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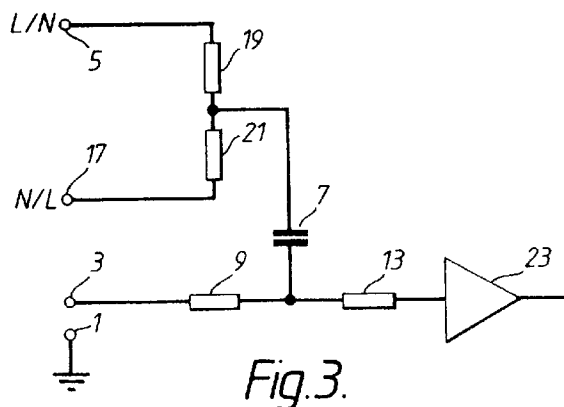
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(54) **Flame detection circuit and method.**

(57) A flame detection circuit and method using a flame probe (1,3), across which an alternating voltage is applied, is described. The means for applying an alternating voltage comprises a pair of terminals (5,17) for connection across the two rails of an A.C. supply. A pair of resistors (19,21) are connected across the terminals, with an A.C. current path being provided between the node between the resistors (19,21) and the flame probe (1,3), the resistance of each of the resistors (19,21) being equal.



This invention relates to flame detection circuits and methods.

There are many domestic and industrial applications in which it is desirable to detect the presence of a flame, and, as a result of that detection, to operate secondary control systems. Electronically controlled gas-fired appliances, for example, require an adequate means of flame detection to ensure their safe operation. Such flame detection is generally achieved by means of electronic flame detection circuits.

Known flame detection circuits include a flame probe comprising two electrodes which are positioned where a flame is expected. The ionising effect of a flame in the region of the probe causes an alternating voltage applied across the probe to be partially rectified, the D.C. component thus produced providing an indication of whether a flame is in fact present.

Two examples of known flame detection circuits will now be described, with reference to Figures 1 and 2 of the accompanying drawings, in which:

Figure 1 is a schematic circuit diagram of the first flame detection circuit, and

Figure 2 is a schematic circuit diagram of the second flame detection circuit which has been designed to overcome problems occurring with the first circuit.

Referring to Figure 1, the first circuit to be described includes a flame probe comprising two electrodes 1,3. An A.C. voltage is applied across the electrodes 1,3 by means of a terminal 5 for connection to the live rail 5 of an A.C. supply via a capacitor 7 and a resistor 9, the electrode 1 being earthed via the metalwork of the burner (not shown) for producing a flame. Any D.C. offset generated by the flame probe 1,3 due to the presence of a flame, is amplified by a D.C. amplifier 11, connected to the node between the capacitor 7 and resistor 9 by a further resistor 13, and measured with respect to earth.

Such a circuit cannot be used, however, where the live and neutral poles of the A.C. supply can be reversed as is the situation in most countries in Europe other than the United Kingdom, or where the neutral pole is not tied closely to the local earth. It is known to overcome this problem by use of the circuit shown in

Figure 2, which is an adaptation of the circuit of Figure 1, and in which corresponding components to those in Figure 1 are correspondingly labelled. The primary winding 15 of a transformer is connected across two terminals 5,17, these being intended for connection to the live 5 and neutral 17 rails respectively of an A.C. supply. The flame probe 1,3 is connected across a secondary 18 of the transformer, the output of the transformer being referenced to earth.

Whilst such a circuit operates satisfactorily, and overcomes the above problem of producing a universal flame detection circuit, it is however, disadvantageous to have to provide such an isolating transformer

in the circuit.

It is an object of the present invention to provide a flame detection circuit which may be used in situations where the polarity of the A.C. supply may be reversed, or where the neutral pole is not tied closely to the local earth, but wherein the use of an isolating transformer is avoided.

According to a first aspect of the present invention there is provided a flame detection circuit comprising a flame probe, means for applying an alternating voltage across the flame probe, and means responsive to the D.C. component induced by the flame probe in the presence of a flame to provide an indication of whether a flame is present in the vicinity of the flame probe, the circuit being characterised in that the means for applying an alternating voltage comprises: a pair of terminals for connection to the two supply rails of an A.C. supply, impedance means connected across the terminals, and an A.C. current path between a node in the impedance means and the flame probe such that the impedances between the node and each terminal are substantially equal.

Thus, in a flame detection circuit in accordance with the invention, the need for an isolating transformer is avoided by the use of relatively cheap and compact components.

According to a second aspect of the present invention there is provided a flame detection method using a flame probe, in which an alternating voltage is applied across the flame probe, and the D.C. component induced by the flame probe in the presence of a flame is monitored to provide an indication of whether a flame is present in the vicinity of the flame probe, the method being characterised by the steps of connecting an impedance means across the two supply rails of an A.C. supply, and providing an A.C. current path between a node in the impedance means and the flame probe, such that the impedance between the node and each supply rail is substantially equal.

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

Figures 1 and 2 describe the prior art circuits as have already been described, and

Figure 3 is a schematic diagram of the embodiment of the circuit in accordance with the invention.

Referring to Figure 3, the embodiment of a flame detection circuit in accordance with the invention is an adaptation of the circuit of Figure 2 and thus corresponding components are correspondingly labelled. The transformer 15,18 of the circuit shown in Figure 2 is, however, replaced by a pair of equal valued resistors 19,21 connected across the terminals 5,17, with the node between the resistors 19,21 being connected to the capacitor 7.

Thus in use of the circuit, with the terminals 5,17 connected to the live and neutral supply rails of an A.C. supply, or vice versa, the A.C. voltage supplied to the flame probe is derived from both the live and neutral rails. The amplitude of the voltage supplied to the probe will thus be equal to half that of the A.C. supply voltage. The resultant reduction in the magnitude of the D.C. current produced by the flame probe 1,3, in the presence of a flame, may be compensated for by increasing the sensitivity of the D.C. amplifier 23 used to amplify the D.C. current to twice that of the corresponding amplifier 11 incorporated in the circuits shown in Figures 1 and 2.

In order to ensure minimum further attenuation of the A.C. voltage supplied to the probe 1,3, the impedance of each resistor 19,21 should be chosen to be 10% or less of the impedance of the capacitor 7.

It will be appreciated that the output of the amplifier 23 may be used in a suitable control circuit (not shown) for controlling, for example, a gas supply valve dependent on whether the flame detection circuit provides a signal indicative of the presence of a flame in the vicinity of the flame probe 1,3. An example of a suitable control circuit is described in our co-pending European patent application No. 91308843

Claims

1. A flame detection circuit comprising a flame probe (1,3), means for applying an alternating voltage across the flame probe (1,3), and means responsive to the D.C. component induced by the flame probe in the presence of a flame to provide an indication of whether a flame is present in the vicinity of the flame probe, the circuit being characterised in that the means for applying an alternating voltage comprises a pair of terminals (5,17) for connection to the two supply rails of an A.C. supply, impedance means (19,21) connected across the terminals (5,17), and an A.C. current path between a node in the impedance means (19,21) and the flame probe (1,3) such that the impedances between the node and each terminal (5,17) are substantially equal.
2. A flame detection circuit according to claim 1 in which the impedance means comprises a resistive network (19,21).
3. A flame detection circuit according to either of the preceding claims in which the current path between the flame probe (1,3) and node includes a capacitor (7) whose impedance is chosen such that the maximum impedance between the node and each terminal (5,17) is 10% of the impedance of the capacitor (7).

4. A flame detection circuit according to any one of the preceding claims including amplification means effective to amplify the D.C. component induced by the flame probe (1,3) to an extent so as to compensate for any reduction in the D.C. component caused by the means for applying an alternating voltage (5,17).

5. A flame detection method using a flame probe (1,3), in which an alternating voltage is applied across the flame probe (1,3), and the D.C. component induced by the flame probe in the presence of a flame is monitored to provide an indication of whether a flame is present in the vicinity of the flame probe (1,3), the method being characterised by the steps of connecting an impedance means (19,21) across the two supply rails (L/N,N/L) of an A.C. supply, and providing an A.C. current path between a node in the impedance means (19,21) and the flame probe (1,3) such that the impedances between the node and each supply rail are substantially equal.

