Sept. 11, 1945. C. VOLKMAN 2,384,510

HEATING APPARATUS

Filed Aug. 19, 1940 3 Sheets-Sheet 1

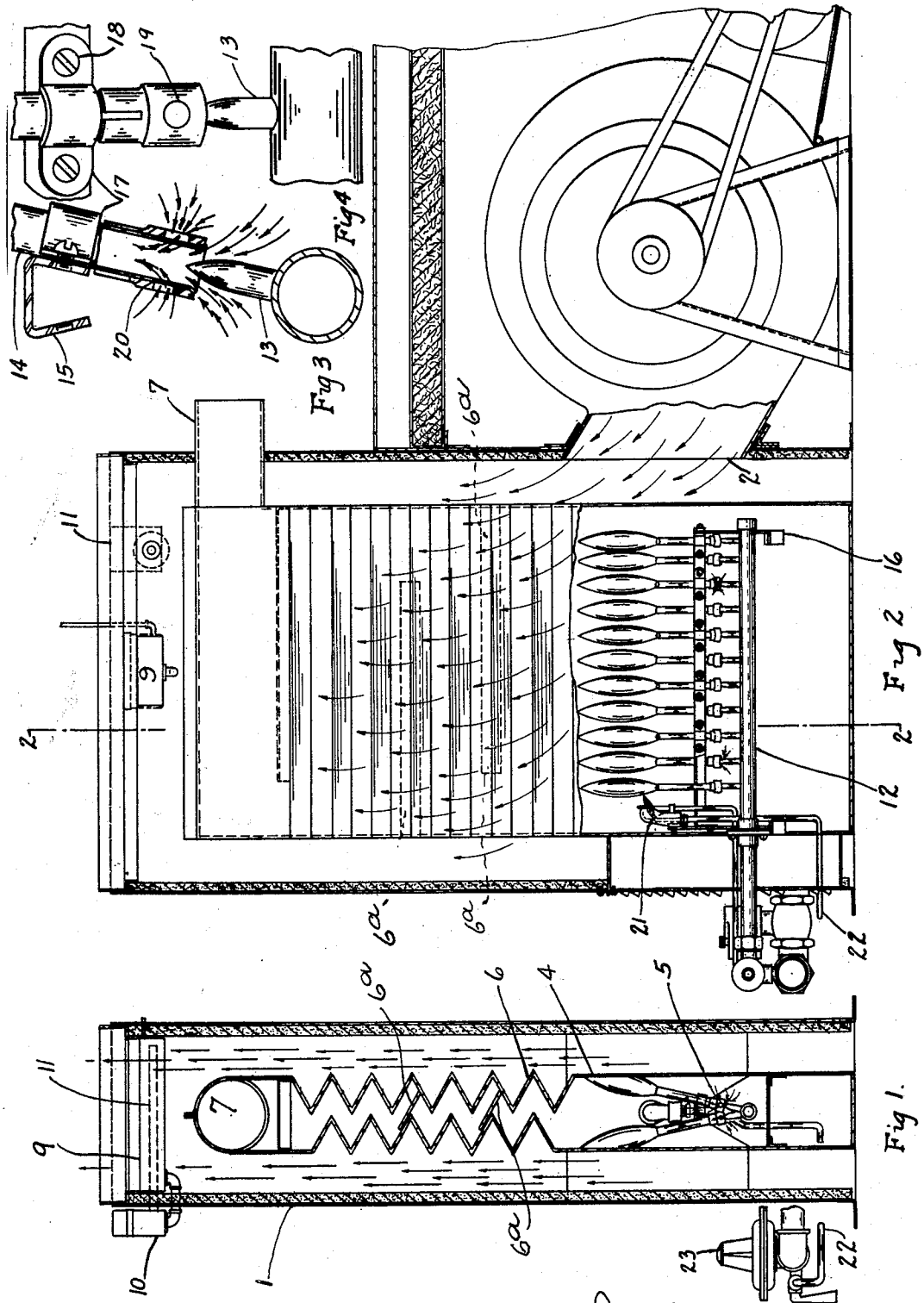


Fig 2

Fig 1.

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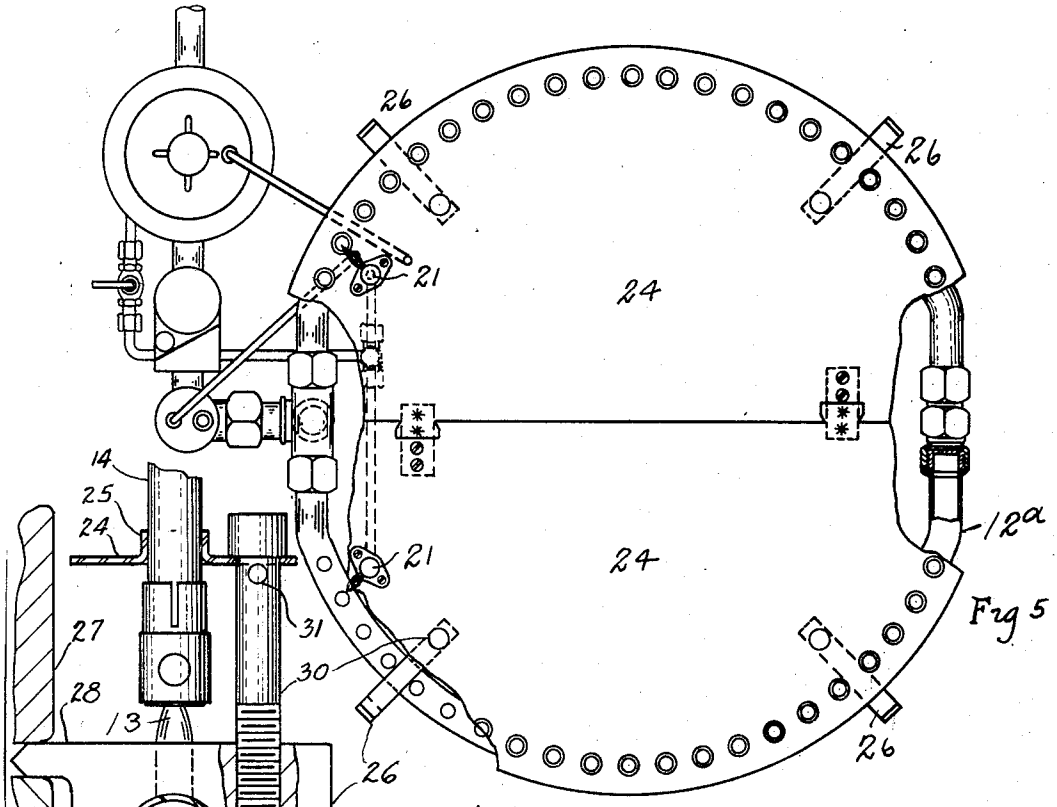


Fig 5

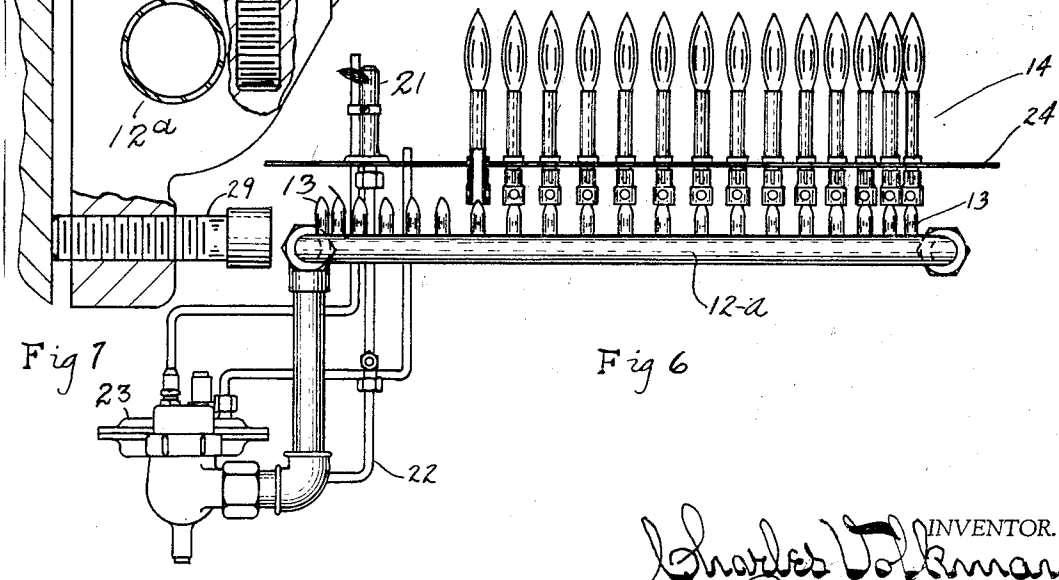


Fig 6

Fig 7

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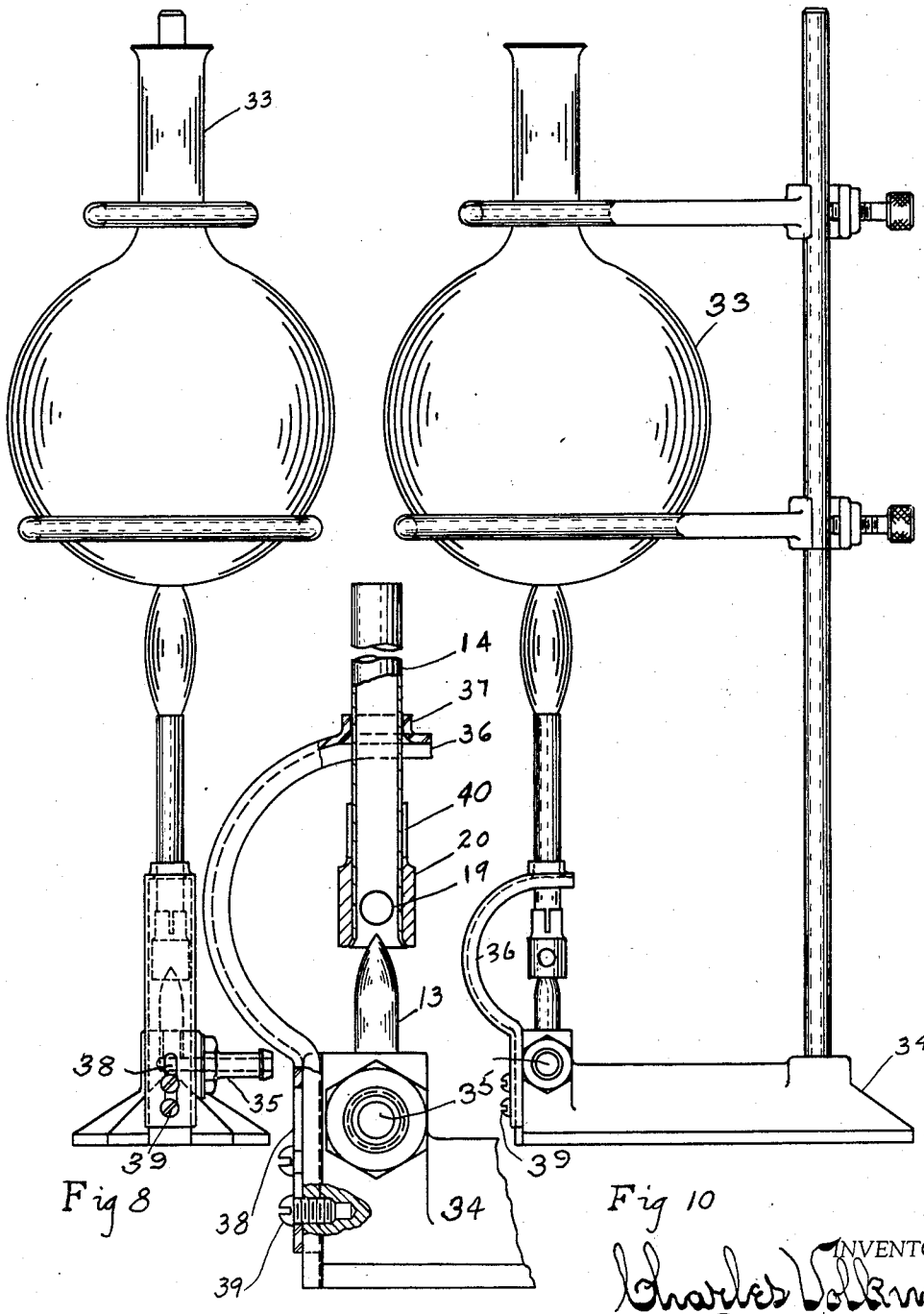


Fig 8

Fig 9

Fig 10

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UNITED STATES PATENT OFFICE

2,384,510

HEATING APPARATUS

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Application August 19, 1940, Serial No. 353,231

11 Claims. (Cl. 126—116)

This invention pertains to heating apparatus, and more particularly to a hot air heater and gas burner therefor.

In the present construction there is contemplated a heater unit through which air is circulated from a ventilating fan or blower, in intimate contact with a flue conducting the products of combustion of a gas burner, the walls of which are of tortuous form to increase the air contact area, and a burner especially adapted for use therewith comprising a plurality of jets of the Bunsen type, having their tubes adjustably mounted for axial movement toward and from the gas supply jets to accommodate the apparatus to different conditions of use and different fuel characteristics.

The object of the invention is to improve the construction of gas operated hot air heaters whereby they may not only be economically manufactured and operated, but will be more efficient in use, automatic in action, uniform in operation, having few operating parts and unlikely to get out of repair.

A further object of the invention is to provide a heater unit having maximum radiating surface and enable free circulation of air currents in contact therewith, with minimum air friction and circulation resistance.

A further object of the invention is to provide an improved form of gas burner, adapted to minimize fuel consumption and increase the generated heat units in proportion to the quantity of fuel consumed.

A further object is to provide an improved burner construction of the Bunsen type and to provide improved adjusting means for regulating the air supply.

A further object of the invention is to provide adjusting means common to a plurality of burner members for enabling their adjustment in unison.

A further object of the invention is to provide a heater unit and a gas burner therefor having the advantageous structural features and inherent meritorious characteristics herein disclosed.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation, or their equivalents, as hereinafter described or illustrated in the accompanying drawings.

In the accompanying drawings, wherein are shown the preferred but obviously not necessarily the only form of embodiment of the invention, Fig. 1 is a vertical sectional view of an assembled hot air heating apparatus embodying the present invention. Fig. 2 is a similar view on line 2—2 of Fig. 1. Fig. 3 is an enlarged detail sectional view of one of the burner elements shown in Figs. 1 and 2. Fig. 4 is a detail side elevation of the burner member shown in Fig. 3. Fig. 5 is a top plan view of a burner assembly embodying the present invention for use in a conventional furnace type heater. Fig. 6 is a side elevation thereof. Fig. 7 is a detail view illustrating the mode of mounting and adjusting in unison the burner assembly shown in Figs. 5 and 6. Figs. 8 and 9 are, respectively, a side and front elevation of a single burner element as employed for laboratory purposes. Fig. 10 is an enlarged side elevation thereof partly in section.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, 1 is an insulated housing or jacket having an air intake orifice 2. The circulated air, after being withdrawn from a building, is returned to the heater housing through the inlet 2 by a rotary fan or blower 3 and discharged thence in heated condition through the top of the jacket 1 for re-circulation. Disposed in spaced relation inside the housing or jacket 1 is a combustion chamber 4 in which is located a burner unit 5 and from which the products of combustion are conducted upward through a zig-zag flue 6 to a chimney outlet 7. The zig-zag formation of the walls of the flue 6 materially increases the radiating surface and contact of the passing air currents. The spacing of the combustion chamber 4 and tortuous flue 6 away from the walls of the housing or jacket 1 affords air passages 8 on all sides of the assembly, leading from the air inlet 2 to the discharge outlet at the top of the housing. Located in the top of the housing 1 is a humidifying pan 9 to which water is supplied through an automatic control valve 10. Also in the top of the housing 1 is a thermostatic control device 11 for regulation of the fuel supply, in accordance with fluctuations of temperature, of the passing air.

The burner assembly 5 within the combustion chamber comprises a manifold 12 having projecting therefrom a plurality of tapered jet nozzles 13. The nozzles 13 are preferably, although not necessarily, arranged in inclined staggered relation with succeeding jet nozzles inclined in alternating directions. Surmounting each jet nozzle, but independently supported in spaced relation therewith, is a mixing tube 14 open at its oppo-

site ends. The several mixing tubes are supported in concentric axially aligned relation with the jet nozzles 13 by a common support 15. In the straight burner assembly disclosed in Figs. 1 and 2 the support 15 is of inverted channel shape having converging side flanges and is supported on end brackets 16. The burner tubes 14 are adjustably clamped to the side flanges of the support 15 by U shaped clips 17 attached to the support by screws 18. By releasing one or both screws 18 the mixing tube 14 can be adjusted toward and from the manifold 12 and caused to surround and enclose the jet nozzles 13 to greater or less depth. The adjustment of the mixing tube relative to the tapered portion of the jet nozzle varies the air entrance orifice in the lower end of the tube to correspondingly vary the combustible mixture of gas and air. In addition to the inflow of air through the open end of the tube about the jet nozzle, the lower end of the tube 14 is provided with one or more transverse air inlet orifices 19. A revoluble valve sleeve 20 surrounds the lower extremity of the tube and has therein corresponding holes to be adjusted into greater or less overlapping relation with the lateral holes 19 in the mixing tube, thereby regulating their air capacities.

The combustible mixture formed within the tubes burns from the top thereof with a typical Bunsen shaped flame and gives off intense heat. The character, shape and color of the flame and degree of heat generated, being dependent upon the proportion of air admitted, are regulated by the axial adjustment of the tubes toward and from the jet nozzles, and revoluble adjustment of the valve sleeves 20, or both. A pilot light 21 is provided for ignition purposes and is afforded a supplemental supply of gas through the conduit 22 from a gas regulator unit 23, which is of conventional form and forms no part, per se, of the present invention.

For installation in existing coal furnaces and stoves or other heaters having round combustion chambers there is shown in Figs. 5, 6 and 7 an assembly of different form but embodying the same characteristic features. In this embodiment the jet nozzles 13 are mounted in a circular manifold 12a in vertically disposed parallel relation. The corresponding mixing tubes 14 are mounted in vertically aligned relation with the tapered jet nozzles 13 for unison axial movement toward and from the nozzles.

The plate 24 is provided with an annular series of holes, the margins of which are upwardly drawn to form integral flanges or thimbles 25 which surround the respective mixing tubes 14 which have a tight press fit therein. For convenience of installation, the mounting disc or plate 24 and also the circular manifold 12a are preferably formed in separable sections.

The mounting disc 24 and the manifold 12a are conjointly supported at peripherally spaced points on brackets 26 engaged with the furnace or stove wall 27. Each bracket has a prong or finger 28 to be thrust into a joint in the furnace wall, and on which the burner assembly is suspended. A thrust screw 29 in the dependent portion of the bracket bears against the furnace wall 27 and by its adjustment enables limited adjustment of the bracket for the purpose of leveling the manifold and tube mounting plate. The mounting plate 24 is adjustable relative to the brackets and the manifold 12a by adjusting screws 30 revolubly extending through holes in the mounting plate 24 and threaded into the brackets 26. Each adjusting screw carries a transverse pin 31 therein immediately beneath the plate 24 on which the plate rests while permitting free rotation of the screw 30 to raise or lower the mounting plate and with it the plurality of mixing tubes 14. Relatively spaced pilot lights 21 supplied with gas through the auxiliary supply conduit 22 provide automatic ignition.

For illustrative purposes, a single burner member on enlarged scale is shown in Figs. 8, 9 and 10 as applied to laboratory purposes for heating a flask 33 supported on a stand 34. In the base of the stand is a gas supply conduit 35 corresponding to the previously mentioned manifold 12 and 12a. Projecting from the top thereof is a jet nozzle 13. Suspended above the nozzle 13 in elevated axial alignment therewith is a mixing tube 14. In this instance the tube 14 is fixedly secured in an adjustable mounting arm 36. This arm 36 is of arcuate form and channel shaped in cross section for strength and rigidity. At its top it is provided with a flanged opening or boss 37 within which the tube 14 has a tight press fit. The lower end of the supporting arm 36 is slotted at 38 and secured to the base of the stand 34 by clamp screws 39 through such slot. By raising or lowering the supporting arm 36, the mixing tube 14 is axially adjusted relative to the tapered nozzle 13 to admit more or less air through the bottom of the tube. As previously mentioned, the volume of air is further varied by adjustment of the revoluble valve sleeve 20 which opens or closes the lateral air ports 19. The upper end of the sleeve 20 is split at 40 and is contracted on the tube to yieldingly hold the sleeve 20 in its adjusted rotative position.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. In a heater, a thermally insulated housing having air inlet and outlet openings, a combustion chamber therein, vertically disposed horizontally corrugated parallel walls within the housing disposed in spaced relation with each other and with the housing walls forming a vertically zigzagged flue space therebetween leading from the combustion chamber to the exterior of the housing, air passages from the inlet to the outlet openings intermediate the housing walls and the walls of the combustion chamber and zig-zag flue through which air currents circulate in intimate contact with the zig-zag surfaces of the flue, transverse staggered baffles within the flue defining therein a zig-zag course for products of combustion transversely of the zig-zag course defined by the zig-zag flue walls, an elongated burner within the combustion chamber including

a manifold connected with a fuel gas supply, a plurality of tapered jets projecting therefrom in alternating outwardly inclined relation, a plurality of divergently inclined mixer tubes open at their opposite ends disposed in spaced, axially aligned relation with the jets, directing the discharge from said jets against the inner faces of the combustion chamber walls, the discharge ends of said tubes being overhung by the flue wall corrugations, a support in elevated substantially parallel relation with the gas manifold to which the mixer tubes are attached for relative axial adjustment of the tubes and tapered jets.

2. In a heater, a housing, a combustion chamber, a pair of relatively spaced horizontally corrugated walls within the housing forming a vertically zigzagged flue space therebetween connecting the combustion chamber with the exterior of the housing in spaced relation with the housing walls, air circulating passages intermediate the walls of the housing and the combustion chamber and flue walls, and having air inlet and outlet openings, a gas burner in the combustion chamber comprising a manifold having communication with a source of fuel gas supply, a plurality of tapered jet nozzles projecting upwardly from the manifold in relatively spaced relation, a plurality of mixing tubes open at their opposite ends disposed in concentrically spaced aligned relation with the respective tapered jet nozzles, and having their upper ends disposed beneath and overhung by the corrugations of the flue walls, and a support common to the plurality of mixing tubes adjustably supporting the mixing tubes independently of the jet nozzles for axial adjustment relative thereto.

3. A heater unit including a manifold, communicating with a source of fuel gas supply, a plurality of tapered jet nozzles projecting from the manifold in alternating inclined relation to the vertical, a plurality of mixing tubes one for each jet nozzle, a common support for the tubes upon which the tubes are adjustably mounted independently of the manifold and jet nozzles in spaced aligned relation with the latter, for axially aligned adjustment relative thereto.

4. A heater unit including a straight elongated manifold, communicating with a source of fuel gas supply, a plurality of relatively spaced tapered jet nozzles projecting therefrom in alternating inclined relation to the vertical, an inverted channel shaped bridge member disposed in elevated parallel relation above the manifold, a plurality of mixing tubes open at their opposite ends disposed in concentric axially aligned relation with the jet nozzles and adjustably supported on said elevated inverted channel shaped bridge member independently of the jet nozzles and manifold, and means for independently securing the mixing tubes in their adjusted relation.

5. A heater unit including a supply conduit for fuel gas, a tapered jet nozzle supported thereby, a mixing tube open at its opposite ends disposed in relatively spaced concentric axially aligned relation with the jet nozzle, into which the tapered extremity of the jet nozzle projects, a support on which the tube is supported independently of the jet nozzle support for axial adjustment toward and from the tapered jet nozzle by which the air inlet capacity of the adjacent end of the tube is varied in accordance with the extent of projection of the tapered nozzle thereinto, means for securing the tube in its adjusted position, said tube having an auxiliary air inlet port adjacent its end contiguous to the nozzle, and a revoluble valve sleeve having a registering port therein on the tube movable into greater or less degree of overlapping relation with the inlet port in the tube for varying the supply of air independently of the axial adjustment of the tube.

6. A heater unit, including a manifold communicating with a supply of fuel gas, a plurality of spaced tapered jet nozzles projecting from the manifold, a plurality of mixing tubes open at their opposite ends, one for each jet nozzle, disposed in concentric axially aligned relation therewith into an open end of which the jet nozzle extends, a common support for the plurality of tubes upon which the tubes are supported independently of the jet nozzles, said support being adjustable, and means for adjusting the support to vary the relation of the tubes and jet nozzles whereby the jet nozzles are caused to extend to greater or less extent within the open ends of the tubes to vary the air intake capacities thereof.

7. A heater unit, including an annular manifold communicating with a supply of fuel gas, a plurality of spaced jet nozzles projecting therefrom, an annular series of mixing tubes disposed in axially aligned relation with the respective jet nozzles, a circular plate mounted in elevated spaced relation with the manifold and at all times axially adjustable relative thereto upon which the plurality of mixing tubes are carried, and adjusting means for raising and lowering the circular plate to enable the jet nozzles to project to greater or less extent within the corresponding tubes.

8. A heater unit, including an annular manifold having communication with a source of fuel gas supply, a plurality of spaced tapered jet nozzles projecting therefrom, a circular plate disposed in elevated parallel relation with the manifold, a plurality of mixing tubes carried thereby in axially aligned spaced relation with the jet nozzles, supporting brackets for the circular plate on which the plate and tubes are carried independently of the manifold and nozzles, and adjusting means for raising and lowering the plate and tubes relative to the supporting brackets and manifold to enable axial adjustment of the tubes relative to the jet nozzles by which the nozzles are caused to project to greater or less extent within the open ends of the tubes to vary the air intake capacities thereof.

9. A heater unit, including a manifold having communication with a source of fuel gas supply, a plurality of tapered nozzles carried thereby, a plurality of mixing tubes, one for each jet nozzle, disposed in spaced axially aligned relation therewith and into open ends of which the jet nozzles project, a support common to the plurality of mixing tubes supporting the tubes independently of the nozzles in spaced relation therewith for relative adjustment of the tubes and nozzles by which the nozzles are projected to greater or less extent within the open ends of the tubes to vary the air intake capacity thereof, lateral auxiliary air ports in the tubes adjacent the jets and revoluble valve sleeves surrounding the tubes, which by their adjustment vary the air intake capacity of the tubes independently of their axial adjustment.

10. A heater unit, including a tapered jet nozzle, a mixing tube open at its ends mounted in axial aligned relation therewith and into an open end of which the jet nozzle extends, and dual means for independently varying the air intake capacity of the tube comprising supporting means

for adjustably supporting the tube in different positions of axial adjustment relative to the jet nozzle by which the jet nozzle is caused to project to different extent within an open end of the tube to vary the air intake capacity thereof, a lateral air inlet port in the tube and a valve sleeve revoluble relative to the tube for regulating the capacity of the air intake port, said axial adjustment of the tube and revoluble adjustment of the valve sleeve serving to vary the air intake capacity of the tube independently of each other.

11. A heater unit, including a tapered jet nozzle, a mixing tube disposed in axially aligned spaced relation therewith, into an open end of which the jet nozzle projects, said tube having a lateral air inlet port, a revoluble valve sleeve mounted on the tube controlling the port, and adjustable supporting means for the tube such that the air intake capacity of the tube may be varied either by axial adjustment of the tube or by revoluble adjustment of the valve sleeve, each independently of the other.

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