality of apertures, and an end wall mounted on said pan opposite said block, said end wall being formed with a plurality of transverse serrations.

4. In a burner assembly, in combination, a combustion chamber comprising a flat refractory pan, and a burner having a narrow elongated orifice located along one edge and closely to the plane of said pan for discharging a fuel mixture across said pan, and an upright wall on said pan opposite to said orifice.

5. In a burner assembly, in combination, a combustion chamber comprising a flat refractory pan, and a burner having a narrow elongated orifice located along one edge and closely to the plane of said pan for discharging a fuel mixture across said pan, and an upright wall on said pan opposite to said orifice in the path of said mixture, said upright wall sloping from said pan away from said burner, the fire surfaces of said pan and said wall each being formed with a plurality of serrations.

6. In a burner assembly, in combination, a combustion chamber comprising a refractory rectangular base wall and refractory upstanding side walls, a burner having a narrow elongated orifice extending along one end edge and closely to the plane of said base wall for discharging a fuel mixture to sweep along said base wall and said side walls, and an upstanding refractory wall on the end of said base wall opposite said orifice in the path of said mixture.

7. In a burner assembly, in combination, a combustion chamber comprising a refractory rectangular base wall and refractory upstanding side walls, a burner having a narrow elongated orifice extending along one end edge of said base wall for discharging a fuel mixture to sweep along said base wall and said side walls, and an upstanding refractory wall on the end of said base wall opposite said orifice, said base wall being longitudinally inclined upwardly from said orifice, and an apertured arch over said base wall.

8. In a burner assembly, in combination, a combustion chamber comprising a flat refractory base wall, a burner block having an orifice for discharging a fuel mixture to sweep along the fire surface of said wall, and a plurality of abutting refractory arch members mounted over said wall, each contiguous pair of said arch members defining a plurality of spaced apertures.

9. In a burner assembly, in combination, a horizontally disposed combustion chamber having a base wall, a burner block mounted at the rear of said chamber for discharging a fuel mixture thereto across said wall, and a fuel mixing device comprising an elongated mixing tube connected to said burner block, said tube extending below and completely across said base wall and then at the rear of said wall being curved upwardly and forwardly to establish said connection with said block.

10. In a burner assembly, in combination, a combustion chamber having a refractory pan with secondary air inlet openings, a burner nozzle discharging to said chamber, a mixing device connected to said nozzle, means for supplying fuel to said device, means including a valve for supplying air to said device, a secondary air chamber enveloping said device and communicating with said openings, means including a valve for supplying air to said air chamber, and means for automatically opening said last mentioned valve when said first mentioned valve is opened.

11. In a burner assembly, in combination, a combustion chamber comprising a refractory pan, a burner block at one end of said pan, said block having a laterally elongated orifice for discharging a fuel mixture over the upper surface of said pan, said pan being formed with a plurality of transverse serrations in its upper surface, a plurality of abutting arch members mounted over said pan, said arch members defining a plurality of apertures, and an end wall mounted on said pan opposite said block.

12. In a burner assembly, in combination, a combustion chamber comprising a refractory base wall and refractory upstanding side walls, a burner having a narrow elongated orifice extending along one end edge of said base wall for discharging a fuel mixture to sweep along said

base wall and said side walls, an upstanding refractory wall on the end of said base wall opposite said orifice, and an apertured arch over said base wall.

13. In a burner assembly, in combination, a horizontally disposed combustion chamber having a base wall, said base wall being formed with a plurality of air ports opening therethrough, an air chamber underneath said wall and in communication with said ports, a burner block mounted at the rear of said chamber for discharging a fuel mixture thereto to sweep across said wall, and a fuel mixing device comprising an elongated mixing tube connected to said burner block, said tube extending through said air chamber below and completely across said base wall, and at the rear of said air chamber being curved upwardly and forwardly to establish said connection with said block.

14. In a burner assembly, in combination, a combustion chamber comprising a refractory base wall, a burner block located at one end of said base wall and having a narrow elongated discharge orifice opening along the edge of said end of said wall, said orifice being substantially coextensive in length with said edge, and a burner tube having a flattened end connected to said block, said flattened end being formed with a narrow elongated orifice registering with and discharging into said first mentioned orifice.

15. In a burner assembly, in combination, a combustion chamber comprising a horizontal base wall, a burner having orifice means for discharging a fuel mixture into the rear of said chamber, a fuel and air mixing device comprising an elongated mixing tube extending from the front of said chamber rearwardly underneath said base wall, and means connecting the rear end of said tube to said burner, said means extending from said tube below said base wall upwardly to above said base wall.

16. In a burner assembly, in combination, a combustion chamber having a horizontal base wall with secondary air inlets opening therethrough to admit air from below said wall to said chamber, a burner nozzle for discharging a fuel air mixture into said chamber, a mixing device having an elongated discharge tube located beneath said base wall and connected to said nozzle, means for supplying fuel to said device, means including a valve for supplying air to said device, a secondary air chamber enveloping said tube and communicating with said secondary air inlets, and means for admitting air to said air chamber.

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