

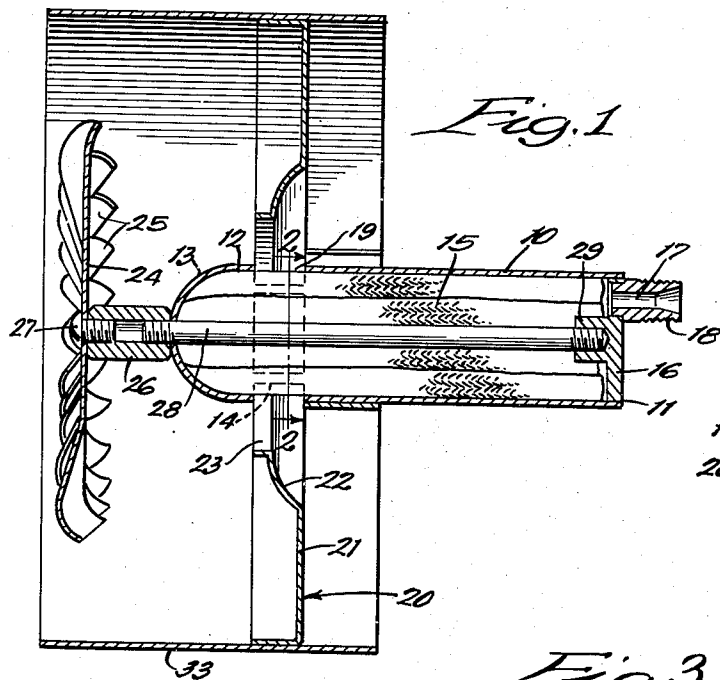
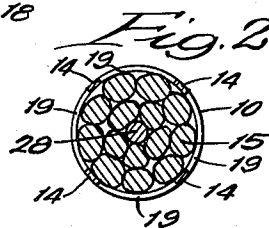
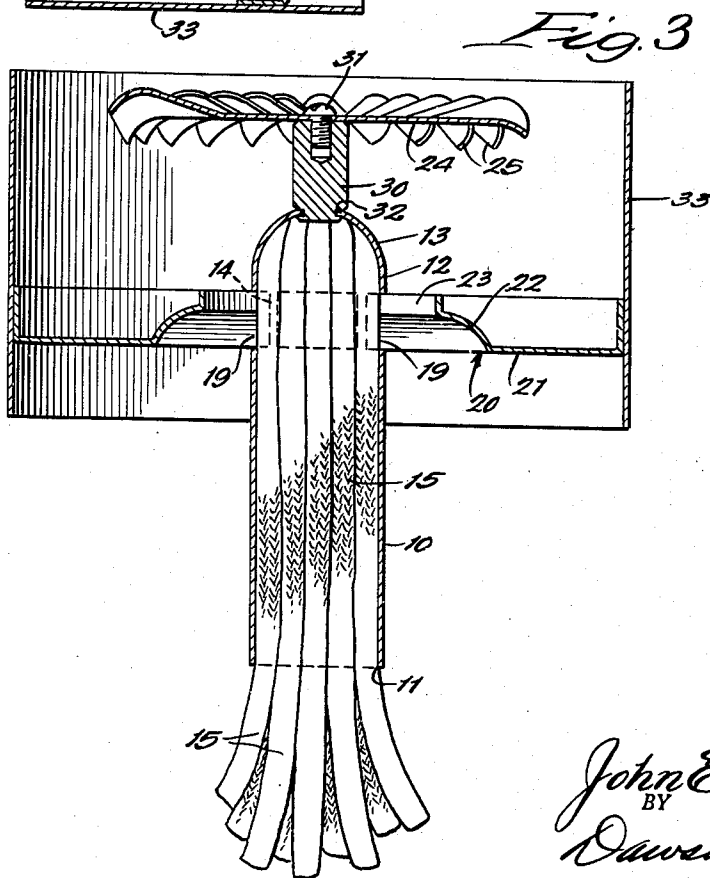
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BURNER ASSEMBLY

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BURNER ASSEMBLY

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This invention relates to a burner assembly and particularly to a liquid fuel burner which may be used in the construction of heating and cooking stoves capable of steady and satisfactory operation with high output under extremely varied atmospheric conditions.

It is an object of this invention to produce a liquid fuel burner assembly which may be used in the manufacture of heating and cooking stoves.

Another object is to produce a liquid fuel burner which may be operated on gravity or capillary feed.

A further object is to produce a liquid fuel burner which is simple in construction, easy to operate and which burns steadily with a minimum amount of smoking with a wide variety of liquid fuels, ranging from alcohols, fuel oil and kerosene to high octane gasoline, such as are produced by cracking processes or by the addition of anti-knock compounds such as tetraethyl lead.

A still further object is to produce a burner assembly of the type described which operates steadily under atmospheric conditions existing in the Arctic region, which can be lit easily and quickly under atmospheric conditions which may vary from minus 65° F. to 125° F. and in the face of fairly strong winds, which is capable of output in the range of 15,000 B. t. u. per hour or more and which does not require the use of pressure generating elements as an incidence to operation and will function for a satisfactory period of time without becoming clogged with carbon or residue from the combustion of additions to anti-knock fuel such as tetraethyl lead.

These and other objects and advantages of this invention will hereinafter appear, and for purposes of illustration, but not of limitation, embodiments are shown in the accompanying drawing in which—

Figure 1 is a sectional elevational view of a burner assembly embodying features of this invention;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1, and

Figure 3 is a sectional elevational view of a burner assembly embodying the modification for capillary feed.

In accordance with this invention, there is provided a fuel burner comprising an elongate housing having an inlet end and an outlet end formed with an opening substantially all around and exposing wick elements arranged within the housing and from which burnable vapors of the liquid fuel emanate. In order to provide sufficient air in intimate association with burnable

vapors for complete combustion, a baffle is employed to provide an air inlet all around the housing in the near vicinity of the vapor openings and to insure more complete combustion and substantial elimination of smoking, another barrier in the form of a spreader is provided just beyond the housing to increase the path of travel of the air and vapor and improve the mixture thereof and to retard the flow of fuel so that combustion will take place below the spreader and burn adjacent to the burner and provide heat for vaporization of the liquid fuel. Other elements for the purpose of increasing the vaporization of the fuel and better utilization of heat generated thereby are also provided and are important to the accomplishment of the objects of this invention.

As shown in the drawing, the burner comprises an elongate tubular housing 10 formed of metal or other rigid material impervious to the liquid fuel or vapors generated therefrom. The tubular housing has an inlet end 11 and an outlet end 12 covered by a burner cap 13 which is connected by strips 14 to the housing to provide a substantially annular opening therebetween through which the burnable vapors released by the liquid fuel are able to pass.

Disposed within the housing is one or more wick elements 15 which may be formed of ordinary fibrous materials or woven fabrics but which are preferably formed of compact bundles of unidirectional glass fibers of the staple or continuous type. For gravity type feed, shown in Figure 1, the wick elements extend from the inlet end which may be closed by a disc 16 to the outlet end which may be closed or open if the wicking is heat resistant, such as of glass fibers, but the outlet end is preferably in the form of a dome shaped metal cap 13. Fuel is introduced through an orifice 17 in a coupling member 18. For capillary feed, the wick members 15 may extend continuously beyond the open inlet end 11 for submergence in a suitable body of liquid fuel whereby the fuel is caused to rise into the housing by way of capillary flow as shown in Figure 3. In either event, the wick elements located within the housing cause the conduction and uniform distribution of fuel from the inlet end to the openings from which the fuel issues as a burnable vapor or gas.

It has been found that best results are secured when air for combustion is introduced from about the housing, especially in the near vicinity of the vapor openings 19 in the outlet end portion of the housing 10. For this purpose, there is pro-

vided an air baffle 20 in the form of a disc member 21 extending radially of the housing with at least the central portion thereof sloped in the direction of gaseous flow as it approaches the housing and preferably having a curvilinear intermediate portion 22 that defines the inlet opening 23 which is of larger dimension than the tubular housing 10 and through which the housing extends to provide an annular space all around preferably near the level of the vapor openings. This arrangement provides for optimum conditions in fuel combustion as compared to less efficient burning which results when air is introduced into the combustion chamber from outside a cylinder or the like spaced a greater distance from the burner housing.

This arrangement causes a large quantity of air to be drawn into the burner region at high velocity as though the air were introduced through a venturi. The rapid movement of air through the confined space causes the air to follow a narrow path and pass rapidly through the combustion region. The velocity is so great that very often the vapor and air are caused to pass through the combustion region before completely mixing and before the vapors or gases have been completely burned, whereby smoking invariably occurs. It has been found necessary under such circumstances to provide a baffle or barrier member just beyond the end of the tubular housing to intercept the movement of the vapors and gases and impart a delaying and mixing action thereto which insures more complete combustion. The baffle, which operates in the manner of a spreader, may be formed of a simple disc member of metal or the like but it is best to provide a spreader in the form of a disc member 24 having the outer portions thereof formed into a number of inclined angular vanes 25 by which a swirling motion is imparted to the portion of gaseous medium passing therethrough.

When a metallic stem or a stem formed of other material having a high heat conductivity is used to connect the spreader 24 with the burner cap 13, the high heat of the spreader will be transmitted to the cap member whereby the rate of vaporization of the liquid fuel be markedly increased thereby further to increase the capacity of the burner per unit cross section of wick space. In the gravity feed type of burner, shown in Figure 1, the stem may be in the form of a coupling member 26 secured, as by a screw 27, onto the one end of the coupling member while the other end is threaded into a rod 28 that extends through an opening in the apex of the burner cap 13 and threadably engages a threaded opening in a stud 29 extending from a central portion of the closing disc 16. The tie rod 28 which extends through the entire length of the housing 10 in intimate contact with wick elements 15, also becomes heated from the spreader and further assists the rate of vaporization of the fuel. In the capillary feed assembly, shown in Figure 3, the stem 30 which is secured at one end to the spreader 24 by a screw 31, has a grooved portion 32 at the other end which is adapted to extend through an opening in the apex of the burner cap 13 which seats within the groove.

The function of the flame spreader is chiefly to arrest the rapid movement of the air in order to promote complete combustion and provide enough heat on the burner cap to vaporize fuel brought in contact therewith by the wick elements. The spreader, however, should not retard the air flow to the extent that it greatly restricts

the amount of air introduced through the air baffle, otherwise the ratio of air to fuel would be insufficient for complete burning. The swirling motion imparted to the air-vapor mixture lengthens the course of travel and more intimately mixes the air and vapor for more complete burning thereby to reduce the tendency for smoking. There is also reason to believe that the mixture of air and vapor is heated up upon contact with the spreader so that higher combustion temperature is reached by a greater proportion of the material.

Instead of employing a single spreader, it is possible to make use of more than one spaced one above the other with the lower one preferably being of the vane type to permit passage of gases more readily therethrough, but in any event, the combined reaction of the spreaders should not be such as to retard the flow of gases so much that insufficient air will be drawn into the combustion area. In practice it has been found best to space the flame spreader about $\frac{1}{4}$ to $1\frac{1}{4}$ inches beyond the outlet end of the housing 10 and in general the spreader is dimensioned to extend outwardly beyond the opening 23 through which air is introduced.

Chiefly for purposes of support and incidentally for protection and for more efficient utilization of the heat generated, an adapter tube 33 may be provided in the form of a tubular metal member of substantially greater dimension than the spreader or tubular housing and which is preferably secured all around to the periphery of the air baffle 20 to extend a short distance therebelow to beyond the level of the spreader 24.

The capacity of the burner depends greatly upon the internal diameter of the housing 10 and the arrangement of wick elements therein. Satisfactory delivery of fuel to provide a combustion rate in excess of 15,000 B. t. u. per hour is achieved by the use of wick elements of the type described packed within a tubular housing having a dimension ranging from $\frac{3}{8}$ to $1\frac{1}{4}$ inches in diameter. It will be understood that the dimensions thereof may be varied correspondingly to the amount of fuel which it is desired to be burned.

It will be apparent from the description that I have provided an extremely light weight burner assembly formed of relatively few simple parts capable of operation under widely varying atmospheric conditions with liquid fuels of various types which might be made available under existing conditions, such as fuel oil and high test gasoline containing anti-knock compounds. The burner assembly of the type described and claimed herein is capable of use interchangeably in cooking or heating stoves fed by gravity or capillary flow and which is capable of uniform and steady operation without smoking in the face of high winds and under widely varying temperature conditions.

It will be understood that a burner of the type described may be disposed vertically as shown or arranged horizontally or inverted depending on the type of operation and structure with which it is associated.

It will be further understood that numerous changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A burner for liquid fuels, comprising a hollow casing having at one end an inlet for the

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passage of fuel therethrough and at the other end an outlet for vapors, a bundle of wicks extending longitudinally of said housing, said housing and wicks forming a closed central area serving as a barrier to the inflow of air through said central area, an air baffle extending about the housing and having an annular opening surrounding said housing and adjacent the outlet thereof through which air may pass in a substantially annular stream to meet vapors from the wicks at the outlet end of said housing, a retarding element supported in spaced relation with said housing and air baffle and beyond the outlet end of the housing to partially confine the vapor and air mixture within the area between said air baffle and said retarding element, and hollow casing means extending about said air baffle and having substantially imperforate side walls so that air for said wicks is provided substantially entirely through said annular opening.

2. A burner for liquid fuels, comprising a substantially imperforate outer hollow casing, an air baffle extending inwardly from said casing and provided centrally with an opening, an elongate housing supported within the opening of said air baffle in spaced relation thereto, whereby air may pass through the restricted space between said housing and said baffle, said housing being provided with an inlet for the reception of fuel and an outlet adjacent said baffle, elongated wicks extending longitudinally of said housing and providing with said housing a barrier against the inflow of air except through the annular opening between said housing and said baffle, and a retarder element supported in spaced relation with said air baffle and said housing and beyond the outlet end of the housing to partially confine air and vapors within the space between such element and said housing.

3. A burner for liquid fuels, comprising an elongate hollow housing having an inlet end for receiving fuel and an outlet end, a bundle of wicks extending longitudinally of said housing and substantially filling the housing in cross-section, whereby passage of air through said housing is excluded, an air baffle extending about said housing and at a spaced distance therefrom to provide a perimetric opening adjacent to and surrounding said housing through which air may

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pass to meet vapors that emanate from said wicks at the outlet end of said housing, a retarder baffle spaced forwardly of said housing to partially restrain the flow of air and vapors forwardly thereof, and a substantially imperforate hollow casing extending about said air baffle, the space between the outlet end of said housing and said retarder baffle being substantially unobstructed so that a flame front within the space can freely advance toward and recede from the housing outlet.

4. The structure of claim 3 in which at least one end of said housing is open and wicks extend beyond said end.

5. In a burner for liquid fuels, an elongated hollow casing open at both ends, at least one wick extending longitudinally of said housing and substantially filling the same, said wick being adapted to communicate at one end with a source of liquid fuel and at the other end thereof extending outwardly beyond said housing to provide a free wick portion, a substantially imperforate cap enclosing said free wick portion while being spaced from the end of said housing to provide a substantially continuous opening therebetween exposing the wick, and a substantially imperforate casing surrounding said housing at least adjacent said free wick portion.

6. The structure of claim 5 in which an air baffle is provided centrally with an opening therethrough receiving said housing therein, the opening in said baffle being adjacent said opening provided between the cap and housing.

7. The structure of claim 6 in which a retarder baffle is spaced axially from said cap.

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