United States Patent

Shakiba

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[45] **Apr. 4, 1972**

[54] KEROSENE COMBUSTION BURNER

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[22] Filed: **Mar. 19, 1970**

[21] Appl. No.: **21,036**

[52] **U.S. Cl.** **431/208**

[51] **Int. Cl.** **F23d 11/44**

[58] **Field of Search** 431/208, 41, 11, 161, 207

[56] **References Cited**

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3,118,490	1/1964	Page-Roberts et al.	431/208 X
2,104,940	1/1938	Woolery	431/41
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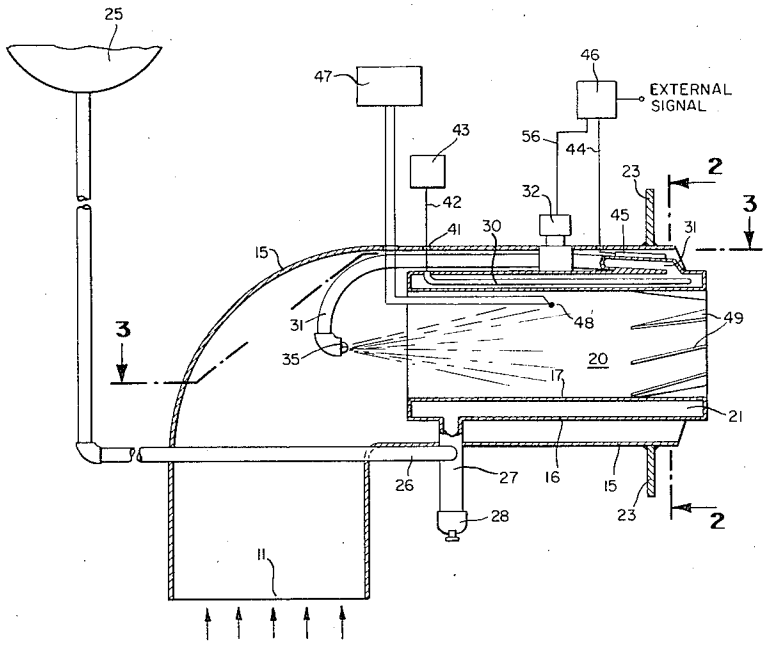
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[57] **ABSTRACT**

A kerosene combustion burner for highly efficient fuel use is provided comprising an inner cylindrical combustion chamber surrounded concentrically by an outer cylinder, forming therebetween a fuel supply chamber wherein the fuel is heated and transformed to superheated vapor which is controllably fed through a nozzle and introduced into the combustion chamber where, in its vaporized form it burns efficiently. In operation, heating elements in the fuel supply chamber initially cause vaporization of the fuel, with temperature sensor means permitting passage of vapor to the nozzle when the temperature has acquired a predetermined value, and turning off said heating elements when the heat of combustion is sufficient to maintain vaporization and steady state operation.

5 Claims, 3 Drawing Figures



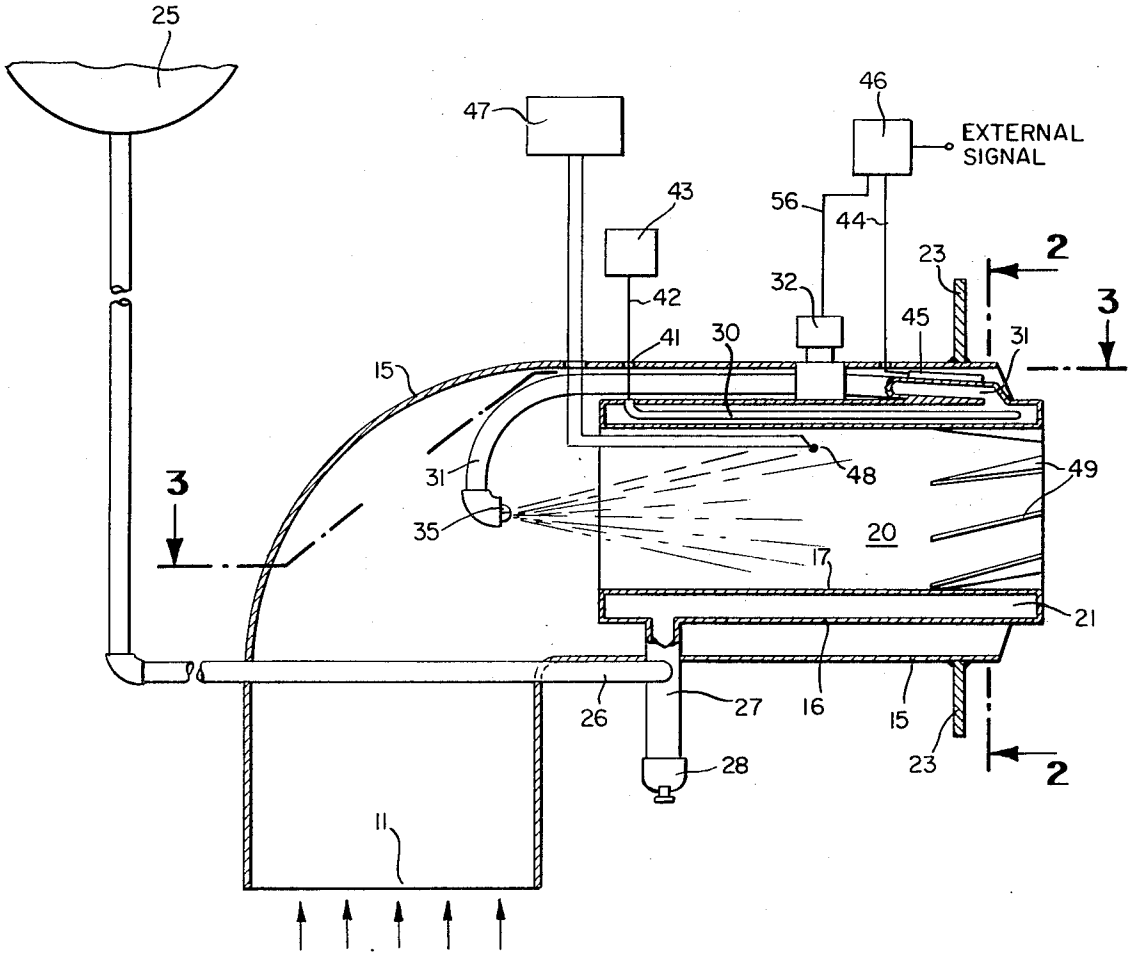


Fig. 1

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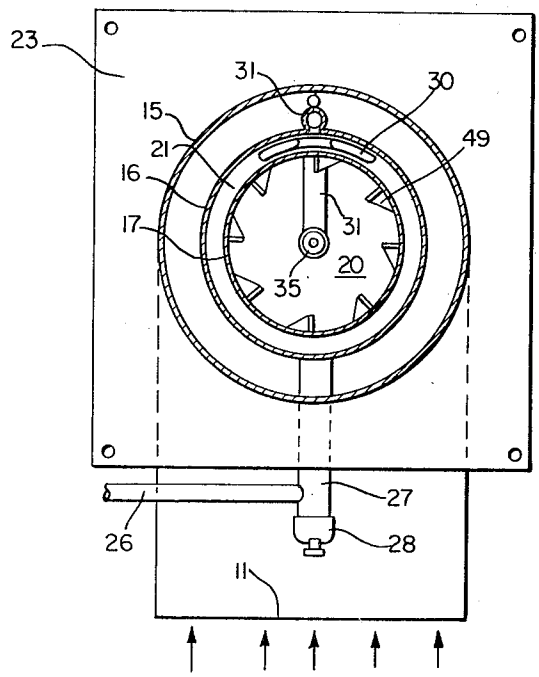


Fig. 2

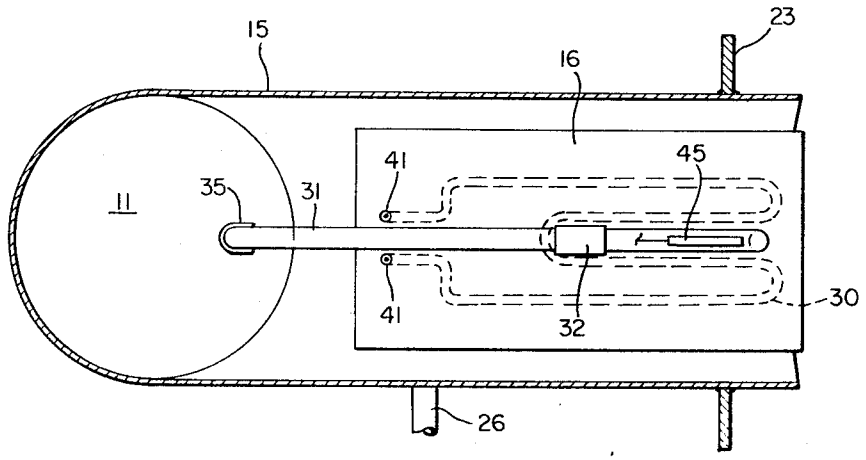


Fig. 3

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KEROSENE COMBUSTION BURNER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention lies in the field of combustion burners and, more particularly, kerosene combustion burners having pre-vaporization chambers for transformation of the fuel into superheated vapor prior to injection into the combustion chamber.

2. Description of the Prior Art

It has long been recognized that the efficiency of an oil burner can be increased by vaporizing the fuel prior to combustion, so that a more perfect combustion can take place. There have been attempts in the art to provide inexpensive and efficient oil burners incorporating some degree of vaporization. See, for example, U.S. Pat. No. 2,571,629. However, such attempts have generally led to cumbersome and inefficient designs not suited for small to intermediate size general purpose burners. There remains a considerable need for a burner which will efficiently vaporize low cost heating fuel and controllably supply same to a combustion burner so as to obtain maximum efficiency of combustion.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an expensive combustion burner, which provides extremely high efficiency of combustion.

It is a further object of this invention to provide a combustion burner having means for vaporizing the fuel by the heat of combustion prior to introduction of such fuel into the combustion chamber.

It is a further object of this invention to provide an automatically controlled combustion burner which, in is steady state, vaporizes the fuel with its its own heat of combustion before combustion of such fuel.

It is a further object of this invention to provide a combustion burner with temperature-controlled starting means for vaporizing the fuel.

Accordingly, the kerosene combustion burner of this invention comprises two concentric cylinders, the interior of the inner cylinder forming a combustion chamber, and the chamber between said inner cylinder and the outer cylinder forming a fuel supply chamber, into which fuel is introduced from an external fuel tank. Placed within the fuel supply chamber is an electrical heating means for heating the fuel and transforming same into vapor, and a vapor supply line is provided exterior of said chamber for transporting such vapor to a nozzle from which it is injected and sprayed into the combustion chamber. The fuel is mixed with air which enters the combustion chamber through a conventional air inlet, being drawn by the suction provided by combustion. The vapor supply line is controlled by a solenoid valve which remains closed until fuel has been vaporized to a predetermined temperature, which is sensed by conventional thermostat means. At the same time that vapor is introduced into the combustion chamber through the solenoid valve, sparks are introduced into the chamber to initiate combustion. Upon steady state combustion, a second thermostatic signal turns off the electric heating means, the heat of combustion then being sufficient to maintain vaporization of the fuel in the fuel supply chamber. The solenoid valve may be actuated by external control signals to turn off the combustion burner when desired.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the combustion burner, showing some portions in cross section and indicating certain components diagrammatically.

FIG. 2 is an end view taken along lines 2—2 as shown in FIG. 1.

FIG. 3 is a top view taken along lines 3—3 as shown in FIG. 1, indicating the placement of the heating elements within the fuel supply chamber.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, an air inlet 11 is shown, comprising the open end of a cover 15 which surrounds the combustion burner. Interior of the cover is a first outer cylinder 16 and a concentric inner cylinder 17. The inner cylinder 17 defines a combustion chamber 20, and the space between inner cylinder 17 and outer chamber 16 is utilized as a fuel supply chamber 21.

The fuel, typically kerosene, is stored in a conventional fuel tank 25 which is connected to chamber 21 through inlet pipe 26. The tank 25 is maintained at a height of approximately 6 feet, or greater, above the bottom level of chamber 21. A stagnation pipe 27 and drain 28 are provided for draining the chamber. Although a gravity type of fuel feed is shown as the preferred embodiment, it is appreciated that other types of feed could be adapted to the apparatus. The cylinders 16 and 17 and the cover 15 are held in place by a fastening plate 23, as seen clearly also in FIG. 2.

Referring now to FIG. 2 as well as FIG. 1, heating elements 30 are shown positioned at the top of fuel supply chamber 21. The heating elements are conventional electrical elements with proper exterior insulation, having the function of raising the temperature of the fuel to the point of vaporizing same. The elements are located at the top of chamber 21 since, upon vaporization, the lighter vapor will fill the upper part of chamber 21, forcing the cooler and heavier kerosene to a lower level. The heating elements then heat the vapor to a superheated condition, raising the pressure of the vapor to approximately 1½ atmosphere. A typical configuration of the coils in shown by the dashed lines in FIG. 3.

Connecting with the upper portion of chamber 21 is a vapor supply line 31, which line is controlled by solenoid valve 32. As long as valve 32 remains closed, no vapor may continue to the end of the supply line 31, which is tipped by nozzle 35. When solenoid valve 32 opens, permitting flow therethrough, the vapor may pass to the end of supply line 31, where it is ejected out of nozzle 35 and into the combustion chamber 20. In order to provide an efficient distribution of the vapor spray within chamber 20, the diameter of chamber 20 may be suitably designed to be approximately one-half the length of the chamber.

Heating elements 30 are coupled to current carrying conductors 42 which are coupled through outer cylinder 16 at openings 41 to a power source 43. Adjacent vapor supply line 31 and near the inlet thereto is a thermostat 45, comprised of conventional thermistor or other temperature sensing elements. Thermostat 45 is connected through a coupling line 44 to conventional electronic switching circuitry 46 which in turn is connected through line 56 to and controls solenoid valve 32. Conventional spark supply apparatus 47 provides electrical energy to conventional spark generator 48 within the combustion chamber 20. The burner of my invention may be provided with a continuous spark or a discontinuous spark generator with a flame detector, depending upon the preference of the designer. Mounted at the back part of chamber 20, or the point of flame exit, are a series of fins 49 which are designed to control the form of the flame as it exits from the burner.

In operation, fuel is supplied from tank 25 through line 26 and into the fuel supply chamber 21. When the operation of the combustion burner is initiated, power is supplied to heating elements 30 which heat and vaporize kerosene in chamber 21. The vaporized kerosene will be blocked by solenoid valve 32 until thermostat 45 detects the existence of a predetermined temperature corresponding to vaporization of the kerosene. At this time, an electrical signal is sent to switching circuitry 46, which causes the solenoid valve 32 to switch into an open condition, permitting flow of vapor throughout the length of vapor supply tube 31 from whence it is discharged through nozzle 35 and sprayed into combustion chamber 20. Simultaneously with the operation of solenoid valve 32, the

spark supply apparatus **47** is energized, so as to provide sparks at spark generator **48** located within chamber **20**, thereby to commence combustion of the vaporized kerosene which mixes with air drawn in through inlet **11**.

With the commencement of combustion, the heat of combustion within chamber **20** begins to affect conditions within fuel supply chamber **21**, further raising the temperature there. When thermostat **45** detects a second predetermined temperature, signifying a high level of heat transfer from chamber **20** into chamber **21**, heating elements **30** are turned off, permitting steady state operation of the combustion chamber. From this time on, the heat of combustion maintains a supply of superheated vapor in chamber **21**, with such vapor being transmitted through vapor supply line **31** to nozzle **35**. The combustion creates a sufficient pressure differential between the chamber and the outside to continuously draw air in through inlet **11**.

As has been pointed out previously, switching circuitry **46** may be connected to receive external signals for regulation of the kerosene combustion burner. If an external signal is received calling for turning off the burner, the solenoid valve is closed, shutting off the supply of fuel to combustion chamber **20**, thus terminating the production of heat. With the loss of heat, the fuel in chamber **21** is not vaporized and there is accordingly no problem of excessive pressure build-up in that chamber. Further, as long as switching circuitry **46** has received an "off" signal, heating elements **30** are kept inactive, and are not re-energized until the burner receives an "on" signal.

From the above it is seen that the invention provides a highly efficient means of pre-vaporizing fuel and of obtaining very efficient combustion within the main chamber **20**. The vapor supply line **31** is placed on top of and adjacent to chamber **21**, such that there is effectively no loss of heat from the vapor in its travel to nozzle **35**. Once combustion has been achieved, the burner is self-sustaining, and heating elements **30**, no longer being necessary for vaporization, are turned off.

It is to be noted that control of the burner may be accomplished with various conventional techniques, while staying within the scope of the invention. Thus, two thermistors, or temperature sensitive devices, may be used in thermostat **45**, one to detect the temperature at which the valve **32** is to be opened, and one to detect the temperature at which the heating elements **30** are turned off. Each thermistor may be coupled separately through coupling line **44** to circuitry **46**, wherein two separate signal detectors would generate control signals corresponding to the respective detected temperatures. The heating elements may be controlled by a conventional relay which is operated by such a control signal.

I claim:

1. A combustion burner comprising:

a. a first inner cylinder, defining a combustion chamber within same and having an open input end and an open output end;

b. a second outer cylinder, positioned concentrically around said first inner cylinder, said first and second cylinders being of equal length and defining therebetween an annular space, said annular space being closed at both ends, thereby forming a fuel supply chamber;

c. fuel supply means for supplying fuel into said fuel supply chamber;

d. heating means adapted to be turned off in response to external control and having heating elements positioned within said fuel supply chamber, for supplying heat energy within said chamber for the initial vaporization of some of said fuel in said fuel supply chamber;

e. injection means communicating said combustion chamber input end with said fuel supply chamber for controllably feeding said vaporized fuel into said combustion chamber;

f. temperature sensing means positioned adjacent to said injection means for sensing the temperature of said vaporized fuel in said injection means, and controllably connected to said heating means so as to turn off said heating means upon achievement of a predetermined temperature of said vaporized fuel;

g. air intake means for supplying air into said input end;

h. sparking means for igniting said vaporized fuel fed into said combustion chamber in combination with said air to achieve combustion of said vaporized fuel; and

i. some of the heat of said combustion being communicated through said first cylinder to said fuel supply chamber, whereby the temperature of the vaporized fuel in said fuel chamber is raised to said predetermined temperature and steady state combustion is maintained with said heating means turned off.

2. The combustion burner described in claim **1** wherein said heating means comprises electrical heating elements connected to a source of electrical energy, said elements being located at the top of said fuel supply chamber.

3. A combustion burner comprising:

a. a first inner cylinder, defining a combustion chamber within same and having an open input end and an open output end;

b. a second outer cylinder, positioned concentrically around said first inner cylinder, said first and second cylinders being of equal length and defining therebetween an annular space, said annular space being closed at both ends, thereby forming a fuel supply chamber;

c. fuel supply means for supplying fuel into said fuel supply chamber;

d. heating means having heating elements positioned withing said fuel supply chamber, for supplying heat energy within said chamber for the vaporization of some of said fuel in said fuel supply chamber, said heating means comprising electrical heating elements connected to a source of electrical energy, said elements being located at the top of said fuel supply chamber;

e. injection means communicating said combustion chamber input end with said fuel supply chamber for controllably feeding said vaporized fuel into said combustion chamber, comprising a supply line communicating with the top of said fuel supply chamber near the end thereof adjacent to said output end, said supply line running longitudinally along the outer top of said second cylinder toward the input end of said combustion chamber, and terminating in a nozzle positioned to discharge said vaporized fuel into said combustion chamber, said supply line being controlled by a solenoid actuated valve;

f. temperature sensing means positioned adjacent to said injection means for sensing the temperature of said vaporized fuel in said injection means, and controllably connected to said heating means;

g. air intake means for supplying air into said input end; and,

h. sparking means for igniting said vaporized fuel fed into said combustion chamber in combination with said air.

4. The combustion burner described in claim **3** wherein said temperature sensing means comprises temperature sensitive electrical circuit elements positioned on the outside surface of said supply line near the point of communication of said supply line with said fuel supply chamber, and in heat transfer communication with the inside of said supply line.

5. A combustion burner as described in claim **4** wherein said temperature sensing means is electrically connected to said solenoid actuated valve and to said heating elements to open said solenoid actuated valve when said vapor temperature exceeds a first predetermined limit and to turn off said heating elements when said vapor temperature reaches a second predetermined limit.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,653,794 Dated April 4, 1972

Inventor(s) Hosein M. Shakiba

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, Line 26, change "expensive" to --inexpensive--.

Column 1, Line 34, change "is" to --its--.

Column 1, Line 35, after "with", delete "its".

Signed and sealed this 1st day of August 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents