

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
23 October 2003 (23.10.2003)

PCT

(10) International Publication Number
WO 03/087640 A2

(51) International Patent Classification⁷: **F16K 31/00**

(21) International Application Number: PCT/GB03/01249

(22) International Filing Date: 24 March 2003 (24.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0207999.4 5 April 2002 (05.04.2002) GB
0225237.7 30 October 2002 (30.10.2002) GB

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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SAFETY APPARATUS

(57) **Abstract:** Safety apparatus for cutting off the fuel supply to an appliance or device, which runs on combustible fuel, in response to receipt of a signal from a remote hazard detector. The apparatus comprises a valve (10) mounted within a housing (12) which is disposed between the outlet of the fuel supply and the fuel inlet of the appliance or device. The apparatus further comprises a radio signal receiver unit (26) for receiving a signal from a remote hazard detector (not shown), such as a fire, smoke, gas or carbon monoxide detector. The valve (10) is usually in a position so as to permit fuel flow between the fuel supply and the appliance or device via the housing interior. However, if the receiver unit (26) receives a signal from the hazard detector indicating the presence of a potential hazard, the valve is deployed (by means of solenoid 24) so that a blocking plate (22) moves to a position in which it blocks the fuel flow path and effectively switches the appliance or device off. The invention also extends to apparatus for automatically cutting off the electricity supply to an electrical appliance or device in the event of a potential hazard being detected.



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Safety Apparatus

This invention relates to safety apparatus and, more particularly, to safety apparatus for interrupting or preventing the flow of fuel to a fuel-driven appliance or other device in the event of an emergency, such as a fire, a fuel leak or a build up of carbon monoxide or other harmful gas being detected within a predetermined area around the appliance or device.

Many appliances and devices run by combustion of carbon-based fuels. For example, gas burners and cookers are widely used, in both domestic and industrial premises, for heating, burning and cooking. Another example is an internal combustion engine used to drive most motor vehicles. Obviously, such appliances and devices pose a fire hazard in the event of a fuel leak and, in the event of a fire in the vicinity of such appliances and devices, there is a serious danger of an explosion due to the significant rise in temperature of the fuel caused by the fire.

Further, it is well known that respiring life forms are adversely affected by the inhalation carbon monoxide, smoke and other combustion products above a certain level. Indeed, inhalation of carbon monoxide, smoke and other combustion products can lead to death. As carbon monoxide is effectively colourless and odourless, an individual or animal that is inhaling carbon monoxide generally becomes overcome by the gas without realising why. Carbon monoxide often results from incomplete combustion of carbon-based fuels in a burner. Faulty gas burners are often a source of carbon monoxide in buildings. Carbon monoxide is also formed in internal combustion engines, and can build up when the engine is run in a confined space. In addition, smoke frequently arises as a result of incomplete combustion in such devices and appliances.

Detectors exist and are widely used for detecting fire, smoke, carbon monoxide, gas leaks, and the like. Such detectors generally provide an audio and/or visual warning to a user of the presence of a hazard. Once the user is aware of the presence of a potential hazard, they can switch off any appliances and devices which run on combustible fuels, either to prevent further

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build up of smoke, carbon monoxide or other combustion products or to prevent an explosion caused by a fire.

However, it is obviously undesirable and, in many cases, dangerous or impossible for a user to enter the vicinity in which a hazard has been detected to switch the appliance or device off. Further, the hazard may occur when there is nobody in the vicinity of the device or appliance (or the hazard detector), such that no action is taken to prevent or minimise the harmful effects of the detected hazard.

Furthermore, although it is strongly advisable to have such devices or appliances serviced every, say, twelve months, many people do not adhere to such advice, with the potential effect that the appliance or device may be operated even though it may be faulty and potentially hazardous.

I have now devised arrangements which overcome the problems outlined above. Thus, in accordance with a first aspect of the present invention, there is provided apparatus for interrupting or cutting off the fuel supply to an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device, receiving means for receiving a radio frequency signal from a remote location, and means for deploying said cut-off means to prevent said flow of fuel in response to the receipt of said signal.

The cut-off means preferably comprises a valve which may be mounted in a unit connected or connectable between the fuel supply and the appliance or device. The valve beneficially comprises a solenoid and a blocking device for blocking the flow of fuel from or through a pipe. In this case, the blocking means may be mounted within the flow path, with the solenoid also being mounted or disposed within the flow path, or externally thereof. The valve is preferably normally open, permitting the flow of fuel, and, in response to the receipt of a radio frequency signal from, for example, a smoke, fire or carbon monoxide detector, the solenoid is deployed to move the blocking means to a position in which it blocks the flow of fuel to the appliance or device.

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The receiver means may be battery powered and/or mains powered. In the case of a battery powered receiver means, the battery or batteries are preferably rechargeable. The apparatus may be usually run from the mains electricity supply, with a battery back-up being provided in case of failure of the mains supply.

Of course, it is also often desirable to interrupt or switch off the electricity supply to electrical appliances and devices in the event of a hazard, such as a fire, especially if that device or appliance is causing or has caused the hazard. Thus, in accordance with a second aspect of the present invention, there is provided apparatus for interrupting or cutting off the electricity supply to an electrical appliance or device, the apparatus comprising cut-off means for selectively preventing the passage of electricity to or within said appliance or device, receiving means for receiving a radio frequency signal from a remote location, and means for deploying said cut-off means to prevent said passage of electricity in response to the receipt of said signal.

The cut-off means preferably comprises a trip switch which is beneficially deployed to break the connection between a mains power supply and the appliance or device in response to the receipt of a signal from, for example, a gas, fire or smoke detector.

In either case, the apparatus may be used to cut out the fuel or electricity supply to a plurality of devices or appliances connected thereto.

The present invention extends to an appliance or device including the apparatus of the first or second aspects of the present invention arranged to receive a radio frequency signal from remote hazard detector to cause the cut-off means in either case to be deployed.

In accordance with a third aspect of the present invention, there is provided apparatus for interrupting or cutting off the fuel supply to an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device and timing means for causing said cut-off means to be deployed when a predetermined period of time has elapsed.

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The predetermined time may, for example, represent a service or maintenance period for the appliance or device.

The timing means and/or said cut-off means preferably includes a reset mechanism, and the reset mechanism is beneficially arranged such that it can only be operated by one or more authorised persons, such as a service engineer or the like, once the required maintenance or other action has been carried out in respect of the appliance or device.

The apparatus may include means for transmitting one or more messages to a remote location when the predetermined period of time has elapsed and/or shortly before the predetermined time has elapsed. Such means for transmitting messages may include or comprise a telephone dialling means, which is beneficially adapted to transmit an e-mail and/or telephone text message (SMS) to a remote location.

In accordance with a fourth aspect of the present invention, there is provided safety apparatus for use with an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device, means for deploying said cut-off means, and means for transmitting a message to a remote location in response to deployment of said cut-off means.

The apparatus may include detection means for detecting at least one combustion product in an area in which the appliance or device is located, and means for deploying the cut-off means in response to detection of said at least one combustion product. Alternatively, or in addition, the apparatus may include means for receiving a radio frequency signal from a remote location, and means for deploying said cut-off means in response to receipt of the signal.

The message transmitted to the remote location preferably includes an indication that a potentially hazardous situation exists in respect of said appliance or device, if that is indeed the case.

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The apparatus beneficially includes reset means for resetting the cut-off means and thereby permitting the flow of fuel to or within the appliance or device to resume. Again, such reset means is preferably operable only by one or more authorised persons.

In accordance with a fifth aspect of the present invention, there is provided safety apparatus for use with an appliance or device which employs combustible fuel, the apparatus comprising timing means for determining when a predetermined period of time has elapsed, and means for transmitting a message to a remote location when and/or shortly before said predetermined period of time has elapsed, indicating that action in respect of said appliance or device is required to be taken.

The means for transmitting a message may include or comprise a telephone dialler, which is preferably adapted to transmit an e-mail or telephone text message (SMS) to a remote location indicating that action in respect of the appliance or device is required to be taken.

The safety apparatus of the fifth aspect of the invention may include cut-off means for preventing the flow of fuel to or within the appliance or device, and means for deploying the cut-off means when the above-mentioned predetermined period of time has elapsed. The safety apparatus may again comprise reset means for resetting the timing means and/or the cut-off means, in which case the reset means is preferably operable only by one or more authorised persons.

In all cases, the cut-off means beneficially comprises a valve disposed between the appliance or device and its fuel supply.

In all cases, means may be provided to play back a pre-recorded voice message, identifying for example a problem, potential problem, or an action required to be taken. This may be in addition to or instead of any other warning means.

The valve, when deployed, preferably blocks a fuel flow path between said fuel supply and the appliance or device. The valve may be deployed by means of a solenoid, the solenoid being

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provided with an electrical current or voltage in response to receipt of a signal from a remote location to move the valve to a position in which it prevents said flow of fuel to the appliance or device. The solenoid may be disposed within or externally of the fuel flow path.

The cut-off means may be disposed within a housing having an inlet connected or connectable to a fuel supply and an outlet connected or connectable to the appliance or device.

The safety apparatus may be operable by means of an electrical power supply, provided by a mains power supply and/or one or more (possibly rechargeable) batteries.

Embodiments of the present invention will now be described by way of examples only and with reference to the accompanying drawings, in which:

Figure 1 is a schematic diagram of apparatus according to a first exemplary embodiment of the present invention; and

Figure 2 is a schematic diagram of apparatus according to a second exemplary embodiment of the present invention.

Referring to Figure 1 of the drawings, apparatus according to an exemplary embodiment of the first aspect of the present invention comprises a valve 10 mounted within a housing 12. The housing 12 is provided with an inlet 14 and an outlet 16, the inlet 14 having a connector 18 for connection of the housing to the outlet of a fuel (such as gas) supply and the outlet 16 having a similar connector 20 for connection to the fuel inlet of a gas appliance or device.

The valve 10 comprises a blocking plate 22 connected to a solenoid 24 within the housing 12. During normal operation of the appliance or device, the blocking plate 22 is in the position shown, i.e. away from the inlet 14, such that there is provided a flow path for the fuel to flow from the inlet 14 to the outlet 16 via the housing 12.

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The apparatus further comprises a radio signal receiver unit 26 mounted on a receiver mounting plate 28 provided on the outside of the housing 12. The receiver unit 26 is electrically powered, usually via the electrical mains (through, for example, a 9V mains adaptor 30), with a back-up battery supply 32 being provided in case of failure of the mains supply.

In response to a radio frequency signal received from, for example, a smoke, fire or carbon monoxide detector (indicating that smoke, fire or carbon monoxide has been detected in the vicinity of the appliance or device to which the apparatus is connected), or a timer mechanism (indicating that a predetermined period of time has elapsed, say twelve months, and the appliance or device is required to be serviced), the solenoid 24 is deployed to move the blocking plate 22 towards the inlet 14 and block the flow of gas therefrom the appliance or device, thereby switching the appliance or device off. A reset means (not shown) may be provided to manually (or automatically) reset the apparatus and move the valve back to the original position in which gas is permitted to flow from the supply to the appliance or device in the event that the detected hazard is eliminated or the appliance or device has been serviced.

Referring to Figure 2 of the drawings, apparatus according to an exemplary embodiment of the second aspect of the present invention comprises a unit 100 connected across mains power input 102 and output 104 terminals. The unit can be selectively turned on or off by means of a switch 106, which may be manually or remotely operable.

The unit 100 includes a printed circuit board 108 on which is mounted a radio signal receiver unit 110 (and/or a timer mechanism - not shown), a low voltage transformer 112 for reducing the voltage supply from the mains to the receiver unit 110, and a relay unit 114. The relay unit 114 includes a relay switching mechanism 116 and a reset button 118 (manually or remotely operable). In use, if the unit 100 is switched on (i.e. the switch 106 is closed) and the radio signal receiver unit 110 receives a signal from a remote hazard detector (such as a gas, smoke or fire detector) or the timer mechanism indicates that a predetermined period of time has elapsed, the relay switching mechanism 116 is caused to open, thereby breaking the mains power supply connection to the appliance or device (not shown) to which the unit 100 is

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connected and/or valve such as that described with reference to figure 1 is deployed to prevent flow of fuel to or within the appliance or device. Once the hazard has passed, or the device or appliance has been serviced, the reset button 118 may be used to close the connection, thereby resuming the power supply to the appliance or device (and/or a similar reset means may be provided to re-open the cut-off valve and reset the timer).

The unit 100 is optionally provided with one or more warning/power lights 120 to indicate that the power supply to the unit 100 is on (or off), that the unit 100 has been deployed because a hazard has been detected, that the fuel supply to the device or appliance has been cut-off, that the appliance or device is required to be serviced, etc.

Embodiments of the present invention have been described above by way of examples only and it will be apparent to a person skilled in the art that modifications and variations can be made to the described embodiments without departing from the scope of the invention as defined in the appended claims.

Claims:

1. Apparatus for interrupting or cutting off the fuel supply to an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device and timing means for causing said cut-off means to be deployed when a predetermined period of time has elapsed.
2. Apparatus according to claim 1, wherein said predetermined time represents a service or maintenance period for said appliance or device.
3. Apparatus according to claim 1 or claim 2, wherein said timing means and/or said cut-off means includes a reset mechanism.
4. Apparatus according to claim 3, wherein said reset mechanism is arranged such that it can only be operated by one or more authorised persons.
5. Apparatus according to any one of claims 1 to 4, including means for transmitting one or more messages to a remote location when said predetermined period of time has elapsed and/or shortly before said predetermined time has elapsed.
6. Apparatus according to claim 5, wherein said means for transmitting messages includes a telephone dialling means, and means for transmitting an e-mail and/or telephone text message to a remote location.
7. Safety apparatus for use with an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device, means for deploying said cut-off means, and means for transmitting a message to a remote location in response to deployment of said cut-off means.

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8. Safety apparatus according to claim 7, including detection means for detecting at least one combustion product in an area in which said appliance or device is located, and means for deploying said cut-off means in response to detection of said at least one combustion product.
9. Safety apparatus according to claim 7, including means for receiving a radio frequency signal from a remote location, and means for deploying said cut-off means in response to receipt of said signal.
10. Safety apparatus according to claim 8 or claim 9, wherein said message transmitted to said remote location includes an indication that a potentially hazardous situation exists in respect of said appliance or device.
11. Safety apparatus according to any one of claims 7 to 10, including reset means for resetting said cut-off means and thereby permitting said flow of fuel to or within said appliance or device to resume.
12. Safety apparatus according to claim 11, wherein said reset means is operable only by one or more authorised persons.
13. Safety apparatus for use with an appliance or device which employs combustible fuel, the apparatus comprising timing means for determining when a predetermined period of time has elapsed, and means for transmitting a message to a remote location when and/or shortly before said predetermined period of time has elapsed, indicating that action in respect of said appliance or device is required to be taken.
14. Safety apparatus according to claim 13, wherein said means for transmitting a message includes a telephone dialler, and means for transmitting an e-mail or telephone text message to said remote location indicating that action in respect of said appliance or device is required to be taken.

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15. Safety apparatus according to claim 14, including cut-off means for preventing the flow of fuel to or within said appliance or device, and means for deploying said cut-off means when said predetermined period of time has elapsed.
16. Safety apparatus according to any one of claims 13 to 15, further comprising reset means for resetting said timing means and/or said cut-off means.
17. Safety apparatus according to claim 16, wherein said reset means is operable only by one or more authorised persons.
18. Apparatus according to any one of claims 1 to 12 or 15, wherein said cut-off means comprises a valve disposed between said appliance or device and its fuel supply.
19. Apparatus according to claim 18, wherein said valve, when deployed, blocks a fuel flow path between said fuel supply and said appliance or device.
20. Apparatus according to claim 18 or claim 19, wherein said valve is deployed by means of a solenoid, said solenoid being provided with an electrical current or voltage in response to receipt of said signal from said remote location to move said valve to a position in which it prevents said flow of fuel to said appliance or device.
21. Apparatus according to claim 20, wherein said solenoid is disposed within said fuel flow path.
22. Apparatus according to claim 21, wherein said solenoid is disposed externally of said fuel flow path.
23. Apparatus according to any one of claims 18 to 22, wherein said cut-off means is disposed within a housing having an inlet connected or connectable to a fuel supply and an outlet connected or connectable to said appliance or device.

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24. Apparatus according to any one of claims 18 to 23, being operable by means of an electrical power supply.
25. Apparatus according to claim 24, wherein said electrical power supply is provided by a mains power supply.
26. Apparatus according to claim 24 or claim 25, wherein said electrical power supply is provided by one or more (preferably rechargeable) batteries.
27. Apparatus for interrupting or cutting off the fuel supply to an appliance or device which employs combustible fuel, the apparatus comprising cut-off means for preventing the flow of fuel to or within said appliance or device, receiving means for receiving a signal from a remote location indicative of a potential hazard, and means for deploying said cut-off means to prevent said flow of fuel in response to the receipt by said receiving means of a signal from said remote location.
28. Apparatus according to claim 27, wherein said cut-off means comprises a valve disposed between said appliance or device and its fuel supply.
29. Apparatus according to claim 28, wherein said valve, when deployed, blocks a fuel flow path between said fuel supply and said appliance or device.
30. Apparatus according to claim 28 or claim 29, wherein said valve is deployed by means of a solenoid, said solenoid being provided with an electrical current or voltage in response to receipt of said signal from said remote location to move said valve to a position in which it prevents said flow of fuel to said appliance or device.
31. Apparatus according to claim 30, wherein said solenoid is disposed within said fuel flow path.

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32. Apparatus according to claim 30, wherein said solenoid is disposed externally of said fuel flow path.
33. Apparatus according to any one of claims 27 to 32, wherein said cut-off means is disposed within a housing having an inlet connected or connectable to a fuel supply and an outlet connected or connectable to said appliance or device.
34. Apparatus according to any one of claims 27 to 33, being operable by means of an electrical power supply.
35. Apparatus according to claim 34, wherein said electrical power supply is provided by a mains power supply.
36. Apparatus according to claim 34 or claim 35, wherein said electrical power supply is provided by one or more (preferably rechargeable) batteries.
37. Apparatus for interrupting or cutting off the electricity supply to an electrical appliance or device, the apparatus comprising cut-off means for selectively preventing the passage of electricity to or within said appliance or device, receiving means for receiving a radio frequency signal from a remote location, and means for deploying said cut-off means to prevent said passage of electricity in response to the receipt of said signal.
38. Apparatus according to claim 37, wherein said cut-off means is a trip switch for breaking a connection between said appliance or device and its electrical power supply in response to receipt of said signal.
39. Apparatus according to any one of claims 27 to 38, adapted to cut-off the fuel or electricity supply to a plurality of devices or appliances in response to receipt of a signal by said receiver unit from a remote location.

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40. Apparatus substantially as herein described with reference to the accompanying drawings.
41. Safety apparatus substantially as herein described with reference to the accompanying drawings.
42. An appliance or device including apparatus according to any one of the preceding claims.

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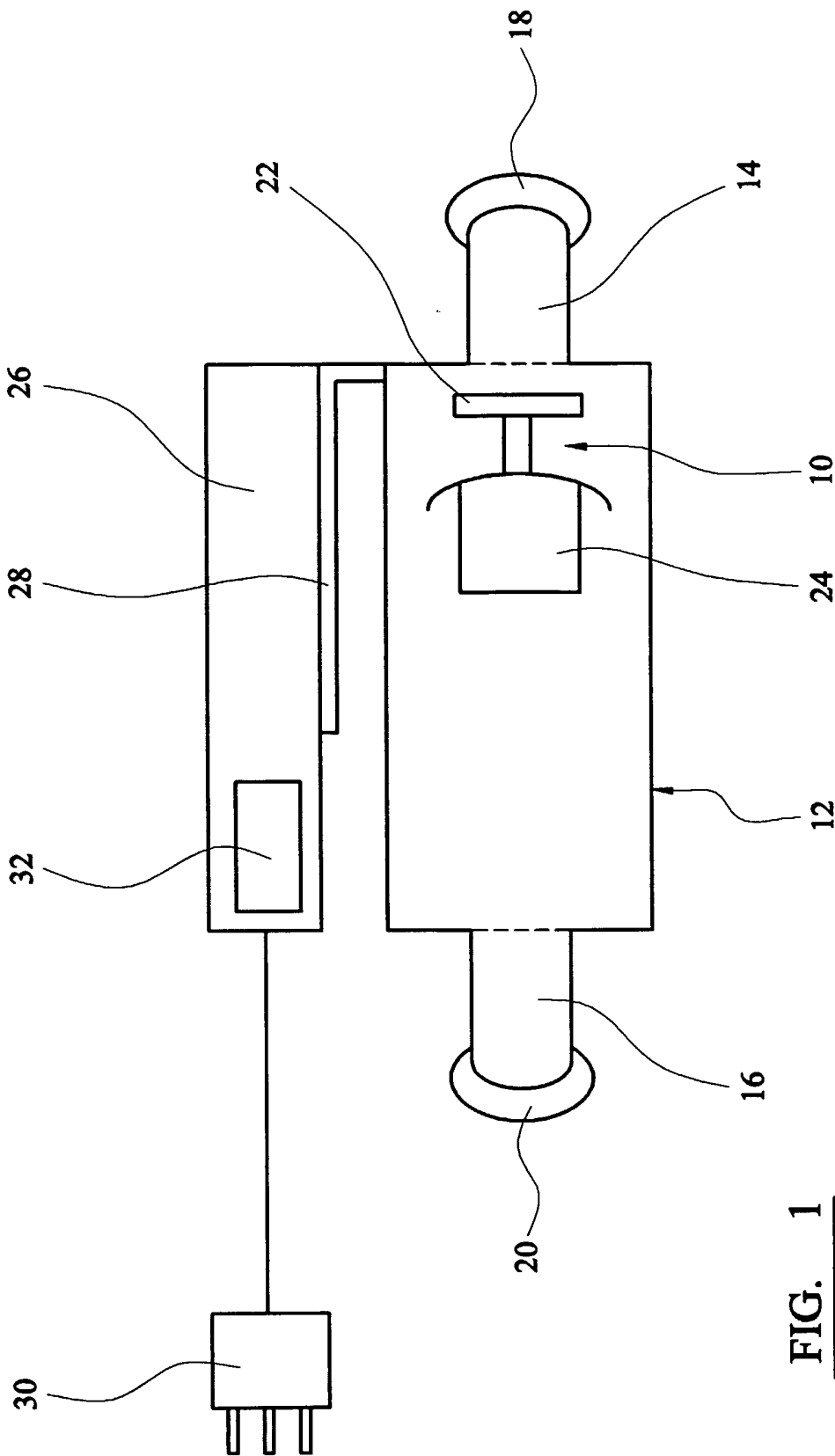
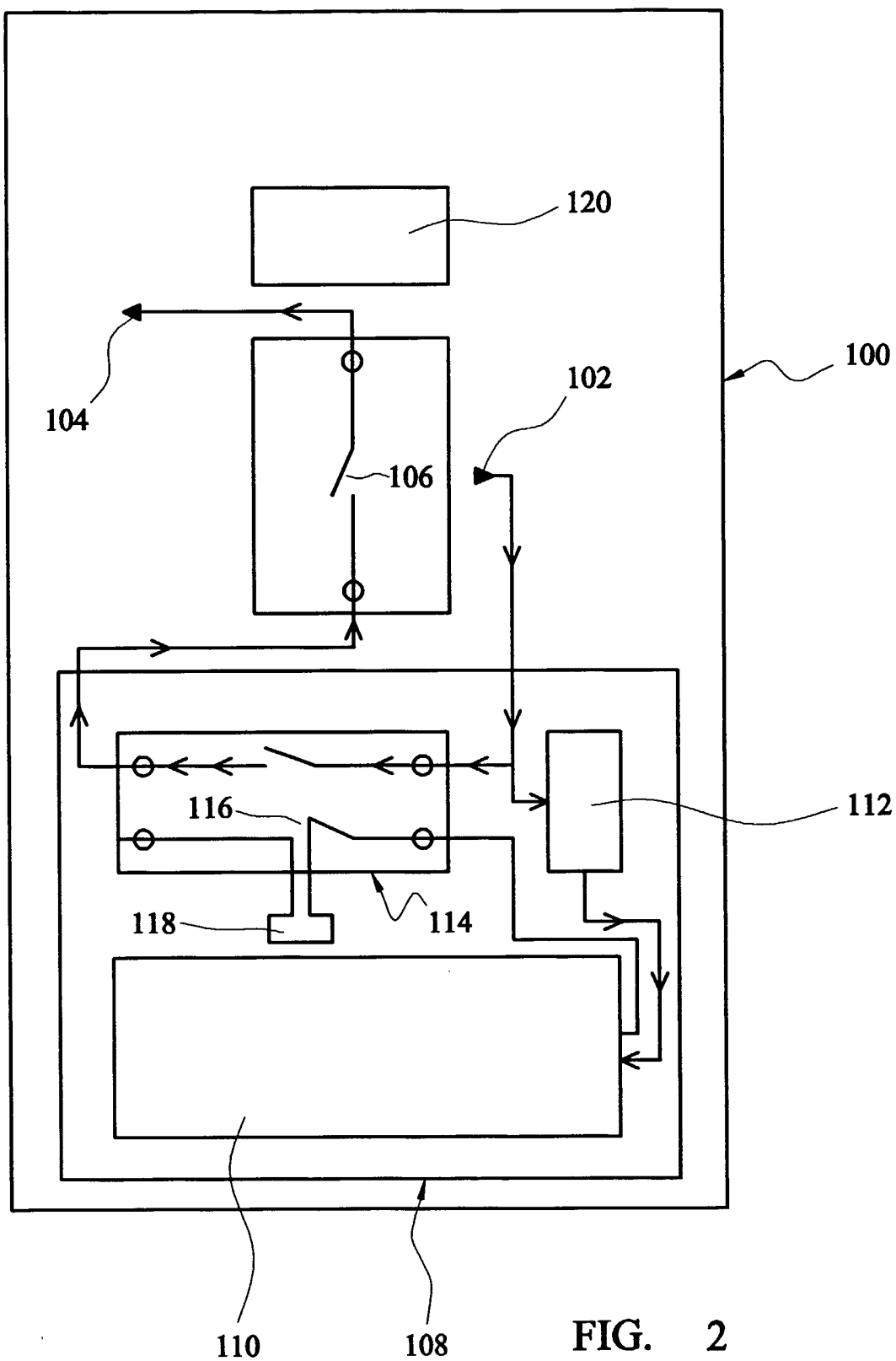


FIG. 1

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**FIG. 2**