

[54] ACCESS APPARATUS CONTROL SYSTEM

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[58] Field of Search **340/279, 52 R, 53, 64, 340/365 E, 274 R, 274 C, 276; 180/99; 307/10**

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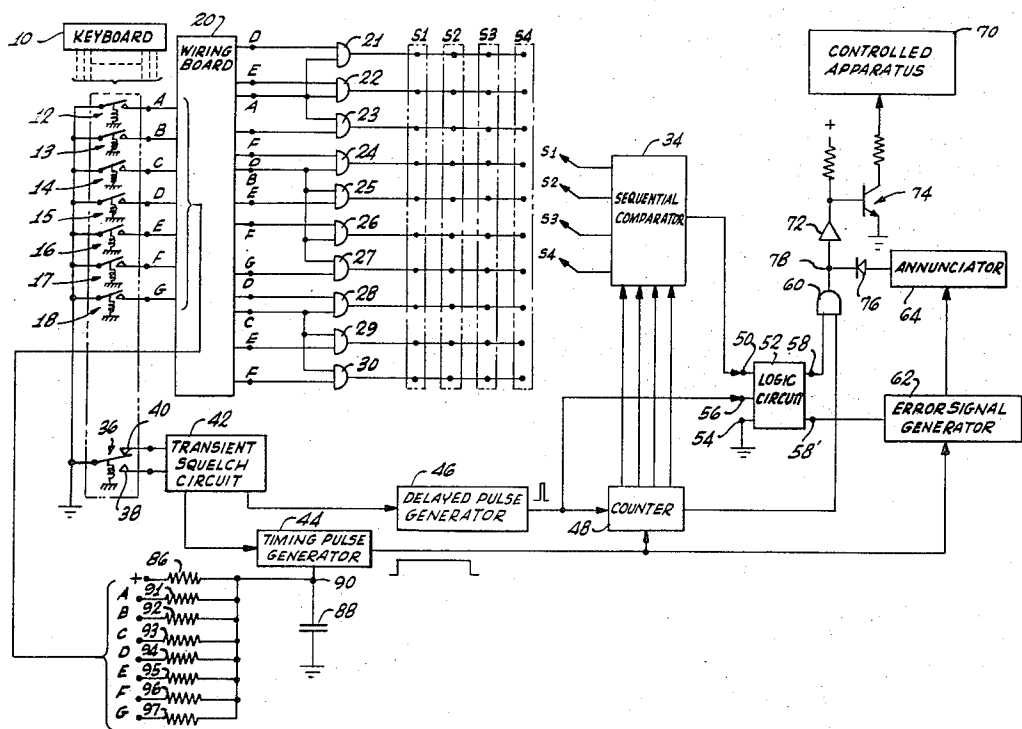
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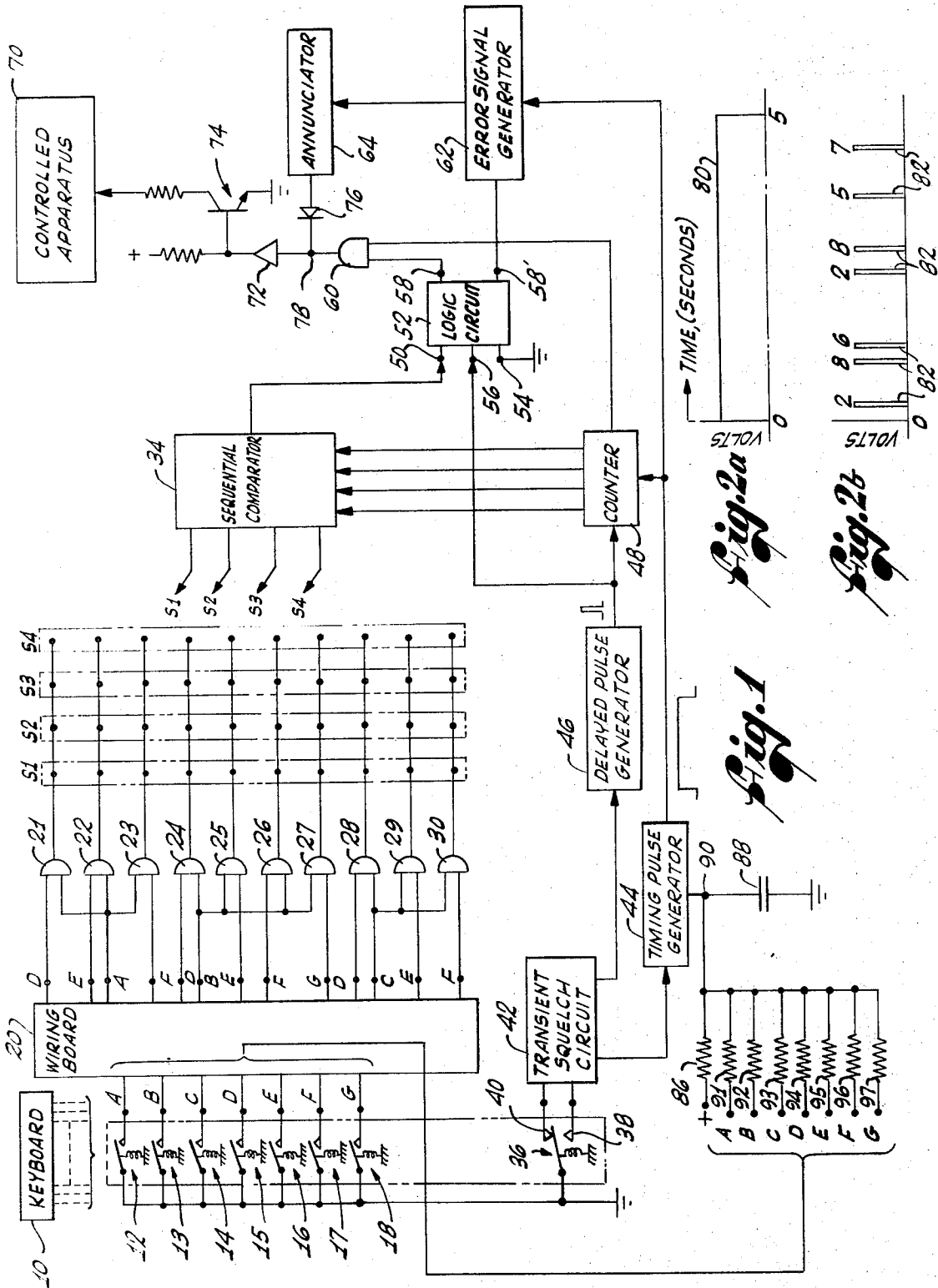
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[57] **ABSTRACT**

A decimal-coded or equivalent keyboard network is adapted upon each keyboard pushbutton actuation to operate a pulse generator and cause a pulse to be applied to a counter for controlling a sequential comparator. Also connected to the comparator are the movable contacts of four single-pole, multiple-throw switches having fixed contacts connected to the outputs of the keyboard network. Where successive pushbutton operations occur in proper order, controlled apparatus is rendered operable. The first pushbutton operation also triggers a timing pulse generator, and the duration of the timing pulse is ample so that pushbuttons can be actuated in the correct sequence. If the proper pushbuttons are not actuated in the correct sequence, operation of the controlled apparatus is inhibited. If a predetermined number of errors occur, an annunciator signals this fact. If two or more pushbuttons are actuated simultaneously, resistive elements coupled between the keyboard network and the reset terminal of the timing pulse generator cause the timing pulse to be terminated and prevent operation of the controlled apparatus.

1 Claim, 3 Drawing Figures





ACCESS APPARATUS CONTROL SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to systems with manually operable keyboards to be manipulated in a coded sequence for effecting operation of electrically controlled apparatus such as turnstiles, doors, parking lot gates and the like.

2. Description of the Prior Art

Electrical systems for controlled apparatus are known which are operable via different sets of switches that are operated manually and magnetically, respectively. See, for example, U.S. Pat. No. 3,430,200, wherein a keyboard and a magnetized card are used in conjunction to operate respective sets of switches in accordance with respective pushbutton and card codes to effect operation of apparatus such as a device for indicating whether the codes are properly matched. With a validly coded card in the arrangement disclosed in such patent, operating a selected number of pushbuttons in proper sequence results in a signal indicating that the pushbutton code is the proper one for that particular card code.

However, the keyboard and associated circuitry in such arrangement can be "fooled" by operating all pushbuttons simultaneously the requisite number of times. Thus, the keyboard and circuitry operated thereby cannot be relied on alone to limit operation of controlled apparatus to a selected number of persons.

SUMMARY OF THE INVENTION

This invention embraces a keyboard-controlled system that can be used without magnetic cards to operate selected apparatus, wherein the system has an internal code that is selectively settable and cannot be determined from the keyboard code, and wherein the system will detect any deviation from the operation of a single pushbutton at a time and prevent operation of the controlled apparatus.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a combined schematic and block diagram of the system of the invention; and

FIG. 2a and FIG. 2b are graphs of respective timing pulse and delayed pulse waveforms to aid in explaining the system.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENT

This invention employs a decimal-coded keyboard network or its equivalent. This may comprise a conventional keyboard with ten switches, and wherein each pushbutton operates via appropriate circuitry and a respective switch to develop a corresponding logic level output. Alternatively, this invention embraces comparable keyboard schemes of less expensive construction. Thus, referring to FIG. 1, a keyboard 10 is illustrated for operating a number of normally open switches, shown as single-pole, single-throw switches 12-18. The movable contacts of these switches are connected to reference or ground potential, and their fixed contacts are connected to respective terminals A-G of a wiring board 20. At the right of the board 20 are shown simi-

larly labeled terminals A-G which are connected to the inputs of gates 21-30. Each of the gates 21-30 has its inputs connected to different ones of the terminals A-G. It will be understood that like labeled terminals are directly connected via the board 20.

The output of each of the gates 21-30 is shown connected to respective fixed contacts of single-pole, multiple-throw switches S1, S2, S3, S4 that correspond to the respective thousands, hundreds, tens and units digits of a four-digit number. The movable contacts of such switches S1-S4 are connected to a sequential comparator 34, and their positions determine the code that is set into the system, and hence the sequence of pushbutton operations at the keyboard. Assume the example that the movable contact of the S1 switch engages its fixed contact that is connected to the output of gate 21, the movable contact of the S2 switch engages its fixed contact that is connected to the output of gate 23, the movable contact of the S3 switch engages its fixed contact that is connected to the output of gate 28, and the movable contact of the S4 switch engages its fixed contact that is connected to the output of gate 27.

For these settings of the movable contacts S1-S4, the gates 21, 23, 28, and 27 are to be rendered operable in that order. However, these settings are not detectable with reference to keyboard pushbutton operations. For these purposes, the keyboard 10 is adapted upon each pushbutton operation to close two of the switches 12-18, e.g., as is known with a telephone type touch tone keyboard. By way of example, for a keyboard with pushbuttons numbered 1, 2, . . . 9, 0, pressing the four pushbuttons numbered 2, 8, 5, 7 in sequence effects closure of switches 12-18 in the following pairs:

12, 15
12, 17
14, 15
13, 18

Correspondingly, the pushbutton operations in this example causes both inputs of the associated gates 21, 23, 28 and 27 to be connected to ground in that order. It should be noted that the four-digit pushbutton code 2857 does not provide any indication of the code that is set into the system via switches S1-S4.

In addition to the switches 12-18, the keyboard operates a single-pole, double-throw switch 36 which has its respective fixed contacts 38, 40 coupled through a transient squelch circuit 42, e.g., a flip-flop, to a timing pulse generator 44 and a delayed pulse generator 46. The output of the timing pulse generator is connected to the reset terminal of a counter 48, such as a three binary digit counter. The input to the counter is connected to the delayed pulse generator 46, and its four logic signal leads are connected to the sequential comparator 14. The timing pulse generator 44 may be a conventional Schmidt trigger, or so-called one-shot, having a reset terminal.

It should be noted that switch 36 and gates 21-30 are not needed where a conventional decimal-coded keyboard network is used. In such case, respective fixed contacts S1-S4 are connected to respective switch outputs, and each switch is connected directly to the transient squelch circuit 42.

The movable contact of switch 36 is normally biased against its fixed contact 40 that is connected to the delayed pulse generator 46. Upon actuation of the first keyboard pushbutton, a timing pulse of substantial du-

ration, e.g., 5 seconds, is developed by the generator 44, and a pulse of relatively short duration, e.g., 5 microseconds, is developed by the generator 46 upon each pushbutton operation. The timing pulse initiated by the first pushbutton operation is unaffected by succeeding individual pushbutton operations. As will be seen, the relatively long timing pulse gives a person ample time to operate the four pushbuttons in correct sequence. However, in the event of an inadvertent error on the first attempt, he must wait until the pulse terminates and then operate the pushbuttons in the correct sequence.

The sequential comparator may be any suitable arrangement of logic devices. For example, four gates each connected to a pair of the logic signal leads of the counter 48 so as to be enabled in sequence, may have their outputs and the movable contacts of switches S1-S4 connected to the inputs of other respective gates that are enabled only when the gates 21-30 are enabled in the order of the previously explained example. Such gate arrangements and connections within the comparator are not shown since they will be apparent to those skilled in the art.

The output of the comparator, which may comprise the outputs of gates therein connected together, is connected to an input terminal 50 of a logic circuit 52 that has a grounded input terminal 54 and a gate terminal 56 to which the delayed pulse generator is connected. The circuit 52 which may be a flip-flop well known in the art, has an output terminal 58 connected to one input of a gate 60, and a complement output terminal 58' that is connected to an error signal generator 62 which is coupled to alarm apparatus indicated as an annunciator 64. Thus, the voltage on the output terminal 58' is low, i.e., a logic "0," if that on the output terminal 58 is high, i.e., a logic "1," and vice versa. The circuit 52 may be a conventional J-K flip-flop. The remaining input of the gate 60 is connected to the counter 48, and the error signal generator 62 is coupled to the timing pulse generator 44.

After a pulse from the generator 46 is applied to the gate terminal of the circuit 52, the voltage on the output terminal 58 is at ground or above ground depending upon the potential of the input terminal 50 relative to ground. If the keyboard pushbuttons are operated in the correct sequence, the voltage on the output terminal 58 remains the same throughout the sequence, and at the end of the fourth operation the remaining input to the gate 60 is placed at the voltage level of the output of the counter 48 so as to enable the gate 60 and effect operation of controlled apparatus 70, e.g., electromagnetically operated gates, doors, turnstiles and the like.

In this latter connection, the output of the gate 60 in the illustrated arrangement is coupled via an inverter 72 to the base of a transistor 74 wherein the collector is resistively coupled to the controlled apparatus 70, the emitter is grounded, and the base is resistively coupled to the positive terminal of a power source. Where the gate 60 is an "OR" gate and its inputs are low, the transistor base is positive to establish emitter-collector flow whereby to effect operation of the controlled apparatus 70. This operation occurs upon termination of the timing pulse if the pushbutton were operated in the correct sequence, i.e., 2, 8, 5, 7 in the above example. In such case, the counter causes the associated input of the gate to be low.

If any pushbutton is operated that is not in the predetermined sequence, its actuation causes the associated input to gate 60 to be raised. The error signal generator 62 responds to the change in potential on the complement terminal 58' to develop an error signal, which is applied to the annunciator upon termination of the timing pulse to cause the potential at the junction 78 to be raised and thereby inhibit operation of the transistor 74 and apparatus 70.

The annunciator preferably is the type adapted to be set to count a predetermined number of errors, and to operate an alarm when that number of errors occurs. In one arrangement, the alarm is set off whenever incorrect pushbutton operations occur within three successive timing pulses. Thus, FIG. 2a illustrates the timing pulse 80, and FIG. 2b illustrates pulses 82 generated by the delayed pulse generator 46. FIG. 2b represents the situation wherein a person presses pushbuttons 2, 8 and 6, and then starts over and actuates the buttons 2, 8, 5, 7 in the correct sequence before the timing pulse 80 terminates. Since the third pushbutton operation was incorrect, an error signal is generated in response to the change at output terminal 58', which does not change again until the timing pulse terminates and the system is reset. The subsequent operation of pushbuttons in the correct sequence thus has no effect. If other such errors are made during the two succeeding timing pulses the annunciator establishes the alarm signal, which may be visual, audible, or both, to warn an attendant to investigate.

If the correct sequence of pushbutton operations illustrated in FIG. 2b occurs at the outset of the next succeeding timing pulse, the annunciator is reset via diode 76 to count from zero. Thus, it will be seen that the annunciator is reset each time the controlled apparatus is operated.

It will be noted that if all keyboard buttons are operated simultaneously each of four times, the buttons 2, 8, 5 and 7 are of course operated in the correct sequence. This invention includes means to render this tactic ineffective. To this end, the simultaneous operation of two or more pushbuttons automatically abruptly terminates the timing pulse so as to inhibit operation of the apparatus 70.

As illustrated, a resistor 86 and capacitor 88 are connected between the positive terminal of a power source and ground, and their junction 90 is connected to the reset terminal of the timing pulse generator 44. Connected between the junction 90 and the terminals A-G are respective resistors 91-97. When a single pushbutton is pressed, thereby to close two of the switches 12-18, two of the resistors 91-97 are connected in parallel between the junction 90 and ground. The combination of these two resistors with the resistor 86 and capacitor 88 establishes a high whereby to permit continued operation of the generator 44 to generate a pulse of desired duration, e.g., 5 seconds in the example herein. However, if two pushbuttons are pressed simultaneously, the effect of the four of the resistors 91-97 is to lower the voltage at the reset terminal 90 as to cause the generator 44 to respond to it as a reset pulse. Accordingly, it is impossible to effect operation of the apparatus 70 in this manner.

It will be apparent that the movable contacts of the switches S1-S4 can be changed as desired to install a new code in the system. Correspondingly, of course, the individuals who are to gain access to the apparatus

70 are furnished the new pushbutton code that is necessary to operate the system to that end.

I claim:

1. In combination:

decimal coded or like keyboard means having a plurality of manually operable key elements and a network including switches to be actuated by said key elements;

apparatus to be coupled to and operated from a power source when predetermined key elements are actuated in a predetermined sequence;

means operable upon actuation of the first key element in a sequence to develop a timing pulse, said timing pulse developing means being normally operable to develop a pulse of predetermined duration, said timing pulse developing means having a reset terminal;

means operable upon each key element actuation to develop a momentary pulse;

sequential comparator means;

a plurality of single pole, multiple throw switches connected between said comparator means and said keyboard network;

counter means connected between said momentary pulse developing means and said comparator means for conditioning said comparator means for operation upon each occurrence of a momentary

pulse,

said comparator means being adapted to develop a first logic level output where network switches are coupled to multiple throw switches by key element actuation, and a second logic level output if network switches are not coupled to multiple throw switches by key element actuation;

means responsive to first logic level outputs of said comparator means to couple said apparatus to the power source,

said coupling means being enabled by said counter means upon the last key element actuation of a sequence, whereby key element actuations in the predetermined sequence effects operation of the apparatus after the last key element actuation thereof, said coupling means being inhibited by a second logic level output by said comparator means from coupling the apparatus to the power source;

and resistive means in circuit with said reset terminal and said network switches,

said resistive means being operable upon simultaneous actuation of two or more key elements to reset said timing pulse generator and thereby terminate said timing pulse short of said predetermined duration.

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