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(54) **Vigilant fire alarm system.**

(57) The system comprises central control means (10) and a plurality of remote stations (21,23) capable of communicating with said control means wherein the communication between said central control means and each remote station by means of at least one tone burst whereby data passing between control means and the remote station is determined by the duration and/or the number of tone bursts transmitted.

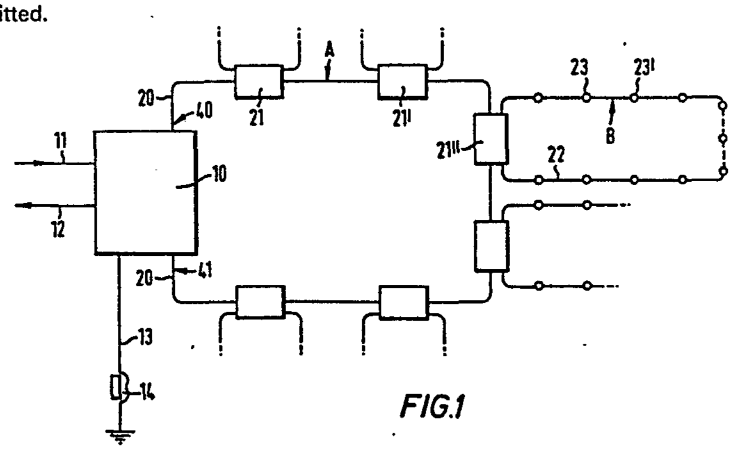

FIG.1

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TITLE

"VIGILANT FIRE ALARM SYSTEM"

DESCRIPTION

The present invention relates to a communicator system and has particular reference to a communication system for use with fire, intruder and access systems incorporating the advantages of a microprocessor and associated technology. Many proposals have been advanced for the use of microprocessor technology in the use of fire intruder and access systems. In particular, proposals have been submitted for a pair of ring circuit conductors to be placed in a building in which alarm indications are desired, the ring conductors being connected to central processing means either within the building or via modems externally therefrom. Detectors/sensors are connected at spaced intervals along said conductors; such a system generally operates on the basis that the central processing system will sequentially or systematically interrogate each detector/sensor connected across the pair of ring conductors. The ring conductors in this case are used as a source of both general power and as a communication means to the central processor.

Such a system operates by the transmission of digital data between the central processor and the various sensors and detectors in the ring circuit.

While basically satisfactory and capable of extensive development towards automated alarm systems with a reduced tendency towards false alarms, many difficulties are associated with such an arrangement. Because of the nature of the digital information transmitted, the quality of the conductors forming the ring circuit to the central processor needs to be of a high standard and this in turn, having regard to the size of buildings, such as factories, normally protected, involves a very considerable penalty in terms of the cost of wiring. Secondly, because of the quantity of digital information transmitted there is always a tendency for errors to occur either on trasmission or reception, thus giving rise to an alarm/fault condition.

For this reason, although such ring circuit/central processor systems have been proposed extensively in practice, the price and technical disadvantages have not been overcome.

Furthermore, to provide a comprehensive system all feeding central information back to one station in a large factory a very complexed wiring system becomes necessary and in practice several conductor rings of high quality are thus further increasing the cost.

The present applicants have devised a general improvement in communications systems which seeks to overcome the problem of using high quality electrical conductors in such fire alarm systems.

According to the present invention, there is provided an alarm system comprising

(i) a main conductor loop

(ii) a nodal unit provided within said loop

(iii) a subsidiary conductor loop associated with each nodal unit

(iv) at least one sensor associated with each subsidiary conductor loop; and

(v) control means operatively connected with said main power loop and adapted to monitor sequentially the status of a first nodal unit and the sensors in the subsidiary loop associated therewith and thereafter, to monitor the second and subsequent nodal units and the sensors associated therewith in sequence, the arrangement being such that in the event of a break or short in the main and/or subsidiary loop, the nodal units and/or the sensors cause or allow communication with the units and/or sensors adjacent said break or short without loss of performance therefrom.

The present invention has the advantage, therefore, that the units react to a break or short in the main and/or subsidiary loops to switch out or isolate the break or short and communications are provided around a loop, this means that the breaking of that loop allows communication from either direction. The control means preferably permits reading of data from and to each nodal unit and sensor in either direction either in the main and/or subsidiary conductor loops.

The communication system in accordance with the present invention may be a burglar alarm system, a fire alarm system an access control system, a system for monitoring and controlling the energy requirements of a building or a combination of some or all of these. The control means may include a microprocessor capable of reading analog data and/or digital data supplied from a sensor to the processor in the control means. The said processor may then examine, store and collate the information received to identify whether a situation is normal or whether there is a potential alarm condition, or if there are any abnormal signals as a result of a system fault. The control means may drive peripheral devices such as visual display units and printers and may provide automatic communications via telephone and/or radio in the event of a fault or alarm being diagnosed and may be provided with means selectively for calling police fire or maintenance services depending upon the nature of the alarm that is raised. In a typical example of the present invention the sensors may be adapted to sense a fire or incipient fire condition and changes in sensor performance can be identified and the sensors themselves interrogated by the microprocessor provided in the control means.

The present invention also includes a communications system comprising central control means and a plurality of remote stations capable of communicating with said control means wherein the communication between said central control means and each remote station by means of at least one tone burst whereby data passing between control means and the remote station is determined by the duration and/or the number of tone bursts transmitted. The control means may provide a trigger signal for response by remote stations and a trigger signal may preferably be of a different sense to the sense of a tone burst from the remote station. The remote station may be nodal unit or sensor unit of the fire alarm system of the present invention.

In another embodiment of the present invention in order that the unit may react to a break or short to switch out or isolate the break or short in both the main power loop or the subsidiary power loops, each nodal unit and/or detector may be provided with a fault indication and control circuit. In a particular embodiment, a control circuit for switching a device to an alternative supply in response to a fault in a ring conductor loop including a pair of supply conductors may comprise transistor means for monitoring a potential difference between said pair of supply conductors, switching means capable of switching to isolate a portion of one of said supply conductors, said portion being connected via an operating device to the other of said supply conductors and diode means connecting said portion to said one supply conductor to bridge the or each switching means, the arrangement being such that in the event of a fall in the potential difference between said conductors below a thresh-hold due to a fault, the transistor causes or allows the switching means to act to isolate said portion from the fault whereby the operating device maintains its function via said diode-connection to a non-faulted portion of said supply conductor. The switching means may be either electromechanical or may be a field effect transistor. Other switching means may also be employed such as transistor switches etc.

A communication system in accordance with the present invention providing for interrogation of the sensors associated therewith may, in the case of a fire alarm, have the following features and advantages:-

1. Early warning of a fire or an incipient fire situation from the processed information available from the fire sensor.

2. The system will be self-monitoring to identify any system or detect fault or deviation from normal.

3. The ability to call up a system as required for routine service calls.

4. The ability to ignore infrequently occuring transient faults and to filter out the effects of such information errors caused by these faults.

5. The information can be stored in the system log which will then provide an audit trail relating the past history of the equipment and further may provide an historical record or log of the maintenance carried out.

The sensor in accordance with the present invention may be a fire sensor which will operate on one or more of the following principles:-

thermal detection,
optical flame detection,
ionisation smoke,
light scatter smoke
obscuration smoke

The sensors of the invention may include access control sensors, ultrasonic detectors, passive infra red detectors and microwave Deppler sensors.

The system in accordance with the present invention may be associated with an audible alarm such as an alarm bell or a siren.

In a particular embodiment of the present invention, a fire sensor may sense the environmental phenomenon to which it is sensitive, convert this to a digitally coded analogue signal for onward transmission to the control unit. The control unit interprets the sequence of signals and communicates any deviation from normally expected trends, activate an audible alarm and where appropriate, activate suitable digital communications equipment for communication with fire, police and/or caretaking authorities. At the same time the control means may act to operate a range of devices such as door release units, emergency lighting units, ventilators and so on.

Although described with respect to fire alarm systems it is to be understood that the system of the invention may be used with fire intruder and access systems.

Following is a description by way of example only and with reference to the accompanying informal drawings of a method of carrying the invention into effect.

In the drawings:-

Figure 1 is an informal sketch of a fire alarm system in accordance with the present invention.

Figure 2 is a diagram of a tone burst communication for use in the fire alarm system of Figure 1.

Figure 3 is a detail of Figure 2.

Figure 4 is a circuit diagram of the switch mechanism for the nodal units and detectors of Figure 1.

Figure 5 is a block diagram of the line drive circuitry for a control unit of the alarm of Figure 1.

Figure 6 is a diagram showing the build up of the tone pulse of Figures 2 and 3 with timing of the switches in Figure 5.

The system illustrated in the accompanying drawing comprises a control unit indicated generally at 10 having a power supply 11 and a general output bus 12 for output equipment such as VDU's, printers, digital communicators and the like, all of known construction, configuration and function. The control unit 10 may be supplied with an alarm line 13 having an audible alarm means 14, such, for example, as a bell. The control unit 10 is provided with a main conductor ring 20 consisting of a pair of conductors 40+, 40~ at a first end of loop 20 and 41+, 41~ at a second end which extends as a closed ring around a building or area to be protected, the arrangement being such that the ring 20 is provided with power and/or signal input outout in each direction therearound. The ring 20 is provided with a plurality of nodal units 21, 21', 22" coupled in series within main loop 20.

Each nodal unit 21 is provided with a pair of subsidiary ring conductors 22, each subsidiary ring conductors 22 having a plurality of sensors 23 which in the case of a fire alarm will be fire detectors, the fire detectors 23 being connected between the conductors consisting subsidiary ring 22 at spaced intervals therearound. Each nodal unit 21 incorporates a series of switches which are capable, in response to a fault or a short circuit signal in the main ring 20, of opening switches to provide an open circuit.

In the event, therefore, of a short circuit at point A in the main ring, the short circuit would be detected between nodal units 21 and 21' and each of nodal units 21 and 21' would operate to dis-enable main loop between nodal units 21 and 21' thereby isolating the short circuit. Each of nodal units 21 and 21' would still be operative due to the fact that nodal units 21 would be fed direct by main ring 20 from control unit 10 and nodal unit 21' would be similarly served by the other portion of main ring 20. In the event of an open circuit at point A, the system would operate in precisely the same way except there would simply be a discontinuity in a conductor between nodal unit 21 and nodal unit 21'.

Each of the detectors 23 in a subsidiary ring 22 are similarly provided with a switching means whereby in the event of a short circuit in a subsidiary ring at, for example point B, between detectors 23 and 23' of subsidiary ring 22 the detectors 23 and 23' would react to provide an open circuit each side of the short circuit at point B and yet each of detectors 23 and 23' would remain operative, since the current can flow and signals can pass from and to nodal unit 21'' each way around the subsidiary ring 22.

The control unit 10 includes means for addressing sequentially nodal units 21 and then in sequence each of the detectors in the subsidiary ring 22 associated therewith and then proceed to the next nodal unit 21' and sequentially to each of the detectors in the subsidiary ring associated therewith and so on.

Figure 5 is a block diagram of the line drive circuitry of control unit 10. In the diagram, switches L, S, D, and Delta (Δ) are operated from a microprocessor board forming part of control unit 10.

From the diagram, it will be seen that the closing of switch L will apply full voltage across the primary loop conductor 40+ and 40-, while the closing of switch S will apply a full voltage across conductors 41+ and 41-.

Closing of switch D causes the voltage across the detector loop to drop to zero. The detector loop components are preset by a long (in Figure 2, a 288 millisecond (ms)), positive pulse applied to the detector loop by closing switches L and S. This ensures that the first nodal unit 21 in the loop will be addressed first. Subsequent negative going pulses 32 of duration 1.5 ms (see Figure 2) will address in sequence the individual detectors 23 associated with that particular nodal unit (21). The next positive going pulse 33, of 100 ms duration addresses the next nodal unit 21' and the sequence is repeated for all the detectors 23' associated with that nodal unit. This is repeated until all the nodal units in the system have been addressed.

In all but the first 100ms of long positive pulse 31, switches L and S are synchronous. During this initial 100ms period, however, switch L is <u>on</u> and S is <u>off</u> and during this period only switch delta (Δ) is open.

In normal operating conditions the detector will see the full length of pulse 31 since it will pass completely around main ring 20 from 40+, 40-, to 41+, 41-. If the ring 20 is open-circuited, then nodal units in certain sections will not receive the first 100ms of the pulse 31; this omission is registered by each of such nodal units to give a subsequent indication of the position of the open circuit fault when the said affected nodal units are addressed.

When switches L, S and D are open and switch delta (Δ) is closed, the main loop 20 is being supplied from both ends 40 and 41 with one half of the supply voltage via impedance 220, thus constituting the datum voltage level 30 of the signal pulse.

Typically the address is effected by means of tone burst which is shown in some detail in Figures 2 and 3 of the accompanying drawings. The power supply on the pair of conductors of ring 20 is at a steady state indicated at 30. At the commencement of the addressing sequence, control unit 10 outputs a positive pulse or tone burst 31 of a duration in the specific example illustrated of 288 milliseconds. This pulse serves to zero sequentially all the nodal units and in their associated detectors in the ring 20. At the same time the first nodal unit (21) in the ring 20 is activated to respond to an input pulse. The initial pulse 31 causes nodal unit 21 to address sequentially each detector in it's subsidiary ring. A pause in signal transmission of 202.5 milliseconds is allowed for nodal unit to reply and complete it's address of all the detectors 23 in its subsidiary ring B. The first 12.8 milliseconds following the end of the tone burst 31 is permitted for a reply by the nodal unit itself as to the status of the node including any fault indications which are determined in the manner hereinafter described. The return information is given by way of a negative pulse relative to the trigger pulse for the nodal unit 21 and the length of that tone burst determines the status of that node.

Thereafter, a period of approximately 5 milliseconds is allowed as a "break glass" window as hereinafter described.

The nodal unit itself is then caused to transmit a 1.5 millisecond negative pulse to address the first detector in the circuit. The detector then has a period of 10.5 milliseconds within which to reply. The length of the tone burst transmitted in that 10.5 millisecond period determines the nature of the reply. A second pulse 32' triggers the response from the second detector in the subsidiary circuit to nodal unit 21 and so on. At the completion of the sequence after 202.5 milliseconds nodal unit 21 will have completed it's address and will not be responsive to further short trigger pulses shorter than the 288 millisecond trigger pulse which initiates the sequence.

At the completion of the first sequence of information from nodal unit 21, the control unit 10 provides a further pulse 33 of approximately 96 millisecond duration which then triggers the next nodal unit (21') in ring 20. Again, this nodal unit 21' repeats the sequence of addressing each detector in its circuit and at the completion of that address and response by the detectors, a nodal unit 21' is disenabled and a further 96 millisecond pulse activates the next nodal unit 21'' in the circuit for response in a similar way. This sequence continues until all the nodal units in circuit have addressed sequentially each of the detectors in their subsidiary circuit, all the responsive tone bursts having been fed back to the central control unit 10. In the particular embodiment in accordance with the present invention, the period for complete address of a full system is 4.968 seconds.

It will be appreciated by a man skilled in the art that the information collected in one complete sequence around the detection and nodal circuits will provide information which can be compared with datum information held in the control unit 10. Variations of any responses in terms of length of response pulses from both nodal unit status and detector units will indicate a change in status and will enable conditional information to be prepared by the computer or central control unit 10 as to the status of any or all of the detectors and any or all of the nodal units. The detectors 23 can be the same or different and once the steady state parameters have been determined any variation from that steady state parameter can be used and interpreted to produce a number of conditions between fault, caution, abnormal heating to full alarm.

Each or some of the nodal units 21 may include a manual alarm point such, for example, as a manual alarm of the break glass type.

Because of the extensive period of the 4.968 second addressing sequence, in the event of a manual alarm, it is necessary to provide in each nodal address sequence a short period in which the break glass units can superimpose their pulses within the circuit. A break glass unit once triggered will give something approaching a pulse long enough to provide a tone burst during the gap referred to as the break glass window in the nodal circuit described above.

When a nodal unit has a manual call point signal latched to it, it produces a 300 microsecond negative going response pulse to main loop 20 for detection by the detector loop at a time 17.5 ms after the next nodal address pulse 34 (see Figure 3). It should be noted that this occurs whether the particular nodal unit is being addressed or not. The detection of this pulse at the control unit 10 will result in a full alarm being transmitted by control unit 10 irrespective of the nodal status and detector status given elsewhere.

On receipt of a manual alarm pulse described above, the control unit 10 initiates a search procedure; a presetting positive pulse is transmitted and all the nodal units are sequenced in rapid succession; no detectors are addressed at this stage. The total cycle time is 820ms and during this cycle the manual call point location can be determined and verified. 3 seconds after initiation of the manual call point signal, the said signal decays, thus allowing the system to revert to normal operation. The particular nodal unit connected with the tripped manual alarm point will continue to give an alarm status signal during address by control unit 20 until such time as the call point and the associated nodal unit are reset.

The tone burst in this specific example operates at a frequency of 10 KHz and the nodal unit response is arranged to give a specific number of cycles at a nominal frequency of 10 KHz, the number of cycles being dependant on the appropriate conditions associated with that particular nodal unit, for example:-

Normal condition	128 cycles
Detector loop fault	96 cycles
Open circuit	80 cycles
Short circuit	64 cycles
"Break-glass" line fault	48 cycles
Remote input fault	32 cycles
BG or input alarm	16 cycles

In addressing individual detections 23 within the nodal circuit or subsidiary ring 22, the frequency response from individual detectors is such that the duration of the reply pulse train is an analogue representation of the sensed fire condition level. Under normal conditions, the duration is of the order of 3 ms; an increasing fire signal level will increase the duration of the pulse train.

Different types of detector 23 are arranged to have different nominal response frequencies so that each nodal unit 21 can distinguish different detector types within its subsidiary loop 22 as well as its location therein. In this embodiment the nominal response frequencies are as follows:-

Photoelectric sensors	6 KHz
Ionization Sensors	8 KHz
Thermal Sensors	10 KHz
Other unspecified type(s)	12 KHz

Figure 6 shows the timing sequence of switches L, S, Δ, and D to produce the tone burst of Figures 2 and 3.

The sequential address of each nodal unit provides for the status of the detectors in each nodal unit loop 22 and the presence of faults to be communicated to the control unit 10. The control unit operates with hexadecimal numbering with the nodal units being numbered zero to a maximum of 15 in the main ring and the detectors on each subsidiary ring being numbered 1 to 15 around the subsidiary ring. The control unit 10 commences a sequence of address and provides a continuous scheduling address sequentially for each of the nodal units in the main ring. Thus, in the embodiment illustrated in Figure 1 of the accompanying drawings, the control unit will initially address nodal unit 21 (numbered zero) and then sequentially each of the detectors on each subsidiary ring 1 to F associated therewith. The control unit 10 will then seek to address nodal unit 21' (numbered 1) and then each of detectors 0, 1, 2.....F in the subsidiary ring 22 associated therewith and so on completely around the main ring 20. The period for a complete address will depend on the number of nodal units within a circuit and the number of detectors in each subsidiary circuit.

In the event of a fire alarm condition being sensed by detector 23' in the subsidiary ring 22 associated with nodal unit 21'', a signal would be despatched around the main ring to the control unit 10 whereby the alarm condition would be registered and output would be transmitted along output 12 to digital communicator or the like, and at the same time, audible alarm 14 would be rendered operative. The system described above provides all the advantages of the normal intelligence system and provides, therefore, for the elimination of a number of false alarm circumstances. For example, excessively rapid or abnormally slow rise in sensor signals can readily indicate a false condition and in these circumstances the system can contain its own built in check.

In the event of a fault, the switching circuit shown in Figure 4 becomes effective. The main ring 20 comprises a pair of conductors 40 and 41 which form part of the main loop A+ and A- being on one side of the nodal unit 21 and B+ and B- being on the other.

The main ring circuit in this particular embodiment is provided with a take-off 42 from main conductor 41 and the main conductor 41 is capable of being provided with an isolated portion 43 juxtaposed the junction 42 with the main conductor 41 by means of a field effect transistors, 44/44' on each side of junction 43. A load resistor 45 bridges main loop 41 A-, B- between field effect transistors 44/44' (see Figure 4). Connection 42 is connected via the operating main body of the nodal unit to the positive conductor 40. Positive conductor 40 is provided with a line connection 45 which is connected to provide a positive supply via 46 to the base of PNP transistor 47. This enables current flow via line connection 48 and transistor 47 and the associated circuitry to maintain the field effect transistors 44/44' closed thus connecting the main conductor A- and B- with isolatable portion 43 and nodal unit connection 42.

In the event of a fault, the reduction in the potential difference between conductor 40 and conductor 41 below a threshold will result in a corresponding reduction in the positive voltage applied to the base of transistor 47 and will thus stop the flow of a substantial current through the transistor 47 thus causing or allowing the field effect transistors 44/44' to open. In these circumstances, the junction 43 is isolated from main loop A- and the connection 42 is then connected to the main loop 41 by means of diodes 50 and 51 respectively. If, therefore, the fault is in the main conductors A- A+, then the diode connection will be effected via diode 51 and nodal unit will rendered operative again and the fault indication can be included in the nodal reply as described with respect to Figures 2 and 3.

The particular advantage of the system described above is that it provides automatic switching in the event of a fault, it provides a clear indication of the area of the system in which the fault lies and it does not permit the fault to render any part of the circuit inoperative. Furthermore, the nature of the data transmission by means of tone bursts or time measured pulses does away with the problem of the transmission of direct digital information and the system as a whole permits the use of a much cheaper wiring installation because of the ready indication of the fault. The system further reduces substantially the tendencies of such an automated fire alarm system to issue false alarms.

CLAIMS

1. A communications system comprising central control means and a plurality of remote stations capable of communicating with said control means wherein the communication between said central control means and each remote station by means of at least one tone burst whereby data passing between control means and the remote station is determined by the duration and/or the number of tone bursts transmitted.

2. A system as claimed in claim 1 wherein the control means provides a trigger signal may preferably be of a different sense to the sense of a tone burst from the remote station.

3. An communications system comprising
(i) a main conductor loop
(ii) a nodal unit provided within said loop
(iii) a subsidiary conductor loop associated with each nodal unit
(iv) at least one sensor associated with each subsidiary conductor loop; and
(v) control means operatively connected with said

main power loop and adapted to monitor sequentially the status of a first nodal unit and the sensors in the subsidiary loop associated therewith, and thereafter to monitor the second and subsequent nodal units and the sensors associated therewith in sequence,

the arrangement being such that in the event of a break or short in the main and/or subsidiary loop, the nodal units and/or the sensors cause or allow communication with the units and/or sensors adjacent said break or short without loss of performance therefrom.

4. A system as claimed in anyone of claims 1 to 3 wherein the control means comprises a microprocessor capable of reading analog data and/or digital data supplied by a sensor.

5. A system as claimed in any preceding claim wherein control means is adapted to drive peripheral devices selected from one or more visual display units, printers, automatic communications via telephone and/or radio, and in the event of a fault or alarm being diagnosed, to device means for selectively for calling police or fire services depending upon the nature of the alarm indicated.

6. A system as claimed in anyone of the preceding claims wherein communications between the essential control means and the plurality of remote nodal units and associated sensors is by means of at least one tone burst whereby data passing between control means and the remote station is determined by the duration and/or the number of tone bursts transmitted.

7. A system as claimed in anyone of the preceding claims wherein the control means transmits a trigger signal for initialising the response by said nodal units and their associated sensors.

8. A system as claimed in claim 7 wherein a trigger signal is of a different sense to the tone burst received from the nodal units and/or their associated sensors.

9. A system as claimed in anyone of the preceding claims wherein each nodal unit and/or detector unit is provided with a fault indication and control ciruit adapted to react to a break or short in one or both of the main conductor loop and a subsidiary conductor loop.

10. A system as claimed in claim 9 wherein the fault indication and control circuit comprises a pair of supply conductors, transistor means for monitoring a potential difference between said pair of supply conductors, switching means capable of switching to isolate a portion of one of said supply conductors, said portion being connected via an operating device to the other of said supply conductors and diode means connecting said portion to said one supply conductor to bridge the or each switching means, the arrangement being such that in the event of a fall in the potential difference between said conductors below a predetermined thresh-hold due to a fault, the transistor causes or allows the switching means to act to isolate said portion from the fault whereby the operating device maintains its function via said diode-connection to a non-faulted portion of said one supply conductor.

11. A system as claimed in claim 8 wherein the switching means is a relay.

12. A system as claimed in claim 10 wherein the switching means is electromechanical or is a field effect transistor.

13. A system as claimed in anyone of the preceding claims wherein the sensors are sensors adapted to operate in a fire alarm system and will operate on one or more of the following principles:-

thermal detection,
optical flame detection,
smoke ionisation detection,
smoke light scatter detection,
smoke obscuration detection,
card detection,
intruder detection.

14. A system as claimed in anyone of the preceding claims including an audible alarm such as a bell or siren associated with the control unit and/or a nodal unit.

15. A system as claimed in any preceding claim wherein the control means includes a pair of power supply conductors, a pair of equivalent impedances connected in series between said power supply conductors, primary and secondary output lines connected to a junction point between said two impedances, a junction in the negative conductor provide primary and secondary negative conductor loops, fault detector circuits provided between the primary and secondary positive supply and the primary

and secondary negative supply, a first switch means between the main input and the positive primary supply downstream of a diode to the connection with the impedances, a second switch between the main positive supply and the secondary positive supply, a third switch means between each of said primary positive and secondary supplies incorporating diode connections therebetween and a false switch means for connecting the secondary negative supply to the primary negative supply, the arrangement being such that on closing the first switch means, full voltage supply is applied across the primary loop conductor between the positive primary supply and the negative primary supply, while closing the second switch means will apply a full voltage across the corresponding secondary positive and negative supplies to the loop.

16. A system as claimed in claim 15 wherein closure of the third switch causes the voltage across the detector loop to fall to zero.

17. A system as claimed in claim 14 or claim 15 wherein the detector loop components are constructed and arranged to be preset by a long positive pulse supplied to the detector by closing the first and second switches thus

ensuring that the first nodal unit in the primary loop is subject to the first address from the control unit.

18. A system as claimed in claim 17 wherein negative going pulses are applied by closure of third switch means to produce negative going pulses to address in sequence the individual detectors associated with a said nodal unit.

19. A system as claimed in claim 18 wherein a further positive pulse is applied to the primary and secondary circuit by closure of the first and second switches to address the next nodal unit in the main loop and the sequence of switching is repeated until all the nodal units in the system have been addressed.

20. A system as claimed in anyone of claims 15 to 19 wherein the first and second switch means operate synchronously except for an initial period of the long positive pulse and during this initial period the first switch means is open thereby permitting detection of a fault within the main conductor loop.

21. A system as claimed in anyone of claims 15 to 19 wherein the first, second and third switches means are open and the fourth switch means is closed, whereby one half of the supply voltage is applied to the main conductor loop thus constituting the datum voltage level of a signal pulse.

22. A system as claimed in anyone of claims 15 to 20 wherein the pulse is in a form of a tone burst and wherein the control means includes signal decoding means to determine the number of cycles of the duration of each tone burst received, thus indicating the condition of nodal units and their associated detectors.

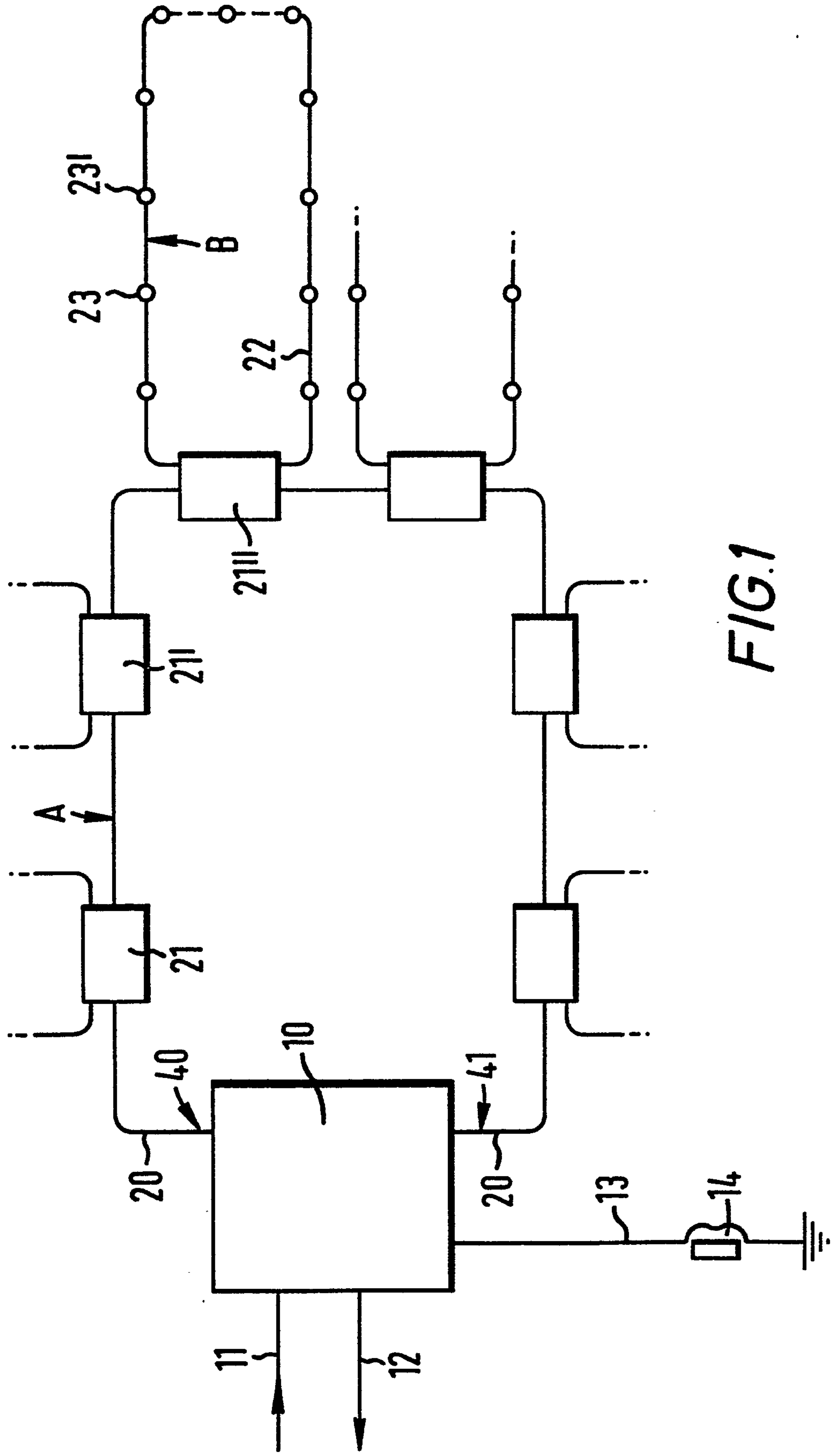
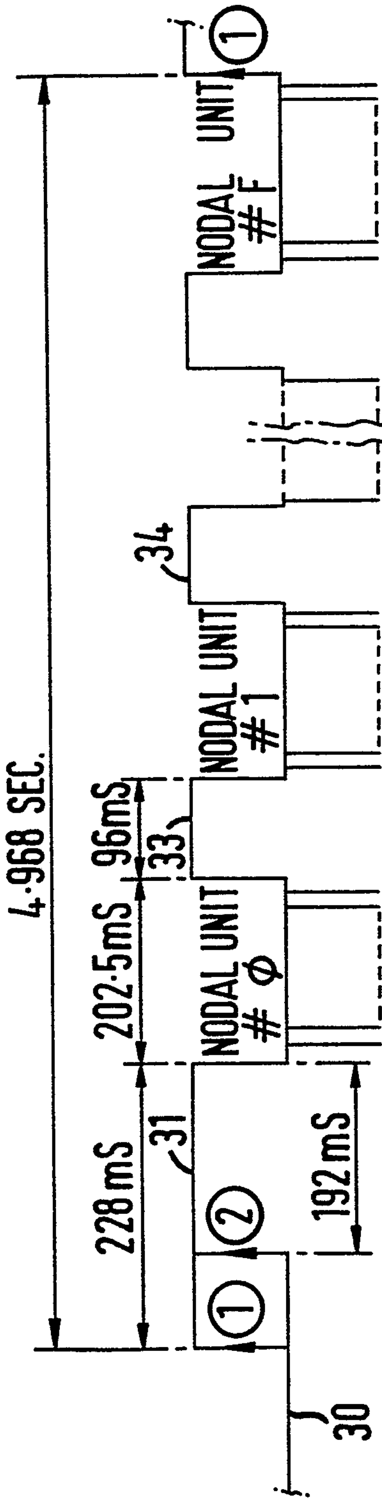


FIG.1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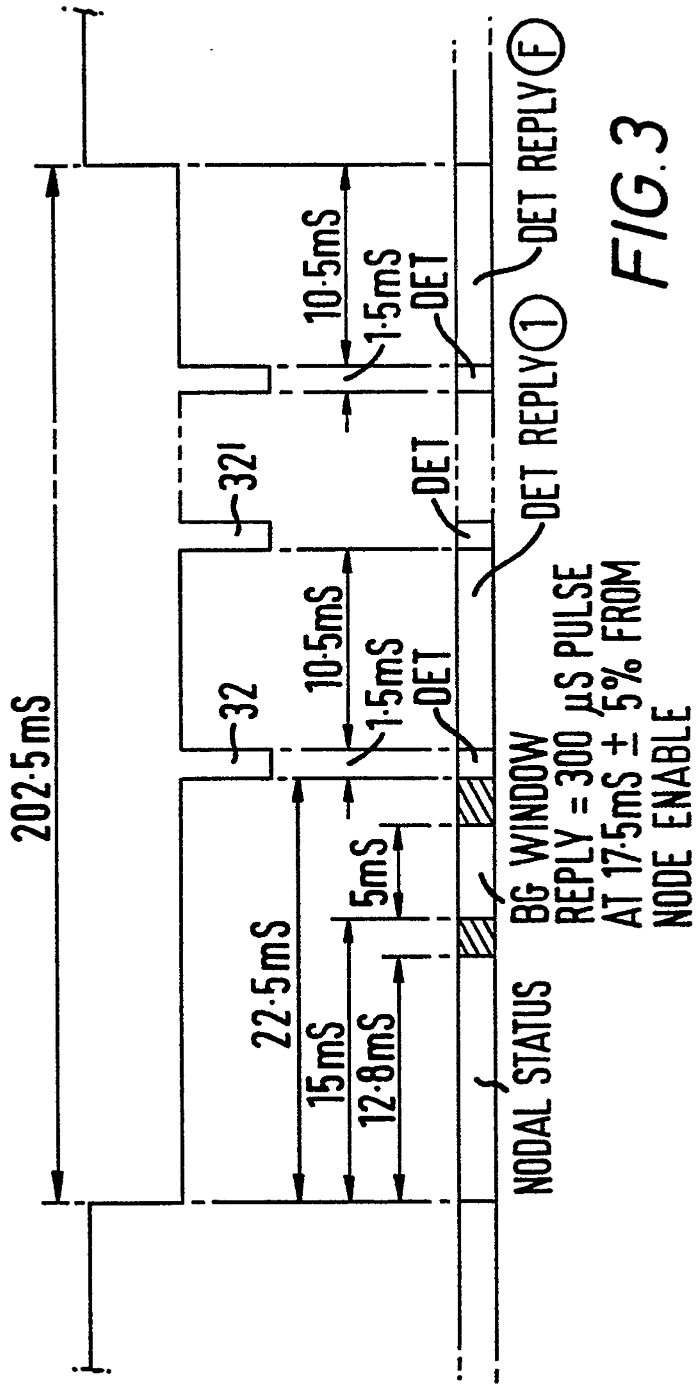
31
33
34
1
2

FIG.2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DET
32
32'
DET REPLY
DET REPLY 1
DET REPLY F
NODAL STATUS
BG WINDOW
REPLY = 300 µS PULSE
AT 17·5mS ± 5% FROM
NODE ENABLE

FIG.3

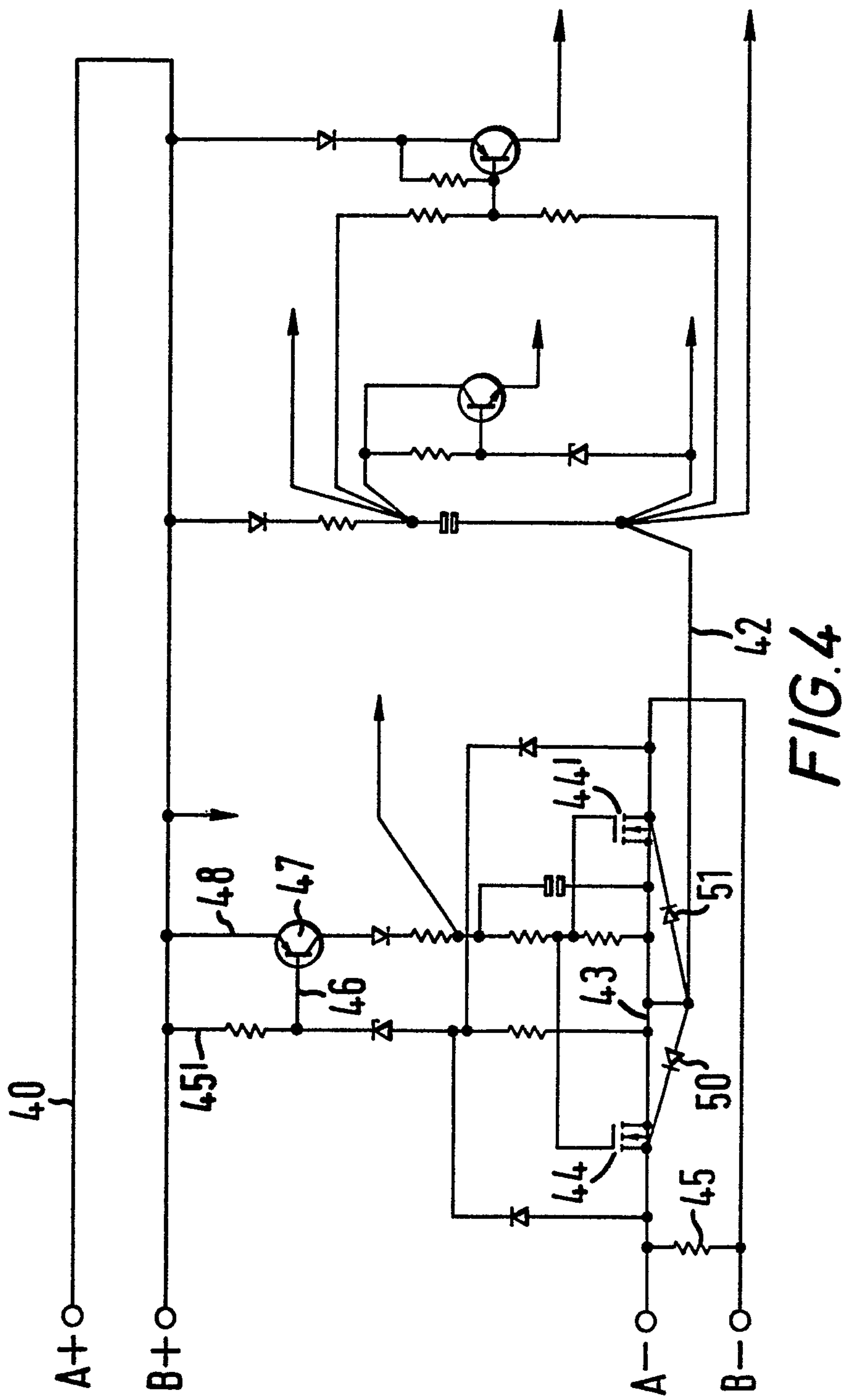

FIG.4

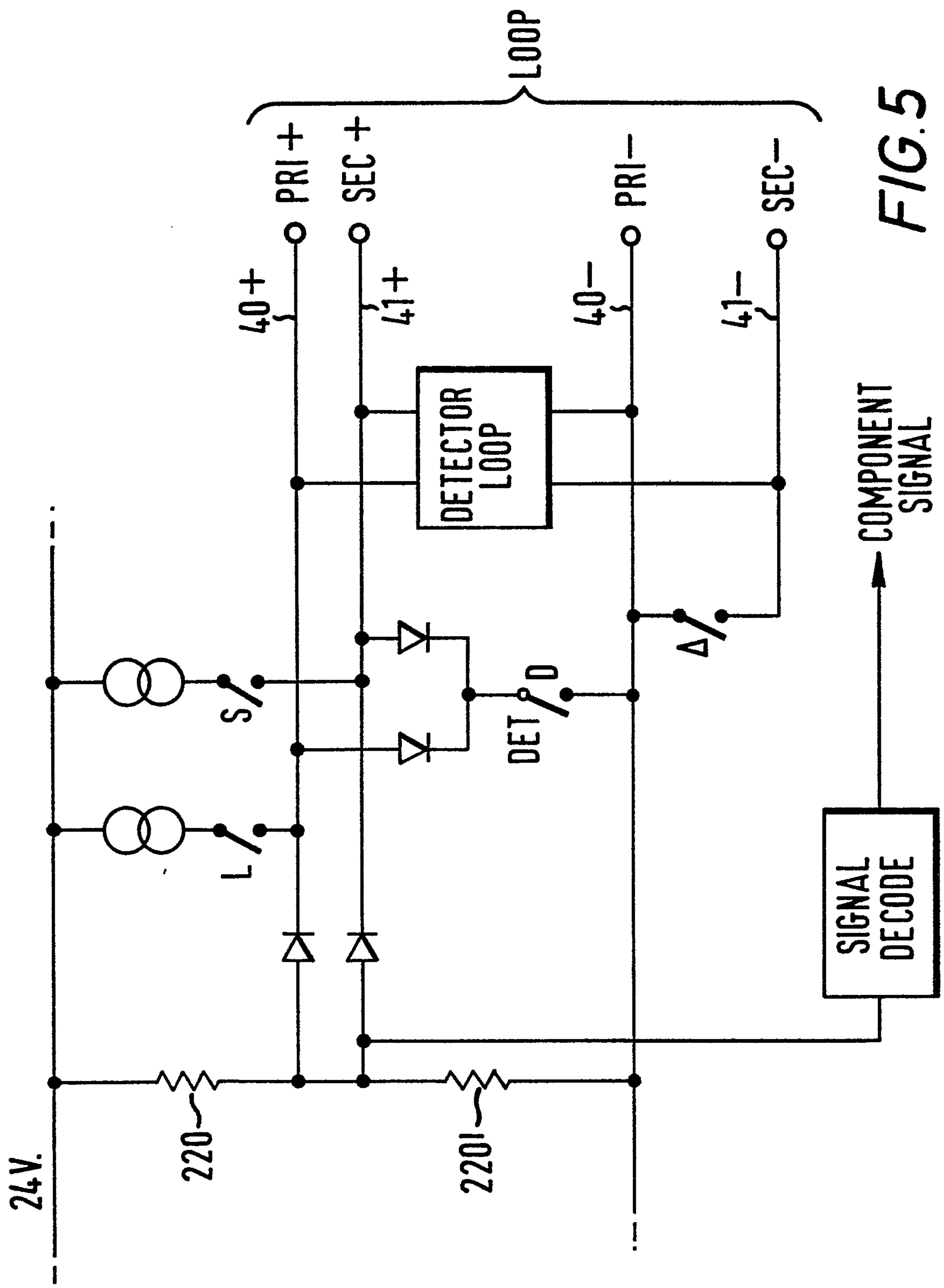
LOOP
PRI +
SEC +
PRI−
SEC−
40+
41+
40−
41−
DETECTOR LOOP
COMPONENT SIGNAL
S
L
DET
D
Δ
SIGNAL DECODE
24V.
220
220I

FIG.5

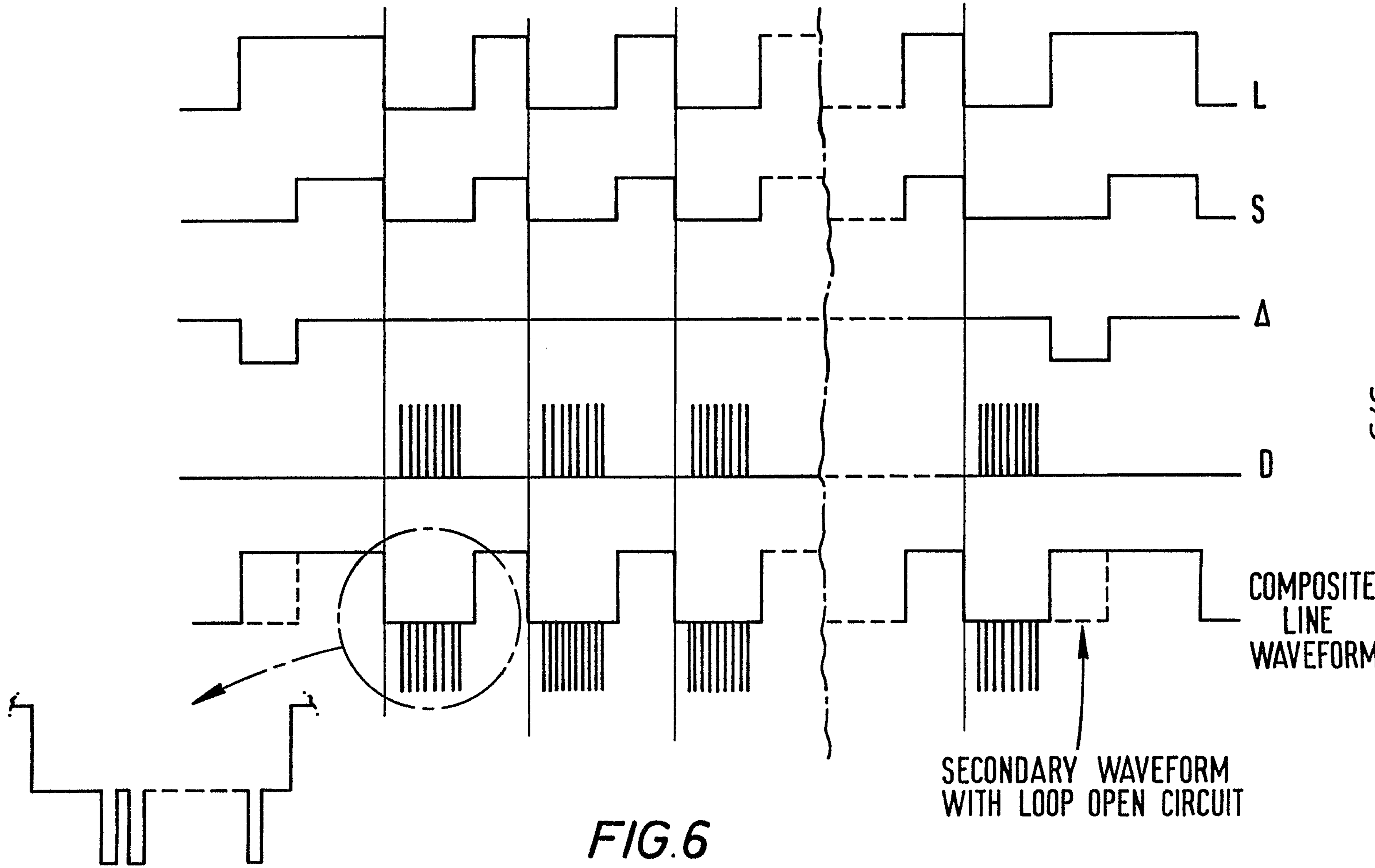
L
S
Δ
D
COMPOSITE
LINE
WAVEFORM
SECONDARY WAVEFORM
WITH LOOP OPEN CIRCUIT

FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

0156474

Application number

EP 85 30 0866

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 4)
			G 08 B 26/00
Y	US-A-3 927 404 (G.F. COOPER) * Figure 1; column 4, lines 24-29; column 3, lines 21-33 *	1	
A		3,6	

Y	US-A-3 815 093 (H.L. CARETTO et al.) * Figure 1; abstract *	1	
A	* Figure 1;. column 6, lines 44-46 *	5,14	

A	US-A-3 716 834 (H.G. ADAMS) * Figure 4; column 9, lines 52-67; column 10, lines 31-34 *	3	**TECHNICAL FIELDS SEARCHED (Int. Cl.4)**

P,A	EP-A-0 111 178 (CERBERUS) * Figure 1; page 2, lines 7-10; page 1, line 24 - page 2, line 2 *	2,8,13	G 08 B 26/00

P,A	EP-A-0 111 982 (AMERICAN DISTRICT TELEGRAPH CO.) * Figure 1; page 6, lines 12-20; page 7, lines 17-20 *	5,4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	20-05-1985	BREUSING J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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