

12

EUROPEAN PATENT APPLICATION

21 Application number: 81302847.9

51 Int. Cl.³: **F 24 H 1/18**
F 24 H 9/18, F 23 D 13/10

22 Date of filing: 24.06.81

30 Priority: 27.06.80 AU 4256/80

43 Date of publication of application:
06.01.82 Bulletin 82/1

64 Designated Contracting States:
AT BE CH DE FR GB IT LI NL

71 Applicant: **VULCAN AUSTRALIA LIMITED**
125 Highbury Road
Burwood Victoria(AU)

72 Inventor: **Trihey, John Massey**
89 Kalinda Road
Ringwood Victoria(AU)

74 Representative: **Boon, Graham Anthony et al,**
Elkington and Fife High Holborn House 52/54 High
Holborn
London, WC1V 6SH(GB)

54 A liquid heater and a gas burner therefor.

57 A liquid heater such as a domestic hot water heater which comprises a vessel (4), means defining a chamber (18) beneath the vessel, said chamber having a constricted outlet (44), and a gas burner assembly (26, 28) which in operation discharges combustion gases into the chamber at a sufficient pressure to force the combustion gases through said constricted outlet. Also disclosed is a gas burner (28) which is formed with a multiplicity of radially directed flutes (76) and between which are formed passages for secondary air.

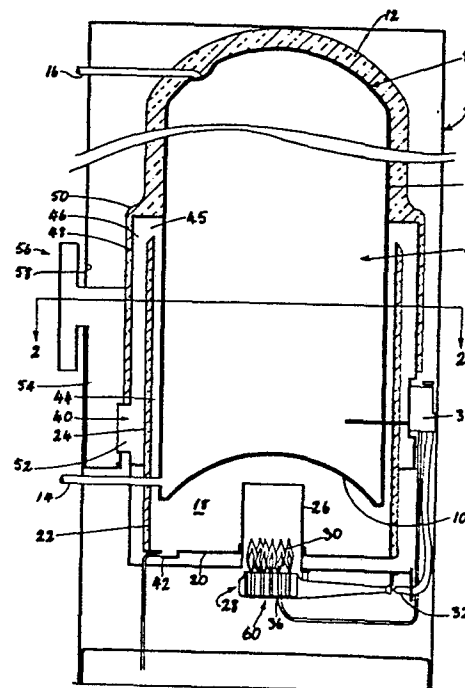


Fig 1

- 1 -

"A LIQUID HEATER AND A GAS BURNER THEREFOR"

This invention relates to a liquid heating device especially, but not exclusively, a domestic water heater. The invention also relates to a novel form of gas burner for use in the heater.

5 In gas fired liquid heaters, it is usually necessary to include an unimpeded flue path for combustion products to ensure reliable combustion of the gas. Unfortunately, considerable heat energy is lost through the flue path directly by the combustion
10 gases. Heat is also lost indirectly when the gas burner is not operating by convection currents which cause heat to be lost from the hot water. Normally, it is not possible to reduce the size of the flue outlet or form the flue in a tortuous path or in a path in
15 which the combustion gases must travel in a downward direction since a normal gas burner will not produce enough pressure to force the combustion products through the flue unless assisted by a fan. The general object of the present invention is to avoid the drawback noted
20 above by providing new combustion arrangements which operate at relatively high pressure and so can force the combustion products through a constricted flue outlet.

- 2 -

More specifically, the invention provides a gas fired liquid heater comprising a vessel, means defining a chamber beneath the vessel, said chamber having a constricted outlet, and a gas burner assembly 5 which in operation discharges combustion gases into the chamber at a sufficient pressure to force the combustion gases through said constricted outlet.

Preferably, the gas burner assembly includes a gas burner and a tubular member which extends into 10 the chamber, the arrangement being such that in operation flames from the gas burner heat said tubular member to an elevated temperature.

The invention also provides a gas burner comprising an annular base, an outer sidewall extending 15 upwardly from the outer periphery of the base, and an inner sidewall extending upwardly from the inner periphery of the base, said inner sidewall being formed with an array of inwardly directed flutes and interposed wall portions which lie adjacent to an upper part of 20 the outer sidewall, whereby said burner has a ring of gas openings defined by the upper edges of the flutes and by parts of the upper edge of said outer sidewall, there being air passages between adjacent flutes.

The invention will now be more fully 25 described with reference to the accompanying drawings, in which:

- 3 -

Figure 1 is a cross section through a preferred embodiment of the invention,

Figure 2 is a cross section along the line 2-2,

5 Figure 3 is a plan view of the gas burner of the invention, and

Figure 4 is a sectional view taken along the line 4-4.

The liquid heating device of the invention 10 comprises an outer housing 2 which is of generally rectangular cross section, as seen in Figure 2. Located within the housing is a pressure vessel 4 having cylindrical sidewall 6, a convex top 8 and concave bottom 10. The upper part of the sidewalls 6 15 and the top 8 are covered with a layer 12 of insulating material. The vessel 4 has a cold water inlet 14 and a hot water outlet 16 located near the bottom and top respectively of the vessel.

Located beneath the bottom 10 of the vessel 20 is a chamber 18 which is defined in part by the concave bottom 10 of the vessel, an annular plate 20 and the lower portion 22 of a cylindrical intermediate wall 24. The inner periphery of the annular plate 20 is connected to a tubular member 26 which is open at 25 both ends. A burner 28 is located just below the open end of the tubular member 26 and is arranged to produce an annular ring of flames 30 adjacent to the

- 4 -

inner surface of the member 26. The burner 28 is fed with gas from a jet 32, the supply of gas thereto being controlled by a gas regulator 34 which is of standard form. The burner 28 also includes a pilot burner assembly 36 which is also of standard form, and includes a pilot burner thermocouple and sparking electrodes.

The chamber 18 is closed except for the following openings: first, the opening at the lower end of the tubular member 26 where the burner 28 is located; secondly, a tortuous flue path 40 and thirdly relatively small condensation outlet 42. The flue path 40 comprises a first annular upward leg 44 which is defined between the sidewall 6 of the vessel and the intermediate wall 24. The cylindrical sidewall 24 may comprise a sheet metal inner wall, insulating material and a metal foil outer wall. The first leg 44 connects to a second downwardly extending leg 46 which is defined between the outer wall of the intermediate wall 24 and a sheet metal wall 48. The wall 48 is clad with insulating material 50.

The second leg 46 terminates in an outlet register 52 which opens into a duct 54 which extends upwardly and terminates in a balanced flue 56. As best seen in Figure 2, the duct 54 is located in one of the four corner spaces left within the housing 2 by the cylindrical vessel. The housing 2 includes air inlet openings 58 located adjacent to the flue 56 air from the openings 58 being free to move down towards the burner 28 in the free spaces defined between the

- 5 -

housing and the vessel. As will be described shortly, the burner 28 has a central opening 60 which serves as an opening for a substantial part of the secondary air inlet for combustion.

5 The operation of the heater is as follows. When the burner 28 is operating, the products of combustion are discharged into the chamber 18 where heat transfer to the bottom 10 and sidewalls 6 of the vessel takes place. Additionally, the flames 30 of
10 the burner raise the temperature of the tubular member 26 which in use preferably glows red hot. The member 26 tends to maintain the high temperature of the combustion gases and constrain them to move in a generally vertical direction. The member 26 could be
15 regarded as functioning like a short hot flue. The combined effect of burner 28 and the hot tubular member 26 increase the pressure within the chamber 18 to a sufficient extent that the products of combustion are forced through the tortuous flue path 40 which includes
20 the downward leg 46. It will be noted that heat transfer directly to the sidewalls of the vessel can take place as the combustion products pass through the first leg 44 of the path 40, as well as through the bottom 10.

 The liquid heater defined above has been
25 found to be very efficient in that when the burner 28 is operating there is a relatively large surface area available for heat transfer to the water vessel 4 and when the burner 28 is not operating, the tortuous flue path 40 substantially prevents any flow of convection
30 currents through the flue path 40, the hot gases being

- 6 -

trapped in the transition region 45 between the first leg 44 and the second leg 46 of the flue path. In fact, the arrangement is so efficient that the pilot tube 36 can be adjusted so that it can make up the heat losses 5 which would be due to the very small loss which occurs from the flue 56 and from the housing 2.

Figures 3 and 4 illustrate the burner 28 of the invention. The burner has an annular base wall 64 formed with an upturned lip 68 on its inner periphery. 10 The outer periphery of the base is formed into a cylindrical wall 70 which steps inwardly to a reduced diameter upper portion 72. The burner includes a sheet metal member 74 which is folded so as to have a plurality of radially inwardly extending flutes 76. 15 Those portions of the member 74 which do not form the flutes 76 lie adjacent to the reduced diameter portion 72 of the sidewalls of the burner. The member 74 rests on an annular gasket 75. Gas is supplied to the burner 28 via a supply pipe 78 and circulates about 20 the burner through the toroidal chamber 77 formed between the sidewalls 70 and the member 74. The gas then flows in a generally vertical direction and issues from the upper parts of the flutes 76. When the burner is operating, secondary air is drawn from the outer 25 periphery of the burner and through the central opening 60 of the burner and is then free to pass into the spaces between adjacent flutes thereby enabling very efficient combustion to take place. As seen in Figure 3 the pilot assembly 36 partially obstructs the 30 opening 60, thus assisting in maintaining the chamber at a higher pressure when the main burner is operating.

- 7 -

A prototype of the invention has been tested and found to perform in a very efficient manner. The prototype included a vessel which was approximately 380mm in diameter. In that arrangement the tube member 5 26 was constructed of stainless steel and approximately 120mm in width 150mm in length and its top located about 50mm from the concave bottom 10 of the vessel. The first leg 44 of the flue path was about 500mm in axial length and approximately 8mm in width whereas the 10 second leg 46 was approximately 20mm in width. The pressure within the chamber 18 was measured to be about 0.015 inches of water gauge above the air pressure within the housing when the burner 28 was operating at 25 mj input.

15 Many modifications will be apparent to those skilled in the art without departing from the spirit and scope of the invention. For instance, the duct 54 could be omitted and the register 52 open directly to atmosphere.

- 1. -

CLAIMS:

1. A gas fired liquid heater comprising a vessel (4), means defining a chamber (18) beneath the vessel, said chamber having a constricted outlet (44), and a gas burner assembly (26, 28) characterised in that the gas burner assembly in operation discharges combustion gases into the chamber at a sufficient pressure to force the combustion gases through said constricted outlet.
2. A heater as claimed in Claim 1 wherein the outlet opens to a flue path which includes first and second legs (44, 46) characterised in that the arrangement is such that in operation the combustion gases move upwardly in the first leg and downwardly in the second leg.
3. A heater as claimed in Claim 1 or 2 wherein the gas burner assembly includes a gas burner (28) and a tubular member (26) characterised in that the tubular member extends into the chamber and in that, in operation, flames (30) from the gas burner heat said tubular member to an elevated temperature.
4. A heater as claimed in Claim 3 wherein said tubular member functions as a short hot flue.
5. A heater as claimed in Claim 2 or 3 wherein the burner includes combustible gas outlet means (72, 74) characterised in that the gas outlet means produces an annular ring of flame, said ring of flame being located adjacent to the inner wall of said tubular member.
6. A heater as claimed in Claim 2, 3 or 4 characterised in that said tubular member is made from stainless steel.

- 2. -

7. A heater as claimed in any preceding claim wherein the vessel has a bottom wall (10) characterised in that said bottom wall defines the upper periphery of the chamber.

8. A heater as claimed in Claim 7 characterised in that the vessel includes a sidewall (6) which defines part of the first leg (44) of said flue path.

9. A heater as claimed in Claim 8 characterised in that the vessel is cylindrical and includes a layer (24) of insulation between the first leg and the second leg of said flue path.

10. A heater as claimed in Claims 7, 8 or 9 characterised by the provision of a balanced flue (56) located at the end of said flue path.

11. A heater as claimed in Claim 10 wherein the vessel is located in a housing (2) which is generally rectangular in cross section, characterised in that the balanced flue is located near one corner of the housing, said flue path including a third leg (54), which extends upwardly from an outlet of the second leg to the balanced flue.

12. A heater as claimed in Claim 5 characterised in that the combustible gas outlet means includes a ring of gas openings and upwardly extending air passages between adjacent openings.

13. A heater as claimed in Claim 12 wherein the burner has an annular base (66), and outer sidewall (70, 72) extending upwardly from the base and an inner sidewall (74), extending upwardly from the inner periphery of the base, characterised in that the inner

sidewall is formed with an array of radially directed flutes (76) and interposed wall portions which lie adjacent to an upper part (72) of outer sidewall whereby each of said gas openings is defined by the upper edge of said flutes and a portion of the upper edge of said outer sidewall.

14. A heater as claimed in Claim 13 characterised in that the lower part (70) of the outer sidewall is of wider diameter than the upper part (72), the lower part, together with the base and lower part of the inner sidewall (74) defining a generally toroidal gas supply passage (77).

15. A gas burner comprising an annular base (66), an outer sidewall (70, 72) extending upwardly from the outer periphery of the base and an inner sidewall (74), extending upwardly from the inner periphery of the base characterised in that said inner sidewall is formed with an array of inwardly directed flutes (76) and interposed wall portions which lie adjacent to an upper part (72) of the outer sidewall, whereby said burner has a ring of gas openings defined by the upper edges of the flutes and by parts of the upper edge of said outer sidewall, there being air passages between adjacent flutes.

1/3

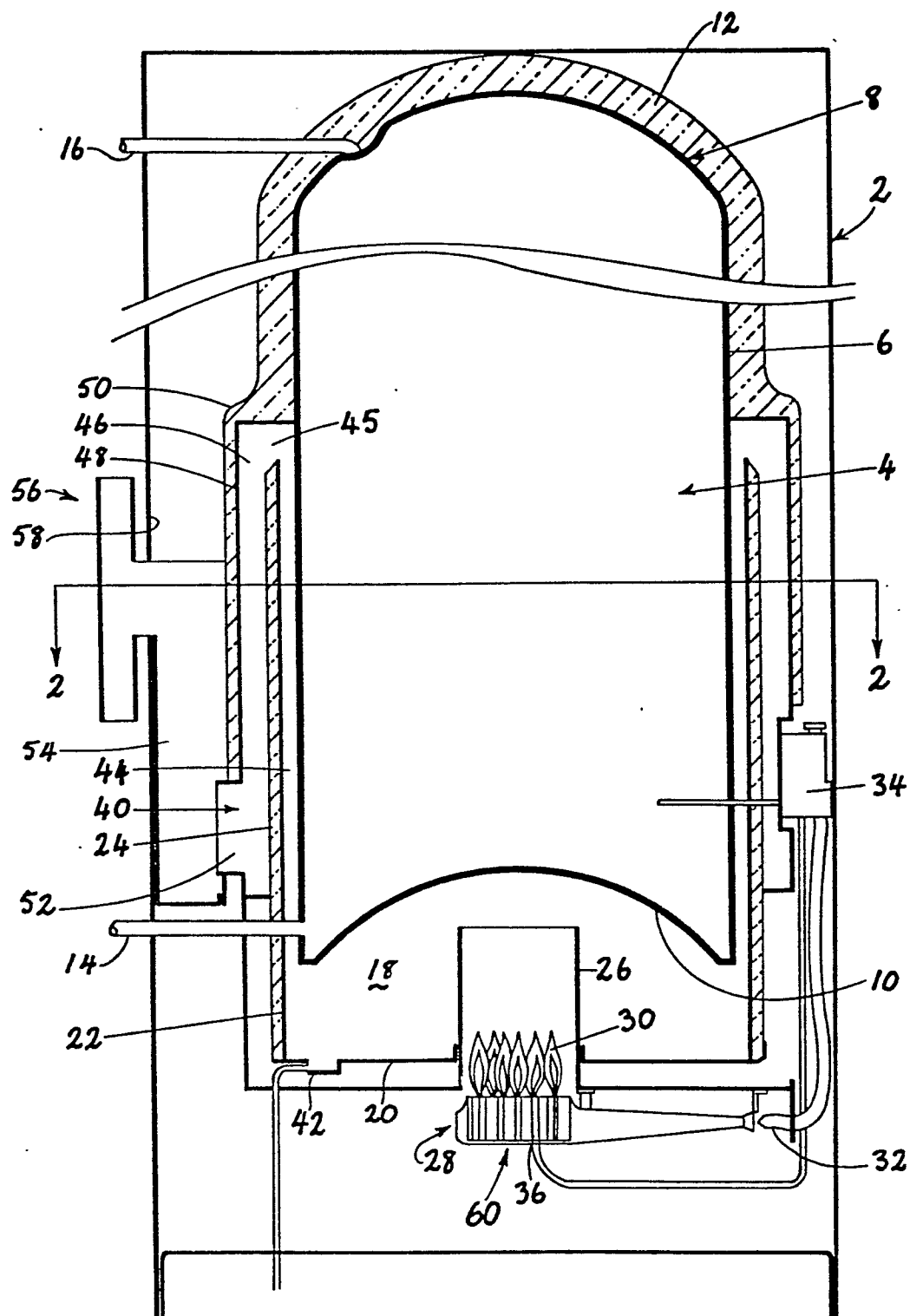
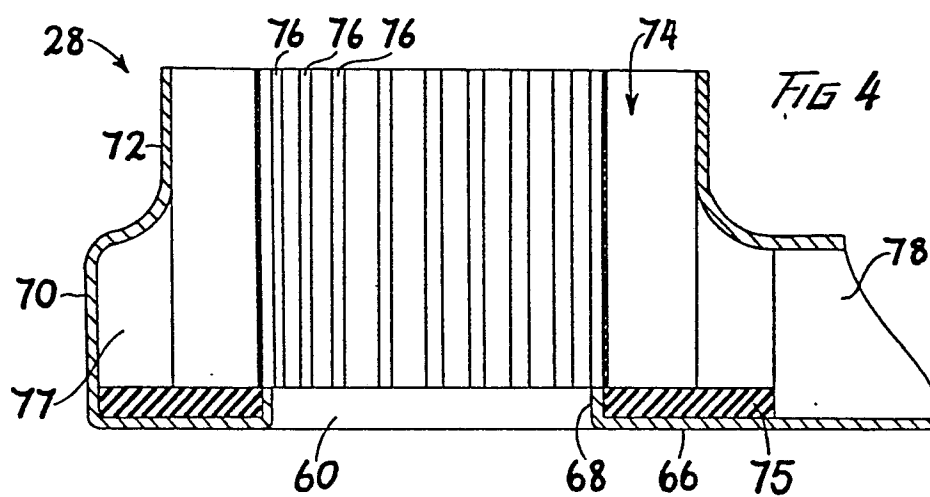
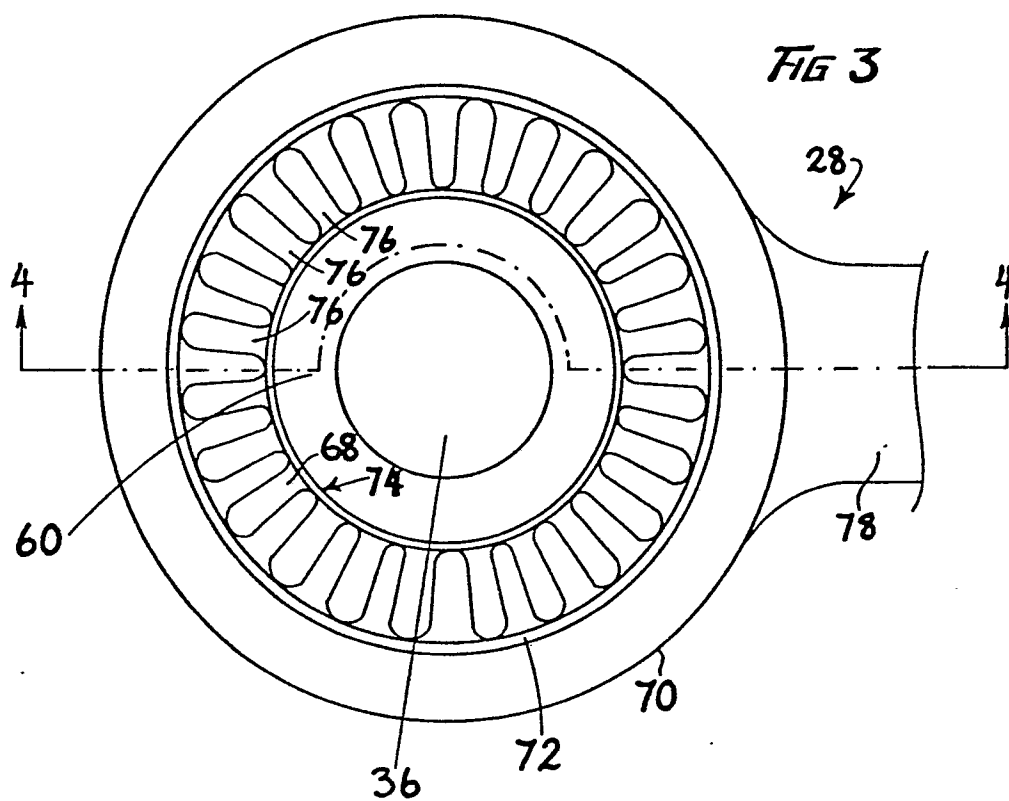


FIG I

3/3





European Patent
Office

EUROPEAN SEARCH REPORT

0043232

Application number

EP 81 30 2847

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>US - A - 2 487 705 (HANDLEY)</u> * Column 2, lines 23-38; figures * ---	1,2,7-9	F 24 H 1/18 F 24 H 9/18 F 23 D 13/10
	<u>US - A - 1 618 735 (STOREY)</u> * Page 1, lines 27-70; figures * ---	1,2,8,9	
	<u>GB - A - 2 007 341 (MITSUBISHI)</u> * Abstract; figure 2 * ---	1,7,10	
	<u>CA - A - 901 414 (CARTER)</u> * Claim 1 * ---	1,10,11	TECHNICAL FIELDS SEARCHED (Int. Cl.) F 24 H F 23 D
	<u>FR - A - 1 447 396 (THERMOR)</u> * Page 2, right-hand column, paragraph 2; figure 2 * ---	3-5	
	<u>DE - C - 527 194 (V. LINDE)</u> * Page 2, lines 93-96; figure 2 * ---	3,4	
	<u>US - A - 2 610 675 (DOWNE)</u> - Column 2, line 30 to column 3, line 24; figures 1-4 * -----	5,12,15	CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
☒ The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	28.09.1981	VAN GESTEL	