April 30, 1957 E. K. SMITH 2,790,490

OIL BURNER

Filed Nov. 1, 1954

FIG. 1

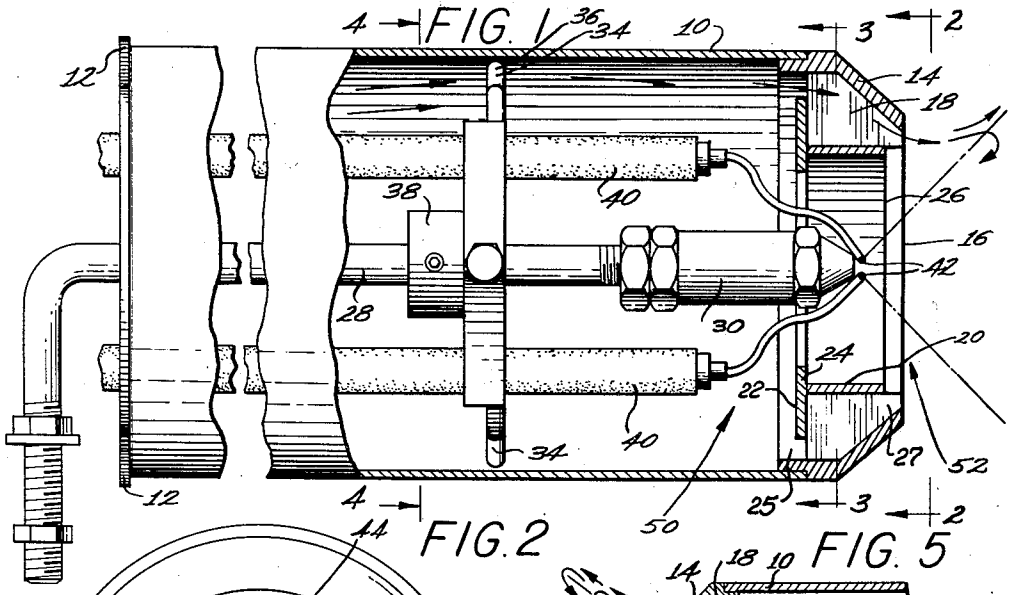


FIG. 2

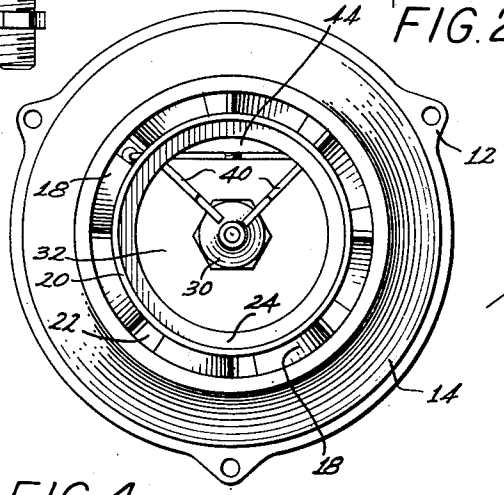


FIG. 5

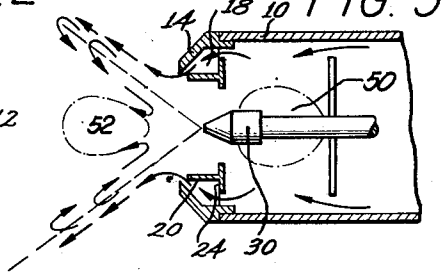


FIG. 4

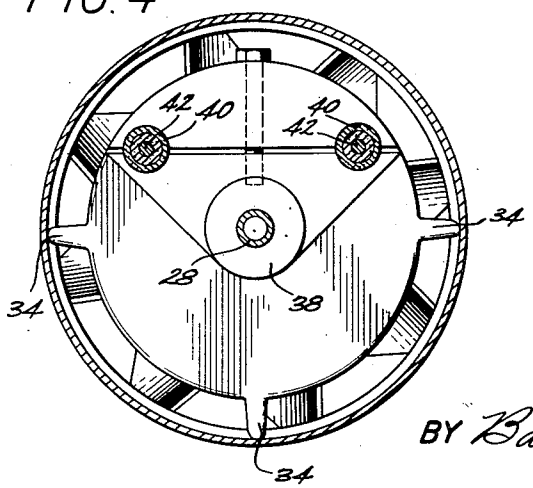
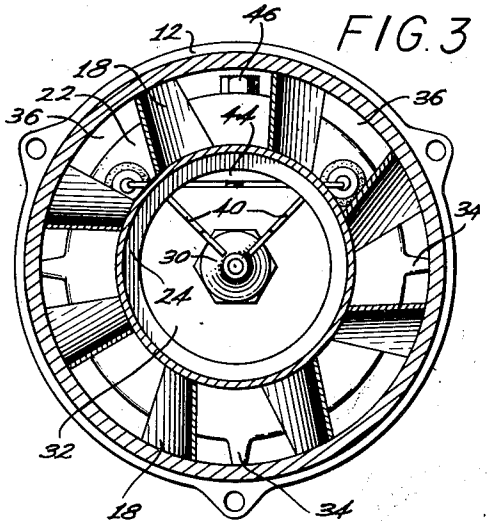


FIG. 3



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2,790,490

OIL BURNER

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Application November 1, 1954, Serial No. 466,061

7 Claims. (Cl. 158—76)

This invention relates generally to liquid fuel burners and more particularly to an oil burner of the gun type having novel air-directing, proportioning, and baffling means.

It is a primary object of this invention to provide a liquid fuel burner having novel means for maintaining an automatically self-compensating volumetric equilibrium of the overall combustion air supply.

It is another object of this invention to provide a burner construction having novel air-directing, proportioning, and baffling means operative to first form two partial vacuum zones, one immediately upstream and the other immediately downstream of the fuel spray nozzle tip, and to then cooperate with the fuel spray cone to automatically maintain the relative location and volumes of the partial vacuum zones over a predetermined range of fuel flow rates.

It is a further object of this invention to provide a gun-type oil burner having fixedly positioned and non-adjustable air-directing, proportioning, and baffling means for automatically maintaining balanced streams of air flow, wherein said air-directing, proportioning, and baffling means cooperates with the fuel spray cone in a manner so as to permit the latter to automatically apportion and control both primary and secondary air flow volumes over a range of fuel flow rates of from 0.65 to 1.65 gallons per hour.

It is still another object to provide air-directing, proportioning, and baffling means cooperating with the spray cone of a liquid fuel burner to effect self-compensating ratio control of the primary and secondary air flow volumes under low or less than normal draft conditions.

It is still a further object to provide a gun-type oil burner having a fixed and non-adjustable throat-ring assembly surrounding the spray nozzle tip adjacent the mouth of the blast tube, and further having a fixed but removable disc baffle mounted upstream of the nozzle tip, said throat-ring assembly and disc baffle having fixed areas and cooperating with the oil spray cone to enable it to automatically control the volumetric ratio of primary and secondary air supply without any need for mechanical adjustment of parts.

It is yet another object to provide a burner construction permitting substantially pulsation-free or "nozzle" combustion, wherein the flame is established at a maximum distance from the fuel nozzle tip, without the necessity for auxiliary venting in the combustion chamber.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my oil burner whereby the objects contemplated are obtained as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawing, wherein:

Figure 1 is a top plan view, partly broken away and in horizontal cross-section, of the blast tube and nozzle assembly of a gun-type oil burner constructed in accordance with the present invention;

Figure 2 is an end elevational view, looking in the direction indicated at 2—2 on Figure 1;

Figure 3 is a vertical cross-section taken substantially as indicated by the line 3—3 on Figure 1;

Figure 4 is another vertical cross-section taken substantially as indicated by the line 4—4 of Figure 1; and

Figure 5 is a diagrammatic view illustrating the paths of movement of the air flow through the burner during operation.

Referring now to the drawing I have indicated at 10 the air or blast tube of a gun-type oil burner constructed in accordance with the present invention. The rear end of the blast tube 10 is provided with a mounting flange 12 for attaching the tube to an air blower in the well-known manner. The forward end of the tube 10 carries a terminal end ring 14. The end ring 14 provides a cylindrical side wall portion and a converging frusto-conical terminal portion, and is preferably formed as a single unitary casting.

The blast tube terminal end ring 14 provides a circular discharge mouth 16. A plurality of helical vanes 18 extend inwardly from the ring 14, and may be integrally cast as portions of the ring, or may be separate vane members suitably attached thereto, as by welding.

A throat-forming ring 20 is centrally disposed in concentric relation within the end ring 14 and the helical vanes 18, and is rigidly secured to the inner longitudinal edges of the helical vanes 18, as by welding. An annular collar flange 22 is secured to the ring 20 at its inner end, and provides a radially outwardly extending baffle surface. The collar flange 22 also provides a radially inwardly extending baffle portion 24, which may be formed as a separate annular ring or as an integral extension of the throat ring 20 or collar flange 22. The forward end of the throat ring 20 provides a circular mouth 26, which is slightly upstream and inwardly spaced a fixed distance from the mouth 16 formed by the terminal end ring 14. The throat ring 20 and the cooperating annular flange portions 22 and 24 constitute a unitary throat assembly. This fixed positioning of parts represents a highly important feature of this invention.

The outer peripheral edge of the annular collar flange 22 terminates in definite spaced relation to the cylindrical portion of the blast tube 10 and terminal end ring 14, in concentric relation therewith. The relative spacing of these parts provides an annular inlet passageway 25 for air flow into the space or chamber defined between the outer periphery of the collar flange 22 and the rear inner wall portion of the terminal end ring 14. The forward ends of the end ring 14 and the throat ring 20 are spaced so as to provide an annular outlet passageway 27 for air flow therebetween.

The relative spacing of the various parts is predetermined so that the flow area of the annular inlet and outlet passageways 25 and 27 of the chamber defined between rings 14 and 20 are substantially equal. It will be apparent that this space or chamber between rings 14 and 20, in which the helical vanes 18 are disposed, provides a flow-enlargement space between the annular inlet and outlet passageways 25 and 27. In this manner, a plurality of small cushioning bodies or volumes of air are provided for steadying the flow therethrough across the helical vanes 18. These cushioning volumes serve to equalize small fluctuations in the rate of air flow so as to permit a steady and even flow of air past the vanes 18.

An oil pipe 28 is centrally positioned within the blast tube 10 and extends longitudinally therein. The forward end of the oil pipe 28 carries a spray nozzle 30. The orifice end of the spray nozzle 30 terminates within the throat ring 20, preferably at a distance in the range of about ½ to ⅝ of an inch upstream of the discharge

mouth **16**. I find the most desirable spacing to be at a distance of about 1/16 of an inch.

A disc or baffle plate **32** is fixedly secured to the oil pipe **28**. The plate **32** provides a supporting means for centrally positioning the oil pipe **28** within the blast tube **10**. The plate **32** is of smaller diameter than the blast tube **10**, and is provided with a plurality of radially outwardly extending legs **34** which engage the walls of the blast tube **10** for centering and supporting the plate **32** therein. The spaced relationship of the outer periphery of the plate **32** and the side wall of the blast tube **10** serves to provide an annular flow passageway **36** about the plate **32** closely adjacent the walls of the blast tube **10**.

I have particularly designed the burner construction of the present invention for use within an operating range of fuel flow rates of from 0.65 to 1.65 gallons per hour (G. P. H.), inclusive. It is important at these flow rates to select the flow-obstructing area of the baffle plate **32** so as to be equal to 65% of the total cross-sectional area of the air blast tube **10**. Further, it is also highly important to position the baffle **32** within the blast tube **10** at a point upstream from the discharge mouth **16** a distance equal to the diameter of the blast tube **10**. In addition, the annular inlet and outlet passages **25** and **27** adjacent the end edges of the vanes **18** and between the terminal end ring **14** and the throat ring **20** are predetermined so as to each have a total flow area equal to about one-half of the annular passageway **36**.

This optimum selection of areas and positioning of parts permits a constant, non-adjustable relation of all-metallic components of the air directing, proportioning, and baffling parts of the burner. Once the initial selection of baffle areas and positions has been made, variations in the choice of fuel nozzle orifice size alone, in the specified fuel flow range, will effect control of the ratio of primary and secondary air volume to support combustion during burner operation without the necessity for any adjustment of parts.

The baffle plate **32** is formed with a central boss which is suitably apertured to receive the oil pipe **28** therethrough. Insulated supports **40** of a pair of electrode wires **42** extend through complementary cutaway portions of the plate **32** and a removable segment portion **44** thereof. A set screw **46** serves to secure the insulated supports **40** in fixed position, as clearly shown in Figure 4 of the drawing.

Operation

By means of the novel arrangement of the metal parts of my burner construction, and particularly the co-relation between the disc baffle and the throat ring assembly, as described above, I have provided a wholly new and improved operation for a liquid fuel burner. I have provided constant-area and non-adjustable relations of air control components capable of achieving smooth, efficient, and quiet operation at all fuel flow rates within the relatively low flow range of 0.65 to 1.65 G. P. H., inclusive. The optimum operating conditions for my burner are approached as draft conditions are lowered to a minimum value very nearly equal to atmospheric pressure. My novel construction wholly eliminates any need for auxiliary venting to eliminate flame pulsations, and makes it possible to position the base of the flame at a maximum distance of about 3 to 4 inches from the mouth of the burner blast tube, while at the same time maintaining combustion stability, and substantially eliminating flame fluctuations or "snapping back" which results in excessive combustion noise.

Further, a balanced volumetric ratio of primary and secondary combustion air is automatically maintained by my construction for all fuel flow rates within the predetermined capacity range, thereby rendering the flame characteristics of my burner self-compensating in

proportioning and regulating the flow of both primary and secondary combustion air volumes, and eliminating all adjustments other than the selection of a nozzle tip having the desired fuel flow rate and the corresponding total volume of air admitted at the burner blower.

In an operating installation employing the features of my burner construction, an overall or total flow of inlet air will be admitted to the blast tube **10** from a suitable blower fan of the squirrel-cage type in the well-known manner. The quantity of this total inlet air is predetermined by the usual means of adjusting the free area at the blower fan inlet at constant fan speed so as to provide the necessary total air volume for supporting combustion at the particular rate of fuel flow which is predetermined by the particular nozzle tip size and spray angle which have been selected. The air is then automatically apportioned within the blast tube by means of my disc baffle and throat ring assembly, in cooperation with the oil spray cone, into the proper volumetric ratio of primary and secondary air streams.

The primary air stream is the peripheral air flow adjacent the blast tube walls, and constitutes the major volume of combustion air. The secondary air stream is the air flow at the center of the blast tube adjacent the oil nozzle tip. The primary air is of greater volume than the secondary air because of the positive baffling effect of the barriers **32** and **22**, and the barrier effect of the oil spray cone (indicated in dot-dash lines on Figures 1 and 5). The separation of the overall volume of inlet air into primary and secondary streams of flow serves to establish and balance the two partial vacuum zones (indicated in Figure 5 at **50** and **52**) in a manner so as to maintain flame euqilibrium, over a range of flame sizes at various fuel flow rates, without the need for any mechanical adjustment of parts.

As clearly shown in Figure 1 of the drawing, the throat ring **20** provides no positive means for imparting any whirling motion to the secondary air, but merely constitutes an unobstructed tunnel or flow throat. All whirling motion of the secondary air after leaving the throat mouth **26** is imparted by the whirling motion of the oil spray and natural draft conditions alone, and the air is not forced into such motion by means of static pressures ordinarily employed or any structural means. The positive whirling means conventionally employed by the prior art to effect a swirling of the combustion supporting air under static pressure for mixture with the oil spray cone, at conventional oil pressures of about 100 p. s. i., cannot be efficiently synchronized with the flow of combustion supporting air, at conventional air pressures of about ½ inch of water column, or with the different spray cone sizes of various fuel flow rates employed. In my construction, the whirling oil spray itself induces or aspirates all of the combustion supporting air it may require, thereby merging into the flame the outer (primary) and inner (secondary) air through the paths provided, at a synchronized rate both as to volume and direction, and in accordance with the physical film strength or "skin-tension" of the hollow oil spray cone. In this manner, the oil cone itself does its own regulating or apportioning of the required primary and secondary air volumes. The oil cone itself also serves both as a baffle, to hold back excess secondary air, and as an induced feeding means to aspirate the larger volume of primary air required for efficient combustion. It should be noted that the primary air is introduced at the outer periphery of the discharge mouth **16**, where the skin-tension of the oil spray begins to disintegrate, thus delivering it in an uninterrupted flow to the core of the flame.

The term "draft" is defined as the "negative" pressure condition which prevails between the zone above the visible flame of combustion and the top of the flue or stack through which the products of combustion are disposed of or vented. The draft pressure is distinguished from the blower pressure which prevails in the blast tube.

Preferably, my burner construction is operated at a stack pressure which is slightly less than atmospheric pressure. Such a pressure is termed a "negative" pressure in that it results in a gauge reading which is less than atmospheric. Reference to negative pressures in the present description is intended to mean pressure below atmospheric, and therefore constituting a slight vacuum condition.

It is of particular importance that my construction is capable of smooth, noiseless, and efficient operation under less than normal draft conditions. I have also achieved highly satisfactory performance under conditions wherein the draft pressure is zero or slightly positive (in excess of atmospheric pressure). By utilizing the physical force effects of the oil spray in establishing the flame, I am able to achieve uniform performance despite wide variations in the draft conditions. It will be apparent that upon initiation of combustion, the consequent heated air surrounding the flame will rise by natural convection and cause a pressure differential to be established, thereby creating a draft substantially immediately after ignition.

The hollow oil spray cone provides a barrier or separating wall between the partial vacuum zone **50** at the forward end of the blast tube and the partial vacuum zone **52** which prevails at the core of the oil spray within the combustion chamber. The spray cone has its apex at the nozzle orifice, and is preferably delivered at the conventional oil flow pressure of about 100 p. s. i. The oil cone itself acts to aspirate or carry forward the flow of air from the burner blast tube into the combustion zone. The actual physical strength or "skin-tension" of the coil cone immediately adjacent the nozzle orifice is proportional to the rate of oil flow. This strength is greater at the apex of the oil cone and diminishes as the cone enlarges outwardly. Since the volume of air which will be aspirated by the spray cone is dependent upon the physical strength of the forward flowing oil, it will be apparent that the supply of air from the burner blast tube which is induced into the combustion zone will be greatest where the "skin-tension" begins to disintegrate (where the outer or primary air is introduced at outlet **27**), and will be least where the "skin-tension" is greatest (where the inner or secondary air is introduced as an induced slip-stream at the mouth **26**). In this way, both air streams are controlled and regulated in a self-compensating manner in response to variations in the oil flow over a range of 0.65 to 1.65 G. P. H.

The blower fan operates under intake conditions which cause the fan to be "starved" for the overall air supply required for highest combustion efficiency at the predetermined rate of oil flow. In this way, the fan strives to move all of the air which is available to it through the blower intake toward the mouth of the blast tube, at which point the oil spray cone will operate to positively aspirate into the combustion chamber all of the air necessary for optimum combustion efficiency. It is not possible, however, to wholly eliminate the blower fan, because the oil spray does not have a sufficient aspirating power to draw the required air from a remote distance. Under practical operating conditions, therefore, the pressures within the blower fan housing will be negative. This constitutes an important forward step over the prior art, wherein the static pressure conditions must necessarily be positive.

Noise is an undesirable operating characteristic of many presently known domestic burner constructions. The term "noise" is generally employed to designate the loud reverberations or pulsations which are the result of interruptions and fluctuations in the combustion process. Such pulsing combustion is due to spasmodic alternations of the fuel-air mixture ratio between adequate and inadequate oxygen supply. Such pulsing results in the base of the flame jumping away from and "snapping back" toward a normal position with respect to the nozzle orifice. The further away from the nozzle and other

metal parts of the burner that the base of the flame is positioned during operation, the less will be the likelihood of undesirable carbon formation which results from contact and radiation by the flame or its reflected heat upon metal burner parts which become moist with oil. The further away the base of the flame is positioned, however, the more difficult it becomes to control flame stability, and avoid pulsation and the risk of having the flame float away entirely.

The "noise" referred to herein is the pulsing or reverberating sound due to interrupted or irregular burning, and is not the steady sound of smoothly merging fuel-air mixture which accompanies low-velocity stable combustion. The normal steady sound of stable combustion, without the loud pulsation noise of interrupted or irregular combustion, is relatively quiet and may be referred to as substantially "noiseless" combustion.

The most important underlying factor essential to stable combustion is the manner in which the carbon of the fuel and the oxygen of the air are united under conditions of draft in the combustion chamber. Combustion chamber or stackdraft is necessary for relatively complete combustion, and serves the purpose of carrying away the combustion by-products. The lower the draft, or the nearer the stack pressure approaches atmospheric pressure, the greater will be the opportunity for efficient combustion to take place at a relatively slow rate, whereby substantially improved heat exchange to the heating plant will be made possible. Mere slow combustion alone, however, is not sufficient unless smooth mixing and proportioning of the carbon and oxygen elements is effected. The basic purpose of my burner construction is to lower the draft pressure and consequently the volume of total air flow through the burner blast tube with a corresponding minimum natural draft condition within the combustion chamber and stack. In this way, it is possible to substantially reduce the excess air requirements, upon which high combustion efficiency (in conventional installations) necessarily depends, without producing the adverse effects of smoke, soot, hard carbon deposits, or odor of unburned gases.

It is common practice in many of the presently known domestic heating installations to provide a small vent for admitting air directly over or under the flame to overcome combustion pulsations and minimize noise. Although by regulating the size of such vents it is possible under negative draft conditions to equalize the combustion process and correct the problem of combustion pulsations, the cooling effect of the excess air thus admitted upon the flame substantially reduces combustion efficiency. Further, the practice of auxiliary venting frequently results in a highly objectionable escape of combustion odors into the room air of a domestic heating installation during the burner starting cycle.

My self-compensating burner construction effectively controls the air supply to the fuel so as to permit the base of the frame to be positioned and maintained a maximum distance away from the mouth of the blast tube and all other metal parts. This separating distance is at least twice that found in conventional burners, and is maintained constant so as to effectively eliminate flame pulsation ann consequent "noise." Further, the need for auxiliary venting is eliminated.

The essence of my novel structural arrangement is the achievement of a functional operation, over a design range of low firing rates, wherein the base of the flame, or the point at which the united flow of oil and air commence to burn with a visible flame, is maintained at a relatively fixed or stationary position, and at a maximum separating distance downstream of the nozzle tip and blast tube mouth. My construction operates to achieve this function over a range of stack draft conditions both above and below normal draft pressure. Optimum operating conditions for my burner construction are ap-

proached as draft pressure approaches an irreducible minimum.

Changes may be made in the construction and arrangement of the parts of my oil burner without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical improvements which may be reasonably included within their scope.

What I claim as new and desire to obtain by Letters Patent of the United States is:

1. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and define a passageway therebetween, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation within said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a discharge passageway from said chamber, said inlet and discharge passageways being substantially equal in cross sectional area and smaller than the cross sectional area of said chamber, said chamber providing a cushioning volume for regulating an even discharge of air flow therefrom, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member.

2. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and define a passageway therebetween, the flow obstructing area of said baffle plate being equal to about 65% of the total cross-sectional area of said air blast tube, said baffle plate being positioned upstream of the discharge mouth of said tube a distance substantially equal to the diameter of said blast tube, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation with said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a discharge passageway from said chamber, said inlet and discharge passageways being substantially equal in cross sectional area and smaller than the cross sectional area of said chamber, said chamber providing a cushioning volume for regulating an even discharge of air flow therefrom, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member.

3. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and define a passageway therebetween, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation within said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a restricted discharge passageway from said chamber, said inlet and discharge passageways being smaller than the cross sectional area of said chamber, said chamber providing a cushioning volume for regulating an even discharge of air flow therefrom, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member.

4. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and define a passageway therebetween, the flow obstructing area of said baffle plate being equal to about 65% of the total cross-sectional area of said air blast tube, said baffle plate being positioned upstream of the discharge mouth of said tube a distance substantially equal to the diameter of said blast tube, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation with said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating wtih the forward end of said tube to define a restricted discharge passageway from said chamber, said inlet and discharge passageways being smaller than the cross sectioanl area of said chamber, said chamber providing a cushioning volume for regulating an even discharge of air flow therefrom, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member.

5. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, an oil tube terminating in a spray nozzle upstream of and closely adjacent the forward end of said tube, said nozzle when supplied with oil at a predetermined pressure serving to discharge a

spray cone of oil at a flow rate within the range of 0.65 to 1.65 G. P. H., a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and a passageway therebetween, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation within said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, said nozzle extending forwardly into said throat passageway, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a restricted discharge passageway from said chamber, said inlet and discharge passageways being smaller than the cross sectional area of said chamber, means for providing a volume of air to said blast tube, the air moving through said chamber constituting primary air and the air moving through said throat constituting secondary air, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flow therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member, whereby said hollow oil spray cone operates to aspirate both primary and secondary air outwardly from said chamber and throat in proportion to the rate of fuel flow, so that the provision of combustion air is varied in response to changes in fuel flow rate.

6. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, an oil tube terminating in a spray nozzle upstream of and closely adjacent the forward end of said tube, said nozzle when supplied with oil at a predetermined pressure serving to discharge a spray cone of oil at a flow rate within the range of 0.65 to 1.65 G. P. H., a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and a passageway therebetween, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation within said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, said nozzle extending forwardly into said throat passageway, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially inwardly and outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a restricted discharge passageway from said chamber, said inlet and discharge passageways being smaller than the cross sectional area of said chamber, means for providing a volume of air to said blast tube, the air moving through said chamber constituting primary air and the air moving through said throat constituting secondary air, said ring and collar members and said baffle plate providing structural means cooperating with the air moving through said blast tube to form a first reduced pressure zone for said secondary air flow, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the primary air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member, whereby said hollow spray cone operates to form a second reduced pressure zone and to aspirate both primary and secondary air outwardly from said chamber and throat in proportion to the rate of fuel flow, so that the provision of combustion air is varied in response to changes in fuel flow rate.

7. A liquid fuel burner comprising an elongated air blast tube having its rear end adapted to receive a flow of inlet air and having its forward end adapted to discharge into a combustion chamber, a baffle plate disposed within said tube, means cooperating with said baffle plate to position it in spaced relation to the walls of said tube and define a passageway therebetween, a generally cylindrical ring member centrally disposed in longitudinally coaxial relation within said tube forwardly of said baffle plate, said ring defining a central throat passageway therethrough, an annular collar member secured to the rear end of said ring and providing a baffle surface generally normal to the longitudinal axis of said ring and entirely rearwardly thereof, said baffle surface extending radially outwardly of said ring throat passageway, said ring being spaced from the walls of said tube to define a chamber therebetween, said radially outwardly extending portion of said collar being spaced from the walls of said tube to define a restricted inlet passageway into said chamber, the forward end of said ring cooperating with the forward end of said tube to define a restricted discharge passageway from said chamber, said inlet and discharge passageways being smaller than the cross sectional area of said chamber, said chamber providing a cushioning volume for regulating an even discharge of air flow therefrom, and a plurality of vanes in said chamber helically disposed relative to the longitudinal axis of said tube for imparting a spin to the air flowing therethrough, said vanes being positioned radially outwardly of said ring and forwardly of said collar member.

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