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(54) **A MONITORING DEVICE**

ÜBERWACHUNGSVORRICHTUNG

DISPOSITIF DE SURVEILLANCE

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Description

[0001] THIS INVENTION relates to a monitoring device for monitoring an apparatus having first and second states and for providing an output signal indicating that the apparatus has undergone a pre-determined sequence of changes of state. Prior art document WO-A-8 501 708 discloses an anti-theft ignition system in which the ignition system is enabled once a predetermined series of pulses are input from the ignition switch and compared with a stored code.

[0002] The monitoring apparatus of the present invention finds particular application as a security or anti-theft device for monitoring changes in the state of an apparatus to be protected and providing an alarm signal in the event of unauthorised removal of the apparatus. In the case of electrically operated apparatus, the monitoring device may provide an alarm signal in the event that the equipment is disconnected from its power source and moved without a pre-determined sequence of connections to and disconnections from its power source having first been carried out.

[0003] In its broadest aspect, the present invention provides a monitoring device for monitoring an apparatus having first and second states, comprising: detecting means for detecting each change of state of the apparatus between its first and second states; timing means for measuring the duration between successive changes in the state of the apparatus as detected by the detecting means; memory means for storing first, second and third pre-determined durations; comparing means for comparing the timing of detected changes in the state of the apparatus and delivering an output signal in the event that first and second changes of state of the apparatus are detected within a duration not exceeding the first pre-determined duration, a third change of state is detected after the second change of state at a time corresponding to the second pre-determined duration and a fourth change of state is detected after the third change of state at a time corresponding to the third pre-determined duration; and means for emitting timing signals during the second and third durations after detecting the second and third changes of state respectively.

[0004] In order that the present invention may be more readily understood, embodiments thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic block diagram of a monitoring device embodying the present invention incorporated in an anti-theft device connected to an apparatus to be protected against unauthorised removal;

Figure 2 is a schematic block diagram of a monitoring device embodying the present invention incorporated in another anti-theft device; and

Figure 3 is a timing diagram illustrating the timing of signals in an anti-theft device incorporating a monitoring device embodying the invention.

[0005] Referring firstly to Figure 1, an anti-theft device embodying the present invention comprises a monitoring device 1, a trembler unit 2 and an alarm unit 3 and serves to protect an electrical or electronic apparatus 4 against unauthorised removal.

[0006] The monitoring device has a pair of input terminals 1A and 1B which are respectively connected to the power lines 4A and 4B of the apparatus 4 to be protected so as to sense the voltage applied to the apparatus 4. The voltage on the power lines 4A and 4B may vary from 1.5 to 350V AC or DC.

[0007] The trembler unit 2 is incorporated in the monitoring device 1 which is mounted on the apparatus 4 to be protected and includes a trembler switch 5 which operates in response to movement of the apparatus 4 and a trembler circuit 6 providing a motion-detected signal on an output line 7 of the trembler unit. The motion detected signal delivered by the trembler unit is applied to an input 8 of the alarm unit 3 via a disarm latch 9 which, in its normal condition, connects the output line 7 to the input line 8, thereby passing the output signal of the trembler unit 2 to the alarm unit 3.

[0008] The alarm unit 3 comprises a sound control 10 connected to the input line 8 and having an output line 11 connected to a piezo-electric buzzer 12.

[0009] The monitoring device 1 comprises a voltage rectifier 14 connected to the input terminals 1A and 1B and having a charger output 15 connected to a battery charger 16 arranged to charge a battery 13 constituting an internal power supply of the monitoring device 1. When the apparatus 4 is powered, i.e. switched on, the voltage rectifier 14 charges up the battery 13 via the charger 16. When the equipment 4 is not powered, i.e. switched off, the battery 13 provides operating power for the device.

[0010] A signal output of the rectifier 14 is optically coupled to the input of a pulse detector 17 by means of an opto-isolator which comprises a transmitter in the form of a light-emitting diode 18 connected to the signal output of the rectifier and a receptor in the form of a light-sensitive transistor 19 connected to the input of the pulse detector 17. The output line 20 of the pulse detector 17 is connected via a hold and extend circuit 21 to a counter 22 which receives clock pulses from an internal clock 23 of the monitoring device 1. The counter 22 is connected to first and second latches 24 and 25 and has a first output 26 connected to a sequence correct counter 27. A second output 28 is connected to a second input of the sound control 10 of the alarm unit 3. The sequence correct counter 27 has a first output 29 connected to a control input of the disarm latch 9 and a second output 30 connected to a third input of the sound control 10 of the alarm unit 3.

[0011] The pulse detector 17 detects each change in

the power status of the apparatus 4 between its powered and unpowered states and delivers an output signal on its output 20 to hold and extend circuit 21 which is set to an interpretation state if it receives two output signals from the detector 17 within a first pre-determined duration which may be selected to be between 0.1 seconds and 1 hour but is typically of the order of five seconds. The first and second latches 24 and 25 respectively store second and third pre-determined durations for comparison with counts accumulated in the counter 22 during operation of the device as hereinafter described.

[0012] The sequence correct counter 27 applies a disabling signal on its output 30 to the sound control 10 of the alarm unit 3 when the apparatus 4 is connected to its power source and applies an enabling signal to the sound control 10 on output 30 when the apparatus 4 is disconnected from its power source.

[0013] The anti-theft device described above with reference to Figure 1 operates so that activation of the alarm unit 3 occurs in the event that the apparatus 4 is moved whilst the equipment is disconnected from the power supply without the power supply to the apparatus 4 having first been subjected to a coded sequence of on/off states.

[0014] Thus, as long as the apparatus 4 is powered, the output 30 of the correct sequence counter 27 disables the sound control 10 of the alarm unit 3 and movement of the apparatus 4, resulting in movement of the trembler unit 2, does not activate the piezo-electric buzzer 12 of the alarm unit.

[0015] If authorised disconnection and movement of the apparatus 4 is required, the apparatus 4 must be first subjected to a coded sequence of connections and disconnections of its power supply in order to render the disarmed latch 9 operative to disconnect the alarm unit 3 from the trembler unit 2, since the output signal on line 30 from the sequence correct counter 27 will enable the sound control 10 of the alarm unit 3 on disconnection of the power from the apparatus 4.

[0016] The first step in performing the coded sequence of changes in the power status of the apparatus 4 is to switch the apparatus on and then off within a period of time which does not exceed the first pre-determined duration set by the pulse detector unit 17. This is represented by the pulse 31 in diagram 3a of Figure 3. Detection of pulse 31 by hold and extend circuit 21 at its input causes the circuit 21 to enter its interpretation state as shown at 32 in diagram 3b of Figure 3. After a pre-determined time delay determined by circuit 21 and selectable between 0 seconds and 1 hour, the counter 22 is started by a signal from the circuit 21 as indicated at 33 in diagram 3c of Figure 3. At the same time, the counter 22 provides an output on line 28 to the sound control 10 of the alarm unit 3 to cause the piezo electric buzzer 12 of the alarm unit to emit timing signals in the form of a regular series of short sounds or beeps as indicated at 35 on diagram 3d of Figure 3.

[0017] At a pre-determined time in this series of

beeps, corresponding to a second predetermined duration selectable between 1 second and 1 hour and set by the first latch 24 and ascertained by counting the beeps 35, the power supply is again switched on as indicated at 36 in diagram 3a of Figure 3. The circuit 21 then stops the counter 22 and the counter then compares the count at this time with the second pre-determined duration set by latch 24 and, if it corresponds, a first correct sequence pulse is delivered to the correct sequence counter 27 on output line 26 of the counter 22 as shown at 37 in diagram 3e of Figure 3.

[0018] After a further period corresponding to the delay period of the circuit 21, the counter 22 is again started as indicated at 36 in diagram 3c of Figure 3 and the piezo electric buzzer 12 emits a further series of beeps 35. After a time corresponding to a pre-determined third duration selectable between 1 second and 1 hour and set by the second latch 25, the apparatus 4 is again switched off as indicated at 38 in diagram 3a of Figure 3, thereby stopping the counter 22 as indicated at 39 in diagram 3c of Figure 3 and stopping the emission of beeps by the piezo electric buzzer 12. If the count in the counter 22 at this time corresponds to the third pre-determined duration stored in latch 25, the counter delivers a second correct sequence pulse on its output 26 to the correct sequence counter 27 as indicated at 40 in diagram 3e of Figure 3.

[0019] Upon receipt of this second correct sequence pulse 40, the correct sequence counter 27 delivers a signal on its output 29 to operate the disarm latch 9 as indicated at 41 in diagram 3f of Figure 3, so as to prevent output signals from the trembler unit 2 from reaching the alarm unit and thereby enabling movement of the disconnected apparatus 4 without activation of the alarm unit 3. This alarm disarmed state is preferably indicated by the device 1 emitting, for example, five short tones.

[0020] When the apparatus 4 is re-connected to the power as indicated at 42 in diagram 3a of Figure 3, the output signal on the output 29 of the correct sequence counter 27 is removed and, as indicated at 43 in diagram 3f, the disarm latch 9 reverts to its normal condition in which the output of the trembler circuit 2 is connected to the input of the alarm unit 3.

[0021] Should the apparatus 4 be disconnected and moved without first carrying out the above described coded sequence of power connections and disconnections, the disarm latch 9 will be in its normal condition and the alarm unit 3 will be activated by the trembler unit 2. When the power to the apparatus 4 is disconnected, the alarm not being disarmed, the device 1 will emit, for example, three short tones - an alarm active indication. This warns, for example, a shop assistant that movement of the apparatus 4 in this condition would trigger the trembler to cause an alarm condition.

[0022] Although the above described monitoring device 1 is described as monitoring the voltage on the power lines 4A and 4B, it is envisaged that the device could equally be arranged to monitor current, for example in

the range of 1mA to 1A.

[0023] Although the above device 1 has been described as having its inputs 1A and 1B connected to the power lines of the apparatus 4, the inputs may be directly or indirectly coupled to the power lines or indeed signal lines of the apparatus 4.

[0024] Should the alarm unit 3 be activated by disconnection of the apparatus 4 from its power source and unauthorised removal of the apparatus 4, the alarm can be simply de-activated merely by re-applying power to the apparatus to the power supply.

[0025] Figure 2 shows the monitoring device 1 embodying the present invention incorporated in another anti-theft device which also includes a tamper system comprising, for example, a light-sensitive resistor 50 provided inside a housing of the device and connected to the disarm latch 9, so that illumination of the resistor 50, resulting for example from a person tampering with the housing of the device or the equipment in which the device is installed, will cause an output signal to be delivered to the disarm latch 9 and thereby activate the alarm. A signal applied to input 51 of the device 1 determines whether the device is in a monitoring state to monitor change of the power states of the apparatus 4 or is in a programming state in which selected pre-determined periods and a delay period may be programmed into the latches 24 and 25 and the circuit 21 via inputs 52-55. A signal applied to input 56 of device 1 selects whether the presence or absence of voltage or current determines the change of state periods. The tamper system may be provided as a separate unit located externally of the housing of the device 1.

[0026] This tamper system can be disarmed by entering an appropriately coded sequence through the power lines of the apparatus 4 being monitored. Should the tamper system be activated, the switching of the apparatus 4 being monitored to an on state will not silence the alarm. The internal power source of the monitoring device 1 must be removed, in this case, to silence the tamper alarm.

[0027] The buzzer 12 has two levels of output an attenuated level and an alarmed level. The attenuated level is muted compared to the alarmed level. The attenuated level is used for signalling all beeps, tones and indications. The alarm level is used only when the unit is activated as an alarm.

[0028] It will be appreciated that a monitoring device or anti-theft device embodying the present invention may be incorporated during manufacture into an apparatus to be monitored or may be provided as an attachment thereto.

[0029] The device 1 is preferably provided with a battery monitor which generates two tones intermittently over a designated period should the internal power supply, the battery 13, of the device 1 fall below a certain level.

[0030] When the device 1 is initially powered up and is not connected to the apparatus 4 being monitored or

no signal has yet been received by the device 1 from the apparatus 4, then the device is in a so-called 'test' state. This state is terminated when a signal from the apparatus 4 being monitored is first received.

[0031] When the device 1 is in the 'test' state, it generates test tones upon activation of various signals. For example, when the alarm detection circuit is activated (e.g. by triggering the trembler) it generates a series of tones. This series of tones is extended should the tamper system also be activated.

[0032] The device 1 may be placed in a programming state either by initiation by an external trigger or automatically when the device 1 is first in the disarmed state. The device has a default code sequence which is accepted as the code for the device. Should the user of the device allow the disarming state to time out (time-out occurring when the device generates the first sequence of tones and the equipment does not change state during this period), then the default code sequence is adopted.

[0033] It will be appreciated that a monitoring device embodying the present invention presents the great advantage that it is armed and disarmed merely by connecting and disconnecting its power supply and does not require the use of a separate key switch for arming and disarming the alarm as required by presently available anti-theft devices used to protect such apparatus.

30 Claims

1. A monitoring device (1) for monitoring an apparatus having first and second states, comprising: detecting means (17) for detecting each change of state of the apparatus between its first and second states; timing means (22,23) for measuring the duration between successive changes in the state of the apparatus as detected by the detecting means; memory means (21,24,25) for storing first, second and third pre-determined durations; comparing means (27) for comparing the timing of detected changes in the state of the apparatus and delivering an output signal in the event that first and second changes of state of the apparatus are detected within a duration not exceeding the first pre-determined duration, a third change of state is detected after the second change of state at a time corresponding to the second pre-determined duration and a fourth change of state is detected after the third change of state at a time corresponding to the third pre-determined duration; and means (3) for emitting timing signals during the second and third durations after detecting the second and third changes of state respectively.
2. A monitoring device according to Claim 1, wherein the timing means starts to measure each of the durations between the second and third changes of

state and the third and fourth changes of state after a pre-determined delay.

3. A monitoring device according to Claim 1 or 2, wherein the timing signals are audible signals. 5
4. A monitoring device according to Claim 3, wherein the timing signals comprise a regular series of short sounds or beeps. 10
5. A monitoring device according to any preceding claim, including an alarm unit wherein the output signal of the comparing means disarms the alarm unit. 15
6. A monitoring device according to Claim 5, wherein the alarm unit is disarmed in one of the first and second states of the apparatus and is armed in the other state in the absence of the output signal from the comparing means. 20
7. A monitoring device according to Claim 5 or 6 including a sensor which is operable, upon activation, to supply an alarm signal to the alarm unit to produce a warning signal if the alarm unit is enabled. 25
8. A monitoring device according to Claim 7, wherein the sensor is a trembler unit adapted to supply the alarm signal to the alarm unit upon movement of the trembler unit. 30
9. A monitoring device according to Claim 7 or 8, wherein the warning signal is an audible signal.
10. A monitoring device according to any preceding claim, wherein the apparatus is electrically operated apparatus and the first and second states of the apparatus are the power on and power off states of the apparatus. 35
11. A monitoring device according to any preceding claim, wherein the input means comprises a pair of input terminals for coupling to electrical lines of the electrical apparatus to be monitored. 40
12. A monitoring device according to Claim 11, wherein the pair of input terminals are configured to be connected to the apparatus to sense changes in voltage. 45
13. A monitoring device according to Claim 11, wherein the pair of input terminals are configured to be connected to the apparatus to sense changes in current. 50

Patentansprüche

1. Überwachungseinrichtung (1) zum Überwachen einer Vorrichtung, die einen ersten und einen zweiten Zustand aufweist, mit folgenden Merkmalen: eine Erfassungsvorrichtung (17) zum Erfassen jeder Zustandsänderung der Vorrichtung zwischen dem ersten und dem zweiten Zustand; eine Zeitgebervorrichtung (22, 23) zum Messen der Dauer zwischen aufeinanderfolgenden Zustandsänderungen der Vorrichtung, die von der Erfassungsvorrichtung erfaßt wurden; eine Speichervorrichtung (21, 24, 25) zum Speichern einer ersten, einer zweiten und einer dritten vorgegebenen Dauer; eine Vergleichervorrichtung (27) zum Vergleichen der Zeiten der erfaßten Zustandsänderungen der Vorrichtungen und zum Abgeben eines Ausgangssignals in dem Fall, daß eine erste und eine zweite Zustandsänderung der Vorrichtung innerhalb einer Dauer erfaßt werden, welche die erste vorgegebene Dauer nicht überschreitet eine dritte Zustandsänderung nach der zweiten Zustandsänderung zu einer Zeit erfaßt wird, die der zweiten vorgegebenen Dauer entspricht, und eine vierte Zustandsänderung nach der dritten Zustandsänderung zu einer Zeit erfaßt wird, die der dritten vorgegebenen Dauer entspricht; und eine Vorrichtung (3) zum Ausgeben von Zeitsignalen während der zweiten und der dritten Dauer nach der Erfassung der zweiten bzw. der dritten Zustandsänderung.
2. Überwachungseinrichtung nach Anspruch 1, bei der die Zeitgebervorrichtung die Messung jeder Dauer zwischen zweiten und dritten Zustandsänderungen und dritten und vierten Zustandsänderungen nach einer vorgegebenen Verzögerung beginnt.
3. Überwachungseinrichtung nach Anspruch 1 oder 2, bei der die Zeitsignale hörbare Signale sind.
4. Überwachungseinrichtung nach Anspruch 3, bei der die Zeitsignale eine regelmäßige Reihe aus kurzen Tönen oder Piepsen umfassen.
5. Überwachungseinrichtung nach einem der vorangehenden Ansprüche mit einer Alarmeinheit, wobei das Ausgangssignal der Vergleichervorrichtung die Alarmeinheit deaktiviert.
6. Überwachungseinrichtung nach Anspruch 5, bei der die Alarmeinheit bei einem der ersten und zweiten Zustände der Vorrichtung deaktiviert und bei dem anderen Zustand aktiviert wird, wenn kein Ausgangssignal von der Vergleichervorrichtung vorhanden ist.
7. Überwachungseinrichtung nach Anspruch 5 oder 6

mit einem Sensor, der bei Aktivierung betriebsbereit ist, um ein Alarmsignal an die Alarmeinheit zu liefern, um ein Warnsignal zu erzeugen, wenn die Alarmeinheit enablt ist.

8. Überwachungseinrichtung nach Anspruch 7, bei der der Sensor eine Vibrationseinheit ist, die das Alarmsignal an die Alarmeinheit bei Bewegung der Vibrationseinheit abgeben kann.
9. Überwachungseinrichtung nach Anspruch 7 oder 8, bei der das Warnsignal ein hörbares Signal ist.
10. Überwachungseinrichtung nach einem der vorangehenden Ansprüche, bei der die Vorrichtung eine elektrisch betriebene Vorrichtung ist und der erste und der zweite Zustand der Vorrichtung Einschalt- und Ausschalt-Zustände der Vorrichtung sind.
11. Überwachungseinrichtung nach einem der vorangehenden Ansprüche, bei der die Eingabevorrichtung zwei Eingangsanschlüsse zum Anschließen elektrischer Leitungen der zu überwachenden elektrischen Vorrichtung aufweist
12. Überwachungseinrichtung nach Anspruch 11, bei der die zwei Eingangsanschlüsse so konfiguriert sind, daß sie mit der Vorrichtung verbunden werden, um Spannungsänderungen zu erfassen.
13. Überwachungseinrichtung nach Anspruch 11, bei der die zwei Eingangsanschlüsse so konfiguriert sind, daß sie mit der Vorrichtung verbunden werden, um Stromänderungen zu erfassen.

Revendications

1. Dispositif de contrôle (1) pour contrôler un appareil ayant un premier et un deuxième états, comprenant : un moyen de détection (17) pour détecter chaque changement d'état de l'appareil entre son premier et son deuxième états ; un moyen de chronologie (22, 23) pour mesurer la durée comprise entre les changements successifs de l'état de l'appareil tels que détectés par le moyen de détection ; un moyen mémoire (21, 24, 25) pour mémoriser les première, deuxième et troisième durées prédéterminées ; un moyen de comparaison (27) pour comparer la chronologie des changements détectés de l'état de l'appareil et pour délivrer un signal de sortie dans le cas où les premier et deuxième changements d'état de l'appareil sont détectés pendant une durée ne dépassant pas la première durée prédéterminée, un troisième changement d'état est détecté après le deuxième changement d'état à un instant correspondant à la deuxième durée prédéterminée et un quatrième changement

d'état est détecté après le troisième changement d'état à un instant correspondant à la troisième durée prédéterminée ; et un moyen (3) pour émettre des signaux de chronologie pendant les deuxième et troisième durées après détection respectivement des deuxième et troisième changements d'état.

2. Dispositif de contrôle selon la revendication 1, dans lequel le moyen de chronologie commence à mesurer chacune des durées comprises entre les deuxième et troisième changements d'état et entre les troisième et quatrième changements d'état après un délai prédéterminé.
3. Dispositif de contrôle selon la revendication 1 ou 2, dans lequel les signaux de chronologie sont des signaux audibles.
4. Dispositif de contrôle selon la revendication 3, dans lequel les signaux de chronologie constituent une série régulière de sons brefs ou bips.
5. Dispositif de contrôle selon l'une quelconque des revendications précédentes, comprenant une unité d'alarme, dans lequel le signal de sortie du moyen de comparaison désarme l'unité d'alarme.
6. Dispositif de contrôle selon la revendication 5, dans lequel l'unité d'alarme est désarmée dans un des premier et deuxième états de l'appareil et est armée dans l'autre état en l'absence du signal de sortie provenant du moyen de comparaison.
7. Dispositif de contrôle selon la revendication 5 ou 6, comprenant un détecteur qui peut fonctionner, lors d'une activation, afin d'appliquer un signal d'alarme à l'unité d'alarme afin de produire un signal d'avertissement si l'unité d'alarme est activée.
8. Dispositif de contrôle selon la revendication 7, dans lequel le détecteur est une unité trembleuse adaptée en vue d'appliquer le signal d'alarme à l'unité d'alarme lors du déplacement de l'unité trembleuse.
9. Dispositif de contrôle selon la revendication 7 ou 8, dans lequel le signal d'avertissement est un signal audible.
10. Dispositif de contrôle selon l'une quelconque des revendications précédentes, dans lequel l'appareil est un appareil actionné électriquement et les premier et deuxième états de l'appareil sont les états sous tension et hors tension de l'appareil.
11. Dispositif de contrôle selon l'une quelconque des revendications précédentes, dans lequel le moyen d'entrée comprend une paire de bornes d'entrée destinées à être couplées aux lignes électriques de

l'appareil électrique à contrôler.

12. Dispositif de contrôle selon la revendication 11, dans lequel la paire de bornes d'entrée est configurée en vue d'être reliée à l'appareil afin de détecter des variations de tension. 5
13. Dispositif de contrôle selon la revendication 11, dans lequel la paire de bornes d'entrée est configurée en vue d'être reliée à l'appareil afin de détecter des variations de courant. 10

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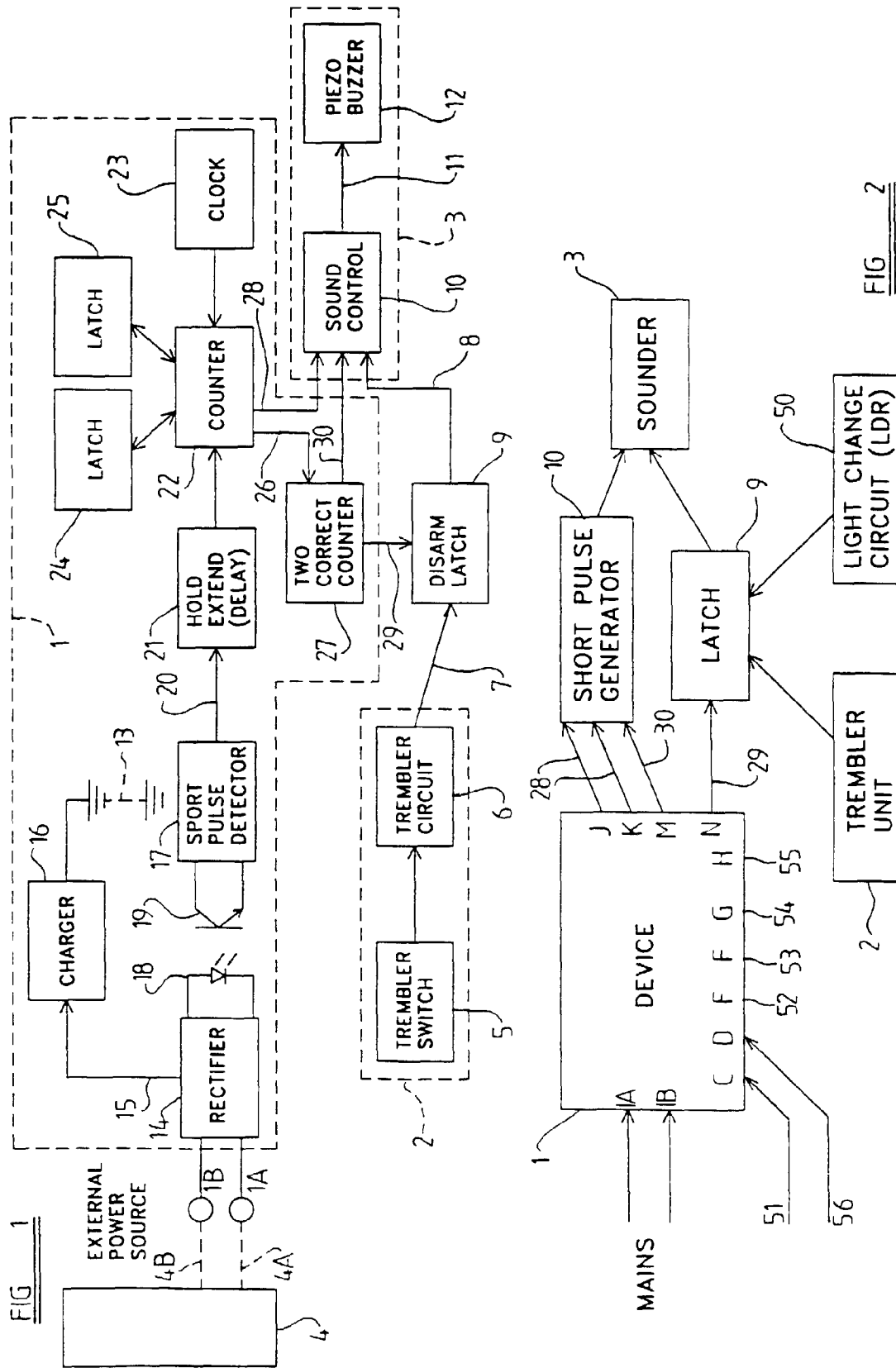
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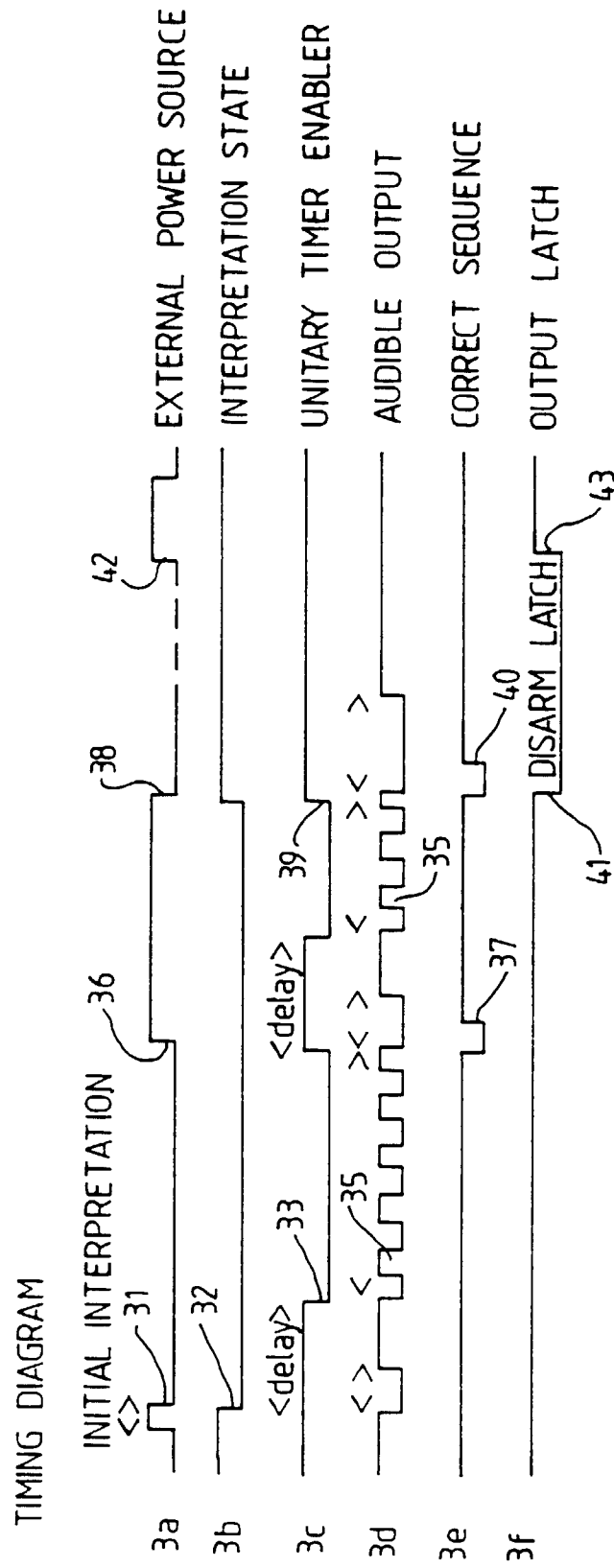


FIG 3