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(72) Inventor: **Chuter, Barry Ian**
Southampton, SO4 5LX (GB)

(74) Representative:
Pratt, Richard Wilson et al
D. Young & Co,
21 New Fetter Lane
London EC4A 1DA (GB)

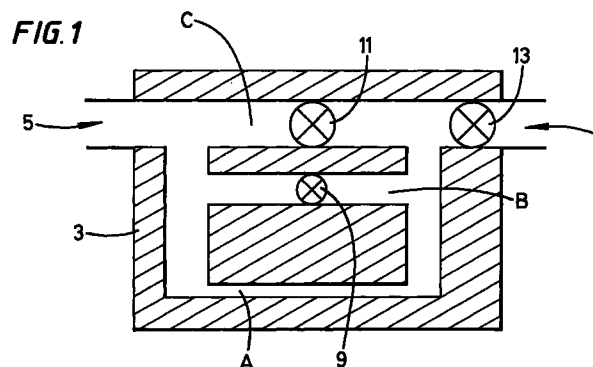
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(71) Applicant:
Kigass Electronics Ltd
Redditch, Worcestershire B98 7SN (GB)

(54) **A supply valve for a fuel burning appliance**

(57) An aspect of the invention provides a supply valve for a fuel burning appliance, the valve comprising: an inlet and an outlet; a plurality of passageways interconnecting the inlet and the outlet; and a plurality of valves each for opening and closing at least one of said passageways.

Another aspect of the invention provides a supply valve for a fuel burning appliance, comprising: an inlet and an outlet; a passageway connecting the inlet to the outlet; an outlet valve for opening or closing the outlet; and a plurality of flow control valves provided between the inlet and the outlet valve, the flow control valves each having members with a bore therethrough, the cross sectional areas of the bores decreasing in a direction from the inlet to the outlet.



Description

This invention relates to a supply valve for a fuel burning appliance.

Modern fuel burning appliances, such as cookers, heaters and boilers, are typically capable of being operated in a variety of different modes. These appliances can be fuelled by a variety of different fluid fuels, such as gas or kerosene.

In modern gas cookers, for example, it is commonplace for means to be provided that enable a user to regulate the temperature in an oven or grill of the appliance. The regulating means typically acts to vary the amount of gas being burnt in the oven and thus to vary the heat generated in the oven.

In these previously proposed appliances the regulating means typically comprise a valve arrangement which is manipulatable by way of external controls on the appliance. In gas cookers, for example, it is commonplace for an external knob to be provided that is rotatable to different gas mark settings. The gas mark settings correspond to a gas flow rate which, when the gas is burnt, causes a predetermined quantity of heat to be given off to heat, for example, an oven in the appliance. A user manipulating the external knob causes an internal valve to be opened or closed between a closed position and a fully open position to regulate the amount of gas entering and being burnt by the appliance.

In one previously proposed appliance, the valve is connected to a sophisticated temperature monitoring system which includes an alcohol or mercury vial which, when heated, gives rise to an electric signal which is monitored by a controller. The controller is connected to a modulated motorised control valve which can be controlled, based on the signals generated by the monitoring system, to restrict or increase the appliance's fuel combustion rate thereby to control the temperature in, for example, an oven of the appliance.

Manufacturers of these appliances are under extreme commercial pressure to ensure that their appliances are competitively priced with respect to other manufacturers appliances on the market. Accordingly, any component cost savings that can be made by a manufacturer can enable that manufacturer to increase the profit margin on the appliance or to reduce the retail price of the appliance, without affecting the profit margin, so that the appliance is more commercially attractive to potential purchasers.

The above described previously proposed valve arrangement has a serious disadvantage in that it is very expensive to manufacture and thus represents an unduly large proportion of the unit cost of the appliance. Significant benefits could be realised if the cost of the valve could be reduced.

A related aspect of this problem is that the valve must be intrinsically safe so that, in the event of valve failure, the risk of unwanted fuel escape is reduced. As a result of this, manufacturers are averse to reducing

the quality of valve components in order to reduce costs, as to do so could result in a valve that could give rise to unwanted fuel escape with potentially life-threatening consequences. Thus, attempts to reduce the valve costs have hitherto not been undertaken as to do so could compromise safety.

It would therefore be highly desirable to solve the above described apparently irreconcilable problems by providing a valve which is both inexpensive and reliably safe. However, no such solutions have yet been proposed.

In accordance with an aspect of the present invention, there is provided a supply valve for a fuel burning appliance, the valve comprising: an inlet and an outlet; a plurality of passageways interconnecting the inlet and the outlet; and a plurality of valves each for opening and closing at least one of said passageways.

In this way, the present invention alleviates the above-mentioned problems by providing a valve which is both inexpensive to manufacture and reliably safe in operation.

Preferably, each of the passageways has a different cross-sectional area.

Each of the passageways may comprise at least one pipe. Alternatively, the passageways comprise channels in a valve body.

Preferably, at least some of the valves are operable in isolation from the other valves. Preferably, at least some of the valves are operable in combination with one or more of the other valves.

Preferably, an outlet valve operable to open and close the outlet is provided.

Preferably, the valves are opened against a resilient bias acting to close the valves.

Preferably, an additional passageway interconnecting the inlet and the outlet without a valve therein is provided. The additional passageway may have a smaller cross-sectional area than any of the said plurality of passageways.

In accordance with a second aspect of the invention, there is provided a supply valve for a fuel burning appliance, comprising: an inlet and an outlet; a passageway connecting the inlet to the outlet; an outlet valve for opening or closing the outlet; and a plurality of flow control valves provided between the inlet and the outlet valve, the flow control valves each having members with a bore therethrough, the cross sectional areas of the bores being different.

In accordance with a third aspect of the invention, there is provided a circuit for controlling the above described supply valve, the control circuit comprising user actuation means, the user actuation means being operable by a user to select a setting for the fuel burning appliance, the valves being operated in response to the selected setting.

Preferably, the user actuation means comprises a switch moveable from a first position where none of the valves are opened and other positions where at least

one of the valves are opened.

Preferably, movement of said switch to a position other than said first position causes said outlet valve to be opened.

Preferably, movement of said switch to a position other than said first position causes light means, such as a light emitting diode, to be energised to warn a user that fuel supply is enabled.

A further aspect of the invention provides a fuel burning appliance comprising a supply valve as described herein. Preferably, the fuel is gas. The appliance may be a cooker, a boiler or a heater.

Embodiments of the invention will now be described, by way of example only, with reference to the following drawings, in which:

Figure 1 is a schematic cross-sectional view of a valve for a fuel burning appliance;

Figure 2 is a schematic representation of a exemplary circuit for operating the valve of Figure 1; and
Figure 3 is a schematic cross-sectional view of a valve according to a second embodiment.

The present invention will now be described with specific reference to an oven of a gas cooker. However, it should be noted that the description of the present invention with relation to a gas cooker is given purely by way of example and that the present invention may be employed in a variety of different appliances, such as heaters and boilers. The invention could also be employed in differently fuelled appliances and as a control valve for cooker burners or grills where the temperature does not need to be monitored.

Accordingly, it should be noted that the invention is not limited to a particular appliance, a particular fuel or to a particular part of an appliance.

With reference to Figure 1, the valve comprises a valve body 3, preferably made from aluminium, an inlet 5 connectable to a fuel supply, for example a gas supply, and an outlet 7 connectable to a fuel ignition circuit, for example.

The inlet 5 and outlet 7 are capable of communicating with each other via three passageways A, B and C. Passageways B and C may be opened or closed by solenoid valves 9 and 11 respectively provided therein. A further output solenoid valve 13 is provided beyond the passageways A, B and C in the outlet 7. The outlet valve 13 is opened or closed to turn on or turn off the supply of fuel to the appliance.

The passageways A, B and C have different cross-sectional areas and thus allow different fuel flow rates therethrough. In this embodiment, passageway C has a larger cross-sectional area than passageway B, and passageway B has a larger cross-sectional area than passageway A. If the outlet valve should fail then the cross sectional area of passageway A is such that only a small quantity of fuel would escape.

With reference to Table 1 below, wherein a "1" indi-

cates an open valve and a "0" indicates a closed valve, closing the outlet valve 13 cuts off the supply of fuel to the appliance. Opening outlet valve 13 enables fuel to be supplied to the appliance through passageway A at a first rate "X". Opening outlet valve 13 and solenoid 11 enables fuel to be supplied to the appliance through passageways A and B at a second rate "X + Y", larger than the first rate. Opening outlet valve 13 and solenoid 9 enables fuel to be supplied to the appliance through passageways A and C at a third rate "X + Z", larger than the second rate. Opening outlet valve 13 and solenoids 9 and 11 enables fuel to be supplied to the appliance through passageways A, B and C at a fourth rate "X + Y + Z", larger than the third rate. Thus, it can be seen that by opening and closing combinations of valves, five flow rates can be provided.

TABLE 1

SOLENOID			FLOW RATE
Valve 9	Valve 11	Valve 13	
1 or 0	1 or 0	0	ZERO
0	0	1	X
0	1	1	X + Y
1	0	1	X + Z
1	1	1	X + Y + Z

The solenoid valves are electrically operated and are preferably opened against a resilient bias such as a spring so that, if the power supply should fail or if the solenoid should malfunction, the valves will be biased to their closed position to cut off the supply of fuel to the appliance.

Figure 2 is a schematic representation of a exemplary circuit for controlling the valve of Figure 1.

With reference to Figure 2, the circuit 20 comprises power means 22 (preferably DC) and a five-way operating switch 24 which is preferably provided on the outside of the appliance.

When the switch is in a first position (i), none of the solenoids are energised and no fuel flows. When the switch is in a second position (ii), only the output valve 13 is energised. When the switch is in a third position (iii), valves 9 and 13 are energised. When the switch is in a fourth position (iv), valves 11 and 13 are energised. Finally, when the switch is in a fifth position (v), valves 9, 11 and 13 are energised.

A light emitting diode may also be provided such that a light is emitted when the switch is in any of positions (ii) to (v), thereby providing a warning to the user that valves are open and fuel is able to flow.

The circuit may include a temperature sensor and a controller so that the energisation of the valves may be automatically conducted in order to regulate the temper-

ature of the oven, for example, in the appliance.

A second embodiment is shown in Figure 3. In this embodiment, the valve 50 comprises an inlet 52, an outlet 54, a single passageway 56 connecting the inlet to the outlet, a plurality of solenoid valves 58 with valve members 60 moveable into and out of the passageway and an outlet valve 62 for enabling or preventing communication between the inlet and outlet.

In this embodiment, the valve members 60(i) to 60(v) are each bored to provide a channel 64(i) to 64(v) through each member which is of different cross-sectional area to that of the passageway. The cross-sectional areas of the channels decrease across the valve members in a direction from the inlet to the outlet. The members are moveable from a first position clear of the passageway to a second position wherein the bores communicate with the passageway to restrict fuel flow therethrough.

As shown in Figure 3, the channel 64(i) of an outer valve member 60(i) has a larger cross-sectional area than the channels 64(ii) to 64(v) of the remaining members, and the channel 64(v) of an inner member 60(v) has a smaller cross-sectional area than the channels 64(i) to 64(iv) of the remaining members 60(i) to 60(iv). The members between the inner and outer members decrease in cross-sectional area in a direction from the outer member to the inner member. The rate of fuel flow may be varied by selectively actuating the valves 60(i) to 60(v) to introduce respective valve members 60(i) to 60(v) into the passageway.

The valves 60(i) to 60(v) may be actuated by a circuit similar to that of Figure 2. By operating a switch, a user is able to control which of the valves is in communication with the passageway and thus vary the flow rate through the passageway. As in Figure 2, the outlet valve is coupled to each of the other valves so that the outlet is automatically open when the switch is operated. The circuit may also include a temperature sensor and a controller so that the energisation of the valves may be automatically conducted in order to regulate the temperature of the oven, for example, in the appliance.

It will be understood, of course, that the present invention has been described herein by way of example only and that modifications may be made within the scope of the invention.

For example, it should be noted that the supply valve described herein could be employed in any type of fuel burning appliance, such as a cooker, heater or boiler. If used in a cooker, the valve can be used to control flow rate in an oven, a burner on a cooker hob or a grill.

Furthermore, whilst an embodiment of the invention has been described herein as having three passageways, it should be noted that further passageways may be provided to provide further settings for use by a user. It should also be noted that the provision of a valve body is merely convenient and not essential as the passageways could be pipes.

It should also be noted that whilst one embodiment described has a plurality of passageways of differing cross-sectional area, it is conceivable that a plurality of pipes of substantially identical cross-sectional area could be provided instead, the pipes being openable and closable in combination to enable adjustment of the fuel flow rate.

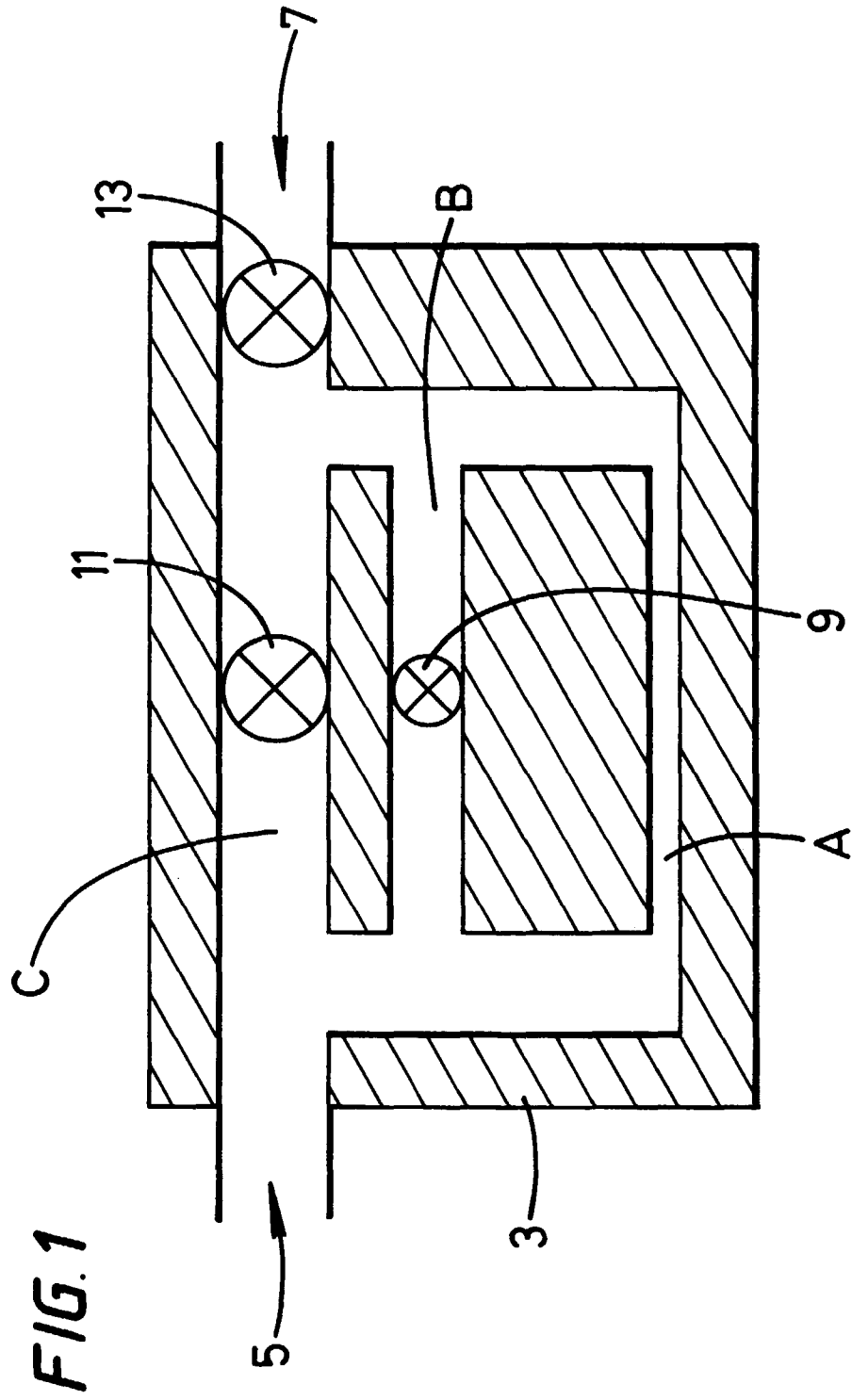
It should also be noted that whilst one described embodiment advantageously enables a combination of valves to be opened, the valves could be arranged so that they are openable in isolation from one another - in which case, the passageways would have to be of varying cross-sectional area if it was desired to vary the flow rate. A mixture of valves operable in isolation and valves operable in combination may also be provided.

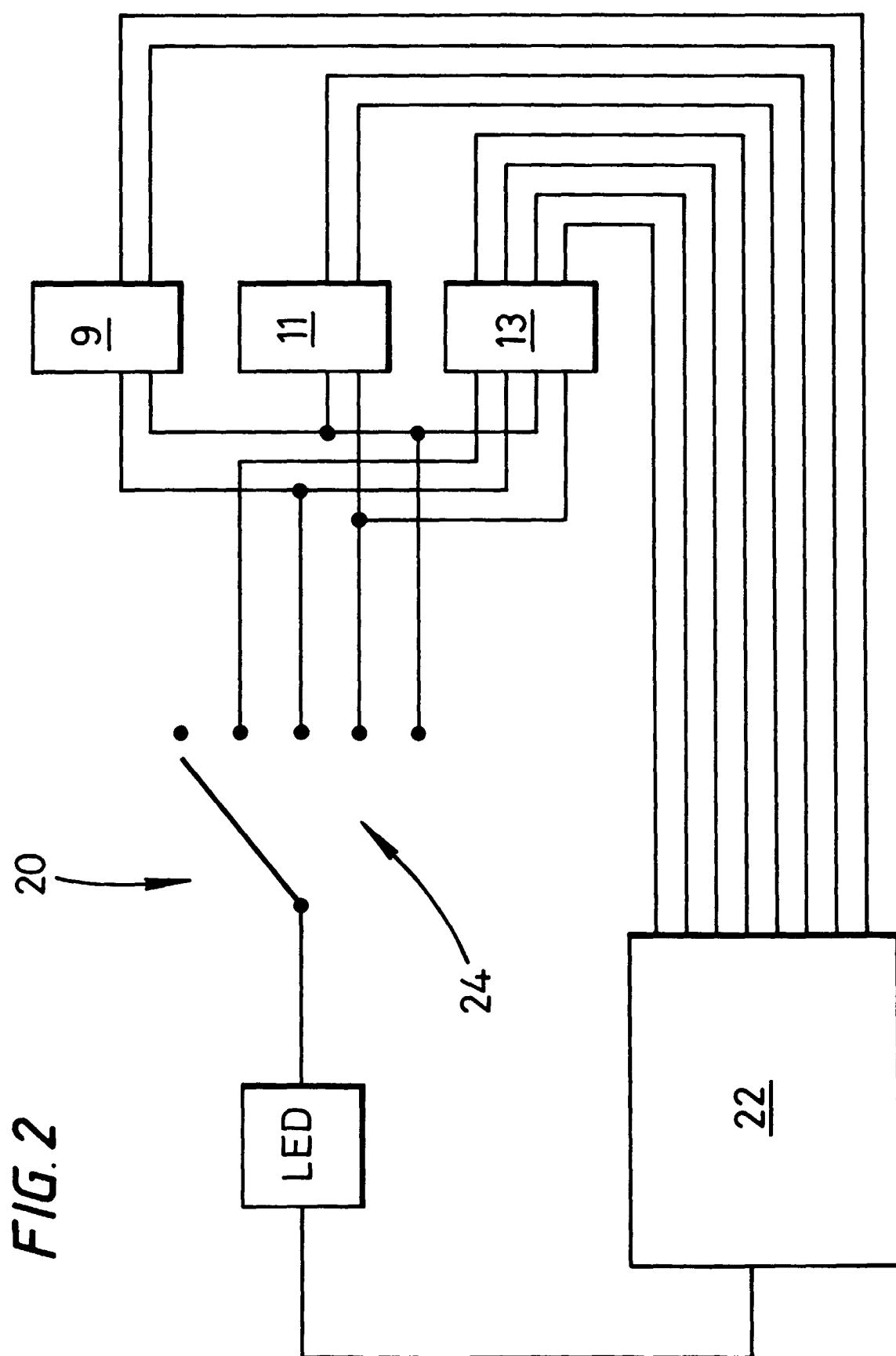
Finally, whilst the valves have been described as each opening a single passageway, it will be apparent that a valve could be used to open and close a number of passageways communicating with that valve. For example, a pair of passageways communicating with the inlet could both communicate with a valve which is openable to communicate with the outlet.

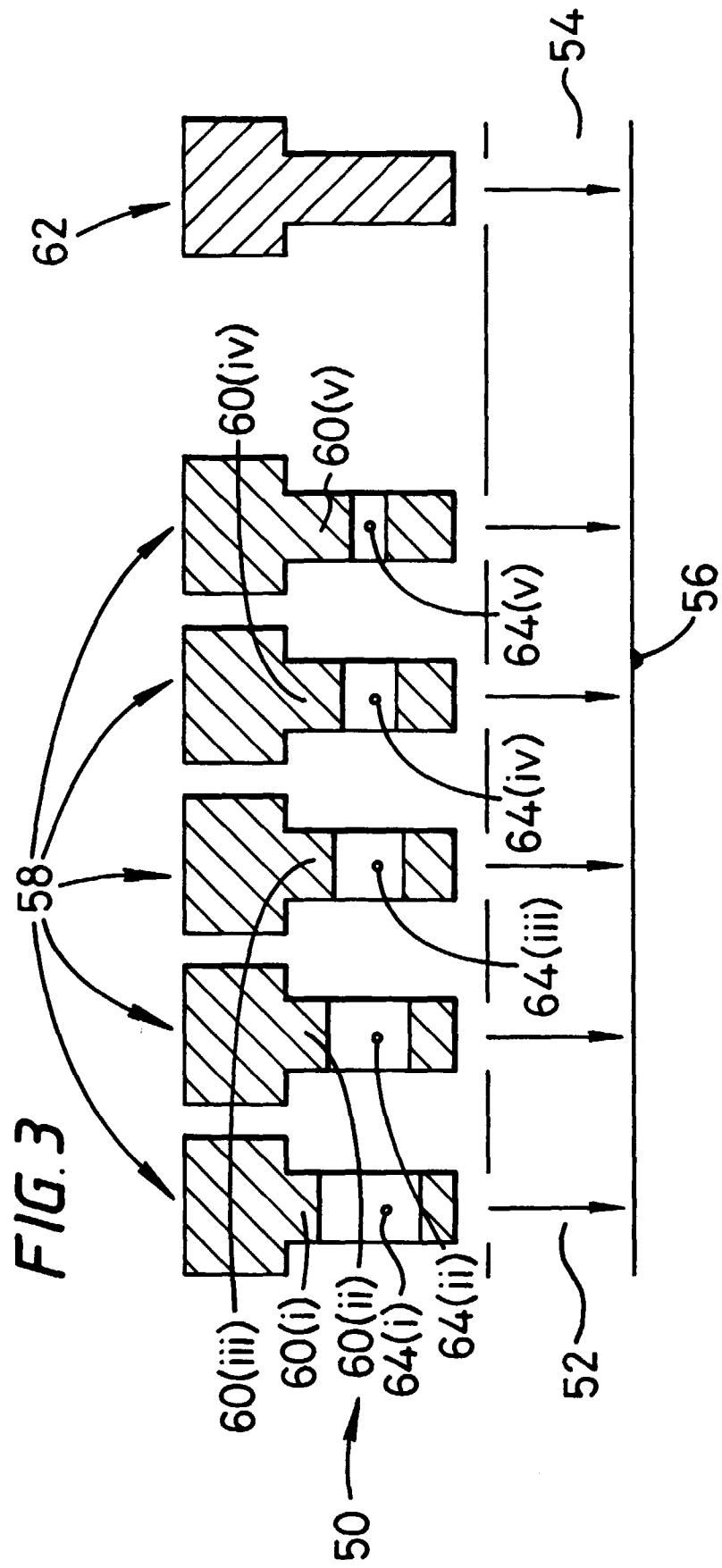
Claims

1. A supply valve for a fuel burning appliance, the valve comprising:
 - an inlet and an outlet;
 - a plurality of passageways interconnecting the inlet and the outlet; and
 - a plurality of valves each for opening and closing at least one of said passageways.
2. A supply valve according to Claim 1, wherein each of the passageways has a different cross-sectional area.
3. A supply valve according to Claim 1 or Claim 2, wherein each of the passageways comprises at least one pipe.
4. A supply valve according to any of Claims 1 to 3, wherein the passageways comprise channels in a valve body.
5. A supply valve according to any of Claims 1 to 4, wherein at least some of the valves are operable in isolation from the other valves.
6. A supply valve according to any of Claims 1 to 5, wherein at least some of the valves are operable in combination with one or more of the other valves.
7. A supply valve according to any of Claims 1 to 6, comprising an outlet valve operable to open and close the outlet.

8. A supply valve according to any preceding claim, or heater.
wherein the valves are opened against a resilient bias acting to close the valves.
9. A supply valve according to any preceding claim, 5
comprising an additional passageway interconnecting the inlet and the outlet without a valve therein.
10. A supply valve according to claim 9, wherein the additional passageway has a smaller cross-sectional area than any of the said plurality of passageways. 10
11. A supply valve for a fuel burning appliance, comprising: 15
an inlet and an outlet;
a passageway connecting the inlet to the outlet;
an outlet valve for opening or closing the outlet;
and 20
a plurality of flow control valves provided between the inlet and the outlet valve, the flow control valves each having members with a bore therethrough, the cross sectional areas of the bores being different. 25
12. A circuit for controlling the supply valve according to any of Claims 1 to 11, the control circuit comprising user actuation means, the user actuation means being operable by a user to select a setting for the fuel burning appliance, the valves being operated in response to the selected setting. 30
13. A circuit according to Claim 12, wherein the user actuation means comprises a switch moveable 35
from a first position where none of the valves are opened and other positions where at least one of the valves are opened.
14. A circuit according to Claim 13 when dependent on Claim 7, wherein movement of said switch to a position other than said first position causes said outlet valve to be opened. 40
15. A circuit according to Claim 14, wherein movement of said switch to a position other than said first position causes light means, such as a light emitting diode, to be energised to warn a user that fuel supply is enabled. 45
50
16. A fuel burning appliance comprising a supply valve according to any preceding Claim.
17. A fuel burning appliance according to Claim 16, wherein the fuel is gas. 55
18. A fuel burning appliance according to Claim 16 or Claim 17, wherein the appliance is a cooker, boiler









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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 4554

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	PATENT ABSTRACTS OF JAPAN vol. 012, no. 229 (M-714), 29 June 1988 & JP 63 025412 A (SANYO ELECTRIC CO LTD; OTHERS: 01), 2 February 1988	1-6, 8-10, 12, 16-18	F23N1/00
A	* abstract; figure * ---	7	
X	NL 8 102 571 A (NEOM) 16 December 1982	1-6, 16-18	
A	* figures * ---	7, 11	
X	PATENT ABSTRACTS OF JAPAN vol. 010, no. 365 (M-542), 6 December 1986 & JP 61 159028 A (MATSUSHITA ELECTRIC IND CO LTD), 18 July 1986	1-6, 8-10, 12-18	
A	* abstract; figure * ---	7	
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 116 (M-216), 20 May 1983 & JP 58 035320 A (MATSUSHITA DENKI SANGYO KK), 2 March 1983	1-6, 16-18	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	* abstract; figure * ---	7, 11	
P, X	EP 0 818 655 A (GAGGENAU) 14 January 1998 * abstract; figures * -----	1-6, 11, 12, 16-18	F23N
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 September 1998	Examiner Kooijman, F
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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