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(54) Short circuit fault isolation means for electrical circuit arrangements.

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Description

The central control unit of a fire detection system monitoring extensive premises may need to be connected to a large number of fire detectors sited throughout the premises. In order to identify with some precision the location of any fire it is state of the art practice to divide the protected premises into local areas or fire zones each separately monitored by the control unit. If many detectors are required to adequately protect the premises it is usually uneconomic to have as many fire zones as detectors because of the high cost of wiring each detectors directly to the control unit and the cost of providing a multicity of monitoring circuits. In practice precision is usually comprised by directly interconnecting closely associated detectors to form fewer, less localised fire zones and connecting each group of detectors to the control unit as shown schematically in figure 1. The control unit 19 identifies in which zone a fire has been detected but not which detector 21 has responded. In such systems the maximum number of detectors 21 grouped together to form a zone is normally restricted to about 25 detectors. The interconnection of a larger number of detectors is not normally practiced, firstly because the greater area monitored by a greater number of detectors reduces to an unacceptable level the precision with which a fire can be located, and secondly because the occurrence of a circuit fault, such as a short circuit, in wiring interconnecting detectors can render all the detectors in that zone inoperative and place an unacceptably large area at risk pending repains, even if the presence of such a fault is indicated at the control unit 19.

Recent technology developments such as the introduction of microprocessors and improved data transmission techniques, now make it practical to manufacture detectors incorporating circuitry means by which each detector in a fire detection system can be made responsive to a uniquely coded address signal that may with advantage be superimposed on the wiring supplying power from the control unit to the interconnected detectors. When a particular detector receives its unique address signal from the control unit the circuitry means associated with the detector responds by transmitting to the control unit a signal containing information about the status of the detector. The control unit may by reference to its pre-programmed memory match the address code of the detector with a precise identification of the detector's location. Therefore, in principle the control unit 20 is able to determine both the status and the precise location of every addressable detector 21 in a fire detection system of the type shown schematically in figure 2 without the need to zone detectors on separate circuits. The elimination of a multiplicity of zone circuits and a simplification of installation wiring are apparent potential benefits of using addressable detectors. In practice the maximum number of addressable detectors connected on one circuit of this type is normally restricted to about 25 detectors because the occurrence of an open and short circuit fault in the wiring can render some or all of the detectors on the circuit inoperative and place an unacceptablly large area at risk pending rapairs. If detectors are interconnected on a wiring loop L, then a single open circuit fault will not render any of the detectors inoperative. The improved reliability afforded by the use of ring circuit may in some circumstances permit a marginal increase in the number of interconnected addressable detectors but the vulnerability of the circuit to a short circuit fault remains a major constraining influence.

Thus the problem to be solved is to provide means whereby circuit elements in a loop circuit can remain in large part operational in the event of a short circuit.

EP-A-O 042 501 discloses one solution to this problem. According to this disclosure a plurality of circuit elements, in thy form of fire detectors are connected in a loop circuit to a bi-directionally supply circuit. The fire detectors are sequentially interrogated in order to send back information to a central station. In the event of a circuit malfunction, the interrogation process is interrupted on reaching a faulty fire detector. The interrogation process then proceeds in the reverse direction until the faulty detector is reached once more whereupon the interrogation process again reverse its drection.

US-A-3652798 discloses a telecommunication system in which junction switches are provided in loop for detecting the absence of signals on a primary line, due to a fault, and for diverting the signals to a secondary line. In the event of the fault, the junction switches all operate together to interrupt primary and secondary lines. They then need to be sequentially actuated, by a signal from the junction switch which first detected the absence of the signals so as to restore operation on a reconfigured loop which includes the primary and secondary lines but not the fault.

The invention provides an alternative solution as defined in claim 1.

In the accompanying schematic drawings:-

Figure 1 illustrates a conventional fire detection system;

Figure 2 illustrates another conventional fire detection system including addressable fire detectors;

Figure 3 illustrates an embodiment of the invention;

Figure 4 illustrates a circuit diagram of one form of bi-directional isolator according to the invention, and

Figures 5-8 illustrate further respective embodiments of the invention.

Figure 3 illustrates an embodiment of the invention in the form of a control unit 20 connected to a loop circuit L of detectors in which groups of one or more detectors 21 are separated by devices containing a novel circuit arrangement as disclosed herein and termed bi-directional short circuit isolators (1, 2, 3, 4). Each isolator (1, 2, 3, 4) contains a circuit arrangement (see Figs. 4 and 5 and following description) which normally provides bi-directional low impedance circuit paths for both of the supply wiring circuits forming the loop circuit L such that detectors 21 may receive power and address signals from either end of the loop L and transmit data signals in either direction to the control unit 20. The circuit arrangement also contains sensing means (TR2, D1, D7, of Fig. 4 or 5) for detecting a short circuit of the loop circuit wiring on either side of the circuit arrangement and switching means TR1 and TR3 of Fig. 4 or 5) controlled by said sensing means and arranged to switch from a low impedance path (through TR1 or TR3) to a high impedance path (TR1 and TR3 biased off) in response to a short circuit fault in the loop circuit. If the short circuit occurs in the type of circuit arrangement shown in Figure 3, the short circuit will be detected by sensing means in bi-directional isolators (1, 2, 3, 4) on both sides of the short circuit and the impedance of the isolators adjacent to the short circuit fault will switch to a high state thus isolating the short circuit fault from the detectors 21 and other isolators located between each high impedance isolator and the control unit 20. Only those detectors 21 located between the adjacent bi-directional isolators (e.g. 2 and 3) are rendered inoperative by a short circuit fault, since the detectors 21 will still receive current (via isolator 1) which passes through the lines which connect them on one side to unit 20 (i.e. as far as, but not beyond isolator 2), and (via isolator 4) which passes through the lines which connect them to the other side of unit 20 (i.e. as far as, but not beyond isolator 3).

Ideally bi-directional short circuit isolators could, with advantage, be connected alternately with detectors such that a short circuit fault of the loop wiring or of a detector renders only one detector inoperative. In practice this may not always be possible because of economic considerations and because isolators may have a low but finite impedence in the low impedence state which gives rise to a cumulative volt drop around the loop circuit if a large number of isolators are used. Embodiments of isolators based on semiconductor circuits can be expectd to provide a volt drop of less than 0.8 volts in the low impedance state. Thus ten isolators may produce up to a 7.2 volt drop from the first isolator to the 10th isolator if a short circuit occurs between the 10th and 11th isolator in a system fitted with 11 isolators for example. A system of this type fitted with modern detectors having a wide operating voltage range can be expected to accommodate a 7.2 volt drop without any performance degradation. The maximum number of detectors which may be connected between isolators will be largely determined by the maximum tolerable number of detectors than can be rendered inoperative in the event of a short circuit. By way of example this number may be approximately 25 if comparable performance with that of conventional fire detection systems using non addressable detectors is used as the criterion. It will therefore be perceived that a loop system using say 11 bi-directional short circuit isolators may interconnect approximately 250 addressable detectors and be no more degraded by a short circuit fault than a conventional 10 zone system with 25 detectors per zone. The loop system of addressable detectors also has advantages that an open circuit fault will not render any detectors inoperative and that the location of detectors can be identified with precision.

Figure 4 shows one form of a practical embodiment in component form of a bi-directional circuit isolator.

When power is applied to terminals 31 and 32 transistor TR2 is driven into conduction by virtue of base drive derived from resistor R1 and bias resistor R5. Transistor TR2 in turn drives transistor TR1 into conduction via diode D4 steering diode D2, resistor R3 and bias resistor R2 thus effecting a low impedance path from terminal 31 to terminal 33 via TR1 and diode D3. Similarly and by virtue of the symmetry of the circuit it can be shown that a low impedance path can be effected between terminals 33 and 31 via transistor TR3 and diode D5 if power is applied to terminals 33 and 34. A low impedance always exists between terminals 34 and 32.

When the isolator as described above is incorporated in a loop circuit the transistor TR1 or TR2 associated with the input terminals receiving the higher supply voltage will be conductive and provide the low impedance path. The terminals receiving the higher voltage are determined -by the proximity of the isolator to the control unit, the presence or absence of short or open circuit faults and possibly the voltage level of any superimposed data transmission signal.

If a short circuit fault occurs across the loop circuit wiring connected to terminals 33 and 34 the drive current for transistor TR2 base cannot be sourced via R6 nor can it be sourced from terminal 31 via R1 because the now forward biasing of diode D7 does not provide sufficient bias voltage to drive transistor TR2 and diode D4 into conduction. The short circuit fault causes TR2 to switch off which in turn ensures that both TR1 and TR3 are both switched off thus isolating the short circuit from that part of the loop circuit connected to terminals 31 and 32. Similarly and by virtue of the symmetry of the circuit it can be shown that a short circuit across wiring connected to terminals 31 and 32 will be isolated from that part of the loop circuit connected to terminals 33 and 34.

Resistor R7 is an optional resistor normally of high value which may be necessary to improve the switch on characteristics of the isolator when power is first applied in circumstances where the detectors connected to the circuit have a capacitive input or require a higher quiescent current that can initially be sourced via resistors R1 and R6 in parallel with D7 or R6 and R1 in parallel with D1 as circumstances dictate.

A further circuit arrangement incorporating short circuit isolators is shown in Figure 5. In this arrangement the isolators are connected in a loop circuit with groups of detectors spurred off between isolators rather than being connected to the loop circuit directly. Those skilled in the art will recognise that this is a particularly suitable circuit arrangement for multi-storey buildings.

It is recognised that an open circuit in the spur wiring could render inoperative those detectors furthest from the loop wiring and beyond the open circuit, but this will not result in an intolerable situation if the number of detectors per spur is limited to about 25 as in conventional zone systems.

A further circuit arrangement is shown in Figure 6. This arrangement has the advantages of the loop circuit and the additional advantage that more than one open circuit fault in the wiring linking detectors does not render any detectors inoperative unless two or more open circuits occur on the same spur.

Further circuit arrangements formed by combining all or parts of circuit arrangements disclosed above and containing one or more isolators whether bi-directional or uni-directional are embodiments of the invention.

The short circuit isolatons disclosed here may constructed in various forms. They may with advantage be incorporated within control units and within detectors or they may be'constructed as separate units which are wired into circuit arrangements as required.

The embodiment of the invention disclosed by way of example in Figure 4 may be implemented in complementary form semiconductors.

A further embodiment of the invention having application with circuits using an alternating electrical supply is illustrated in schematic form in Figure 7. In this figure, a non-polarised bi-directional short circuit isolator 23 (represented by the broken line) comprises two polarised bi-directional short circuit isolators 24a, 24b, interconnected as shown, and connected to a.c. supply lines 25 26.

Fig. 8 illustrates an improvement in the circuitry of Fig. 4 (similar reference numerals or letters identify similar components). In Fig. 8 transistors TR1 and TR3 are VMOS field effect transistors. VMOS devices have the advantage that their "on state" impedance is very low, typically 5 ohms to 0.3 ohms. This means that, in most applications, a smaller voltage drop will be developed across the isolator, thus permitting an increase in the number of isolators which may be introduced into a circuit. Because VMOS devices conduct current bi-directionally in the "on state" it is possible to connect them in series. This has enabled diodes D5 and D3 to be eliminated thus further reducing the voltage drop across the device.

In accordance with another improvement (shown in Fig. 8) an LED indicator LED 1 is provided which illuminates when the short circuit isolator switches to a high impedance state in response to the presence of a short circuit. LED 1 is incorporated within a bridge rectifer circuit, including diodes D9-D12, which produces a rectified voltage in response to a short circuit on either side of the isolator. LED 1 is caused to flash periodically by incorporating it in a oscillator circuit comprising a conventional programmable unijunction transistor oscillator and associated components TR4, R9-R13, C1. By causing LED 1 to flash, the current required to provide indication when a short circuit is detected is reduced.

In accordance with further improvements (shown by Fig. 8), two zener diodes D13, D14 are provided to protect the short circuit isolator from high voltage transients and accidental polarity reversal, and a 10K ohm resistor R14 is connected to the base of TR2 to give a degree of control over the threshold voltage of the short circuit sensing circuitry.

Claims

1. A short circuit detection system comprising a loop circuit (L) connected to a bi-directional unit (20), and circuitry for isolating a section of the loop circuit (L), containing one or more circuit elements (21), from the bi-directional unit (20) in the event of a short circuit in said section and wherein one or more of said circuit elements (21) are connected between adjacent bi-directional isolators (1,2,3,4) in each section of the loop circuit (L), each of said isolators (1,2,3,4) comprising switching means (TR1, TR3) providing a low impedance path and a high impedance path, said high impedance path isolating said circuit elements (21) from said unit (20); and sensing means (TR2, D1, D7) for sensing a short circuit in any one of said circuit elements (21) in said section; said switching means (TR1, TR3) being responsive to said sensing means (TR2, D1, D7) to cause said switching means (TR1, TR3) to provide said low impedance path in the absence of said short circuit and to cause a change in state from the low impedance path to the high impedance path in the presence of said short circuit, characterised in that said bidirectional unit (20) is a power supply unit, said low impedance paths supplying current continuously from said supply unit to said circuit elements, that said circuit elements (21) are fire detectors which are operationally dependent on the power supplied by said unit (20), and that the short circuit sensing means in said bi-directional isolators (1-4) are independently and simultaneously responsive

to a change of voltage level in a short circuited section of the loop (L) between said adjacent isolators whereby only the isolators (2,3) immediately adjacent the short circuited section autonomously and simultaneously block the supply of power to the fire detectors (21) therebetween without preventing the other bi-directional isolators (1, 4) from supplying current continuously from said power supply unit (20) to the non-isolated fire detectors (21).

2. A system according to claim 1, characterised in that a plurality of said circuit elements (21) are connected in series between each pair of said bidirectional isolators (1, 2, 3, 4).

3. A sytem according to claim 1, characterised in that a plurality of said circuit elements (21) are connected in respective spurs (S) between each pair of said isolators (1, 2, 3, 4).

4. A system according to claim 1, characterised in that a plurality of said circuit elements (21) are interconnected in respective loops between each pair of said isolators (1, 2, 3, 4) and that each pair of isolators (1, 2, 3, 4) are also interconnected (Figure 6).

5. A system according to any one of the preceding claims and adapted for the supply of alternating current characterised in that each of said isolators is of a non-polarised form and comprises polarised isolators (1, 2) connected to respective lines (25, 26) supplying said alternating current, opposite poles of said isolators (1, 2) being interconnected (Figure 7).

6. A system according to any one of the preceding claims, characterised in that, in each of said isolators (1, 2, 3, 4), said switching means comprises transistors (TR1, TR3, of Fig. 4) connected to respective diodes (D3, D5) for conducting currents in respective forward and reverse directions in said impedance path.

7. A sytem according to claim 6, characterised in that an impedance (R7) is connected in a shunt path, across said switching means (TR1, TR3) in order to improve the switch-on characteristics of the isolator (1, 2, 3, 4) when power is first applied.

8. A sytem according to any one of the claims 1 to 5, characterised in that, in each of said isolators (1, 2, 3, 4), said switching means comprises VMOS devices (TR1, TR3 of Fig. 8) which conduct currents bi-directionally in said low impedance path.

9. A sytem according to claim 8, characterised in that an oscillating circuit (TR4, R9-R13, C1) is connected across a bridge rectifier circuit (D9, D10, D11, D12) in order to operate an indicator (LED 1) intermittently on detaching a short circuit on either side of isolator (1, 2, 3, 4).

10. A system according to claim 6, 7, 8 or 9 characterised in that said sensing means comprises a transistor (TR2) for biasing the transistors (TR1, TR3) of said switching means to provide respective low impendance paths, the transistor (TR2) of said sensing means being biased by current derived from respective circuits (D1, R1, D7, R6) which diode circuits become respectively forward, or reverse biased in response to a short circuit in one of said current elements (21) whereby the transistor (TR2) of said sensing means is biased into a non-conducting state, thereby biasing the transistors (TR1, TR3) into a non-conducting state to provide respective high impedance paths.

Patentansprüche

1. Kurzschluß-Detektorsystem mit einer Schleifenschaltung (L), die mit einer bidirektionalen Einheit verbunden ist, und einer Schaltungsanordnung zum Abtrennen eines ein oder mehrere Schaltungselemente (21) enthaltenden Abschnitts der Schleifenschaltung (L) von der bidirektionalen Einheit (20) bei Auftreten eines Kurzschlusses in diesem Abschnitt, wobei in jedem Abschnitt der Schleifenschaltung (L) eines oder mehrere der genannten Schaltungselemente (21) zwischen benachbarten bidirektionalen Trennvorrichtungen (1, 2, 3, 4) angeordnet sind, die jeweils Schaltmittel (TR1, TR3) mit einem niederohmigen und einem hochohmigen Strompfad enthalten, wobei der hochohmige Strompfad die Schaltungselemente (21) von der genannten Einheit (20) abtrennt, ferner mit Sensormitteln (TR2, D1, D7) zur Erfassung eines Kurzschlusses in einem der genannten Schaltungselemente in dem genannten Abschnitt, wobei die Schaltmittel (TR1, TR3) auf die Sensormittel (TR2, D1, D7) ansprechen und von diesen derart steuerbar sind, daß sie den genannten niederohmigen Strompfad bilden, wenn kein Kurzschluß vorliegt, und hingegen eine Zustandsänderung von dem niederohmigen Strompfad in den hochohmigen Strompfad Impedanz bewirken, wenn ein Kurzschluß voranden ist, dadurch gekennzeichnet, daß die bidirektionale Einheit (20) eine Stromversorgungseinheit ist und die niederohmigen Strompfade den Schaltungselementen kontinuierlich Strom von der Stromversorgungseinheit zuführen, daß die Schaltungselemente (21) Feuerdetektoren sind, die wirkungsmäßig von der von der Stromversorgungseinheit (20) gelieferten Leistung abhängig sind, und daß die Kurzschluß-Sensormittel in den bidirektionalen Trennvorrichtungen (1-4) unabhängig und gleichzeitig auf eine Anderung des Spanungspegels in einem kurzgeschlossenen Abschnitt der Schleife (L) zwischen den benachbarten Trennvorrichtungen ansprechen, derart daß nur diejenigen Trennvorrichtungen (1, 3), die unmittelbar an den kurzgeschlossenen Abschnitt angrenzen, autonom und gleichzeitig die Stromversorgung für die dazwischen liegenden Feuerdetektoren (21) unterbrechen, ohne daß die anderen bidirektionalen Trennvorrichtungen (1, 4) daran gehindert sind, den nicht abgetrennten Feuerdetektoren (21) kontinuierlich Strom von der Strom-

versorgungseinheit (20) zuzuführen.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß zwischen jedem Paar von Trennvorrichtungen (1, 2, 3, 4) mehrere der genannten Schaltungselemente (21) in Reihe geschaltet sind.

3. System nach Anspruch 1, dadurch gekennzeichnet, daß zwischen jedem Paar von Trennvorrichtungen (1, 2, 3, 4) mehrere der genannten Schaltungselemente (21) in entsprechenden Abzweigungen (S) angeordnet sind.

4. System nach Anspruch 1, dadurch gekennzeichnet, daß mehrere der genannten Schaltungselemente (21) in entsprechenden Schleifen zwischen jedem Paar von Trennvorrichtungen (1, 2, 3, 4) angeordnet sind und daß die Trennvorrichtungen (1, 2, 3, 4) jedes Paars ebenfalls miteinander verbunden sind (Fig. 6).

5. System nach einem der vorhergehenden Ansprüche, das für Wechselstromversorgung ausgelegt ist, dadurch gekennzeichnet, daß die einzelnen Trennvorrichtungen stromrichtungsunabhängig sind und stromrichtungsabhängige Trennvorrichtungen (1, 2) beinhalten, die mit zugeordneten, Wechselstrom führenden Leitungen (25, 26) verbunden sind, wobei entgegengesetzte Pole dieser stromrichtungsabhängigen Trennvorrichtungen (1, 2) miteinander verbunden sind (Fig. 7).

6. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Schaltmittel in den einzelnen Trennvorrichtungen (1, 2, 3, 4) Transistoren (TR1, TR2; Fig. 4) umfassen, die jeweils mit Dioden (D3, D5) verbunden sind, welche in dem genannten niederohmigen Strompfad zur Stromleitung in Vorwärts- bzw. Rückwärtsrichtung dienen.

7. System nach Anspruch 6, dadurch gekennzeichnet, daß eine Impedanz (R7) vorgesehen ist, die die genannten Schaltmittel (TR1, TR3) überbrückt und das Einschaltverhalten der Trennvorrichtungen (1, 2, 3, 4) bei erstmaligem Anlegen der Versorgungsspannung verbessert.

8. System nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die in den Trennvorrichtungen (1, 2, 3, 4) vorgesehenen Schaltmittel VMOS-Elemente (TR1, TR3; Fig. 8) umfassen, die in dem genannten niederohmigen Strompfad in beiden Richtungen stromleitend sind.

9. System nach Anspruch 8, dadurch gekennzeichnet, daß eine im Diagonalzweig einer Gleichrichterbrückenschaltung (D9, D10, D11, D12) angeordnete Oszillatorschaltung (TR4, R9-R13, C1) vorgesehen ist, die bei Erfassung eines Kurzschlusses eine Anzeigeeinrichtung (LED 1) intermittierend betätigt.

10. System nach Anspruch 6, 7, 8 oder 9, dadurch gekennzeichnet, daß die genannten Sensormittel einen Transistor (TR2) umfassen, durch den die Transistoren (TR1, TR3) der Schaltmittel derart vorgespannt werden können, daß sie jeweils einen niederohmigen Strompfad bilden, daß der Transistor (TR2) der Sensormittel durch einen von den jeweiligen Diodenschaltungen (D1, R1, D7, R6) abgeleiteten Strom vorgespannt ist, und daß die Diodenschaltungen ihrerseits bei Auftreten eines Kurzschlusses in einem der Schaltungselemente (21) in Durchlaß- bzw. in Sperrichtung vorgespannt werden, derart daß der Transistor (TR2) der Sensormittel in den nichtleitenden Zustand vorgespannt wird, wobei er die Transistoren (TR1, TR3) in den nichtleitenden Zustand vorspannt, so daß sie hochohmige Strompfade bilden.

Revendications

1. Un système de détection de court-circuit comprenant un circuit en boucle (L) connecté à un élément bidirectionnel (20) et un circuit pour isoler une partie d'un circuit en boucle (L), contenant un ou plusieurs éléments de circuit (21) par rapport à un élément d'alimentation bidirectionnelle (20) dans le cas d'un court-circuit dans ladite partie et dans lequel un ou plusieurs desdits éléments de court-circuit (21) sont connectés entre des isolateurs bidirectionnels (1, 2, 3, 4) dans chaque partie du circuit en boucle (L), chacun desdits isolateurs (1, 2, 3, 4) comprenant des moyens de commutation (TR1, TR3) assurant un trajet à basse impédance et un trajet à haute impédance, ledit trajet à haute impédance isolant lesdits éléments de circuit (21) dudit élément (20) ; et des moyens de détection (TR2, D1, D7) pour détecter un court-circuit dans l'un quelconque desdits éléments de circuit (21) dans ladite partie ; lesdits moyens de commutation (TR1, TR3) agissant en réponse auxdits moyens de détection (TR2, D1, D7) pour amener lesdits moyens de commutation (TR1, TR3) à fournir ledit trajet à basse impédance en l'absence de court-circuit et à provoquer un changement d'état du trajet à basse impédance au trajet à haute impédance en présence dudit court-circuit, caractérisé en ce que ledit élément bidirectionnel (20) est un élément d'alimentation en énergie, lesdits trajets à basse impédance fournissant un courant de manière continue depuis ledit élément d'alimentation auxdits éléments de circuit, en ce que lesdits éléments de circuit (21), sont des détecteurs d'incendie qui sont actionnés en fonction de l'énergie fournie par ledit élément (20), et en ce que les moyens de détection de court-circuit dans lesdits isolateurs bidirectionnels (1-4) agissent indépendamment et simultanément à la variation du niveau de tension dans une partie court-circuitée de la boucle (L) entre lesdits isolateurs adjacents, grâce à quoi seuls les isolateurs (2, 3) immédiatement adjacents à la partie court-circuitée bloquent de manière autonome et simultanée l'alimentation en énergie des détecteurs d'incendie (21) disposés entre eux sans empêcher les autres isolateurs bidirectionnels (1, 4) de

fournir un courant de manière continue dudit élément d'alimentation en énergie (20) aux détecteurs d'incendie non isolés (21).

2. Un système selon la revendication 1, caractérisé en ce qu'une pluralité des éléments de circuit (21) est connectée en série entre chaque paire d'isolateurs bidirectionnels (1, 2, 3, 4).

3. Un système selon la revendication 1, caractérisé en ce qu'une pluralité des éléments de circuit (21) est connectée dans des prolongements respectifs (S) compris entre chaque paire d'isolateurs (1, 2, 3, 4).

4. Un système selon la revendication 1, caractérisé en ce qu'une pluralité des éléments de circuit (21) est interconnectée dans des boucles respectives entre chaque paire d'isolateurs (1, 2, 3, 4) et en ce que chaque paire d'isolateurs (1, 2, 3, 4) est également interconnectée (figure 6).

5. Un système selon l'une quelconque des revendications précédentes et adapté à une alimentation en courant alternatif caractérisé en ce que chacun des isolateurs est de type non polarisé et comprend des isolateurs polarisés (1, 2) connectés aux lignes respectives (25, 26) fournissant ledit courant alternatif, les pôles opposés des isolateurs (1, 2) étant interconnectés (figure 7).

6. Un système selon l'une quelconque des revendications précédentes, caractérisé en ce que, dans chacun des isolateurs (1, 2, 3, 4), les moyens de commutation comprennent des transistors (TR1, TR3, figure 4) connectés à des diodes respectives (D3, D5) pour transmettre des courants dans les directions respectives directe et inverse dans ledit trajet à basse impédance.

7. Un système selon la revendication 6, caractérisé en ce qu'une impédance (R7) est connectée selon un trajet de dérivation aux bornes des moyens de commutation (TR1, TR3) pour améliorer les caractéristiques de fermeture de l'isolateur (1, 2, 3, 4) quand l'alimentation est initialement appliquée.

8. Un système selon l'une quelconque des revendications 1 à 5, caractérisé en ce que, dans chacun des isolateurs (1, 2, 3, 4), les moyens de commutation comprennent des dispositifs de type VMOS (TR1, TR3 figure 8) qui transmettent des courants bidirectionnels dans ledit trajet à basse impédance.

9. Un système selon la revendication 8, caractérisé en ce qu'un circuit oscillant (TR4, R9-R13, C1) est connecté aux bornes d'un circuit redresseur en pont (D9, D10, D11, D12) pour actionner un indicateur (LED 1) de façon intermittente par suite de la détection d'un court-circuit d'un côté ou de l'autre de l'isolateur (1, 2, 3, 4).

10. Un système selon la revendication 6, 7, 8 ou 9, caractérisé en ce que les moyens de détection comprennent un transistor (TR2) pour polariser les transistors (TR1, TR3) des moyens de commutation pour fournir des trajets respectifs à basse impédance, le transistor (TR2) des moyens de détection étant polarisé par un courant provenant de circuits à diodes respectifs (D1, R1, D7, R6), ces circuits à diodes devenant polarisés respectivement en direct ou en inverse en réponse à un court-circuit dans l'un des éléments de circuit (21), d'où il résulte que le transistor (TR2) des moyens de détection est polarisé à un état non conducteur, polarisant ainsi les transistors (TR1, TR3) à un état non conducteur pour fournir les trajets respectifs à haute impédance.

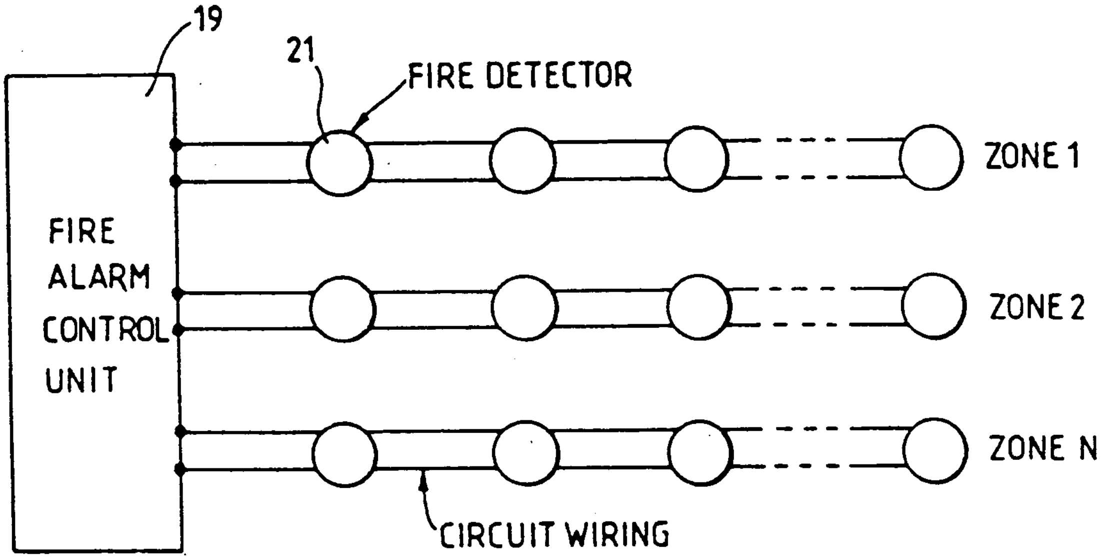
19
21
FIRE DETECTOR
ZONE 1
FIRE
ALARM
CONTROL
UNIT
ZONE 2
ZONE N
CIRCUIT WIRING

Fig.1.

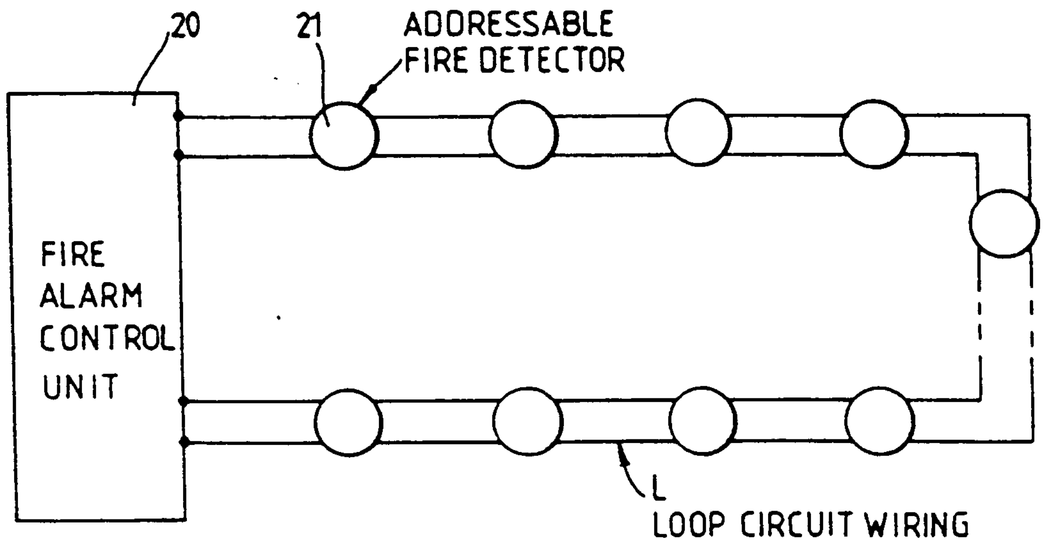
20
21
ADDRESSABLE
FIRE DETECTOR
FIRE
ALARM
CONTROL
UNIT
L
LOOP CIRCUIT WIRING

Fig.2.

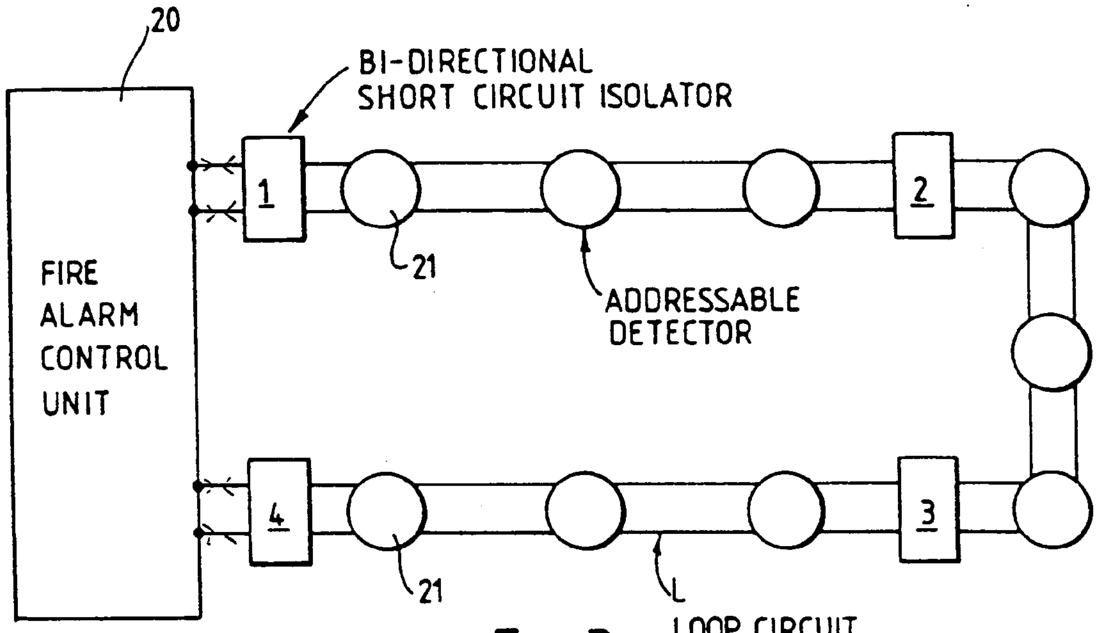
20
BI-DIRECTIONAL
SHORT CIRCUIT ISOLATOR
FIRE
ALARM
CONTROL
UNIT
1
2
3
4
21
ADDRESSABLE
DETECTOR
21
L
LOOP CIRCUIT

Fig.3.

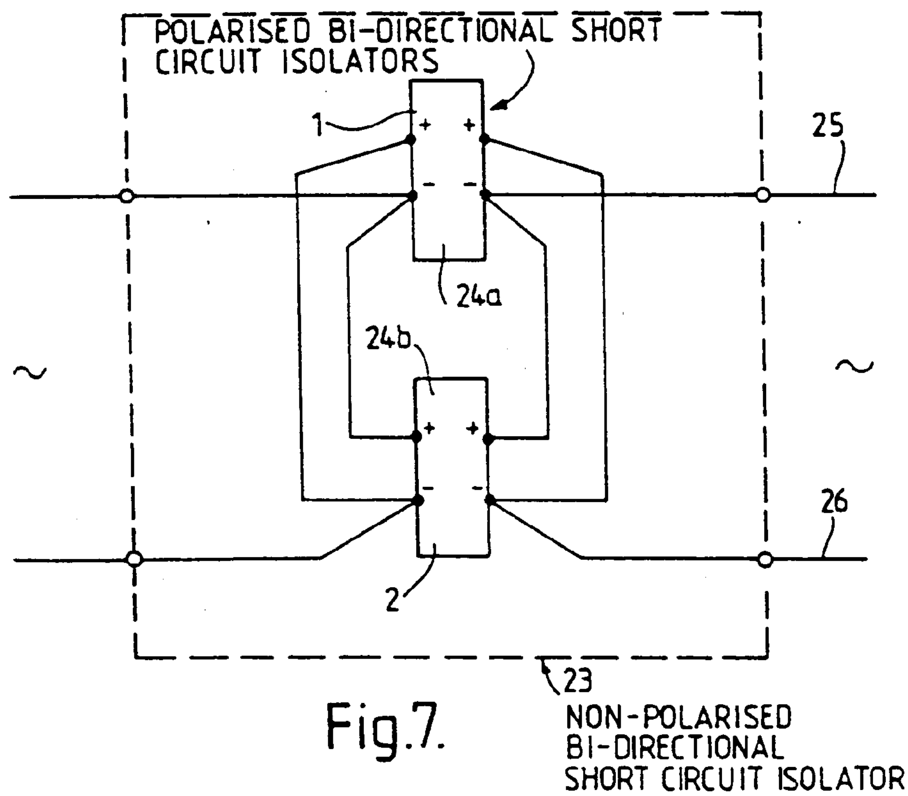
POLARISED BI-DIRECTIONAL SHORT
CIRCUIT ISOLATORS
1
25
24a
24b
~
~
26
2
23
NON-POLARISED
BI-DIRECTIONAL
SHORT CIRCUIT ISOLATOR

Fig.7.

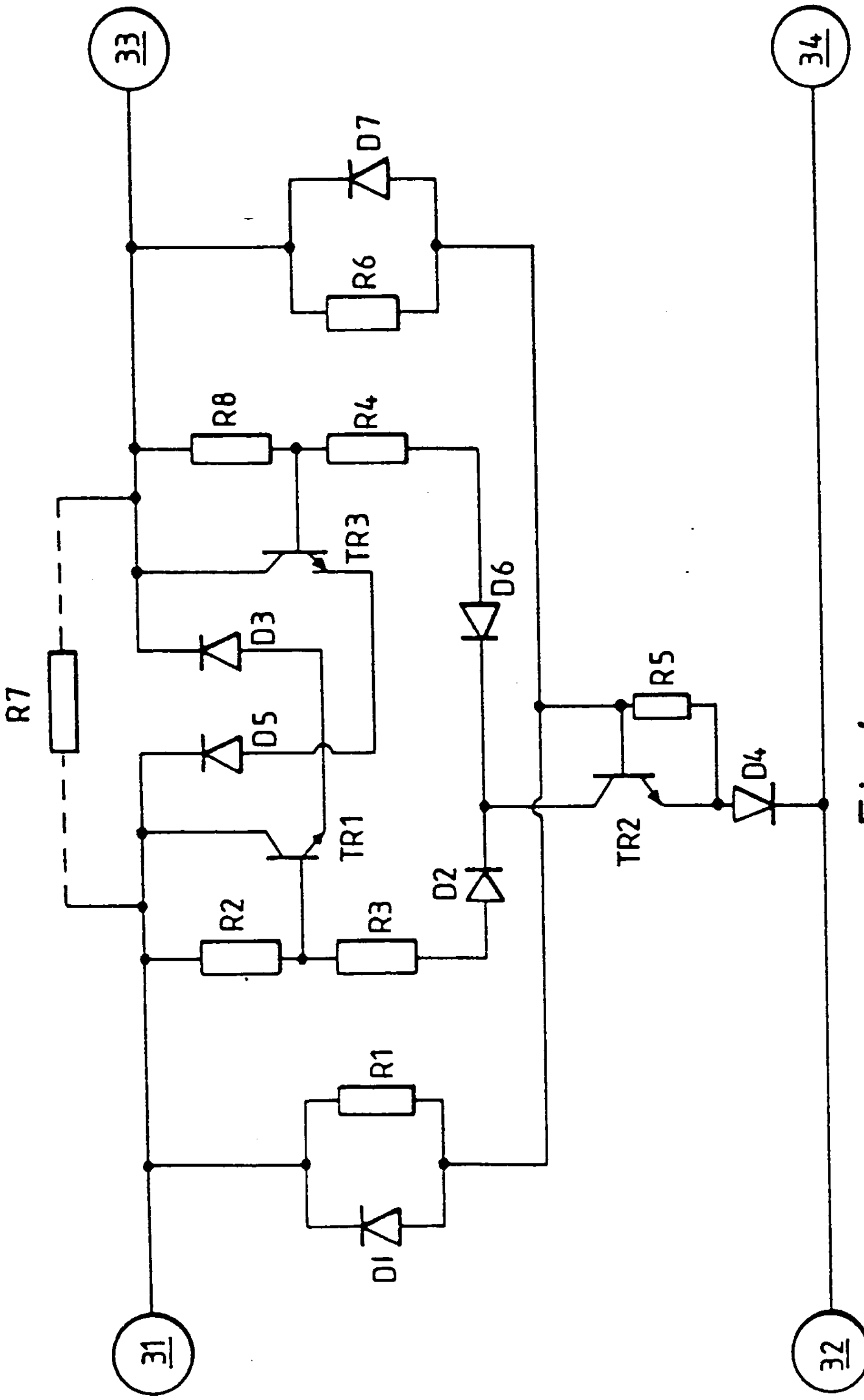

Fig.4.

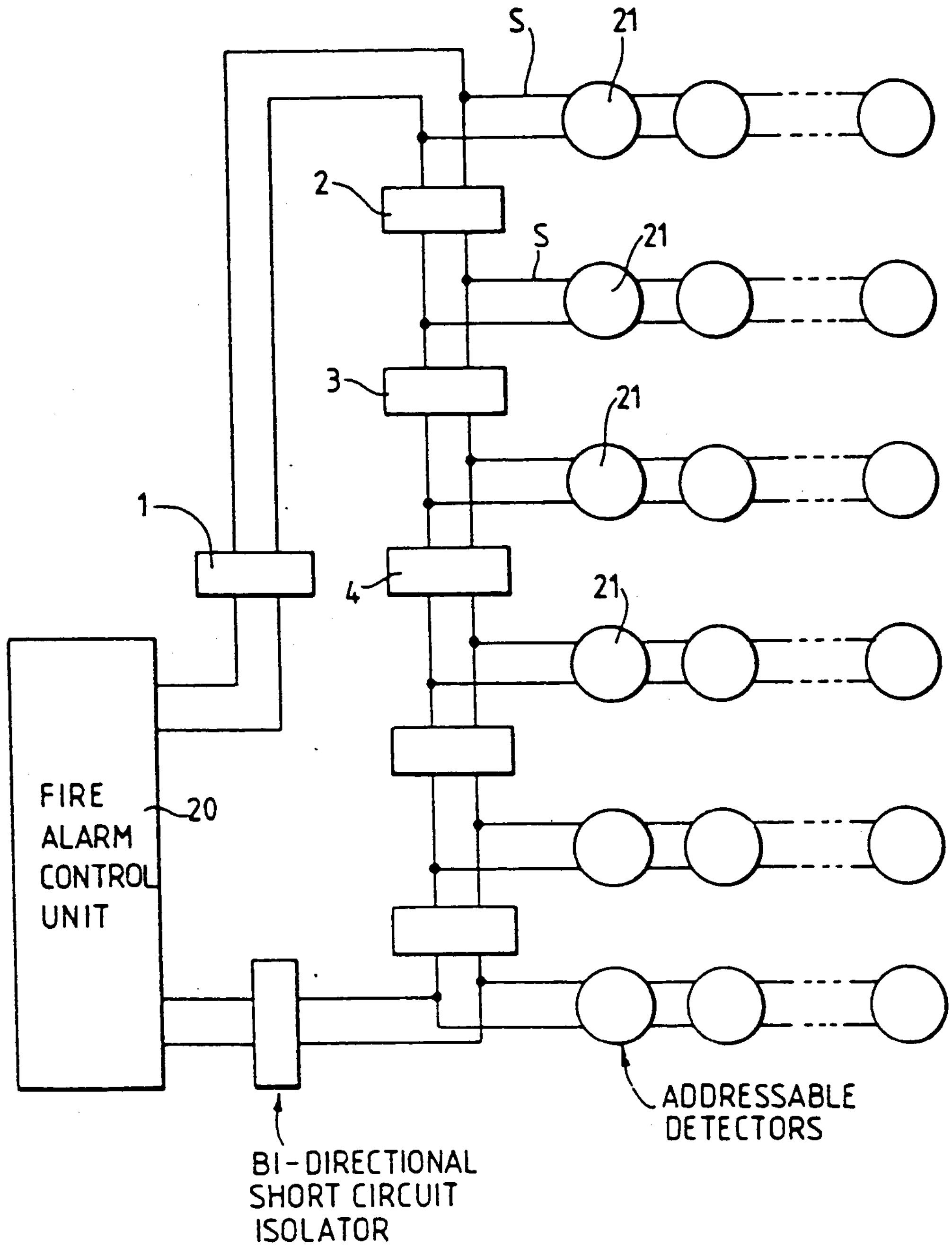
S
21
2
S
21
3
21
1
4
21
FIRE
ALARM
CONTROL
UNIT
20
BI-DIRECTIONAL
SHORT CIRCUIT
ISOLATOR
ADDRESSABLE
DETECTORS

Fig.5.

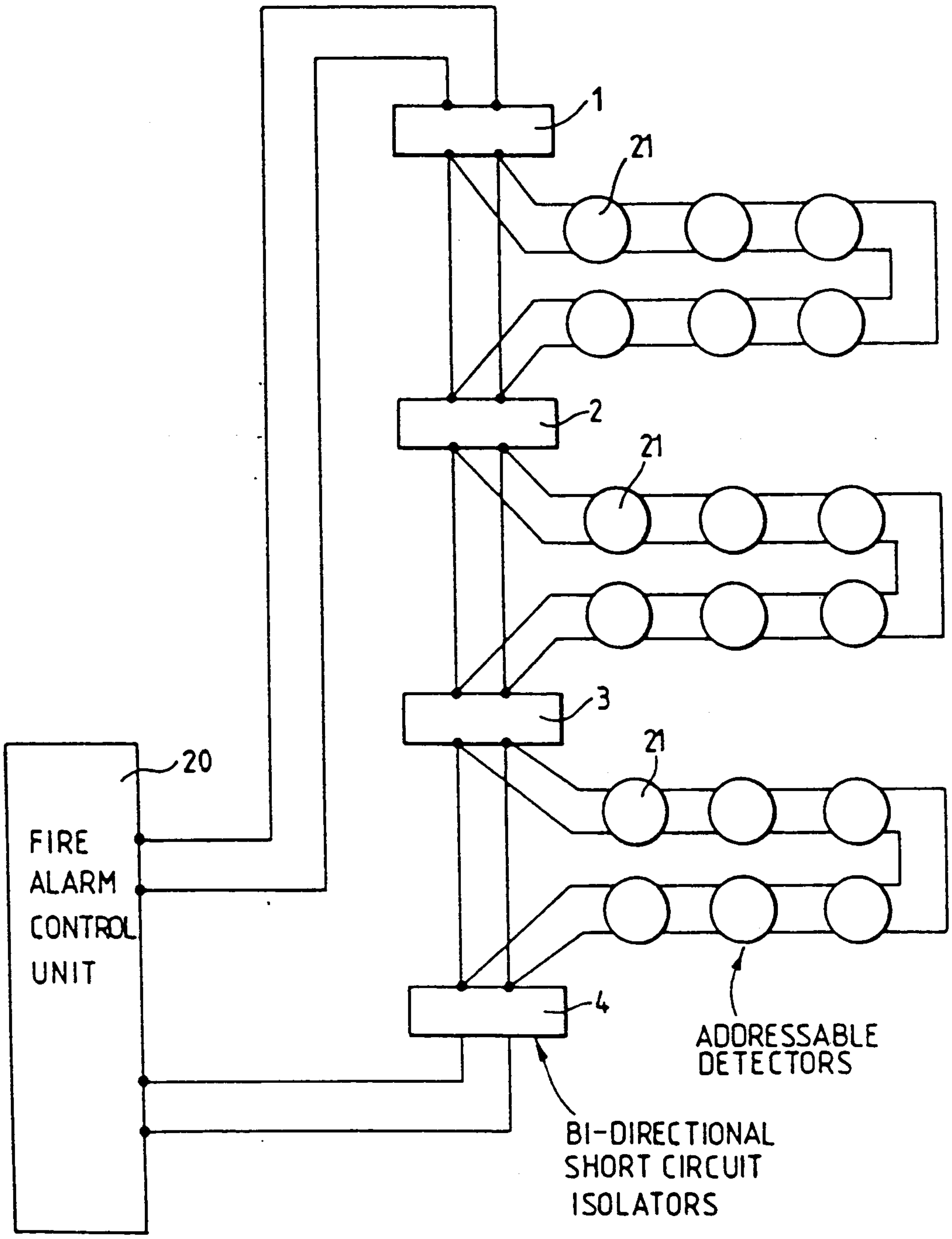
1
21
2
21
3
21
20
FIRE
ALARM
CONTROL
UNIT
4
ADDRESSABLE
DETECTORS
BI-DIRECTIONAL
SHORT CIRCUIT
ISOLATORS

Fig.6.

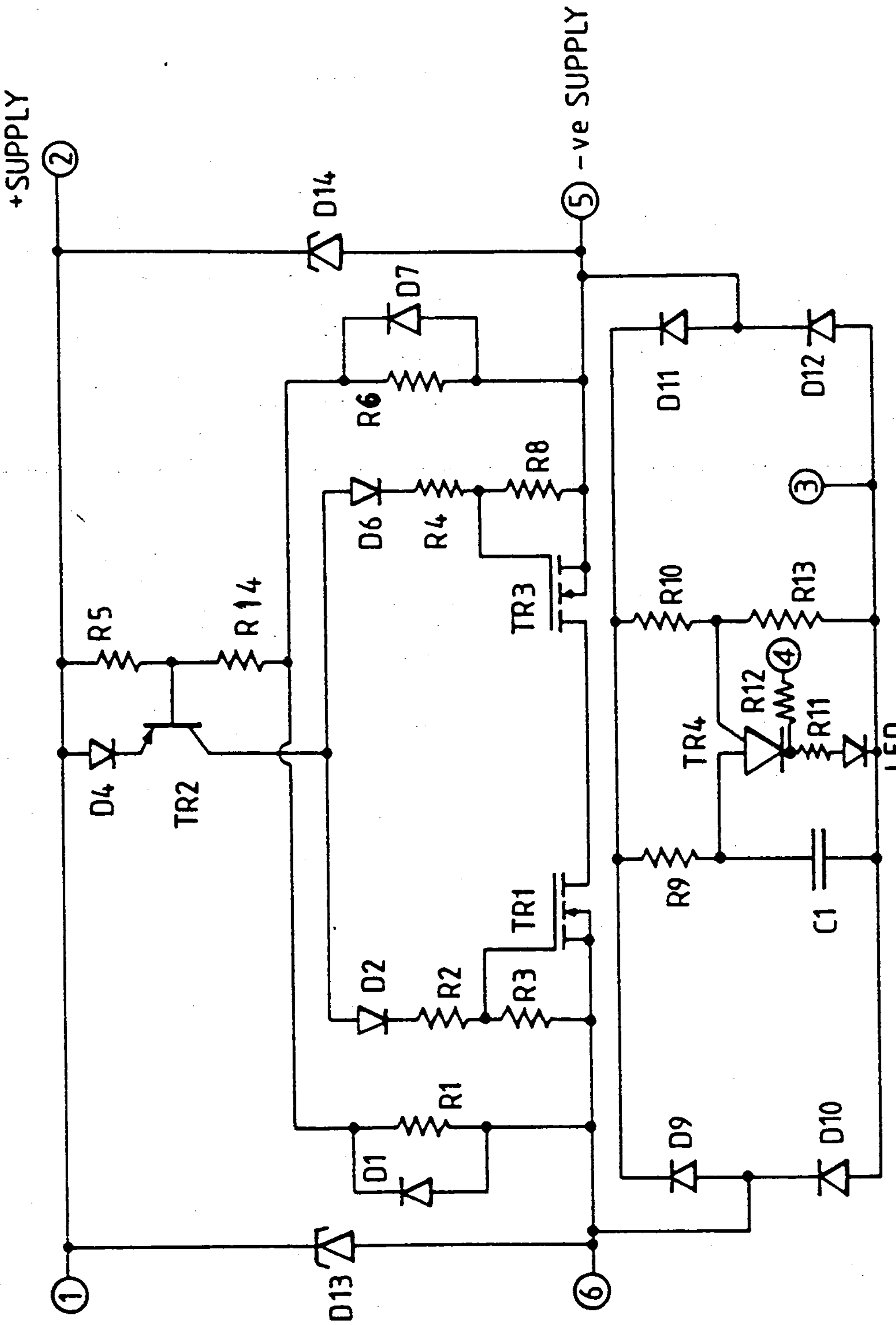
+SUPPLY
2
5
-ve SUPPLY
D14
D7
R6
D11
D12
R8
3
D6
R4
TR3
R10
R13
R5
R14
R12
4
R11
TR4
LED
D4
TR2
R9
C1
TR1
D2
R2
R3
R1
D9
D10
D1
1
D13
6

Fig.8.