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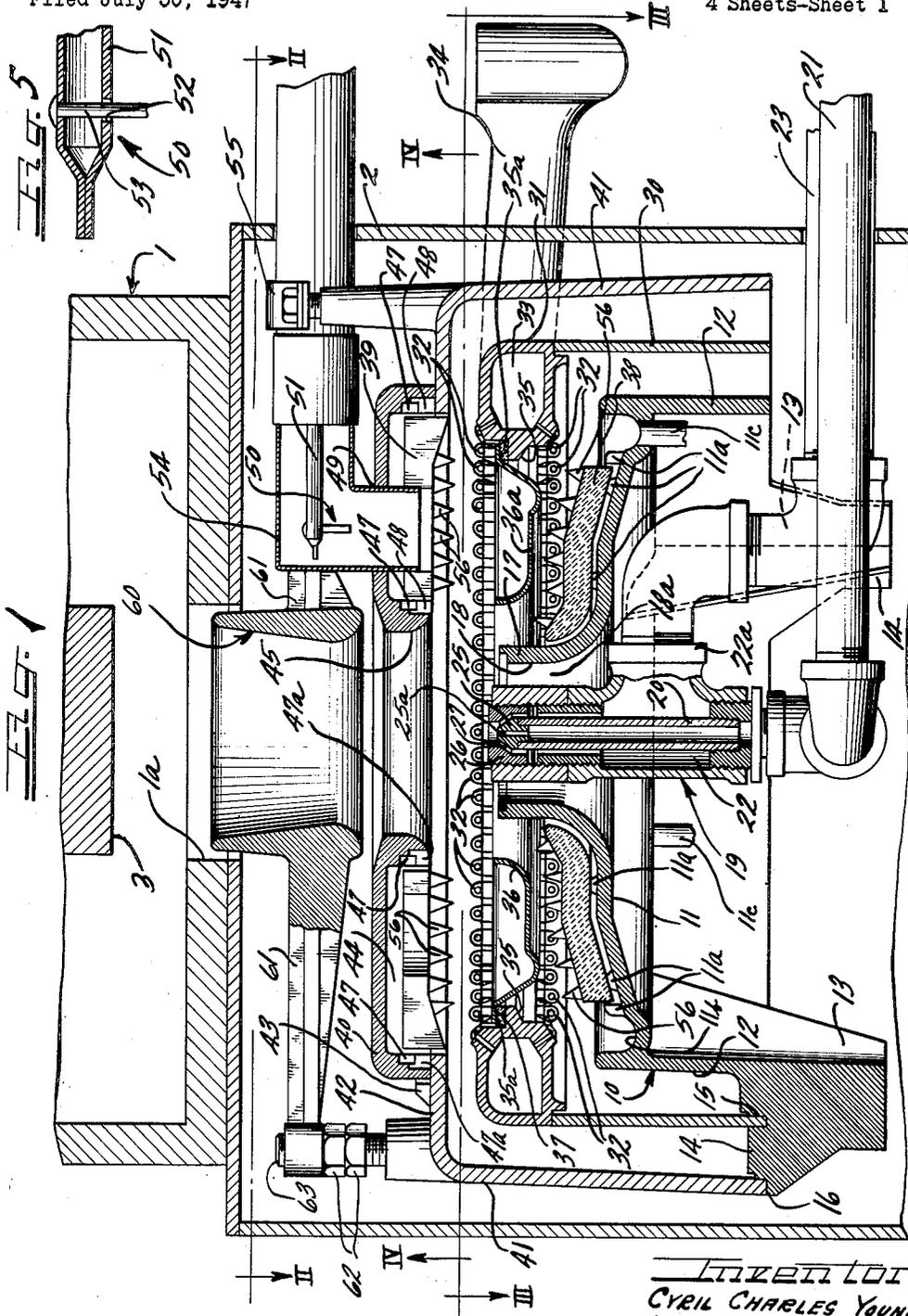
C. C. YOUNG

2,552,301

COMBINATION OIL AND GAS BURNER

Filed July 30, 1947

4 Sheets-Sheet 1



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The Spirit of Charles McKelvey

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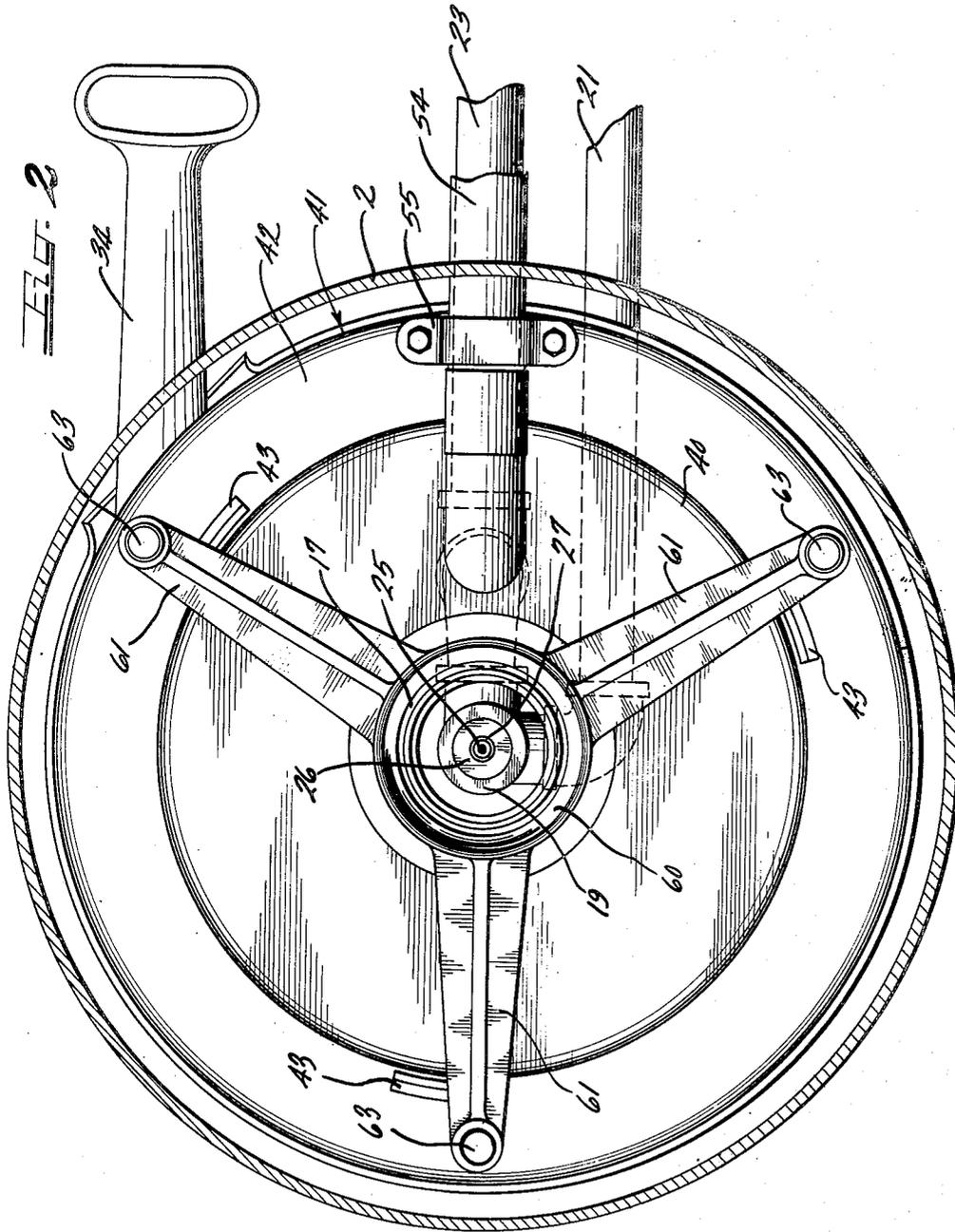
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COMBINATION OIL AND GAS BURNER

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4 Sheets-Sheet 2



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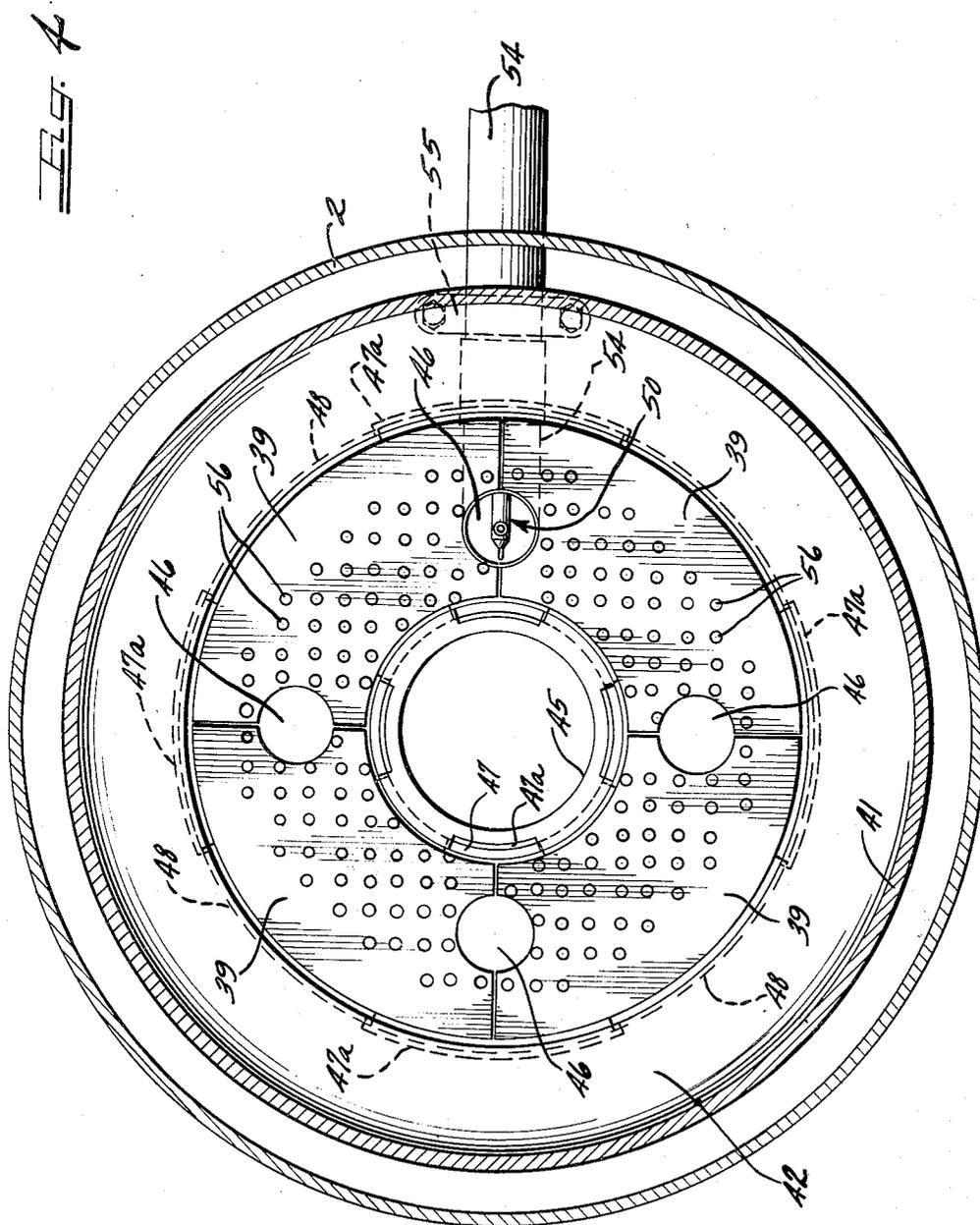
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COMBINATION OIL AND GAS BURNER

Filed July 30, 1947

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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COMBINATION OIL AND GAS BURNER

Cyril Charles Young, Kansas City, Mo.

Application July 30, 1947, Serial No. 764,697

22 Claims. (Cl. 158—11)

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This invention relates to an improved combination gas and oil burner, and particularly to a combination unit suitable for home heating purposes.

The desirability of a burner unit for home heating which will normally operate on gas, but during periods of extreme cold weather or reduced gas supply can utilize an oil fuel in combination with the gas, has long been recognized. However, the majority of combination gas and oil burners heretofore developed have relied upon atomization or spraying of the fuel oil to effect the necessary break up and mixture of fuel oil with air stream for combustion purposes. As the result, such units required either that the oil be supplied to a nozzle under pressure or that it be sprayed against a grate by a spray head rotating at a high velocity. All of such constructions have therefore been necessarily complicated inasmuch as they require motor driven pumps or spraying mechanisms. Hence, the first cost of such units has been far beyond the initial cost of either an individual oil or gas burner unit, and, furthermore, such units have not been reliable in operation but required an excessive amount of maintenance attention.

It is a feature of this invention that a combination gas and oil burner unit is provided which does not necessarily require any form of motor driven mechanism to effect the combustion of either the gas or oil or both fuels combined. Specifically this invention employs a construction wherein the fuel oil is conditioned for efficient combustion by complete vaporization thereof. While vaporizing type oil burners have heretofore been known, all known constructions failed to solve the problem of feeding the oil cleanly to the burner without carbonization. This problem is successfully solved by the construction of this invention. Furthermore, this invention also eliminates the production of carbon or other solid deposits on or in the vaporizer.

A combined oil and gas burner unit embodying this invention effects the conditioning of the fuel oil for proper combustion by vaporizing the fuel oil in a high temperature zone which is produced by a gas burner. In order to effect the necessary intimate mixture of the vaporized fuel oil with combustion supporting air, the burner unit employs a jet of high velocity, but low volume, gas to function as an inspirator fluid and effect the movement of the vaporized fuel oil and/or the main burner gas into a mixing and burning nozzle from which it passes into the combustion chamber of the furnace or similar

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heating units in which the combination burner unit is employed.

A burner construction embodying this invention employs an unusually convenient and economically manufacturable assembly of annular components which cooperate in a unique fashion to define in an unusually compact form the necessary passages for combustion supporting air, inspirator and main burner gas, as well as the vaporizing tray for fuel oil and a vaporizing tray gas heater.

Accordingly, it is an object of this invention to provide an improved combination gas and fuel oil burner, particularly adapted for home heating purposes.

Another object of this invention is to provide a combination gas and oil burner unit wherein the fuel oil is transmuted into a combustible vapor by the employment of heat derived from the gas, and fuel oil vapors are intermixed with the combustion supporting air and burned by virtue of a flow inducing action produced by a gas inspirator jet.

A particular object of this invention is to provide a simple and economical unit for burning either gas fuel alone, or a combination of gas and oil fuels together, through the same identical mixing and combustion media. In the construction of this invention, the passages for combustion supporting air and means for mixing air with combustible gases and vapors, as well as the combustion head or fire box, are identical for both fuels.

A further object of this invention is to provide a compact, sturdy, yet economically manufacturable burner construction for effecting heating of a furnace unit by gas alone or alternatively by a combination of gas and fuel oil.

The specific nature of the invention as well as other objects and advantages thereof will become apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which, by way of preferred example only, illustrate one specific embodiment of the invention.

On the drawings:

Figure 1 is a vertical axial sectional view of a combined gas and oil burner unit embodying this invention;

Figure 2 is a horizontal sectional view taken on the plane II—II of Figure 1;

Figure 3 is a horizontal sectional view taken on the plane III—III of Figure 1;

Figure 4 is a horizontal sectional view taken on the plane IV—IV of Figure 1; and

Figure 5 is an enlarged scale, sectional view of the drip nozzle by which the fuel oil is supplied to the vaporizing tray.

As shown in the drawings:

While the principles of this invention are obviously applicable to many different types of heating units, the exemplary construction shown on the drawings is particularly adaptable for installation in connection with a furnace having an insulated combustion chamber 1 supported in a relatively elevated position on a hollow cylindrical casing 2. The combination oil and gas burner unit embodying this invention may then be conveniently mounted within the confines of the casing 2 and is generally symmetrical with respect to the vertical axis of a fire box opening 1a provided in the bottom of the fire box or combustion chamber 1 of the furnace.

The combination burner unit embodies a base casting 10 having an annular base portion 11 and a depending cylindrical wall portion 12. At spaced intervals around a periphery of wall portions 12, a plurality of supporting leg portions 13 are provided, each of which is further provided with a radially extending flange 14. The top surface of each of the flanges 14 is provided with a pair of circumferentially extending arcuate grooves 15 and 16 respectively, which are radially spaced from each other. Thus the groove 16 may be formed on the peripheral edge of the flanges 14.

The base portion 11 of the base casting 10 has a flared juncture with an upstanding cylindrical hub portion 17 which defines a central bore 18. Within the bore 18 a gas nozzle member 19 is positioned. The gas nozzle member 19 is of generally cylindrical exterior configuration and is substantially smaller in exterior dimension than the bore 18 and hence an annular air space 19a is defined between the central bore of base casting 10 and the gas nozzle 19.

Preferably, the gas nozzle member 19 defines a pair of concentric gas nozzles and hence is of tubular construction. A tube 20 is centrally mounted in the nozzle 19 and is in communication with a pipe 21 which in turn connects to the gas main (not shown). The annular passage 22 defined between central pipe 20 and the interior of the walls of nozzle member 19 has a radial port 22a in communication with a main gas supply pipe 23 which connects with the gas main (not shown) and hence may receive large volume gas flow therefrom.

Central pipe 20 terminates in an inspirator nozzle head 25 which has a relatively small central opening 25a. Hence, a jet of high velocity, yet low volume gas is projected upwardly from the inspirator nozzle 25.

The side surfaces of inspirator nozzle 25 are conically tapered and cooperate with a similarly shaped interior surface of a plug 26 threaded into the end of nozzle cylinder 19 to define an annular conical nozzle 27. This annular nozzle constitutes the main gas supply for the burner unit and will supply relatively large volumes of gas for combustion in the unit. Of course, if desired, the pipe 23 may supply a mixture of gas and air by the insertion of a conventional air mixer in series with the pipe 23.

The innermost groove 15 provided in the radial flanges 14 of the base casting 10 supports a generally cylindrical shell 30 which is mounted thereon in upstanding relation. An annular gas burner element 31 of generally hollow torus-like configuration is mounted upon the top of

shell 30 and in surrounding relationship to the upstanding hub portion 17 of the base casting 10. Burner element 31 is provided with two axially spaced sets of a plurality of gas burner jets 32 extending around its inner periphery and respectively directed angularly upwardly and downwardly and toward the axis of the base casting 10. Each of the jets 32 communicates with the hollow bore 33 of the gas burner element 31 and a tangentially disposed supply pipe 34 provides a combustible mixture of gas and air to the hollow portion 33. Hence, two axially spaced rings of gas flames are produced by the torus-like burner element 31, which will hereafter be referred to as the vaporizer burner.

Vaporizer burner 31 is provided with a radially inwardly extending ledge 35 extending around its inner circumference. A ring 35a of heat insulating material rests on such ledge and, in turn, is utilized to support an annular vaporizing pan or tray 36, which has an out-turned edge 37 which rests on the ring 35a. Vaporizing tray 36 may be of any desired configuration and preferably is provided with a depressed base portion 36a so as to permit a substantial quantity of fuel oil to be collected in the vaporizer tray without danger of spilling therefrom. It will be noted that the tray 36 is thus supported intermediate the two rings of flame produced by the vaporizer burner 31 and hence the tray will be rapidly heated to a high temperature. The insulating ring 35a sealingly mounts the tray 36 without substantial transfer of heat from the hot vaporizer tray to the relatively cool vaporizer burner.

To further amplify the heating effects of the gas jets of the vaporizer burner 31, a pair of refractory rings 38 and 39 are respectively mounted in axially spaced relationship below and above the vaporizer tray 36. Thus, the bottom refractory ring 38 may be conveniently supported upon the top surface of the base portion 11 of the base casting 10. Upstanding ribs 11a may be provided on the base casting to support the refractory element 38 in spaced insulated relationship therewith. Refractory element 38 may be conveniently formed by assembly of four segments.

The upper refractory element 39 is supported in depending relationship from an annular support plate or cover member 40 which in turn rests upon the base portion 12 of an inverted, generally cup-shaped housing 41. Housing 41 is in turn supported in the peripheral grooves 16 in the radial flanges 14 of the base casting 10. The plate 40 may be conveniently located in assembly on the housing 41 by the provision of plurality of peripherally spaced, upstanding lugs 43 thereon. The plate 40 defines an inverted annular trough 44 which surrounds a central aperture 45 which is generally concentric with the axis of the base casting 10. While refractory element 39 may be secured to plate 40 in any conventional manner, in accordance with this invention, the element 39 is preferably formed by assembly of a plurality of arcuate segments. As best shown in Figures 1 and 4, four such segments may be conveniently employed and the mating edges of the segments each define a circular aperture 46 for a purpose to be mentioned later. Radial grooves 47 are provided in the side walls of the annular trough 44 and each of the segments of the refractory element 39 is provided with radially extending ribs 48 which are received in the radial grooves 47 in bayonet assembly, i. e., at one angular position of the seg-

ments of refractory element 39, all of the radial ribs thereon will drop through openings 47a into the radial slots 47 and then be retained in the slots by rotation of the refractory segments to another angular position. By the described construction, the refractory element 39 is supported in spaced, yet depending relationship with respect to the plate 40. To further facilitate the heating effects, the opposed surfaces of the refractory elements 38 and 39 are preferably provided with a plurality of spaced refractory points 56.

The plate 40 is provided with an aperture 49 which is alignable with one of the apertures 46 in the refractory element 39. Hence a passage is provided through plate 40 and refractory element 39 directly overlying the vaporizing tray 36, and this passage is employed to supply a limited flow of fuel oil to the vaporizing tray 36 when it is desired to burn fuel oil in the combined burner unit.

A drip type nozzle 50 is positioned directly above the aperture 49 and is connected to a suitable source of fuel oil (not shown) by a pipe 51. Drip nozzle 50 may comprise any one of several well known forms and may be conveniently fabricated by forming a radial aperture 52 (Figure 5) in the side walls of pipe 51 and assembling a pin 53 radially across the pipe, the pin being of less diameter than the aperture 52 so that fuel oil will flow down the sides of the pin and drip onto the vaporizing tray 36.

To protect the drip nozzle 50 from the high temperatures developed within the burner unit, and to effect the feeding of the fuel oil to the vaporizing tray without carbonization, the nozzle 50 and the supply pipe 51 are preferably encased within a sheet metal conduit 54 which is suitably connected to atmosphere so as to permit a flow of cooling air to be continuously inducted through such conduit. Such air not only provides additional air for combustion of the gas and oil within the burner but also effectively maintains the drip nozzle 50 at a sufficiently low temperature that carbonization of fuel oil thereon is prevented. This is an extremely desirable feature of this invention. Conduit 54 is supported by clamp 55 on member 41.

From the foregoing description, it is apparent that fuel oil supplied to a vaporizing tray 36 will be rapidly evaporated due to the high temperature of the tray and its location within the high temperature zone between the refractory elements 38 and 39. The temperature of the vaporizing zone is maintained sufficiently high to insure the rapid vaporization of fuel oil supplied thereto. While some "cracking" of the fuel oil occurs, any resulting combustibles are completely consumed, due to the high temperature of the vaporization zone and the presence of oxygen in the large air flow sweeping through the passage defined between the members 30 and 41. Any ash or non-combustibles deposited in the tray 36 are also swept into the air stream and carried away by the flue gases. Hence it is assured that the vaporizer pan remains clean.

Hence, the fuel oil is rapidly vaporized from tray 36 and the inspirator action of the jet of gas issued by inspirator nozzle 25, plus the natural or induced draft, tends to draw the fuel oil vapors upwardly toward the fire box opening 1a. The inspirator jet of gas also tends to produce an upward flow of air through the annular passage 18a defined between gas nozzle member 19 and the upstanding hub 17 of base casting 10, and

also between the base casting 10 and the inner walls of the shell 30 and between the outer walls of the shell 30 and the inner walls of support frame 41. Hence, all of the annular frame members function as air baffles to direct the air stream into intimate mixture with the oil vapor and gas.

To effect a more intimate mixture of the fuel oil vapors and the combustion supporting air, as well as the main burner gas if such is being supplied through conical annular nozzle 27, a mixing nozzle 60 is provided of general Venturi configuration. Nozzle 60 is supported by a plurality of radially extending arms 61 upon nuts 62 which are in turn adjustably positioned upon threaded studs 63 mounted in upstanding relationship on the base of the housing 41. Hence the axial position of the mixer nozzle 60 with respect to the opening 45 in the vaporizer cover 40 may be conveniently adjusted. Furthermore, it should be noted that the nozzle 60 is axially spaced with respect to the plate 40 and also is of smaller diameter than the furnace opening 1a so that additional flow of combustion supporting air into the combustion chamber is permitted by the resulting openings.

When the unit is properly adjusted and the optimum axial position of nozzle 60 determined, a thorough mixing action of fuel oil vapors, gas and combustion supporting air occurs in the throat of the nozzle 60 and the burning of the combustibles in the mixture is initiated before the mixture passes out of the end of the nozzle and into the combustion chamber 1. Preferably a target or flame spreader 3 is mounted in chamber 1 in conventional fashion.

The aforescribed arrangement permits high efficiency combustion of the main burner gas supplied by pipe 23, or of the fuel oil with only vaporizer burner gas and inspirator gas being supplied, or of the fuel oil with only vaporizer burner gas, or of a combination of main burner gas and fuel oil. Those skilled in the art will recognize that the described combination gas and oil burner may be conveniently operated in an automatic temperature control system by the application thereto of conventional controls for effecting the conversion from operation by main burner gas alone to operation by fuel oil with the assistance of vaporizer burner gas and the inspirator gas or, if desired, to combined operation of main burner gas and fuel oil. While such controls form no part of this invention, I preferably employ a control system similar to that described and claimed in my copending application Serial No. 764,698 filed on even date herewith.

Furthermore, it will be recognized that for some burner designs and draft conditions the amount of combustion supporting air required when operating the main gas burner alone will be substantially less than that required for the combined gas and oil operation. Hence, it is contemplated that suitable damper and/or draft inducing mechanisms (not shown) be provided to decrease the flow of air into the burner unit when only the main burner gas is employed and increase the flow of air into the burner when a combination of gas and oil is employed. Such damper and/or draft inducing device may be conveniently operated by the temperature control mechanism upon the conversion from one type of operation to the other.

Also, the base portion 11 of base casting 10 may be suitably shaped to provide an annular trough 11b to catch any oil overflowing from tray 36 and

operate a conventional form of cut out (not shown) through drain pipe 11c.

Therefore, it is apparent that the described construction provides an unusually sturdy, compact yet economically manufacturable combined gas and oil burner unit which may be readily installed in new or existing furnaces for home heating purposes and which will provide reliable and efficient operation under all conditions.

It will, of course, be understood that various details of construction may be modified through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A heating unit comprising an annular gas burner, an annular tray disposed adjacent said burner so as to be heated thereby, means for supplying a vaporizable fuel to said tray, whereby said fuel may be vaporized, a duct for guiding an air stream into the central opening of said tray, means in said duct and at the center of said tray to project a flow of combustible gas through the central opening of the tray and a Venturi nozzle disposed in alignment with the central opening of said tray, whereby the air stream and the vaporized fuel may be combined to form a combustible mixture and burned with said gas in said air stream.

2. A heating unit comprising an annular gas burner, an annular tray disposed adjacent said burner so as to be heated thereby, means supplying a vaporizable fuel to said tray for vaporization of the fuel, annular baffle means for guiding an air stream into the central opening of said tray, and a gas nozzle centrally disposed in said annular baffle means and arranged to project a gas flow through the central opening of said tray, whereby the vaporized fuel may be burned with said gas in said air stream.

3. The combination defined in claim 2 wherein said gas nozzle comprises an annular conical nozzle for large volume gas flow and an inspirator nozzle centrally disposed with respect to said annular nozzle and constructed and arranged to produce high velocity, low volume gas flow, thereby facilitating gas and air flow past said vaporizing tray.

4. A heating unit comprising an annular gas burner, an annular tray disposed adjacent said burner so as to be heated thereby, means supplying a vaporizable fuel to said tray for vaporization of the fuel, a first baffle means for guiding an air stream through the central opening of said tray, and a second annular baffle means for guiding an air stream over the top surface of the tray whereby said fuel vaporized on said tray may be burned in said air stream and non-combustibles may be swept off said tray by said air stream.

5. A heating unit comprising an annular gas burner, an annular tray disposed adjacent said burner so as to be heated thereby, means for supplying a vaporizable fuel to said tray, a first annular baffle means for guiding an air stream through the central opening of said tray, a second annular baffle means for guiding an air stream over the top surfaces of said tray, and a gas nozzle centrally disposed in said first annular baffle means and arranged to project a gas flow through the central opening of said tray to assist in producing said air streams, whereby said fuel is vaporized on said tray and burned with said

gas in said air stream and non-combustibles are swept off said tray by said air streams.

6. In a vaporizing type oil burner, a pair of refractory rings, means for supporting said rings in aligned, axially spaced relationship, means for heating said refractory rings to produce a temperature zone therebetween sufficient to vaporize fuel oil, an annular vaporizing pan suspended in said zone, means for supplying a limited flow of fuel oil to said pan, whereby the fuel oil is continuously vaporized, means for producing an air stream through the central opening of said pan, and means for igniting the fuel oil vapor in the air stream.

7. In a vaporizing type oil burner, a pair of refractory rings, means for supporting said rings in aligned, axially spaced relationship, an annular gas burner disposed between said rings and arranged to heat said rings to produce a temperature zone therebetween sufficient to vaporize the fuel oil, a vaporizing pan suspended in said zone, means for supplying a limited flow of fuel oil to said pan, whereby the fuel oil is continuously vaporized, means for igniting the vaporized fuel oil, and means for producing an air stream past said pan, whereby the fuel oil vapor is burned in said air stream.

8. In a vaporizing type oil burner, a pair of refractory rings, means for supporting said rings in aligned, axially spaced relationship, an annular gas burner disposed between said rings and arranged to heat said rings to produce a temperature zone therebetween sufficient to vaporize the fuel oil, a vaporizing pan suspended in said zone, means for supplying a limited flow of fuel oil to said pan, whereby the fuel oil is continuously vaporized, an annular baffle member for directing an air stream through the central opening in said annular pan, and a gas nozzle centrally disposed in said annular baffle member and arranged to produce a gas flow passing through said central opening in said annular tray.

9. The combination defined in claim 8 wherein said gas nozzle comprises an annular conical nozzle for large volume gas flow and an inspirator nozzle centrally disposed with respect to said annular nozzle and constructed and arranged to produce high velocity, low volume gas flow, thereby facilitating gas and air flow past the vaporizing pan.

10. A combination gas and oil burner comprising an annular base casting having a plurality of circumferentially spaced, supporting legs, each of said legs having a radially projecting flange portion, a shell supported on said flange and surrounding said base casting to define an annular air passage, an annular gas burner supported on said shell, an annular tray supported on said gas burner and arranged to be heated thereby, means for supplying a limited flow of vaporizable fuel oil to said tray, and a gas nozzle disposed centrally in said base casting, said gas nozzle being constructed and arranged to produce a jet of gas passing through the central portion of said tray and inducing a flow of air past said tray, whereby the fuel oil is vaporized on said pan and the oil vapor and gas is burned in the air stream.

11. The combination defined in claim 10 wherein said gas nozzle comprises an annular conical nozzle for large volume, low velocity gas flow and an inspirator nozzle centrally disposed with respect to said annular nozzle and constructed and arranged to produce high velocity, low volume gas flow, thereby facilitating air and gas flow past said vaporizing pan.

12. A combination gas and oil burner comprising an annular base casting having a plurality of circumferentially spaced, supporting legs, each of said legs having a radially projecting flange portion, a first annular refractory element supported on the top side of said base casting, an inverted cup-shaped housing supported on the periphery of said flanges, said housing having a centrally apertured base aligned with the central opening of said base casting, a second annular refractory element supported in depending relation to the bottom side of the base of said housing in axially aligned, vertically spaced relation with respect to said first refractory element, a cylindrical shell supported on an intermediate portion of said flanges, thereby defining nested, annular air passages with said base casting and said housing respectively, an annular gas burner supported on said shell intermediate said refractory elements and arranged to heat said elements to produce a high temperature zone therebetween, a pan supported on said burner within said zone, and means for supplying vaporizable fuel oil to said pan.

13. A combination gas and oil burner comprising an annular base casting having a plurality of circumferentially spaced, supporting legs, each of said legs having a radially projecting flange portion, a first annular refractory element supported on the top side of said base casting, an inverted cup-shaped housing supported on the periphery of said flanges, said housing having a centrally apertured base aligned with the central opening of said base casting, a second annular refractory element supported in depending relation to the bottom side of the base of said housing in axially aligned, vertically spaced relationship with respect to said first refractory element, a cylindrical shell supported on an intermediate portion of said flanges, thereby defining nested annular air passages with said base casting and said housing respectively, an annular gas burner supported on said shell intermediate said refractory elements and arranged to heat said elements to produce a high temperature zone therebetween, an annular tray supported on said burner within said high temperature zone, and a gas nozzle disposed centrally within said base casting, said gas nozzle being constructed and arranged to produce a gas flow passing through the central portion of said tray and inducing a flow of air through said air passages and past said tray, whereby fuel oil is vaporized on said tray and burned with said gas in said air stream.

14. The combination defined in claim 13 wherein said gas nozzle comprises an annular conical nozzle for large volume gas flow and an inspirator nozzle centrally disposed with respect to said annular nozzle and constructed and arranged to produce high velocity, low volume gas flow, thereby facilitating air and gas flow past said vaporizing tray.

15. The combination defined in claim 13 plus a Venturi nozzle member, and means for axially adjustably supporting said nozzle member on said housing in spaced, overlying relation thereto, thereby effecting an intimate mixture of the oil vapor and gas in the air stream.

16. In a vaporizing type oil burner, a vaporizing pan, means for supplying a vaporizable fuel to said pan, a gas burner disposed adjacent said pan, said burner having a first series of flame jets disposed relatively above said pan and a second series of flame jets disposed relatively beneath said pan, whereby said pan is disposed in

a zone maintained at a sufficiently high temperature to vaporize said fuel on said pan.

17. In a vaporizing type oil burner, a vaporizing pan, means for supplying a vaporizable fuel to said pan, a gas burner disposed adjacent said pan, said burner having a first series of flame jets disposed relatively above said pan and a second series of flame jets disposed relatively beneath said pan, whereby said pan is disposed in a zone maintained at a sufficiently high temperature to vaporize said fuel on said pan, and means for producing an air stream past said pan to facilitate the burning of said vaporizable fuel and to sweep away any unburned residue from said pan.

18. In a vaporizing type oil burner, a vaporizing pan, means including a cover member for forming a zone surrounding said vaporizing pan, said cover member having an aperture there-through overlying said vaporizing pan, a fuel supply pipe overlying said aperture and arranged to drop a vaporizable fuel into said vaporizing pan, and means defining an air duct surrounding said fuel supply pipe and communicating with said cover member aperture for drawing a stream of cool air into said burner, thereby maintaining said fuel supply pipe at a sufficiently low temperature to prevent carbonization of said fuel.

19. In a vaporizing type oil burner, supporting means, refractory rings carried thereby and together therewith defining a substantially enclosed space, a generally annular gas burner in the enclosed space, an annular vaporizing pan having a central opening and being suspended in said space, means for supplying a limited flow of fuel oil to said pan, said annular gas burner disposed to heat said refractory rings and to raise the temperature in said space whereby said space will constitute a high temperature zone to continuously vaporize the fuel oil in the vaporizing pan, a generally tubular shaped member extending into the central opening of the annular vaporizer pan and a gas nozzle centrally disposed relative to said tubular member and arranged to produce a gas flow past the central opening of said annular vaporizing pan, thereby inducing a flow of air past the pan, said gas nozzle being so constructed and arranged as to emit a large volume gas flow and having an inspirator nozzle portion centrally disposed therein to produce a high velocity, low volume gas flow, thereby facilitating gas and air flow past the annular vaporizing pan.

20. A combination gas and oil burner comprising an annular lower base casting, a shell carried thereby surrounding the lower base casting and together therewith defining an annular air passage, an annular gas burner disposed within the air passage, an annular tray supported in said air passage proximate said burner, said gas burner being operative to raise the temperature in the air passage whereby the air passage will constitute a high temperature zone, means to supply a vaporizable fuel oil to the tray for vaporization in the high temperature zone and a gas nozzle extending upwardly into the central opening of the annular tray to emit a jet of gas through the central portion of the tray, thereby inducing a flow of air past said tray, whereby fuel oil will be vaporized on said tray and the oil vapors and gas may be burned in the upwardly directed air stream flowing past the tray.

21. A combination gas and oil burner comprising a generally annular base casting, a shell

carried thereby surrounding the base casting and together therewith defining an annular chamber with an air passage extending through the center thereof, an annular gas burner disposed in said annular chamber, a lower annular refractory element below the gas burner, an upper annular refractory element above the gas burner, all the aforementioned elements being so constructed and arranged as to cooperatively produce a high temperature vaporizing zone in the general locale of the annular chamber, an annular vaporizing pan in the vaporizing zone, and means for supplying fuel oil to the vaporizing pan, the fuel oil being continuously vaporized under normal operating conditions whereby fuel oil vapors arising from the pan may be burned in a stream of air flowing through the said air passage.

22. A combination gas and oil burner comprising a generally annular base casting, a shell carried thereby surrounding the base casting and together therewith defining an annular chamber with an air passage extending through the center thereof, an annular gas burner disposed in said annular chamber, a lower annular refractory element below the gas burner, an upper annular refractory element above the gas burner, all the aforementioned elements being so constructed and arranged as to cooperatively produce a high temperature vaporizing zone in the general locale of the annular chamber, an annular vaporizing pan in the vaporizing zone, means for supplying fuel oil to the vaporizing pan, the fuel oil being continuously vaporized under normal operating conditions, and a centrally disposed gas nozzle constructed and arranged to produce a gas flow through the central opening of the vaporizing pan, whereby a flow of air will be induced past

the vaporizing pan so that fuel oil vaporized on the vaporizing pan may be burned with said gas in the air flowing past the vaporizing pan.

CYRIL CHARLES YOUNG.

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