(54) Title of the Invention: **An improved flush-fitting gas heating appliance**
Abstract Title: **Flush-fitting gas heating appliance**

(57) Disclosed is a gas-fired heating appliance 11 which may be sealed into an opening in a wall 25 of a room so that it fits flush with the wall level. The heating appliance 11 has an inlet opening 26 for combustion air, flow passages defining a primary exit route for combustion product gases leading from a combustion chamber 13 to a flue outlet 44, and a secondary combustion product outlet route 28 through which combustion product gases can flow in the event of a restriction or obstruction in the flow path from the flue outlet 44. The fire front 19 of the heating appliance 11 is surrounded by a frame 20, the forward edge of which lies in a plane forwardly of the fire front 19 such as to have inwardly facing reveals. At least one of the inlet and outlet openings 26, 28 is located in one of the reveals.
AN IMPROVED FLUSH-FITTING GAS HEATING APPLIANCE

The present invention relates generally to gas heating appliances, and particularly to a gas heating appliance intended to be fitted flush into an opening in a wall for practical and aesthetic reasons.

Although a flush fitting appliance has an appearance with clean lines and a modern aspect, it has the potential disadvantage that the burner of the heating appliance is entirely isolated from the room apart from any air inlets or combustion product outlets formed in the appliance itself. The normal route for combustion product gases is out through a flue opening into a chimney or flue in the building, or transversely through a wall into a so-called “balanced flue” which is normally fitted on the outside wall of a building, and encased in a safety cage to prevent direct contact with the hot combustion products.

Although such a structure works perfectly well in normal circumstances, it is possible for adverse conditions to arise, such as blockage of the chimney flue or balanced flue, for example by birds building nests in the chimney or some form of structural failure in the building, and in such circumstances restricted flow of air through the appliance can result in incomplete combustion, the formation of noxious gases, especially carbon monoxide, and a severe health risk to the occupants of the room.

The present invention seeks to provide an appliance having safety features which mitigate this risk without having to abandon the aesthetic and practical features of a flush-fitting appliance.

According to one aspect of the present invention, therefore, there is provided a gas-fired heating appliance of the type intended to be sealed into an opening in a wall of a room, having an inlet opening for combustion air, flow passages defining a primary
exit route for combustion product gases leading from a combustion chamber of the appliance to a flue outlet, and a secondary combustion product outlet route through which combustion product gases can flow in the event of a restriction or obstruction in the flow path from the flue outlet, in which the fire front of the appliance is surrounded by a frame the forward edge of which lies in a plane forwardly of the fire front such as to have inwardly facing reveals, and in which at least the said inlet opening or the said outlet opening is located in one of the said reveals.

In a preferred embodiment of the invention both the said inlet opening and the said outlet opening are located in the said reveals.

Embodiments of the invention may be provided with means defining a convectional pathway from a convected air inlet to a convected air outlet, and in which at least one of the convected air inlet or the convected air outlet is located in a reveal of the said frame.

Of course, embodiments may be produced in which both the convected air inlet and the convected air outlet are located in a reveal of the said frame.

In a preferred embodiment the said secondary combustion product outlet route is permanently open or unobstructed, and combustion product gases are discouraged from flowing through the secondary outlet route by a pressure differential which exists in normal operation of the appliance.

This latter configuration provides a high degree of safety against the adverse effects of flue blockage since there is no possibility of any closure flaps or doors which might otherwise be provided to secure the combustion product primary exit route from becoming jammed or stuck or otherwise failing to open when the adverse conditions arise.
The secondary combustion product outlet route may be defined by converging flow path walls such that the flow cross-section of the secondary outlet route reduces along the direction of intended flow of the combustion product gases in exiting from the appliance along the secondary combustion product outlet route. By providing a reducing flow cross-section the combustion product gases are discouraged from taking the secondary route in normal operation when the pressure in the room is usually slightly higher than that in the region of the flue outlet so that the combustion product gases are directed to the flue outlet by the "draw" of the flue.

Embodiments of the invention may be constructed in which at least one wall of the secondary combustion product outlet route is defined by a first flow diverter which is inclined upwardly along the direction of the intended flow of combustion product gases exiting the appliance along the secondary combustion product route.

Likewise, the secondary combustion product outlet route may include a second flow diverter which is inclined in an opposite sense from that of the said first flow diverter. This provides a diversion in the flow path sufficient (if the angle of inclination is correct) to discourage the combustion product gases from taking the secondary combustion outlet route in normal operation.

The appliance may be so constructed that a frame surrounds the fire front, and the secondary combustion product outlet route may have a downwardly open exit opening conveniently formed in this frame.

The appliance may be one of a type in which there are provided means defining a convection pathway from a convected air inlet adjacent to or common with the combustion air inlet at a lower part of the front of the appliance, leading to a convected air outlet at an upper part of the front of the appliance through a
convected air pathway which passes in heat exchange relations around the combustion chamber of the appliance, especially to the rear thereof.

An upper part of the convection pathway preferably lies alongside a part of the said secondary combustion product outlet route from which it is separated by a dividing wall.

The secondary combustion product outlet route may occupy a central position with respect to a mid plane of the appliance, with the convection pathway having two branches extending one on either side of the said secondary combustion product outlet route. At the front of the appliance the visual symmetry and practical aspect of this arrangement can be appreciated, with the convected air outlets lying on either side of the outlet from the emergency escape route constituted by the secondary combustion product outlet route.

The means defining a convection pathway may conveniently comprise an outer casing partly surrounding a central fire box or combustion chamber of the appliance.

The secondary combustion product outlet route and the convection pathway may have parts which follow substantially parallel paths in an upper region of the appliance.

The structure of the heating appliance may be such that the primary combustion product exit route includes a baffle plate extending forwardly from the rear of the appliance and around which the combustion product gases are directed to flow in normal operation of the appliance.

Upon installation of the fire front of the appliance this is thus recessed with respect to the wall in which the appliance is fitted, and the frame surrounding the fire front then defines the frontal plane of the appliance intended to be flush with the wall upon
installation. Indeed, such fires may be installed during the decorative finishing of a wall, with the heating appliance being installed before the final dry lining of the wall, allowing the wall panel (or panels) to be fitted into a rebate effectively defined by the surrounding frame.

Although the majority of installations will provide a flue or chimney for the combustion product gases to exit the appliance in normal operation through the flue outlet, certain installations may require a balanced flue passing laterally through a rear wall, and for this purpose an optional rear exit may be provided for connection to a balanced flue.

Embodiments of the present invention will now be more particularly described by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a sectional side view of a heating appliance formed as an embodiment of the present invention:

Figure 2 is an enlarged sectional side view of an upper part of the appliance showing the flow paths through the appliance;

Figure 3 is a plan view from above of the appliance illustrating the relative configuration of the flow paths illustrated in Figure 2;

Figure 4 is a section taken on a line IV-IV of Figure 3; and

Figure 5 is a frontal view of the appliance illustrating the frame.

Referring now to the drawing, and particularly Figure 1 thereof, there is shown a heating appliance generally indicated 11 having an outer casing generally indicated 12 and an inner fire box or combustion chamber 13 lined at the rear with a layer of a refractory material 14 and having a system of gas burners, generally indicated 15 in a lower region thereof. The outer casing 12 forms an air space or cavity 16 between itself and the inner fire box 13, and a lower part of the space 16a is separated into two compartments by a lower baffle 17 which separates the lower chamber 16a from an
internal region or chamber 18 through which flows incoming air on its way to the burners 15 as will be described in more detail below.

The front of the appliance 11 is defined by a glass front wall 19, which is surrounded by a frame 20 having a flange 21 projecting forwardly of the glass front panel 20 to define a surrounding rim with a rebated portion 22 which, as can be seen in Figure 1, receives the dry lining panels of the wall, identified with the reference numerals 24 and 25, so that once installed the appliance has a flush-fitting appearance, with the glass front panel 19 being recessed slightly with a respect to the wall of the building, defined by the panels 24, 25. An opening, or a series of openings 26 in the lower horizontal limb of the frame 20 constitutes the inlet opening for both combustion air following a path into the region 18, and convection air following a path into the lower region 16a. The rear air space or cavity 16 communicates at the top with a space 27 which leads from front to back of the appliance, and communicates with an outlet opening 28 in the frame limb 21 so that convection air from the chamber 16a, heated by contact with the fire box 13 can flow up the air passageway 16 and along the upper chamber 27 to the outlet 28. As illustrated in Figure 3, the upper chamber 27 is separated into three parts by two front-to-back vertical dividers 29, 30 which enclose a central upper region of the chamber to define a central or flue gas region 32. As can be seen in Figure 1, the partitions 29, 30 which separates the flow passage 32 for the flue gases from the two lateral convected air pathways 33, 34 extend along an upper region between an upper wall 35 of the fire box 13 and an upper wall 36 of the outer casing 12, and down the rear path or space 16 with an upright or vertical limb 37 so that the overall partitions 30, 31 comprise L shape dividers extending around the rear upper corner of the fire box.

In the upper part of the fire box 13 is a baffle plate 38 which is inclined downwardly towards the rear of the fire box and has a cranked arm 39 adjacent an outlet opening 40 in the rear wall 41 of the fire box which forms an exit for combustion product gases produced by the burner 15 in the fire box to enter the combustion product flow.
pathway 32 defined between the rear wall 41 of the fire box and the rear wall 42 of the outer casing 12, and between the upper wall 35 of the fire box 13 and the upper wall 36 of the casing 12 and defined between the two partitions 30, 31 so that combustion product gases from the interior of the fire box 13 can follow the pathway shown by the arrows A of Figure 2 into the combustion product flow passage 32.

A flow diverter 45 extends from the rear of the casing 12 forwardly within the passage 32, and is supported at the front by an upright bracket 46. This forms an extended path for the combustion product gases, as shown by the solid arrows of Figure 2, which pass within the flow passage 32 beneath the flow diverter 45 forwardly to its forward edge 48, around this, then rearwardly in an upper part of the flow passage 32 finally exiting through a flue outlet 44 to travel along a flue (not shown) which in practice is connected to a flue spigot 49. In installations where there is no chimney flue, a blanking plate 50 at the rear of the casing 12 may be removed to allow the combustion product gases to pass rearwardly through an opening thus formed into a balanced flue provided for the purpose.

In a forward portion of the upper air space or cavity region between the fire box 13 and the outer casing 12 in the central combustion product flow passage 32, adjacent to the forward ends of the upper, horizontal limbs of the partitions 29, 30 is an upwardly inclined flow diverter 52 which spans the entirety of the central flow passage 32 and creates a converging region at the forward end of the flow passage 32. Forwardly from the forward ends 51 of the partitions 29, 30 is located a second inclined flow diverter 53 having an angle of inclination somewhat greater than that of the flow diverter 52 and in the opposite sense, spanning the entire width of the appliance and acting to guide gases flowing forwardly along the forward part of the upper region in any of the flow passages 32, 33, 34 to turn downwardly towards the opening 28 in the frame 21.

Because this second flow diverter 53 extends across the full width of the upper region of the casing it acts to divert downwardly through the opening 28 not only the convected
air arriving along the outer horizontal convection pathways 33, 34 on either side of this upper region but also combustion product gases in the central pathway 32 as will be described below.

In normal operation the pressure in the region of the flue outlet 44 is slightly lower than that in the room so that combustion product gases follow the path indicated by the solid arrows in Figure 2, and are discouraged from moving forwardly along the tapering passage defined by the inclined flow diverter 52 due to the converging nature of the forward part of this passage. However, in the event of adverse conditions arising, such as by blockage or obstruction of the flue, this passage is open for combustion product gases to pass as shown by the broken line arrows in Figure 2 into the forward region of the upper cavity until encountering the second flow diverter 53 at which point the gases are deflected downwardly through the opening 28 and into the room. Although it is not normally acceptable for combustion product gases to escape into a room from a gas fire, providing the combustion is complete the combustion products are not noxious, and the presence of the escape route through the opening 28 ensures that a draft through the inlet opening 26 is not inhibited by an increase in the pressure in the upper region of the appliance so that complete combustion at the burner 15 can take place.

In this way an aesthetically pleasing clean line around the frame 21 can be achieved in an appliance which is entirely enclosed behind the wall 25 of the building without any risk of danger or injury if adverse flue conditions should arise.
CLAIMS

1. A gas-fired heating appliance of the type intended to be sealed into an opening in a wall of a room, having an inlet opening for combustion air, flow passages defining a primary exit route for combustion product gases leading from a combustion chamber of the appliance to a flue outlet, and a secondary combustion product outlet route through which combustion product gases can flow in the event of a restriction or obstruction in the flow path from the flue outlet, in which the fire front of the appliance is surrounded by a frame the forward edge of which lies in a plane forwardly of the fire front such as to have inwardly facing reveals, and in which at least the said inlet opening or the said outlet opening is located in one of the said reveals.

2. A gas-fired heating appliance as claimed in Claim 1, in which both the said inlet opening and the said outlet opening are located in the said reveals.

3. A gas-fired heating appliance as claimed in Claim 1 or Claim 2, in which there are provided means defining a convection pathway from a convected air inlet to a convected air outlet, and in which at least one of the convected air inlet or the convected air outlet is located in a reveal of the said frame.

4. A gas-fired heating appliance as claimed in claim 3, in which both the convected air inlet and the convected air outlet, are located in a reveal of the said frame.

5. A gas-fired heating appliance as claimed in Claim 3 or Claim 4, in which the said convected air inlet is adjacent to or common with the combustion air inlet.
6. A heating appliance as claimed in any of claims 1 to 5, in which the said secondary combustion product outlet route is permanently open or unobstructed and combustion product gases are discouraged from flowing through the secondary outlet route by a pressure differential which exists in normal operation of the appliance.

7. A heating appliance as claimed in any of claims 1 to 6, in which the secondary combustion product outlet route is defined by converging flow path walls such that the flow cross-section of the secondary combustion product outlet route reduces along the direction of intended flow of the combustion product gases in exiting from the appliance along the secondary combustion product outlet route.

8. A heating appliance as claimed in Claim 7, in which at least one wall of the secondary combustion product outlet route is defined by a first flow diverter which is inclined upwardly along the direction of intended flow of combustion product gases exiting the appliance along the secondary combustion product outlet route.

9. A heating appliance as claimed in Claim 7 or Claim 8, in which the secondary combustion product outlet route includes a second flow diverter which is inclined in an opposite sense from that of the said first flow diverter.

10. A heating appliance as claimed in any of Claims 7 to 9, in which the secondary combustion product outlet route has a downwardly open exit opening into the upper of the said reveals.
11. A heating appliance as claimed in any of claims 3 to 10, in which the convection pathway lies alongside a part of the said secondary combustion product outlet route from which it is separated by a dividing wall.

12. A heating appliance as claimed in Claim 11, in which the said secondary combustion product outlet route occupies a central position with respect to a mid plane of the appliance and the convection pathway has two branches extending one on either side of the said secondary combustion product outlet route.

13. A heating appliance as claimed in any of claims 3 to 12, in which the means defining a convection pathway comprise an outer casing partly surrounding a central fire box or combustion chamber of the appliance.

14. A heating appliance as claimed in any of Claims 3 to 13, in which the secondary combustion product outlet route and the convection pathway have parts which follow substantially parallel paths at an upper part of the appliance.

15. A heating appliance as claimed in any preceding claim, in which the primary combustion product exit route includes a baffle plate extending forwardly from the rear of the appliance and around which the combustion product gases are diverted to flow in normal operation of the appliance.

16. A heating appliance as claimed in Claim 16 or Claim 17, in which the inlet opening or openings for combustion air and/or for convected air is or are formed in the said frame.
17. A heating appliance as claimed in any preceding Claim, in which the primary combustion product outlet route has an optional rear exit for connection to a balanced flue.

20. A heating appliance substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

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<th>Category</th>
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<td>Y</td>
<td>1, 3, 5, 6, 11, 13, 14, 16, 17 at least</td>
<td>US2005/150485 A1 [BARBER] See abstract and note figures 4 and 5 especially</td>
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<td>Y</td>
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<td>WO03/040622 A1 [BURLEY APPLIANCES LTD] See abstract and figures</td>
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**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

| Worldwide search of patent documents classified in the following areas of the IPC |
|--------------------------------|--------------------------------|
| F24C                           |
The following online and other databases have been used in the preparation of this search report:

EPODOC, WPI, TXTE

**International Classification:**

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