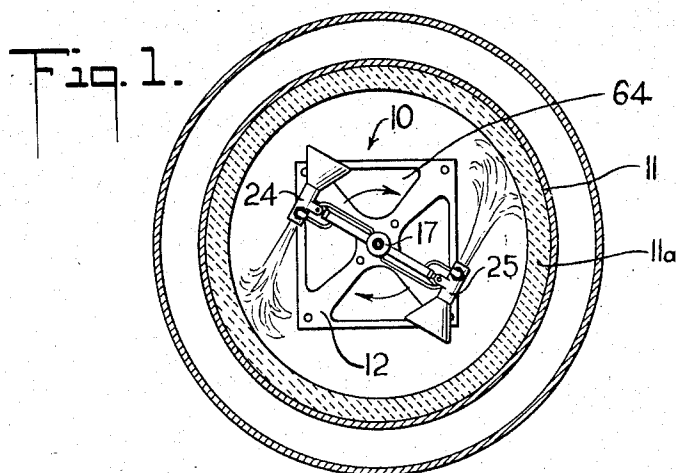
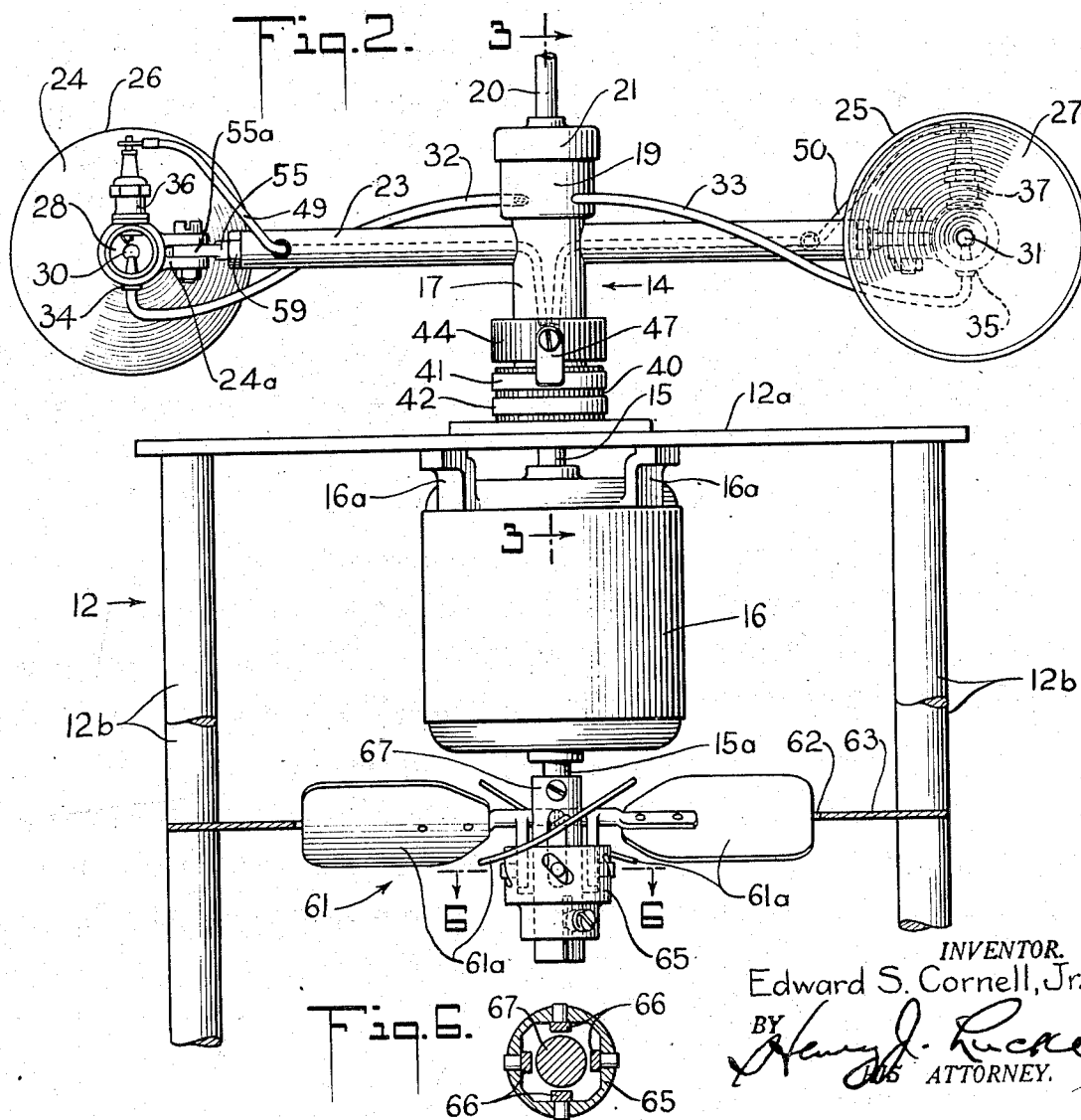


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LIQUID FUEL BURNER UNIT
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2,220,066

2 Sheets-Sheet 1



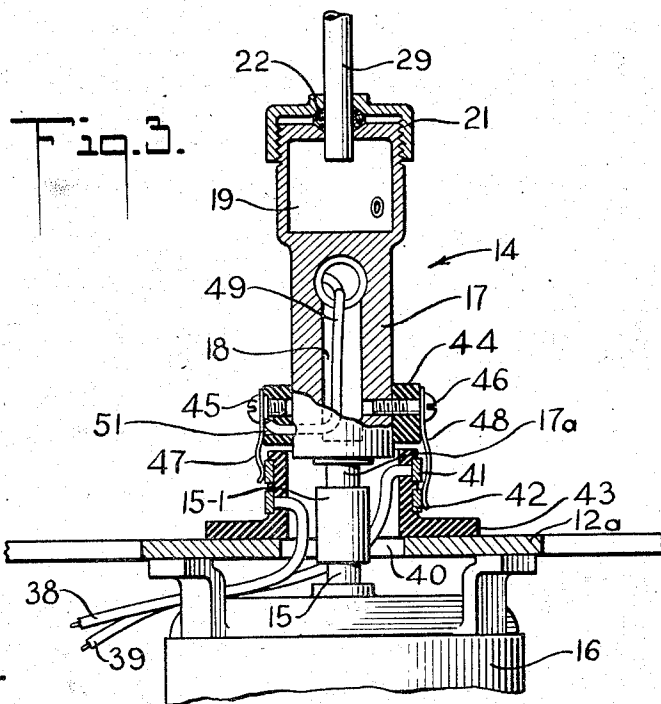
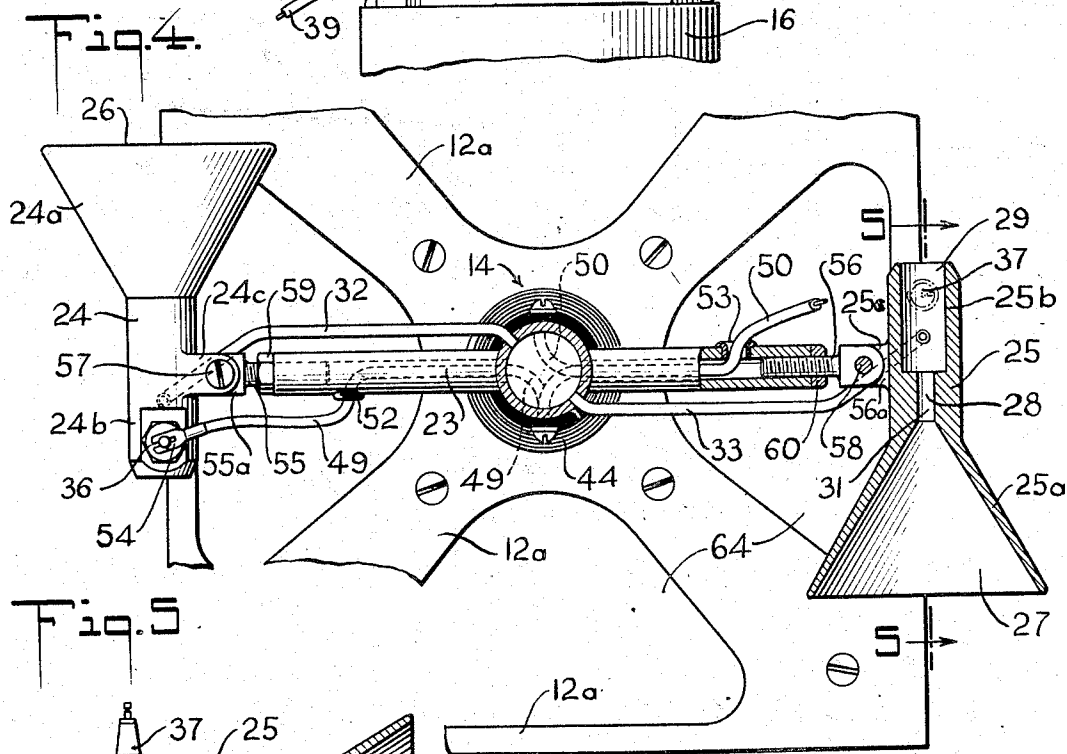
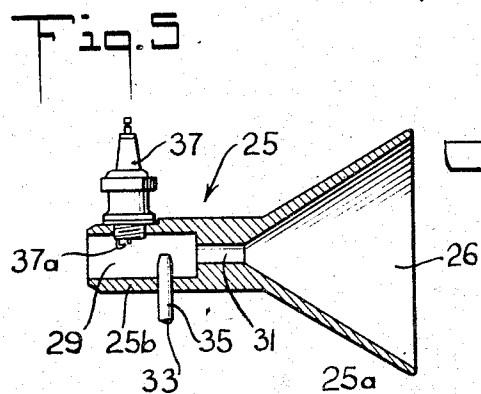
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2,220,066

2 Sheets-Sheet 2



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2,220,066

LIQUID FUEL BURNER UNIT

Edward S. Cornell, Jr., Larchmont, N. Y.

Application July 27, 1938, Serial No. 221,482

10 Claims. (Cl. 158-77)

This invention relates to liquid fuel burners of the rotary type wherein liquid fuel is atomized previous to ignition.

The burning of liquid fuels, particularly heavy fuel oil as commonly utilized for domestic and industrial heating, requires a plentiful supply of air intermixed therewith for the attainment of relatively clean combustion. Rotary burners employing various means for atomizing the liquid fuel prior to ignition are in common use. The present invention represents an improved rotary burner embodying novel means for atomizing the liquid fuel.

A primary object of the invention is to provide a burner for liquid fuel capable of attaining a high degree of atomization of the liquid, previous to ignition, in a manner requiring minimum equipment and minimum operating expense.

An outstanding feature of liquid fuel burners pursuant to the invention resides in the provision for atomization of liquid fuel by the air pick-up action of burner elements moving about a rotational path.

Another feature is the provision for atomization of liquid fuel by air picked up from a stream of air which moves past the rotational path of the burner elements.

The individual burner elements are hollow and open-ended with one end portion outwardly divergent, the element per se being preferably of funnel formation. They are preferably mounted, in mutually spaced relationship on a rotatable support with the open ends thereof directed along the path of rotation for receiving and discharging air which passes therethrough by reason of the rotation of the rotatable support. The funnel-shaped burner elements are placed, respectively, so that their outwardly diverging openings face the direction of rotation and serve to pick up quantities of air and direct them at considerably increased velocities through relatively restricted openings into atomizing chambers, formed adjacent the discharge openings of the burner elements. Means for supplying liquid fuel to the atomizing chambers, in line with the fast moving streams of air, are provided; and, for igniting the atomized mixture, ignition means are disposed in the path of flow of the atomized liquid fuel.

The burner elements are preferably adjustable on their support for regulating the amount of air supplied to the atomizing chambers and for controlling the zones of combustion of the intermixed atomized fuel and air.

A stream of air may be moved upwardly

through the zone of rotation of the burner elements, preferably by means of a fan motivated in common with the rotatable support for the burner elements.

Further features and objects of the invention will be apparent from the following detailed description and the accompanying drawings.

In the drawings—

Fig. 1 represents a top plan view of a preferred embodiment of the invention installed in the fire pot of a heating boiler, the latter appearing in horizontal section.

Fig. 2 represents an enlarged elevation of the embodiment illustrated in Fig. 1, the fire pot and other portions of the heating boiler being omitted.

Fig. 3 represents a vertical section taken on the line 3-3, Fig. 2.

Fig. 4 represents a top plan view, partly in horizontal section, of the structure illustrated in Fig. 2.

Fig. 5 represents a vertical section taken on the line 5-5, Fig. 4.

Fig. 6 is a detail sectional view on line 6-6 of Fig. 2.

Referring to the drawings: burner apparatus 10, pursuant to the invention and representing a preferred embodiment thereof, is illustrated in Fig. 1 as installed in the fire pot of a conventional heating boiler, the fire pot being designated, generally, 11.

The burner unit 10 comprises a supporting frame 12 of table formation having a top 12a and legs 12b, and comprises, further, a rotor assembly 14 mounted at the upper end of the rotor shaft 15 of an electric motor 16, the electric motor 16 being secured to the under-surface of the top 12a by means of lug members 16a, and the rotor assembly 14 being superimposed above the top 12a.

The rotor assembly 14 comprises a central post 17, hollow in its lower portion, as at 18, for a purpose to be hereinafter explained, and hollow in its upper portion, as at 19, to form a reservoir for liquid fuel preliminary to feed thereof to burner elements. A main liquid fuel supply line 20 may lead into the top of the reservoir 19 through capnut 21, the connection being made liquid-tight by the interposed gasket 22. The post 17 is rigidly mounted on the shaft 15 for rotation therewith.

Mounted on the post 17, as part of the rotor assembly 14, and intersecting the hollow interior 18 of the lower portion, is a cross-arm 23 which directly suitably supports, at its extremities, the burner elements 24 and 25. The cross-arm 23

is preferably hollow, the hollow communicating with the hollow 18, for a purpose hereinafter set forth.

The individual burner elements are open-ended and hollow with their open ends directed along the path of rotation. They are preferably of funnel-shape having their outwardly divergent openings directed toward the direction of rotation, and each having an atomizing chamber formed adjacent the small opening thereof, whereby air, gathered and compressed by the outwardly divergent opening, as the rotor assembly rotates, is discharged through the atomizing chamber at high velocity and under pressure.

The burner elements 24 and 25, in the illustrated embodiment, comprise the open end portions 24a and 25a, respectively, having outwardly divergent openings, 26 and 27, respectively, and the open end portions 24b and 25b, respectively, see Figs. 4 and 5, having preferably uniformly diametered atomizing chambers 28 and 29, respectively, formed therein. The outwardly divergent openings, 26 and 27, converge to relatively restricted passageways, 30 and 31, respectively, formed in those portions of the burner elements which lie between the open end portions 24a and 24b, and 25a and 25b, respectively, such relatively restricted passageways 30 and 31 serving to connect the outwardly divergent openings 26 and 27 with the atomizing chambers 28 and 29, respectively. Thus, when the rotor assembly 14 is rotated, upon suitable actuation of the electric motor 16, the burner elements 24 and 25 gather and compress quantities of air in the outwardly divergent openings, 26 and 27, and force such quantities of air, at high velocity, through the relatively restricted passageways, 30 and 31, in pencil-like streams, through and out of the open ends of the atomizing chambers 28 and 29.

Liquid fuel, preferably fuel oil, is fed to the respective burner elements 24 and 25 concomitantly with the rotation thereof. For this purpose, supply pipes 32 and 33 tap opposite sides of the reservoir 19, and lead therefrom to the atomizing chambers of the respective burner elements, entering same, preferably, from the bottom through the medium of feed nozzles 34 and 35, respectively. The feed nozzles extend up to locations preferably just within the pencil-like streams of air which emerge from the relatively restricted passageways, 30 and 31, and have relatively restricted discharge openings for the feed of liquid fuel into the passing streams of air.

Discharge of liquid fuel from the feed nozzles 34 and 35 is accomplished by the injector action of the passing streams of air, aided by centrifugal force, which tends to draw the liquid from reservoir 19 through supply pipes 32 and 33. Particularly effective atomization of the liquid fuel and intermixture therewith of a regulated amount of air in a simple and economical manner is thus had. In certain instances, however, it may be desirable to utilize forced feed as by means of a fuel pump suitably connected in the fuel line or under gravity pressure, this being particularly true when the liquid fuel has a high viscosity.

For igniting the atomized fuel mixture, ignition means are provided, preferably within the confines of the atomizing chambers 28 and 29, respectively.

The ignition means may take the form of spark plugs, as at 36 and 37, the same being threaded through suitably provided openings in the side walls of the atomizing chambers. The spark points of each plug, see 37a, Fig. 5, are desirably

located just within the path of the stream of atomized fuel as it passes from the atomizing influence of the feed nozzles.

For supplying the requisite current to the spark plugs, electrical cables 38 and 39, Fig. 3, comprising wires suitably encased in heat-resistant and electrical insulating material, connect with a suitable source of electrical supply (not shown) and pass through the central aperture 40 of the table top 12a to connect with the slip-rings 41 and 42, respectively, the latter being mounted in mutually spaced relation about an electrical and heat resistant insulator 43 formed, as for example, from vitreous china. The insulator 43 is rigidly mounted on the table top 12a and advantageously surrounds the aperture 40, through which the rotor shaft 15 of the electrical motor 16 is coupled to stub shaft 17a of center post 17 by the coupling sleeve 15-1.

An electrical and heat-resistant insulator 44 is rigidly mounted about the lower portion of center post 17, being rigidly secured thereto by screws 45 and 46, which serve, additionally, to secure the contact fingers 47 and 48 in slip-contact with the slip-rings 41 and 42, respectively. Electrical cables 49 and 50, comprising wires encased within a suitable heat-resistant and electrical insulating covering, pass through apertures, see 51, Fig. 3, provided in the insulator 44, for electrical connection with the contact-fingers 47 and 48, as by means of the screws 45 and 46 functioning as binding posts. The cables 49 and 50 pass through hollow 18 of center post 17, into and through the hollow arms of the cross-arm 23, passing outwardly through openings 52 and 53, respectively, for electrical conducting connection with spark plugs 36 and 37, respectively, as by terminal clips, see 54, Fig. 4. Accordingly, the spark plugs may be electrically energized, as desired, during rotation of the rotary assembly 14.

The ignition means may be provided by electrodes placed and controlled similarly to the spark plugs 36 and 37. Or, it may be desirable to employ ignition means fixed in the walls 11a, at spaced intervals therearound, for igniting the atomized liquid fuel subsequent to discharge from the atomizing chamber. The ignition means may be energized at the commencement of the atomizing action of the burner elements, being cut-off by appropriate thermostatic means after self-sustaining flame temperatures have been reached. Or, in certain instances, energization of the ignition means may be intermittent or continuous.

Operation of the electric motor 16 may be controlled by well-known thermostat means responsive to varying temperatures in the room or other space to be heated, and the ignition means and the fuel pump, if same is provided, may be wired in circuit with the motor 16 for energization concurrently therewith.

The burner elements 24 and 25 are advantageously adjustable in two planes, both horizontally and vertically, for controlling the quantity of air picked up thereby, and for determining the extent of the combustion zone. For this purpose, the burner elements may have sets, 24c and 25c, respectively, of spaced ears extending laterally therefrom to articulatively receive, respectively, the eared ends, 55a, and 56a of screws 55 and 56, respectively, the screws being threaded into the open ends of the relatively hollow arms of cross-arm 23, and the eared ends, 55a and 56a, being pivotally secured between the respective ears of the sets of ears 24c and 25c, respectively, by means of set screws 57 and 58, respectively.

Lock-nuts 59 and 60 serve to secure the screws 55 and 56, respectively, in adjustment relative to the cross-arm 23.

To insure a constant supply of fresh air to the combustion zone of the burner unit, forced draft means is provided. Such means advantageously takes the form of a fan, designated generally 61, mounted on the depending portion 15a of the rotor shaft 15 of motor 16 within the aperture 62 of septum plate 63. The fan 61 has blades which are preferably adjustable in pitch, for supplying air upwardly through the combustion zone. The table top 12a may be apertured, as indicated at 64, for passage of air into and through the combustion zone of the burner.

The pitch of the blades of the fan 61 is preferably adjustable by means of the cam-slotted collar 65 cooperating with the received cam-ends, 66, of the individual blades 61a of the fan, such blades being mounted in the slotted receiving shaft 67, rigidly secured to portion 15a of rotor shaft 15 of the motor, see Figs. 2 and 6.

In operation, the fan 61 urges a continuous current of air upwardly through the combustion zone, from which current, quantities are gathered by the funnel-shaped burner elements 24 and 25, and are forced through the relatively restricted passages 30 and 31 at high velocities for atomizing—within the atomizing chambers 28 and 29—liquid fuel supplied through the feed nozzles 34 and 35. The air-atomized mixtures, thereupon, pass over the spark plugs 36 and 37 and are ignited thereby, or, in case self-sustaining flame temperatures have been attained and the spark plugs de-energized, pass directly into the flame zone for ignition and combustion. During combustion of the atomized liquid fuel, streams of flame shoot relatively backwardly with respect to the individual burner elements as the rotor assembly rotates, thus providing a circumferential combustion zone for the burner unit.

Under certain conditions it may be advantageous to vary the relative positions of the individual burner elements in different horizontal zones for further insuring a constant supply of uncombusted air to the burner elements during rotation thereof, and to enlarge the effective areas of the combustion zones.

Whereas this invention has been described by reference to specific forms thereof, it is to be understood that various changes may be made therein without departing from the spirit of the invention as set forth herein and in the claims that follow.

I claim:

1. In a burner for liquid fuel, at least one burner element, means for rapidly moving said burner element along a continuous path, said burner element including a hollow body having open ends, one of which diverges outwardly, and said body being disposed with its outwardly diverging end directed along said continuous path in the direction of movement, whereby, when said burner element is moved along said path, air is picked up by said outwardly diverging end and is directed in a stream through said hollow body, means for atomizing liquid fuel within said hollow body, and means for igniting the atomized liquid fuel.

2. In a burner for liquid fuel, at least one burner element, means for rapidly moving said burner element along a continuous path, said burner element including a hollow body having open ends, one of which diverges outwardly, and said body being disposed with its outwardly di-

verging end directed along said continuous path in the direction of movement, whereby, when said burner element is moved along said path, air is picked up by said outwardly diverging end and is directed in a stream through said hollow body, means for atomizing liquid fuel within said hollow body, means for igniting the atomized liquid fuel, and means for supplying a forced draft of air through the zone of movement of said burner element.

3. Structure as recited in claim 1 wherein the burner element is mounted for adjustment in both horizontal and vertical planes, providing for control of flow of air into the outwardly divergent open end of said burner element.

4. In a burner for liquid fuel, at least one burner element, means for rapidly moving said burner element along a continuous path, said burner element including a hollow body having open ends, one of said ends diverging outwardly and said body being disposed with its outwardly diverging end directed along said continuous path in the direction of movement, whereby, when said burner element is moved along said path, air is picked up by said outwardly diverging end and is directed in a stream through said hollow body, the other open-end of said hollow body having a bore forming an atomization chamber, and the portion of said hollow body which lies intermediate said open ends embodying a relatively restricted air passage providing the sole communication between said open ends, means for feeding liquid fuel into the path of said air stream within said reduced bore, whereby said liquid fuel is atomized, and means in said bore for igniting the atomized liquid fuel.

5. A burner for liquid fuel comprising a rotatable support; burner elements mounted on said rotatable support, said burner elements being spaced apart transversely of the axis of rotation of said rotatable support by an appreciable distance and being separated by said axis of rotation, said burner elements each being open-ended and hollow and each comprising an open-end portion having an outwardly divergent opening, an open-end portion forming an atomization chamber, and a restricted passage between said open-end portions, the burner elements being so disposed that, when said rotatable support is rotated, those open-ends thereof which are outwardly divergent will lead, and will bite into the surrounding atmosphere; means for atomizing liquid fuel within said atomization chambers; and means for igniting the liquid fuel atomized within the said chambers.

6. A burner as recited in claim 5 wherein the burner elements are adjustably secured to the rotatable support for enabling control of the flow of air thereinto.

7. A burner for liquid fuel comprising a rotatable support; burner elements mounted on said rotatable support, said burner elements being spaced apart transversely of the axis of rotation of said rotatable support by an appreciable distance and being separated by said axis of rotation, said burner elements each being open-ended and hollow and each comprising an open-end portion having an outwardly divergent opening, an open-end portion forming an atomization chamber, and a restricted passage between said open-end portions, the burner elements being so disposed that, when said rotatable support is rotated, those open-ends thereof which are outwardly divergent will lead, and will bite into the surrounding atmosphere; means for atomizing

liquid fuel within said atomization chambers; means for igniting the liquid fuel atomized within the said chambers; means for rotating the said rotatable support; and forced draft means for blowing air through the zone of rotation of said rotatable support.

8. A burner for liquid fuel comprising a rotatable support; burner elements mounted on said rotatable support, said burner elements being spaced apart transversely of the axis of rotation of said rotatable support by an appreciable distance and being separated by said axis of rotation, said burner elements each being open-ended and hollow and each comprising an open-end portion having an outwardly divergent opening, an open-end portion forming an atomization chamber, and a restricted passage between said open-end portions, the burner elements being so disposed that, when said rotatable support is rotated, those open-ends thereof which are outwardly divergent will lead, and will bite into the surrounding atmosphere; piping leading to the respective atomization chambers and opening thereinto for feeding liquid fuel thereto, the feed openings for supplying liquid fuel directly to the respective chambers being relatively restricted and disposed in line with the said restricted passages between said open-end portions; spark plugs having their sparking zones disposed, respectively, within the said atomization chambers between the open-ends thereof and the said feed openings and in line with the said restricted passages between said open-end portions; and forced draft means for blowing air through the zone of rotation of said rotatable support.

9. A burner for liquid fuel comprising a rotatably mounted cross-arm; burner elements adjustably secured to the ends of said cross-arm;

said burner elements each being open-ended and hollow and each comprising an open-end portion having an outwardly divergent opening, an open-end portion forming an atomization chamber, and a restricted passage between said open-end portions, the burner elements being disposed with their divergent openings facing in opposite directions, and said rotatably mounted cross-arm being adapted to rotate in the direction toward which the said divergent openings face; means for supplying liquid fuel to said atomization chambers; means for igniting the liquid fuel atomized within the said chambers; a fan disposed below said cross-arm for blowing air upwardly through the zone of rotation of said burner elements; and means for simultaneously rotating said cross-arm and said fan.

10. A burner for liquid fuel comprising a rotatably mounted cross-arm; burner elements adjustably secured to the ends of said cross-arm; said burner elements each being open-ended and hollow and each comprising an open-end portion having an outwardly divergent opening, an open-end portion forming an atomization chamber, and a restricted passage between said open-end portions, the burner elements being disposed with their divergent openings facing in opposite directions, and said rotatably mounted cross-arm being adapted to rotate in the direction toward which the said divergent openings face; means for igniting the liquid fuel atomized within the said chambers; a fan disposed below said cross-arm for blowing air upwardly through the zone of rotation of said burner elements; and means for simultaneously rotating said cross-arm and said fan, said fan having blades of variable pitch.

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