United States Patent [19]

Sanderson et al.

[11] **3,920,375**

[45] **Nov. 18, 1975**

[54] **BURNER UNITS FOR GAS APPLIANCES**

[75] Inventors: **Neville Edward Sanderson; Bertram Benjamin Youngs,** both of Lowestoft, England

[73] Assignee: **British Domestic Appliances Limited,** Petersborough, England

[22] Filed: **Dec. 4, 1973**

[21] Appl. No.: **421,611**

[52] **U.S. Cl.** **431/78;** 62/148; 431/264; 431/346

[51] **Int. Cl.²** **F23H 5/00**

[58] **Field of Search** 431/346, 350, 264, 78, 431/80, 13; 62/148

[56] **References Cited**

UNITED STATES PATENTS

2,720,851	10/1955	Strunsky	110/119
3,006,408	10/1961	Shepherd	431/346
3,094,978	6/1963	McCray et al.	431/346 X
3,236,284	2/1966	Kemper	431/13
3,364,393	1/1968	Rabe	431/264 X
3,370,436	2/1968	Romanelli	62/148
3,649,156	3/1972	Conner	431/78
3,718,423	2/1973	Matthews	431/264

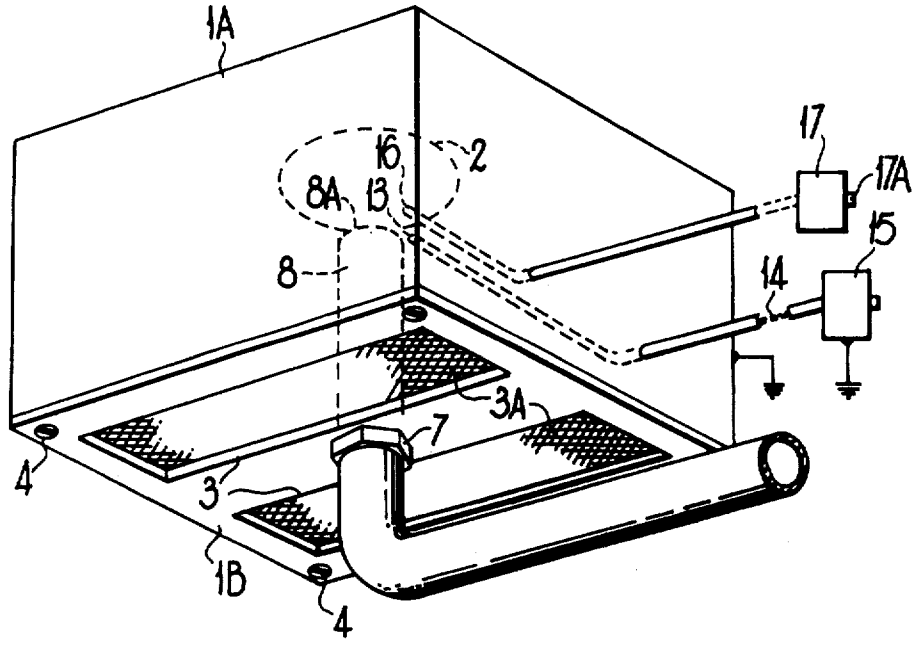
Primary Examiner—Edward G. Favors

Attorney, Agent, or Firm—Kirschstein, Kirschstein, Ottinger & Frank

[57] **ABSTRACT**

A burner unit for gas appliances, more especially gas operated refrigerators, for use in place where an explosive gas or vapour may be encountered, comprises a burner located within a casing having an air intake covered by a fine mesh, and ignition means for the burner also located within the casing but operable from outside the casing.

17 Claims, 8 Drawing Figures



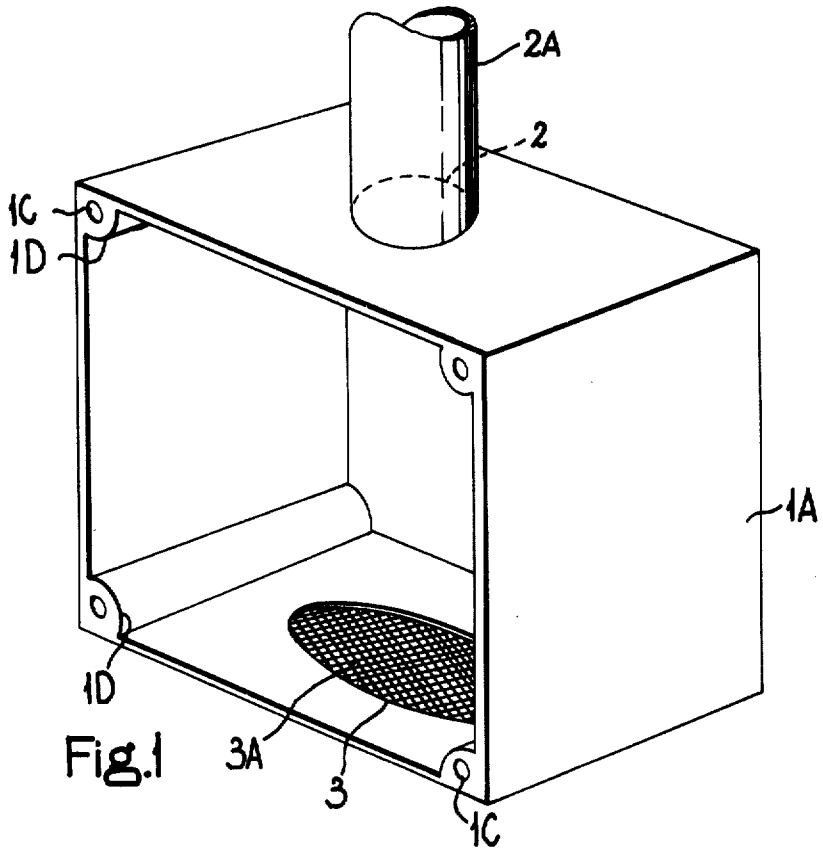


Fig.1

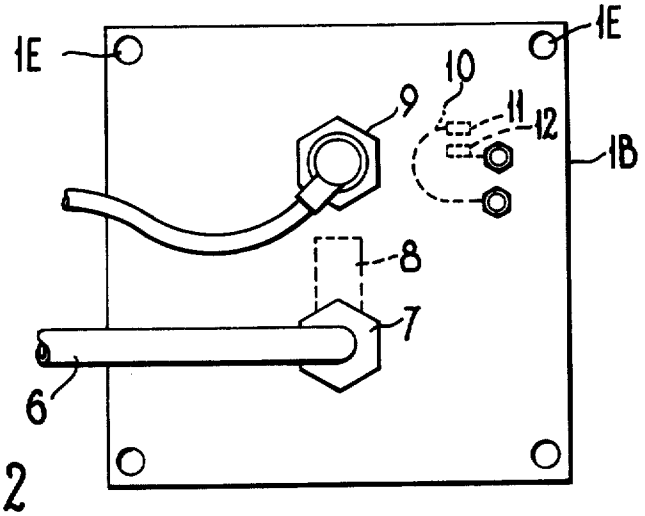


Fig.2

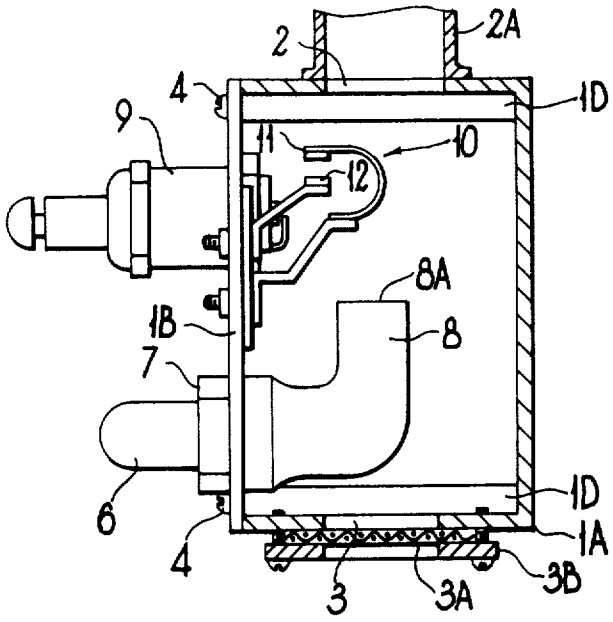

2
2A
4
1D
9
11
10
12
8A
1B
8
7
1D
6
1A
4
3
3A
3B

Fig.3

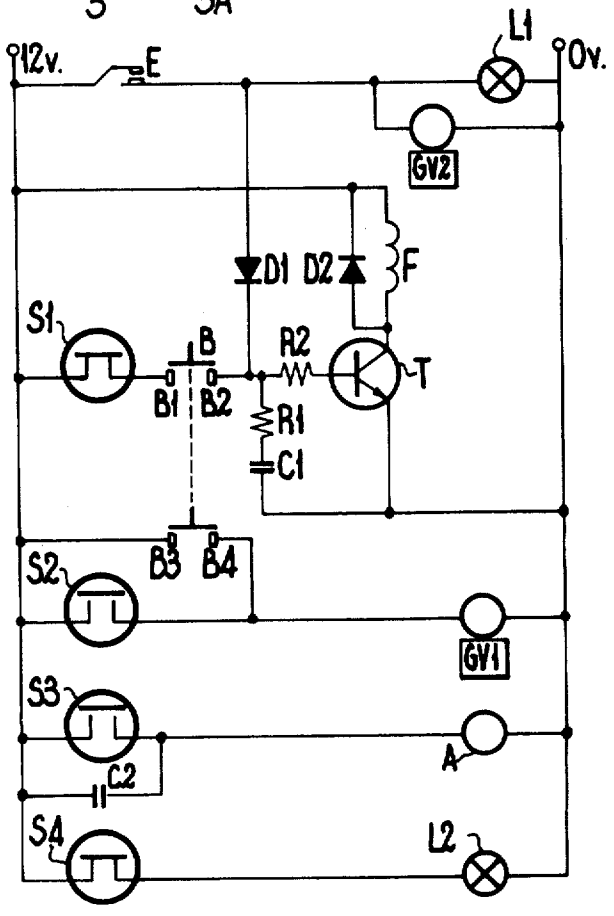

12v.
E
L1
0v.
GV2
D1
D2
F
S1
B
R2
T
B1
B2
R1
C1
B3
B4
S2
GV1
S3
A
C2
S4
L2

Fig.4

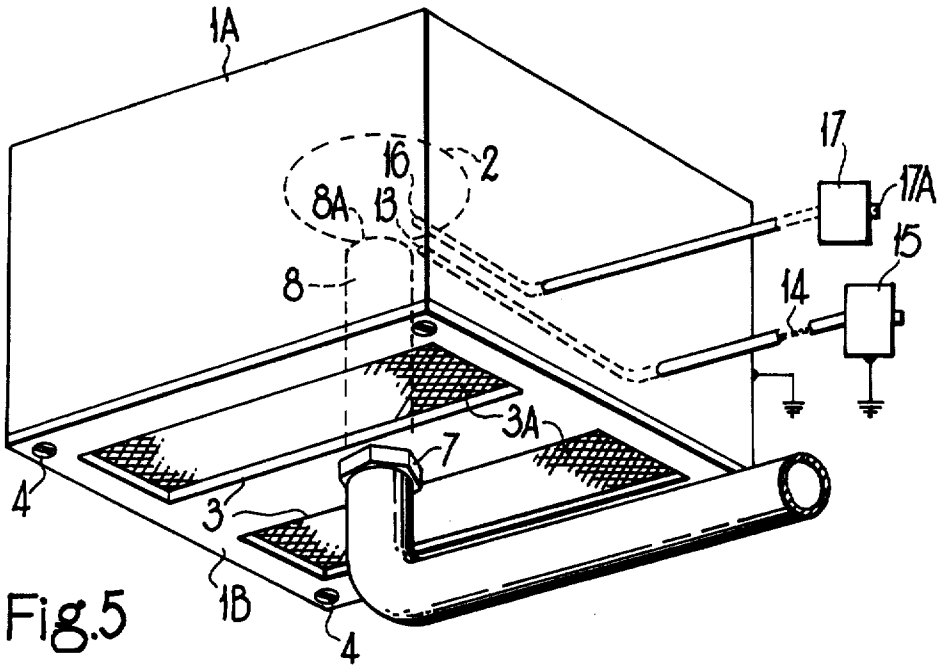


Fig.5

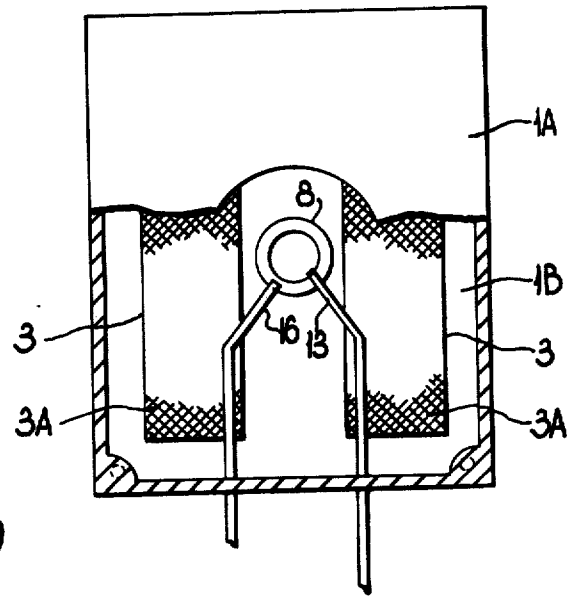
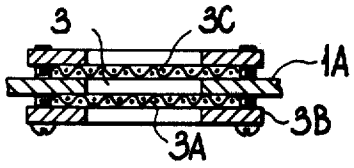


Fig.6

Fig.7



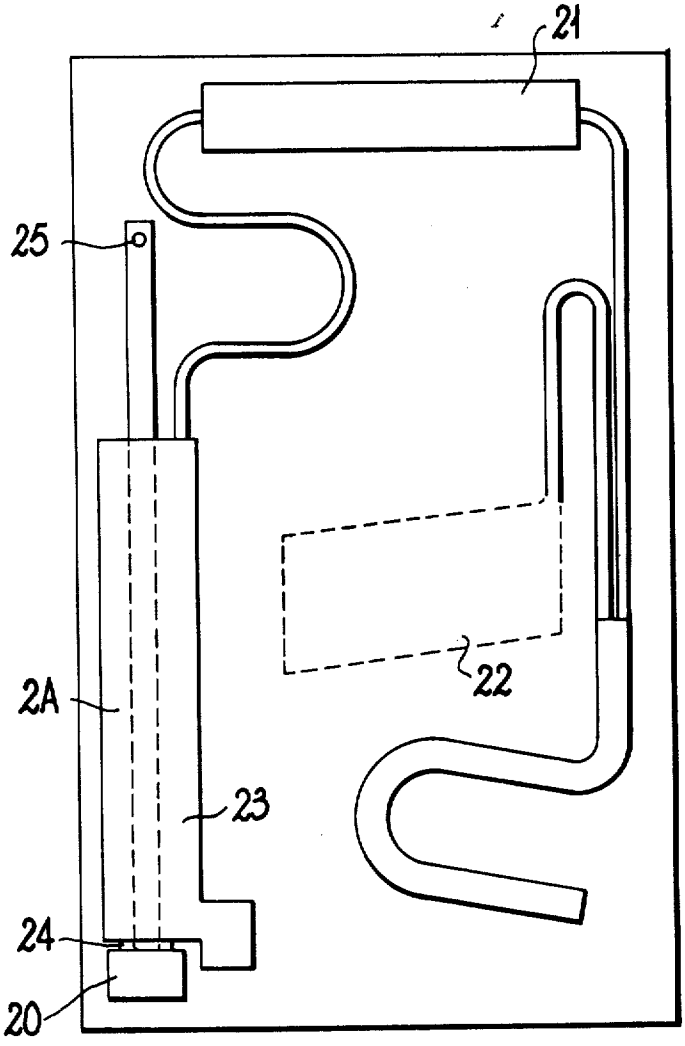


Fig.8

BURNER UNITS FOR GAS APPLIANCES

This invention relates to burner units for gas appliances, more especially those which are required to be installed in places where explosive gases or vapours may be encountered, for example in motorised boats.

Thus it sometimes occurs that petrol seeps from the engine of such a boat or is accidentally spilt into the bilges. The fumes from the petrol being denser than air, form a layer in the bilges which may not be noticed, and if a naked flame is brought into contact with such a layer it will cause an explosion which could be very dangerous. It is now quite common for gas-operated absorption type refrigerators to be installed in motorised boats, and such a refrigerator necessarily incorporates a gas burner to provide the heat source needed to operate the refrigerator. To reduce the risk of the burner flame coming into contact with explosive fumes it has been proposed to have the burner enclosed, with an air intake pipe to the enclosure extending through the hull of the boat. However such an air intake is subject to turbulence in wind which can cause the burner flame to be continually blown out. This problem is only partially overcome by using a vertical pipe through the hull roof as the air inlet pipe, which in any case uses up valuable space.

It is therefore an object of this invention to provide a safe and effective burner unit for gas appliances, especially refrigerators, designed for use in places where explosive gas or vapour may be encountered, and which does not take up a large amount of space.

According, therefore, to the invention a burner unit for a gas appliance comprises an enclosure, a gas burner within the enclosure, a gas inlet pipe extending through a wall of the enclosure to the burner, ignition means located within the enclosure and operable from outside the enclosure to ignite the burner when gas is supplied thereto, a flue outlet for carrying away burnt gases from the enclosure, an air intake for admitting air into the enclosure, and a fine mesh extending across the air intake.

If any explosive gas or vapour should build up about and within such a burner unit, this will cause only a small explosion within the enclosure which, although it may extinguish the burner flame, will be prevented from igniting the surrounding gas or vapour by the fine mesh across the air intake, it being understood that the term fine mesh means a mesh of sufficiently fine aperture size that the passage of a flame therethrough is effectively prevented.

Similarly the initial or re-ignition of the burner within the enclosure can be effected without the risk of an external explosion.

Where the flue outlet is in the form of, or is connected to, a pipe carrying the gases well away from the burner unit, as will usually be the case, we have found that there is little risk of explosive gases entering the burner unit via the flue, but a further fine mesh can be fitted across the flue if desired.

The ignition means may take the form of a spark gap located adjacent the burner, a voltage generating means such as an ignition coil, or piezo-electric unit being provided for producing a spark between the spark gap electrodes, one of which may be provided by part of the burner itself. Alternatively the ignition means may take the form of a wire located adjacent the burner and heatable by the passage of an electric current to a temperature sufficient to ignite gas from the burner.

The enclosure may be provided with a removable panel attachable in a gas tight manner to the rest of the enclosure to provide access to the interior thereof for servicing, the burner conveniently being carried by the panel, which may provide substantially the whole of one wall of the enclosure. An electrode which co-operates with the burner to form a spark gap for igniting gas from the burner is then conveniently carried by the main part of the enclosure, so that the ignition means cannot be operated to produce a spark when the enclosure is opened by the removal of the panel carrying the burner.

Advantageously the burner unit incorporates a gas cut-off device for the burner, arranged to operate to cut off the supply of gas thereto when the burner flame is extinguished.

The burner may, for example, be controllable by an electrical circuit having a starting switch which, upon closure, results in the opening of a gas valve to supply gas to the burner and also results in operation of the ignition means, the circuit incorporating a temperature-controlled switch operable in response to heat from the burner flame to maintain the gas valve in the open condition despite subsequent opening of the starting switch, and to effect the closure of the gas valve in the event of the burner flame being extinguished.

Preferably, however, there are provided a thermally responsive actuating device operable on a gas valve supplying gas to the burner to maintain it in the open condition when the burner is ignited, but which causes or permits the valve to close when the burner flame is extinguished, and means for permitting gas to be supplied to the burner during operation of the ignition means and for a period sufficient to enable the thermally responsive means to open the gas valve.

Preferably the burner unit has associated with it a warning device to show when the burner is extinguished and possibly also an indicating device to indicate when the burner is functioning.

The invention is particularly applicable to burner units for gas-operated absorption type refrigerators designed for use on boats, although the invention may also be employed to advantage in other forms of gas appliances which may be required to be operated in places where explosive gases or vapours might be encountered.

In order that the invention may be more easily understood, two forms of burner unit in accordance with the invention suitable for use in a gas operated absorption type refrigerator will now be described, by way of illustration only, with reference to FIGS. **1** to **8** of the accompanying schematic drawings, in which:

FIG. **1** is a perspective view, in diagrammatic form, of part of the casing of one burner unit in accordance with the invention with a detachable panel removed,

FIG. **2** is a diagrammatic view of the exterior of the detachable panel,

FIG. **3** is a sectional view of the assembled burner unit,

FIG. **4** shows electrical circuitry associated with the burner unit,

FIG. **5** is a perspective view, from below, of the second burner unit,

FIG. **6** is a part sectional plan view of this second burner unit,

FIG. **7** illustrates a modification, and

FIG. 8 is a rear view of one form of absorption type refrigerator incorporating a burner unit in accordance with the invention.

The first burner unit illustrated in FIGS. 1 to 3 has a casing in the form of a rectangular section box comprising a main part **1A**, as shown in FIG. 1, which provides the top, bottom and three sides of the casing, and a removable panel **1B**, shown in FIG. 2, which provides the remaining side of the casing and carries the burner **8**, the panel being securable to the main part of the casing in a gas-tight manner.

For this purpose tapped holes **1C** are provided within fillets in the corners of the main part **1A** of the casing, to permit the panel **1B**, which is provided with similarly positioned holes **1E** adjacent its corners, to be clamped in position over the open side of the main part **1A** by screws **4** (FIG. 3).

An opening **2** is provided centrally in the top of the main part of the casing, above the burner jet, to permit burnt gases to be carried away from the interior of the casing through a flue pipe **2A** secured in a gas-tight manner to the wall of the casing around the opening and projecting upwards therefrom.

The base of the main part **1A** of the casing has an opening **3** which provides the air-inlet, and this has extending across it a fine wire mesh **3A** held in place in any suitable manner, for example by means of an apertured plate **3B** screwed to the base of the casing as shown in FIG. 3, the mesh conveniently being formed of 37 gauge 60 mesh stainless steel gauze.

A gas inlet pipe **6** leads, via a gas-tight screw connection **7**, through the panel to the burner **8**. A sparking plug **9** is also carried by the panel adjacent the burner jet **8A**, and voltage generating means, such as an ignition coil (not shown), is connected to the sparking plug electrodes for generating between them a spark which is capable of igniting gas issuing from the burner. Close to the burner jet **8A** is a bimetallic strip **10** carrying a contact **11** which coacts with a fixed contact **12**, and whose function will be subsequently described.

The electrical connections associated with the burner unit are arranged as shown in FIG. **4**, and are such that when a starting switch in the form of an ignition button B is depressed, thereby electrically connecting pairs of contacts B1 and B2 and B3 and B4, a bias voltage is applied to the base of a transistor T, which bias voltage rises as the charge on a capacitor C1 increases until the capacitor becomes fully charged, and a current flows through a relay F; the latter then operates switches **S1, S2, S3** and **S4** such that **S1** and **S4**, which are normally closed, are opened, and **S2** and **S3** which are normally open, are closed. The transistor remains biased (and hence the relay is kept operating), even though switch **S1** is now open, by virtue of the discharge of the capacitor **C1** which was charged while **S1** and B were both closed. Diode **D2** minimises the effect of the back EMF generated by the relay F. By the operation of button B, switch **S2** is by-passed and a gas valve **GV1** is opened, thereby allowing gas to flow to the burner **8**. The closure of switch **S3** causes a capacitor **C2** (which prevents sparking at the switch **S3**) to discharge, and the current increases in the primary winding of an ignition coil A causing a spark at the sparking plug attached to the secondary winding. The opening of switch **S4** causes a red lamp **L2** to be extinguished. When the capacitor **C1** becomes discharged sufficiently so that there is no operation bias to the transistor T, the relay ceases to function and the switches **S1, S2, S3** and **S4** return to their previous states, and the capacitor **C2** again becomes charged.

If the gas from the burner has been ignited by the spark, the heat of the flame results in the closure of a bimetallic switch E provided by the contacts **11** and **12** of FIG. 1 to complete the circuit through a diode **D1** and, hence, the transistor T is biased on so that it continues to conduct. Therefore, whilst the transistor T is biased on, the relay is operative, switches **S1** and **S4** are opened, and switches **S2** and **S3** are closed and hence, gas flows through the gas valve **GV1** to burner **8**, the capacitor **C2** is discharged, the red lamp **L2** is extinguished and, in addition, a green lamp **L1** is lit.

If, however, the gas has not been ignited by the spark then, when the switches **S1, S2, S3** and **S4** have returned to their previous states, the whole sequence is repeated until such time as the gas is ignited or until the button B is returned to the off position.

Thus, the red light indicates when the gas has not been ignited, the green light indicates when it has been ignited, and no light at all indicates a circuitry breakdown such as battery failure.

This arrangement as described above is ideally suited to refrigerators, for use on motorised boats, where petrol fumes can build up, particularly in the bilges, and make a naked flame dangerous. However with the burner contained in the box of the burner unit, and the air inlet covered by a fine mesh as described above, there can be no flash-back from any explosion of petrol fumes within the box, and thus all that may occur is the extinguishing of the burner. The operator of the boat can see that lamp **L1** is extinguished and that red lamp **L2** is lit to indicate that the burner has gone out because of an explosion (or failure of the gas supply). In this state, of course, the relay will have ceased to function and thus, in particular, switch **S2** will be open and the gas supply to the burner will be cut off. The burner can be re-ignited as above described, again without any risk of causing a major explosion.

The switch E may, if desired, be replaced by a thermistor as this is more sensitive to temperature change or by any other suitable form of temperature sensitive device. Moreover alternative forms of starting circuits can clearly be employed if desired.

The second burner unit illustrated in FIGS. **5** and **6** similarly comprises a casing in the form of a rectangular section box. In this case, however, the main part **1A** of the box forms the four sides and top of the box, and a removable panel **1B** carrying the burner **8** provides the bottom wall of the box, being securable to the main part **1A** in a gas-tight manner by means of four screws **4** in a similar manner to that of the unit previously described.

A gas inlet pipe **6** leads, via a gas-tight screw-connection **7**, through the centre of the panel to the burner **8**, an opening **2** being provided centrally in the top wall of the casing above the burner jet, to permit burnt gases to be carried away from the interior of the casing through a flue pipe (not shown), arranged to be secured in a gas-tight manner to the casing around the opening.

The removable panel **1B**, forming the base of the casing, has two rectangular openings **3** lying one on each side of the connection **7**, each of these openings having a fine wire mesh **3A** extending across it as shown.

An electrode **13** is insulatingly supported by a side wall of the casing so as to terminate adjacent the burner jet **8A**, and is connected via a lead **14** to a piezo-electric igniter, shown schematically at **15**, the burner **8** it-

self providing a co-operating electrode such that when the piezo-electric igniter is operated a spark is generated between the electrode **13** and the burner sufficient to ignite gas issuing from the burner.

A flame sensor **16** is also supported by the side wall of the casing so as to be adjacent the burner jet **8A**, and operates directly on a gas valve controlling the supply of gas to the burner and shown schematically at **17**.

The valve **17** is also openable by a push-button **17A** to enable gas to be supplied to the burner in order that it may be ignited before the flame sensor **16** has been heated sufficiently to hold the valve open.

Thus with the button **17A** of the valve **17** depressed the piezo-electric igniter **15** is operated to generate a spark to ignite the burner, the button of the valve being held depressed for a short period sufficient to enable the flame sensor **16** to maintain the valve **17** in the open condition when sufficiently heated by the burner flame.

If the burner flame should be extinguished for any reason the flame sensor **16** will cause the valve to close, the valve conveniently being associated with some form of a visual indicator for indicating when the valve has moved to the closed position and thereby giving a warning that the burner flame has been extinguished. Such an indicator might, for example, be provided by the push button itself, which may, in such a case, be held in when the valve is open but arranged to return to the 'out' position when the valve is closed by the flame sensor due to the burner flame bieng extinguished, the button conveniently being brightly coloured so that the condition of the valve, and hence of the burner, is readily recognisable.

It will be seen that as in the previous example the presence of the fine mesh **3A** across the air inlet **3** ensures that should petrol fumes build up around the burner unit any explosion will be confined to the burner casing, and ignition of the burner, should the burner flame be extinguished, can also be effected with complete safety.

In either of the two embodiments described the fine wire mesh **3A** across the air inlet **3** may be augmented by a further fine wire mesh also supported across the inlet and spaced slightly form the first, for example a distance of the order of one-eighth to one-fourth inch to give additional protection if desired, for example as shown at **3C** in FIG. **7**.

FIG. **8** represents diagrammatically a rear view of a gas operated absorption-type refrigerator fitted with a burner unit **20** in accordance with the invention and which may be of either of the forms described above by way of example; the refrigerator comprises, in known manner, a condenser and evaporator shown diagrammatically at **21** and **22**, and a heatable boiler **23** for supplying refrigerant in gaseous form to the condenser. The burner unit **20** is shown clamped to the bottom of the boiler **23** with the flue opening **2** in register with the bottom of a flue pipe **2A**, an asbestos gasket **24** forming a gas-tight seal between the flue pipe **2A** and the burner casing. The flue pipe extends upwards through the boiler to heat it and terminates near the top of the refrigerator. The flue outlet **25** which is located at the top and to one side of the pipe may also be fitted with a fine mesh, although since this is disposed well above the burner unit it has been found that there is very little risk of explosive fumes penetrating the burner unit via the flue pipe, so that this is not usually necessary.

We claim:

1. A burner unit for a gas appliance comprising:
A. an enclosure,
B. a gas burner within the enclosure,
C. a gas inlet pipe extending through a wall of the enclosure to the burner,
D. ignition means located within the enclosure and
i. operable from outside the enclosure to ignite the burner when gas is supplied thereto,
E. an air intake for admitting air into the enclosure
F. fine mesh means extending across the air intake and serving as a barrier which prevents the passage of a flame therethrough,
G. a flue extending upwardly in a gas tight manner from an opening in the top of the enclosure for carrying away burnt gases from the enclosure and
H. fine mesh means extending across the flue and serving as a barrier which prevents the passage of a flame therethrough.

2. A burner unit according to claim **1** incorporating a gas cut-off device for the burner and operative to cut off the supply of gas thereto when the burner flame is extinguished.

3. A burner unit according to claim **2** including an electrical control circuit having a starting switch which, upon closure, causes opening of a gas valve to supply gas to the burner, and also operation of the ignition means, the circuit incorporating also a temperature-controlled switch which is operable in response to heat from the burner flame to maintain the gas valve in the open condition despite subsequent opening of the starting switch, but which allows the gas valve to close when the burner flame is extinguished.

4. A burner unit according to claim **3** wherein the temperature-controlled switch is a bimetallic switch or a thermistor.

5. A burner unit according to claim **3** incorporating a relay energisable on closure of said starting switch, and in which closure of the temperature-controlled switch is effective to maintain the relay in the energised condition, the gas valve being openable on energisation of the relay.

6. A burner unit as claimed in claim **5** incorporating a transistor in series with said relay, and in which closure of the temperature-controlled switch is effective to maintain the transistor conductive and thereby to maintain the relay in the energised condition.

7. A burner unit as claimed in claim **5** including a relay switch in the base line of the transistor which is openable to render the transistor non-conductive when the relay is energised unless the temperature-controlled switch is closed, and a capacitor in the base collector circuit of the transistor for maintaining the base bias of the transistor for a predetermined length of time following the opening of the relay switch.

8. A burner unit according to claim **2** including a thermally responsive actuating device operable on a gas valve supplying gas to the burner to maintain it in the open condition when the burner is alight, but which causes or permits the valve to close when the burner flame is extinguished, and means for permitting gas to be supplied to the burner during operation of the ignition means to ignite the burner, and for a period sufficient to enable the thermally responsive actuating device to open the gas valve.

9. A burner unit according to claim **1** in which there is an additional fine wire mesh extending across the air intake and spaced from the first mesh.

10. A burner unit according to claim 9 wherein the additional mesh is spaced from the first mesh a distance of the order of one-eighth to one-fourth inch.

11. A burner unit for a gas appliance comprising:

A. an enclosure,

B. a gas burner within the enclosure,

C. a gas inlet pipe extending through a wall of the enclosure to the burner,

D. ignition means located within the enclosure and

i. operable from outside the enclosure to ignite the burner when gas is supplied thereto,

E. a flue pipe for carrying away burnt gases from the enclosure,

F. an air intake for admitting air into the enclosure, and

G. a fine mesh of sufficiently small aperture size to prevent the passage of a flame therethrough extending across the air intake,

H. the enclosure comprising a main part and a removable panel attachable in a gas-tight manner to the main part,

I. the ignition means being in the form of a spark gap adjacent the burner and a voltage generator operable to generate a voltage sufficient to produce a spark across the spark gap, and the spark gap comprising a pair of electrodes, one of which is carried by the main part of the enclosure and the other of which is carried by the removable panel.

12. A burner unit according to claim 11 incorporating or associated with a warning or indicating device operative to show when the burner is extinguished.

13. A burner unit according to claim 11 wherein the burner itself provides one of the spark gap electrodes.

14. A burner unit according to claim 11 having an additional fine mesh extending across the air intake, and spaced from the first mesh a distance of the order of one-eighth to one-fourth inch.

15. A burner unit according to claim 11 including a pair of spaced wire meshes of an aperture size sufficiently small to prevent the passage of a flame therethrough extending across the flue.

16. A burner unit according to claim 15 wherein the meshes which extend across the flue are spaced apart a distance of the order of one-eighth to one-fourth inch.

17. A burner unit for a gas appliance comprising:

A. an enclosure,

B. a gas burner within the enclosure.

C. a gas inlet pipe extending through a wall of the enclosure to the burner,

D. ignition means located within the enclosure and

i. operable from outside the enclosure to ignite the burner when gas is supplied thereto,

E. an air intake for admitting air into the enclosure,

F. a pair of fine mesh means each extending across the air intake and spaced from one another to serve as barriers to the passage of a flame therethrough

G. a flue extending upwards in a gas tight manner from an opening in the top of the enclosure for carrying away burnt gases from the enclosure and

H. a further fine mesh means extending across the flue to serve as a barrier to the passage of a flame therethrough.

* * * * *