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(54) **Control device.**

(57) A control device includes a fail-safe control circuit for controlling the length of time that a gas valve is open during the ignition cycle of a gas appliance. The control circuit includes a capacitor (11) arranged to charge to a predetermined voltage. During the timing cycle the capacitor is arranged to discharge through the coil (5) of a solenoid shut-off valve.

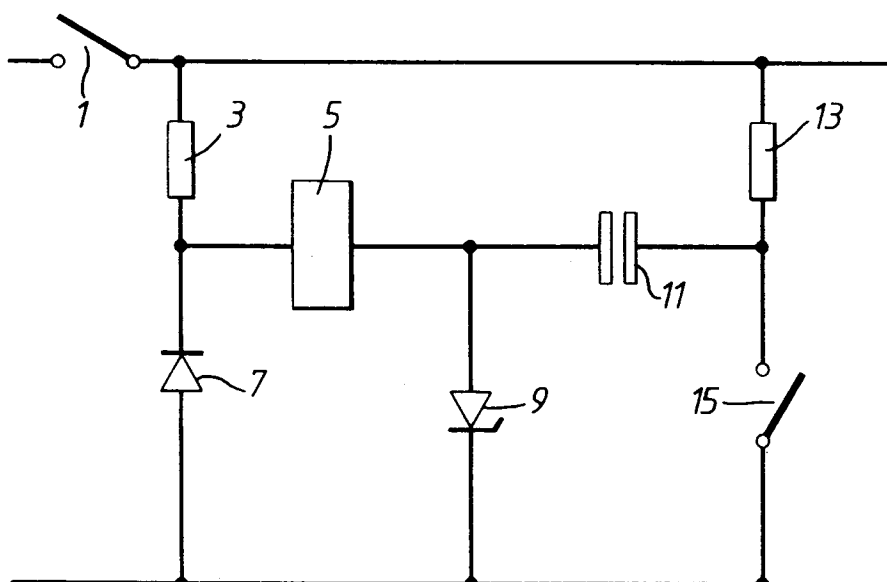


Fig.1.

This invention relates to control devices. The invention has particular, although not exclusive, relevance to safety devices including a fail-safe control circuit for controlling the length of time that a gas or oil valve is open during the ignition cycle of a gas appliance.

There are many such control devices on the market, the devices using a capacitor to store a limited amount of charge, which is used to operate a relay. This relay, in turn, is arranged to operate the gas or oil valve. In the circuits incorporated in such devices, the components are designed to be fail-safe, i.e. short circuit or open circuit faults in any of the components are designed to either cause the relay not to operate, or to operate for a shorter time than would normally be the case. One component which it is not possible to make fail-safe however, is the relay itself. Although the relay will fail-safe in the event that the relay coil becomes either short circuit or open circuit, it will not fail-safe if the relay contacts become welded together due to, for example, an overcurrent in the circuit. Furthermore, as the relay armature is a mechanical device, this may become misplaced causing failure of the relay. It is also possible for the relay to suffer from magnetic remanence, such that the relay will stay temporarily, or permanently, closed after being magnetised by current passing through the relay coil.

It is an object of the present invention to provide a safety device wherein the above difficulties are avoided.

According to the present invention there is provided a control device including a control circuit incorporating a charge storage device, means for charging the charge storage device, and means for subsequently discharging the charge storage device, the device being characterised in that it includes a solenoid valve, charge from the charge storage device being arranged to operate the solenoid valve so as to control a device to be controlled by the circuit.

Thus in a device in accordance with the invention, the control circuit can only fail in a fail-safe manner.

Preferably, the circuit is packaged as part of the solenoid valve assembly. This ensures that unauthorised tampering can be avoided, and that unsafe installation due to faulty wiring between the electronics and the control valve can be eliminated.

One embodiment of a control device in accordance with the invention will now be described, by way of example only, with reference to the accompanying Figures in which:

Figure 1 is a schematic circuit diagram of part of the control circuit included in the embodiment of the control device in accordance with the invention;

Figure 2 is a partially sectioned plan view of the control device of Figure 1; and

Figure 3 is a side view along the direction III of Figure 2.

Referring firstly to Figure 1, the control device is designed to open a gas valve (not shown) for a limited period of time in response to the switching of a switch, or to open the gas valve for an indefinite period on the detection of a flame by a flame probe not shown in the Figure but as described, for example, in our pending U.K. Patent Application GB 2230632A. The detection of a flame by the flame probe is operative to cause a switch 1 within the control circuit incorporated in the control device to close. The switch 1 is connected via a current limiting resistor 3 to a circuit arrangement comprising the coil 5 of a solenoid shut-off valve, the coil 5 being arranged in series between a diode 7 and a zener diode 9. A storage capacitor 11 is connected between the node between the coil 5 and the zener diode 9, and a further node between a resistor 13 and an electronic switch 15.

In use of the control device, the storage capacitor 11 is charged via the resistor 13. When the timing cycle is to start, the switch 15 is closed. Initially the capacitor 11 is discharged via the zener diode 9 to a voltage determined by the breakdown voltage of the zener diode 9. The storage capacitor 11 continues to discharge via the coil 5 and the diode 7. The solenoid valve (not shown in Figure 1) operated by the coil 5 will open until the current supplied by the storage capacitor 11 falls below the hold on current for the solenoid valve. If, however, the flame probe detects that a flame is present the switch 1 will be caused to close, and hold on current will be supplied to the coil 5 via the resistor 3 and the zener diode 9 so as to cause the solenoid valve to remain open. The value of the resistor 3 will be chosen to limit the current supplied to the coil 5 via the resistor 3 and the zener diode 9 to the hold on value only of the solenoid valve, and will not be sufficient to operate the solenoid valve. Thus the gas valve will be prevented from ever opening due to a fault in the flame probe circuit. It will be appreciated that solenoid valves have a characteristic in which there is a large difference between the current required to open the solenoid valve and the hold on current required to keep the solenoid valve open, thus enabling a large value of the resistor 3 to be chosen. Other interlocks (not shown) may be provided to prevent the switch 15 closing if switch 1 is closed by the presence of a flame or the simulation of a flame.

It will be appreciated that failure of the solenoid valve will only occur in the event of either a short circuit or an open circuit in the coil 5. In either event no current will flow in the coil 5, and therefore the solenoid valve will not open.

Referring now also to Figures 2 and 3, it will be appreciated that the circuitry shown in Figure 1 may be packaged as part of the solenoid valve assembly, thus giving a particularly compact and convenient control device. Such a control device is particularly safe as unauthorised tampering with the control circuit is prevented. Furthermore, as the control device is

provided as a single plug in unit, the possibility of a consumer providing faulty wiring between the circuitry and the control valve can be eliminated.

The assembly will typically include one, or as shown in the figures, two solenoid valves with the associated control circuits and solenoid coils 5 being enclosed in a plastics case 17, with the actuators 19 of the solenoid valves projecting from the case so as to enable them to be attached to the gas valve.

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Claims

1. A control device including a control circuit incorporating a charge storage device (11), means (13) for charging the charge storage device (11), and means (5,7) for subsequently discharging the charge storage device (11), the device being characterised in that it includes a solenoid valve, charge from the charge storage device (11) being arranged to operate the solenoid valve so as to control a device to be controlled by the control device.
2. A control device according to claim 1 in which the control circuit is packaged as part of the solenoid valve assembly.
3. A control device according to claim 1 in which the charge storage device (11) is arranged to discharge through the coil (5) of the solenoid valve.
4. A control device according to any one of the preceding claims in which the control circuit is effective to control the length of time a gas valve is open.
5. A control device according to claim 4 in which the circuit is responsive to the output of a flame probe to inhibit operation of the solenoid valve when a flame is not detected by the flame probe.
6. A control device according to claim 5 including means for limiting the effect of the output from the flame probe such that the solenoid valve will not open due to a fault in the output of the flame probe.

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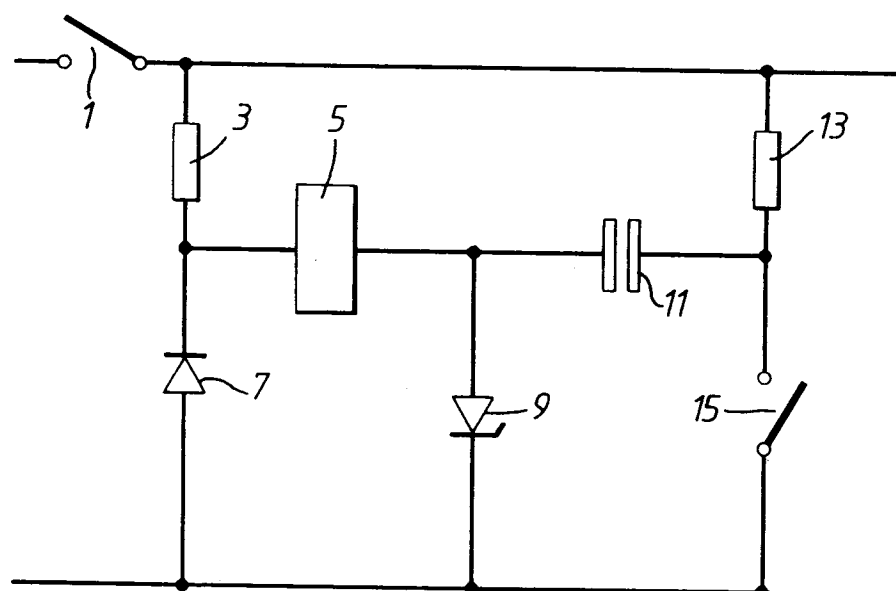


Fig.1.

