United States Patent

Villini

[15] **3,653,795**

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

[54] **SURFACE BURNER SYSTEMS**

[72] Inventor: **Gregorio Villini,** Trieste, Italy

[73] Assignee: **Italo Pellizzetti,** Turin, Italy

[22] Filed: **Feb. 16, 1970**

[21] Appl. No.: **11,603**

[30] **Foreign Application Priority Data**

Feb. 18, 1969 Italy 60306

[52] **U.S. Cl.** **431/247**

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

[58] **Field of Search** 431/208, 247, 328, 123, 37

[56] **References Cited**

UNITED STATES PATENTS

1,409,918	3/1922	Brainerd	431/208
2,785,741	3/1957	Grauers	431/37 X
3,118,490	1/1964	Page-Roberts et al.	431/37
3,152,634	10/1964	Schotsman	431/208 X
3,329,139	7/1967	Vezzoli	431/208 X

Primary Examiner—Edward G. Favors

Attorney—Sughrue, Rothwell, Mion, Zinn and MacPeak

[57] **ABSTRACT**

A surface burner system designed to be fed by fuel in liquid form. There are a conventional mixing chamber having a panel through which a fuel-air gas mixture may pass for combustion at the panel surface, and a venturi into which air and gaseous fuel pass to enter the mixing chamber. The invention provides a vaporiser located near the panel and arranged to be heated by it. The vaporizer contains chamber in which liquid fuel under pressure boils, the vapor passing through an injector nozzle to reach the venturi tube. The flow from the injector nozzle to the venturi can be controlled by manual control means. An electrical resistor preheats the vaporizer body for start-up.

5 Claims, 8 Drawing Figures

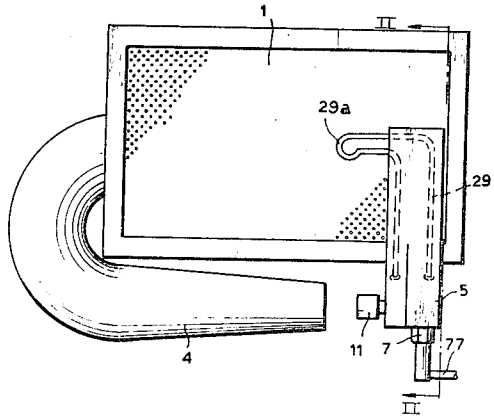


Fig.1

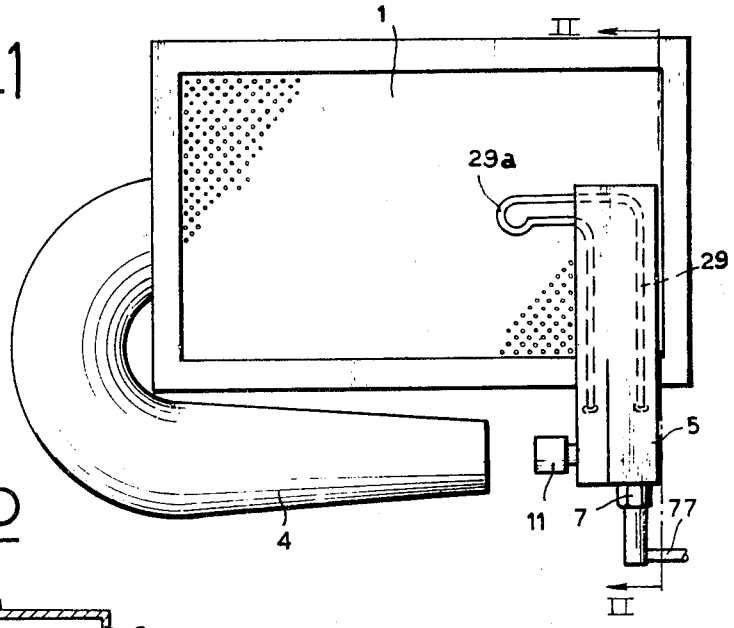


Fig.2

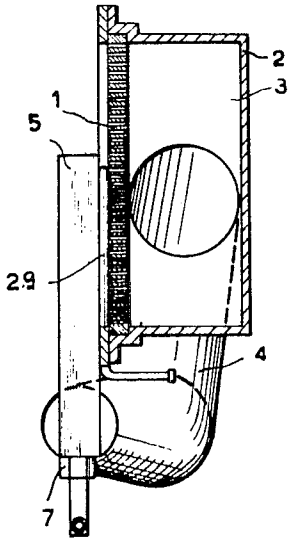


Fig.3

Fig. 6

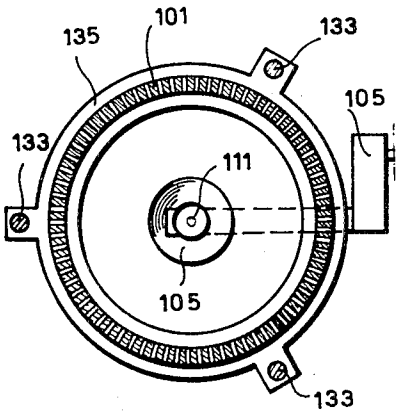


Fig. 5

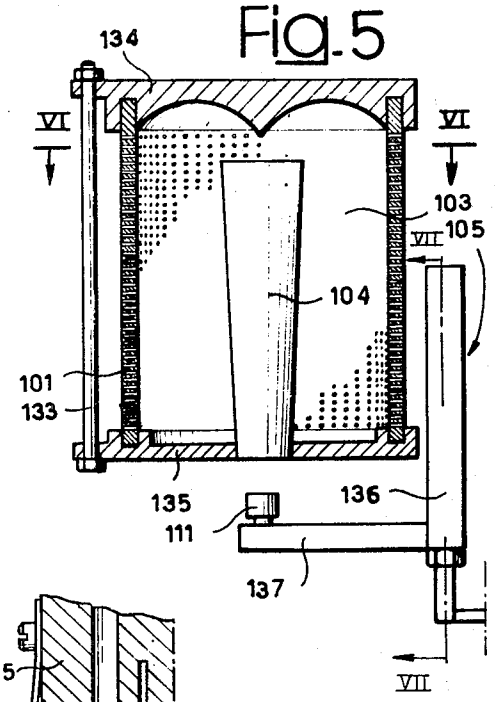


Fig. 4

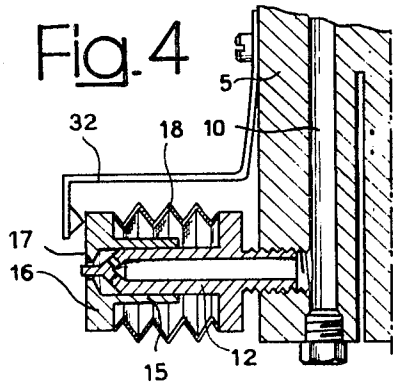


Fig. 7

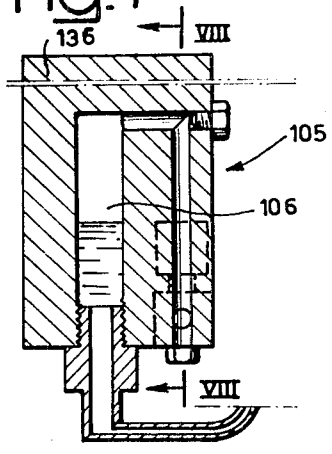
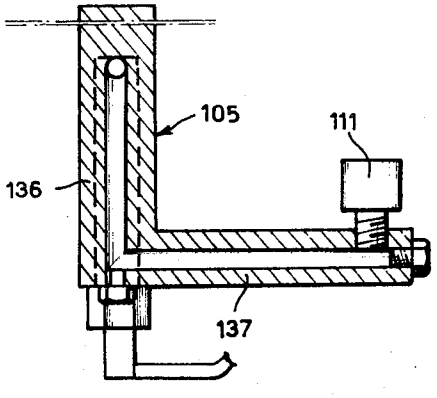


Fig. 8



SURFACE BURNER SYSTEMS

The invention relates to infra-red radiant gas burners of the type commonly used for domestic heating and comprising a mixing chamber to which a gaseous fuel is fed through a venturi tube to which the air of combustion is admitted. The fuel-air mixture is burnt externally of the surface of a porous or perforated heat-resistant panel which forms a wall of the mixing chamber. Passage of the mixture through the panel enhances the pre-mixing of the fuel with the air of combustion. The panel heats up and its incandescence promotes a sound, flameless combustion of the highest reaction efficiency.

Burners of the above-mentioned type have in the past been fed exclusively with fuel in gaseous form.

The invention provides a burner system of the abovementioned type modified for operation with liquid fuels such as kerosene or gasoil.

According to the invention, a surface burner system comprises in combination a mixing chamber having a wall in the form of a panel through which gas may pass and at which panel combustion is adapted to take place, a venturi tube leading into the mixing chamber and adapted to admit gasous fuel and air of combustion; a vaporiser body of heat-conductive material arranged adjacent the panel and adapted to be heated by the panel when the panel heats up, the vaporiser body having an internal cavity forming a vaporizing chamber, means for connecting the vaporizing chamber to a source of liquid fuel under pressure, injector means for feeding fuel vaporized in the vaporizing chamber to the venturi tube for admission to the mixing chamber, and means for controlling flow of the vaporized fuel through the injector means.

The invention will be described blow with reference to the accompanying semi-diagrammatic drawings which show:

FIG. **1** is a front elevational view of a surface burner,

FIG. **2** is a sectional view on line II—II of FIG. **1**,

FIG. **3** is a sectional view on an enlarged scale through a vaporizer as used in the burner of FIGS. **1** and **2**;

FIG. **4** is a fragmentary view similar to that of FIG. **3** and showing a modified embodiment of a vaporiser control as might be used in the burner of FIGS. **1** and **2**;

FIG. **5** is an axial sectional view of a modified embodiment burner

FIG. **6** is a sectional view on line VI—VI of FIG. **5**,

FIG. **7** is a sectional view on an enlarged scale on line VII—VII of FIG. **5**, and

FIG. **8** is a sectional view on line VIII—VIII of FIG. **7**.

In the embodiment shown in FIGS. **1** to **3**, **1** detones a perforated heat-resistant panel closing at the front a casing **2** of a mixing chamber **3** of a surface burner. A venturi tube **4** supplies a mixture of air of combustion and fuel vapor to the chamber **3**. A vaporizer body **5** made of heat-condcutive material, preferably stainless metal or a metal alloy such as an aluminum alloy is fixedly mounted nearly the panel **1**. The body **5** has an internal cavity forming a vaporizing chamber **6** (FIG. **3**).

A liquid fuel, preferably a hydrocarbon such as kerosene or gasoil is fed under pressure from a reservoir (not shown) through a conduit **77** and a connecting pipe **7** to the lower part of the vaporizing chamber **6**. When the panel **1** becomes incandescent on operation of the burner, it heats the vaporizer body **5** to a temperature such that the fuel in the chamber **6** boils. A level **8** is thus established in the chamber **6**, beneath which most of the fuel is liquid and above which the fuel is in a vaporized state. Under the pressure at which the liquid fuel enters the vaporizer, vaporized fuel is forced through conduits, **9**, **10** in the body **5** to an injector nozzle **11** which injects it into the venturi tube **4**. The section of the conduits **9**, **10** is substantially smaller, by at least one-half, than the cross-sectional area of the vaporizing chamber **6**. The nozzle **11** and its adjoining portion of the vaporizer body **5** are spaced far enough from the panel **1** to be at a lower temperature than the portion of the body **5** surrounding the vaporizing chamber **6**. A slot **5***a* in the body **5** impedes transmission of heat to the nozzle **11** from the hot portion of the body **5**.

As seen in FIG. **3**, the nozzle **11** comprises a cylindrical tube **12** provided with an end flange **12***a* and is bored for flow of vapor therethrough. It has a screw-threaded end upstream of the flange **12***a* for attachment to the body **5**. Its other end is closed by a tapered nose portion carrying at its tip a needle **13** and being pierced by a plurality of holes **14** for outflow of vapor.

A sleeve **15** is freely displaceable on the tube **12** and has a flanged end portion **16** centrally bored at **17**. The hole **17**, which functions as an injector orifice can receive the needle **13**.

The flanges **12***a* and **16** are sealing connected by bellows **18**, preferably of metal, which is resiliently collapsible and is connected to the flanges. The bellows seal between the tube **12** and sleeve **15** and then flanges **12***a* and **16** act as a resilient means biasing the sleeve **15** away from the flange **12***a*.

A lever **19** is articulated at **20** to a fixed support S and acts at one end through a contact **21** on the flange **16** of the sleeve **15**. The lever has articulated thereto at its end opposite the contact **21** a rod **24** including a screw-threaded portion **25** extending with a wide clearance through a hole in the support S. A knob **26** is threaded on the portion **25** and is provided with an extension **27** adapted to engage a stop **28** on the support S.

On temporarily moving the lever **19** in the direction of the arrow **22** by pulling the knob **26**, an operator moves the sleeve **15** towards the needle **13**, the orifice **17** engaging the needle **13** and being closed thereby. The orifice **17**, which may tend to clog with long use, can be cleaned even during operation of the burner by taking advantage of the thermal inertia of the incandescent panel **1** and the rapidity with which the knob **26** can be pulled outwards and then returned to its original positions intercepting supply of the fuel for a few seconds only.

Rapid and immediate closing of the injector orifice **17** causes a corresponding rise in the vapor pressure in the chamber **6**, causing liquid fuel to flow back rapidly through the supply conduit to the reservoir. This allows removal of any impurities which may have led to the formation of sludge in the vaporizing system and so making routine cleaning by conventional methods necessary only after relatively long intervals.

By screwing home the knob **26**, the supply of vaporized fuel to the venturi **4** is permanently intercepted and the burner is extinguished. This manner of control may be of advantage in preventing the delay in extinguishing the burner which might arise if the burner were extinguished by cutting off the supply from the reservoir to the vaporizer, since there would then be an inherent risk of contamination of the air surrounding the burner or the outside of the chimney flue (not illustrated) by unburnt gas passing from the vaporizer through the mixing chamber and panel **1**.

It is moreover possible to effect fine adjustment of the fuel supply, and hence of the rate of working of the burner, by gradually screwing the knob **26** inwards and stopping before the hole **17** has been fully closed by the needle **13**, under the action of the lever **19** and contact **21**.

To the burner, the body **5** of the vaporizer is heated to the boiling point of the fuel by means of an auxiliary electric resistor **29** (FIGS. **1** and **2**) arranged intermediate the vaporizer body **5** and panel **1**, having a portion **29***a* exposed on a panel portion which is not covered by the body **5**.

When the body **5** reaches the above-mentioned temperature, a thermostate **30** (FIG. **3**) opens an electrovalve **31** interposed in the supply conduit **77** to allow fuel to flow to the vaporizer and vapor to be injected into the venturi **4**.

The air-vapor mixture issues from the mixing chamber **3** through holes in the panel **1** and impinges upon the incandescent exposed resistor portion **29***a*, causing the mixture to ignite. A further thermostat (not shown) cuts out the circuit of the resistor **29** when the panel **1** is thoroughly ignited.

In the modified embodiment of the control means for the injector nozzle shown in FIG. **4**, a bimetal strip **32** fixed on the vaporizer body **5** acts on the flange **16** at the end of the sleeve **15** in order to cause the nozzle orifice **17** to open automatically at the fuel boiling temperature and reclose in the cold

condition of the vaporizer. Thus the free end of the strip moves away from the vaporizer body **5** when the strip heats, and returns in the opposite direction when the strip cools. An electric heater (not seen in FIG. **4**) heats the strip initially. Special closure means (not illustrated) may be provided to move the flange **16** back to the closed position of the injector **11** when the burner is to be extinguished, or a flow restriction member might be provided in the fuel supply systems for thus purpose.

In the embodiment of the burner shown in FIGS. **5** to **8** a mixing chamber **103** is defined by a cylindrical perforated panel **101** clamped by means of bolts **133** between two circular plates **134, 135**. The body of the vaporizer **105** is of L-shape and comprises a vertical section **136** adjacent to the panel **101** and enclosing a vaporizing chamber **106**, and a horizontal section **137** carrying an injector nozzle **111** aligned with a venturi tube **104** supplying the fuel mixture to the chamber **103**.

The burner system operates similarly to the previously described embodiment.

What I claim is:

1. A surface burner system comprising in combination a mixing chamber having a wall in the form of a panel through which gas may be passed and at which panel combustion is adapted to take place, a venturi tube leading into the mixing chamber and adapted to admit gaseous fuel and air of combustion, A vaporizer body of heat-conductive material arranged adjacent the panel and adapted to be heated by the panel when the panel heats up, the vaporizer body having an internal cavity forming a vaporizing chamber means for connecting the vaporizing chamber to a source of liquid fuel under pressure, injector means for feeding fuel vaporized in the vaporizing chamber to the venturi tube for admission to the mixing chamber, and means for controlling flow of the vaporized fuel through the injector means; said injector means comprising a bored tube secured to the vaporizer body having a perforated outer end for the outlet of vapor and a needle on such outer end, a sleeve slidable on the bored tube and having an injection orifice aligned with the needle and resilient means mounted between the bored tube and the sleeve and urging the sleeve into a position in which the injection orifice is clear of the needle, and said means for controlling the flow of the fuel through the injector means comprising means to move the sleeve axially on the bored tube to cause the injection orifice to receive the needle.

2. A burner system as claimed in claim **1**, in which the means to move the sleeve comprises a manually operated lever system.

3. A burner system as claimed in claim **2**, including screw means for operating the lever system.

4. A burner system as claimed in claim **1**, in which the means to move the sleeve comprises a bimetal strip secured to the vaporizer body.

5. A surface burner system comprising in combination a mixing chamber having a wall in the form of a panel through which gas may pass and at which panel combustion is adapted to take place, a Venturi tube leading into the mixing chamber and adapted to admit gaseous fuel and air of combustion, a vaporizer body of heat-conductive material having an upper part arranged adjacent the panel and adapted to be heated by the panel when the panel heats up, and a lower part located below the panel, the vaporizer body having an internal cavity forming a vaporizing chamber, means for connecting the vaporizing chamber to a source of liquid fuel under pressure, injector means for feeding fuel vaporized in the vaporizing chamber to the Venturi tube for admission to the mixing chamber, and means for controlling the flow of the vaporized fuel through the injector means; said lower part of said vaporizer body being comprised of closely spaced-apart first and second leg portions, the vaporizing chamber having an inlet for liquid fuel disposed in said first leg portion and said injector means being positioned on said second leg portion, whereby the vapor state of the fuel in the injector means is maintained at a temperature intermediate between that of the atmosphere and that of the upper part of the vaporizer body and higher than the temperature of the vaporizer body at the fuel inlet in the first leg portion.

* * * * *