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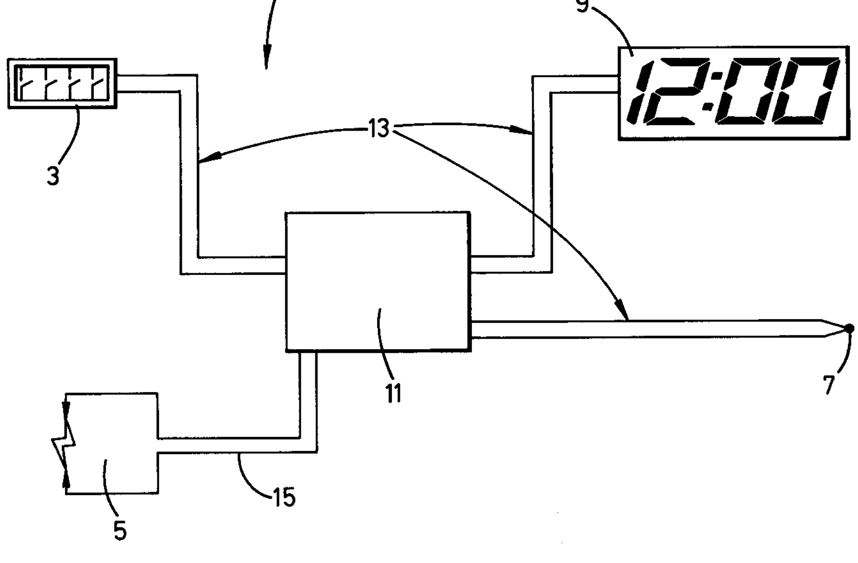
(54) Control system for a fuel burning appliance

(57) A control system 1 for a fuel burning appliance, the control system 1 comprising: ignition means 5 for igniting the fuel with an electrically generated spark; a controller 11 for controlling the ignition means; at least one other system component 9; and means 30 for isolating the at least one other system component at least for the duration of the spark.

FIG. 1



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Description

This invention relates to a control system for a fuel burning appliance, for example a gas appliance.

Modern fuel burning appliances such as cookers, heaters and boilers are typically provided with various components which can be manipulated by a user in order to control the appliance. In a gas cooker, for example, the components may include a system clock which can be set by the user to turn on or turn off the cooker at a predetermined time set by the user.

These modern fuel burning appliances typically include some arrangement for automatically igniting the fuel used by the appliance. The fuel is usually ignited by an electrically powered ignition circuit which is operable to store charge in a capacitor and then, upon actuation of switch means, discharge the capacitor through a primary winding of a transformer to develop a potential of several thousand volts over a pair of spark electrodes connected to the secondary winding of the transformer, the potential generating a spark that is used to ignite the fuel.

This arrangement, whilst providing an elegantly simple mechanism for electronically igniting a fuel such as gas suffers from a serious disadvantage in that the electromagnetic interference caused by the generation of the spark can often interfere with or even damage other components of the appliance control system. The interference or damage can also be caused by leakage, to other system components, of current from the large current pulse discharged by the capacitor.

This electronic interference can visually detract from the overall appearance of the appliance and, in the some cases, can give the impression that the appliance is malfunctioning. The user/owner of the appliance may then call out at engineer for an expensive consultation, only to be told that the appliance is not malfunctioning and that the interference is normal. This leads to bad feeling and dissatisfaction which is highly undesirable with regard to any brand reputation that the appliance manufacturer might be trying to instill in a purchaser in the hope that the purchaser will repeat buy from a range of alternative appliances manufactured by that manufacturer.

In accordance with an aspect of the present invention, there is provided a control system for a fuel burning appliance, the control system comprising: ignition means for igniting the fuel with an electrically generated spark; a controller for controlling the ignition means; at least one other system component; and means for isolating the at least one other system component at least for the duration of the spark.

In this way, the present invention alleviates the above-mentioned problems by providing a mechanism whereby components of an appliance control system are isolated from the ignition circuit so that they are less affected by stray electromagnetic interference caused by spark generation in the ignition circuit.

Preferably, the isolating means includes means for isolating data communications between the controller and the at least one other system component.

Preferably, the means for isolating data communications comprises an optoisolator.

Preferably, the optoisolator comprises a light emitting diode and an associated photodetector.

Preferably, the isolating means includes means for isolating power transmission between the controller and the at least one other system component.

Preferably, the power isolating means comprises a pair of relay switches, each switch being connected to a respective one of a pair of DC power lines and to a respective power input of the at least one other component.

A relay coil powered by the power lines may be provided, which when powered holds the relay switches in a conductive state to allow conduction of power between the controller and the at least one other system component.

A hold-up capacitor connected between and chargeable by the power lines may be provided, the capacitor discharging when the relay switches are in a non-conductive state to power the at least one system component connected thereto.

Preferably, the at least one system component includes a clock. The clock may comprise control means provided within the controller and a display external to the controller and connected to the control means by a cable, the cable comprising a pair of cables for powering the display and a pair of cables for data communication between the control means and the controller. In this case, the isolation means may be provided between the control means and the controller.

Preferably, the controller includes a portion of the ignition circuit, the portion including a capacitor, a transformer, means for discharging the capacitor through a primary winding of the transformer, a ferrite core and a secondary winding of the transformer, the secondary winding being connected by a high tension cable to a pair of spark electrodes external to the controller.

A temperature sensor and user actuation means connected to the controller may be provided, the user actuation means enabling a user to control the system.

In accordance with a second aspect of the invention, there is provided a cable for a control system as described herein, the cable comprising an outer sheath housing a pair of power cables and at least one data cable therein.

In accordance with a third aspect of the invention, there is provided an isolation circuit connectable between a first component and a second component, the circuit comprising at least one relay switch controllable to break a power link between the first and second components and an optoisolator for isolating data communications between the components.

Embodiments of the invention will now be described by way of example only with reference to the following drawings, in which:

Figure 1 is a schematic representation of a control system;
Figure 2 is a schematic representation of a connecting cable suitable for connecting the components of Figure 1;
Figure 3 is a schematic representation of an interface which may be controlled to electrically isolate control system components connected thereto; and
Figure 4 is a schematic representation of the flow of data and other signals in the control system of Figure 1.

The present invention will now be described with specific reference to a control system for a gas cooker. However, it should be noted that the description of the present invention with relation to a gas cooker is given purely by way of example and that the present invention may be employed in an variety of different appliances, and differently fuelled appliances.

With reference to Figure 1, an exemplary control system 1 comprises a user interface 3, a spark ignition circuit 5, a temperature sensor 7, an electronic clock 9 and a controller or microprocessor 11. The interface 3, temperature sensor 7 and electronic clock 9 are connected to the controller 11 by way of cables 13 such as those shown in Figure 2. The ignition circuit 5 is connected to the controller 11 by way of a high tension cable 15 which is capable of conveying a large voltage of several thousand volts across ignition electrodes (not shown) in order to generate a spark for the ignition of a fuel. The exact composition and operation of the ignition circuit is well known and will not be further described herein.

Other components may be provided as required or desired. Accordingly, it should be noted that the scope of the invention is not limited to the provision of a particular number of components, or to components of a particular type.

It should also be noted that the controller may comprise a dedicated controller with external system components or, alternatively, the controller may include elements of the system components therein. For example, the controller may include parts of the ignition circuit and the clock, for example, with only the display of the clock and the spark electrodes of the ignition circuit being external to the controller.

Figure 2 illustrates a schematic representation of the connecter 13 shown in Figure 1 as connecting the interface 3, clock 9 and temperature probe 7 to the controller 11.

With reference to Figure 2, the connector 13 comprises an outer sheath 20 housing a plurality of insulated cables 22. In this embodiment, a pair 24 of the cables 22 are capable of carrying data between the components of the control system, and a further pair 26 of the cables are capable of carrying a DC voltage to the system components, as required, to power them.

Figure 3 is a schematic representation of an interface which may be controlled to electrically isolate control system components connected thereto.

The interface may be connected between the controller 11 and other system components or, alternatively, the interface may be provided within the controller to isolate portions of the controller related to the ignition circuit from other portions related to other system components. For the purposes of this description, it will be assumed that the interface is provided within the controller and that the controller includes at least portions of other system components.

The interface 30 comprises a pair of isolating relays 32 which are respectively connected to DC power lines 34, such as those shown in Figure 2. A relay coil 36, for operating the relays 32 between a closed (conductive) position and an open (non-conductive) position, is connected between and powered by the DC power lines 34.

It will be apparent that the two individual relay switches may be replaced by a single dual pole relay or dual contact relay which would afford equivalent functionality to two individual relay switches, but in a single component.

A hold up capacitor 38 is connected to the DC power lines between the relays 32 and a component to be isolated. The hold up capacitor is charged by the power lines 34 when the relays are closed 32 and, when the relays are open, the hold up capacitor discharges to temporarily power the isolated component connected thereto.

Data lines 40, such as those shown in Figure 2, are connected to an optical isolator 42 provided for isolated data communication between the data lines and the component. The optical isolator 42 comprises a light emitting diode (LED) 44 and an associated photo detector (not shown), the LED being energised to convert electrical data impulses into optical impulses that are detected by the photo detector and converted back to electrical impulses for data transfer to the isolated component. In this way, the optoisolator electrically isolates the component from the data lines, thus electrically protects the component from stray current induced in the data lines by for example the ignition current.

Figure 4 is a schematic representation of the flow of data and other signals in the control system of Figure 1. As shown, signals flowing through the control system comprise data signals 50 between the controller and the components, relay control signals 52 for isolating the components and ignition circuit signals 54 for energising the ignition circuit to generate a spark. The relay control signals may comprise a voltage drop across the power lines 34 to cause the relay coil to be de-energised and the relays to open. The ignition circuit signals typically comprise a high current signal caused by the discharge of a capacitor in the ignition circuit.

As shown in Figure 4, the supply of an ignition signal only occurs when other components of the control system have been isolated from the power supply lines and data transfer between the controller and the other components has been interrupted. Guard periods Δ1 and Δ2 are provided immediately before and immediately after the ignition circuit control signal in order to prevent overlap between the ignition signal and other signals supplied to and received from the components.

A brief discussion of the operation of the control system will now be provided.

When a user manipulates the user interface, for example, data signals 50 are transferred between the components of the control system and the controller. If one of those data signals instructs the controller that a request for the generation of a spark has been made, then the controller emits a relay control signal to de-energise the relay coil, which de-energisation causes the relays to be open and thus the power line connection between the controller and the component to be broken. A period of time Δ1 after the controller has de-energised the components, the controller controls the switch means in the ignition circuit to discharge the capacitor and to emit the high current signal which is stepped-up by the transformer to generate a high voltage across the spark terminals in order to generate the requested spark.

A predetermined amount of time Δ2 after the spark has been generated, the controller re-energises the relay coil and the relays between the power lines and the components are closed for power transfer between the power lines and the components.

When the components are isolated from the controller, the hold up capacitor which has been previously charged by the DC signal flowing in the power lines, discharges to provide power for the isolated component. Once the isolation of the component from the circuit is reversed, the hold up capacitor is once again connected to the power lines and the capacitor recharges ready for the next time that the component is isolated from the control system.

In this way, the present invention provides a means for isolating components of a control system from electromagnetic interference generated by an ignition circuit.

It will be understood, of course, that the present inventions has been described herein by way of example only and that modifications may be made within the scope of the invention.

For example, whilst the system has been described in terms of providing a de-energising signal to the relay coil, it will be appreciated that the system could be adapted to energise the relay coil in order to break the relays. In this case, the relay coil would have to be separately powered from the controller.

Claims

1. A control system for a fuel burning appliance, the control system comprising:

   ignition means for igniting the fuel with an electrically generated spark;

   a controller for controlling the ignition means;

   at least one other system component; and

   means for isolating the at least one other system component at least for the duration of the spark.

2. A control system according to Claim 1, wherein the isolating means includes means for isolating data communications between the controller and the at least one other system component.

3. A control system according to Claim 2, wherein the means for isolating data communications comprises an optoisolator.

4. A control system according to Claim 3, wherein the optoisolator comprises a light emitting diode and an associated photodetector.

5. A control system according to any of Claims 1 to 4, wherein the isolating means includes means for isolating power transmission between the controller and the at least one other system component.

6. A control system according to Claim 5, wherein the power isolating means comprises a pair of relay switches, each switch being connected to a respective one of a pair of DC power lines and to a respective power input of the at least one other component.

7. A control system according to Claim 6, comprising a relay coil powered by the power lines, which when powered holds the relay switches in a conductive state to allow conduction of power between the controller and the at least one other system component.

8. A control system according to Claim 6 or Claim 7, comprising a hold-up capacitor connected between and chargeable by the power lines, the capacitor discharging when the relay switches are in a non-conductive state to power the at least one system component connected thereto.

9. A control system according to any preceding claim, wherein the at least one system component includes a clock.

10. A control system according to Claim 9, wherein the clock comprises control means provided within the controller and a display external to the controller and connected to the control means by a cable, the cable comprising a pair of cables for powering the display and a pair of cables for data communication between the control means and the controller.

11. A control system according to Claim 10, wherein the isolation means are provided between the control means and the controller.

12. A control system according to any preceding claim, wherein the controller includes a portion of the ignition circuit, the portion including a capacitor, a transformer, means for discharging the capacitor through a primary winding of the transformer, a ferrite core and a secondary winding of the transformer, the secondary winding being connected by a high tension cable to a pair of spark electrodes external to the controller.

13. A control system according to any preceding claim, comprising a temperature sensor and user actuation means connected to the controller, the user actuation means enabling a user to control the system.

14. A cable for a control system according to any preceding claim, the cable comprising an outer sheath housing a pair of power cables and at least one data cable therein.

15. An isolation circuit connectable between a first component and a second component, the circuit comprising at least one relay switch controllable to break a power link between the first and second components and an optoisolator for isolating data communications between the components.

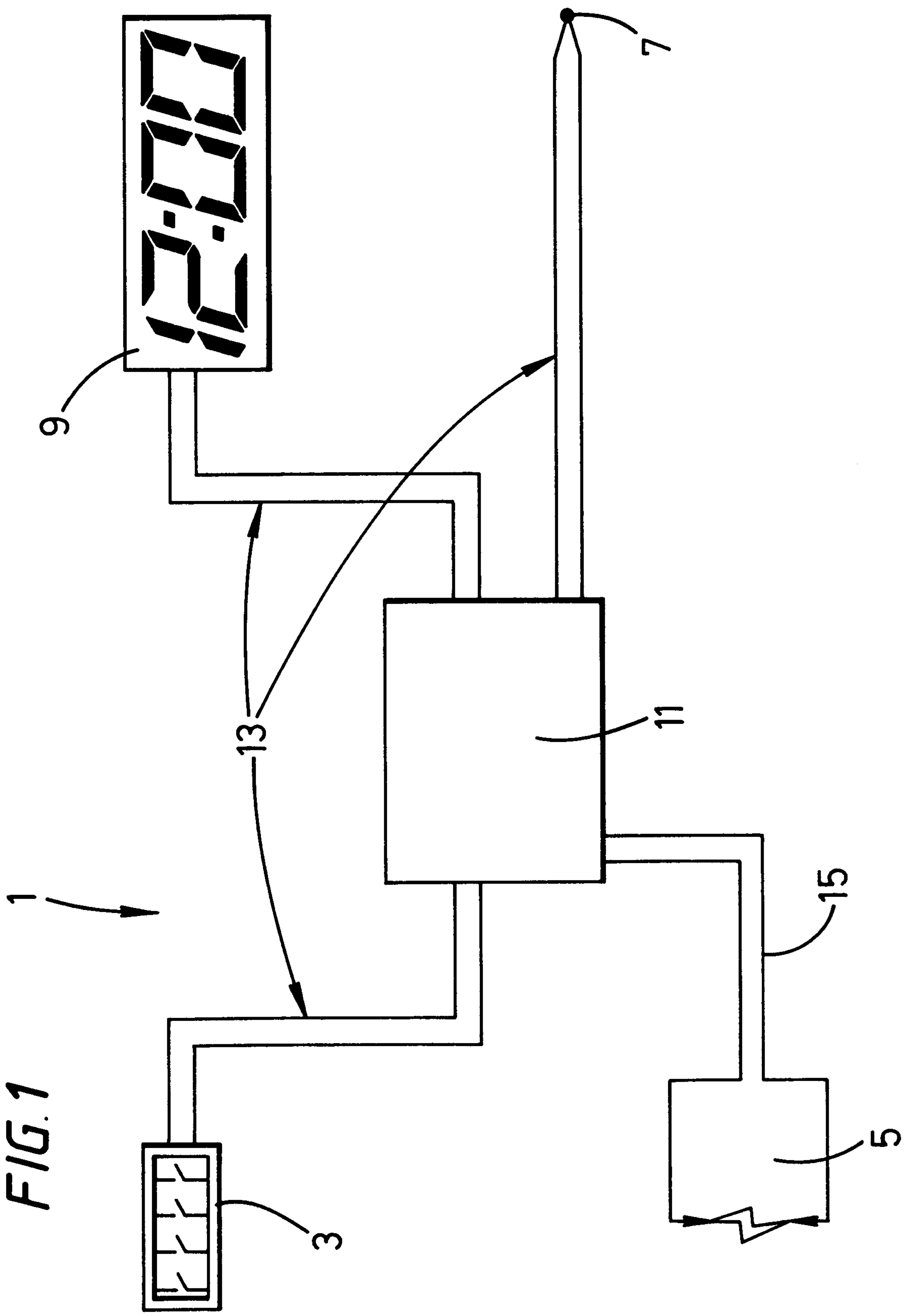


FIG. 1

FIG. 2

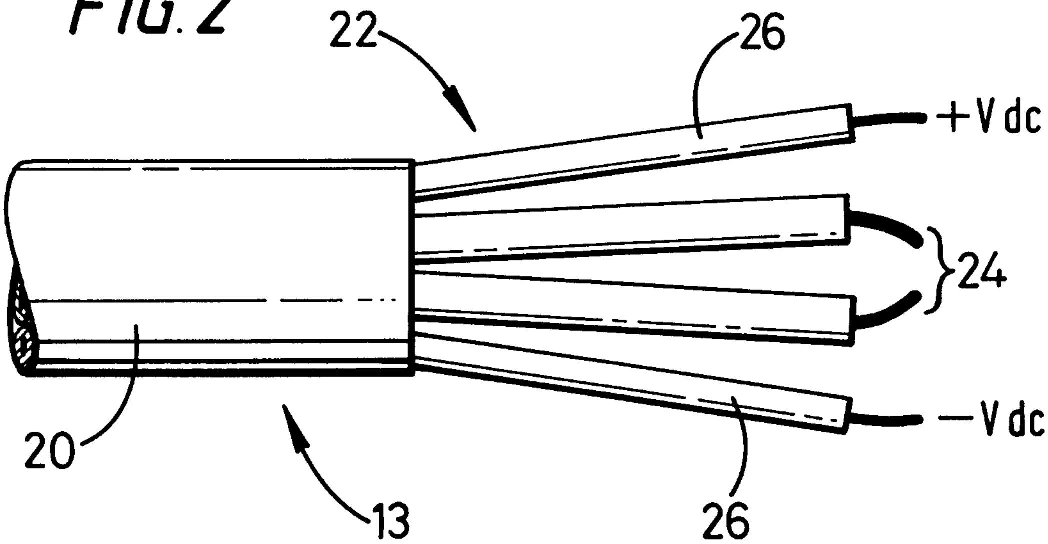
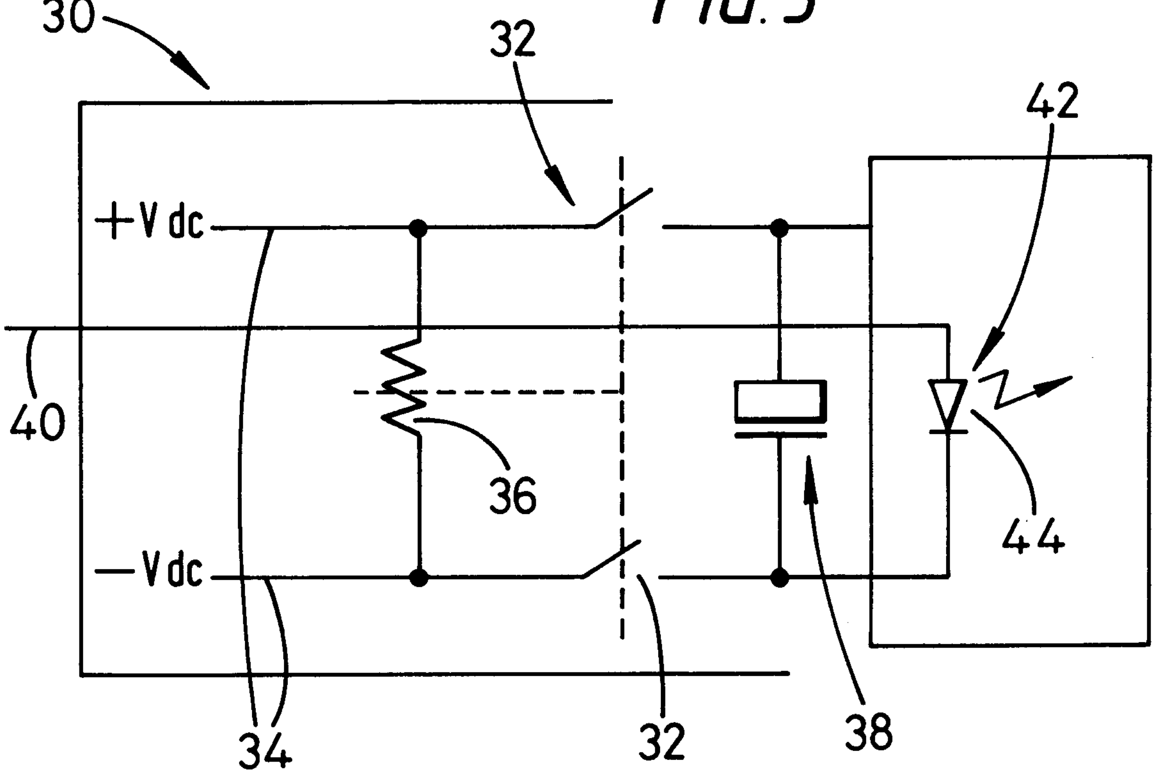


FIG. 3



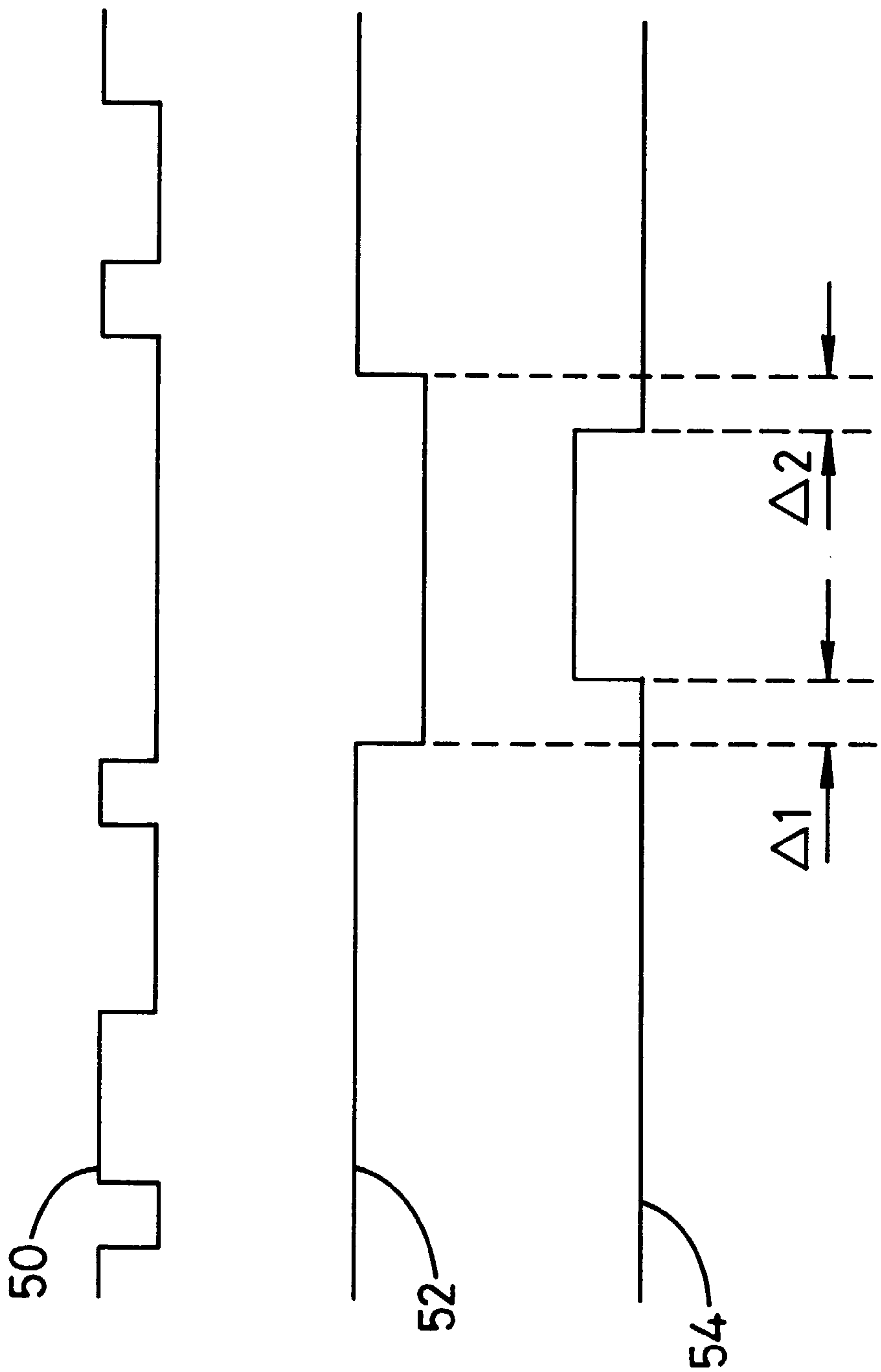


FIG. 4