United States Patent

Davis, Jr. et al.

[15] **3,636,272**

[45] **Jan. 18, 1972**

[54] TIMED CONTROL SYSTEM FOR AUDIO REPRODUCTION WITH A BISTABLE RELAY

[72] Inventors: **Gary F. Davis, Jr.; Nolan Keith Maus,** Columbus, both of Ind.

[73] Assignee: **Gary Davis Music Makers Store, Inc.,** Columbus, Ind.

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[52] **U.S. Cl.**.....**179/100.1 C,** 179/100.2 S, 179/100.3 D

[51] **Int. Cl.**.....**G11b 15/06,** G11b 15/18

[58] **Field of Search**.....179/100.1 C, 100.1 UC, 100.2 S, 179/100.3 D, 6 TA; 317/141 R, 36 TD

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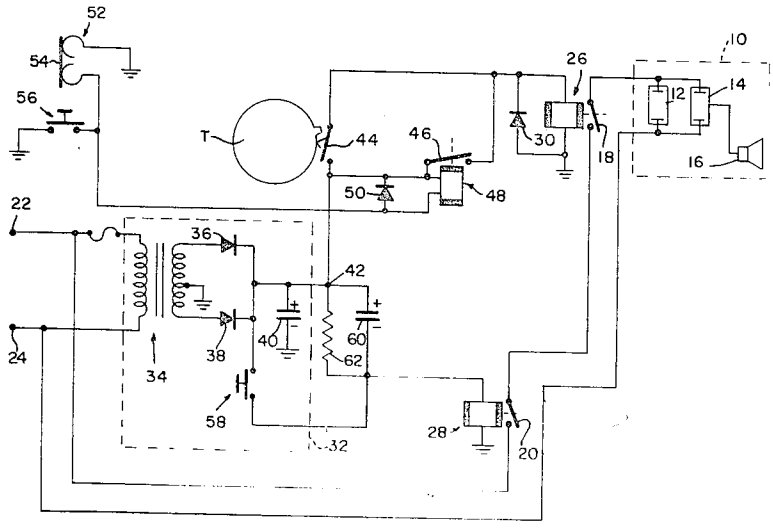
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Primary Examiner—Bernard Konick
Assistant Examiner—Raymond F. Cardillo, Jr.
Attorney—Hood, Gust, Irish, Lundy & Coffey

[57] **ABSTRACT**

A time-controlled audio system comprising a sound reproducing and amplifying system and a control system. The sound system includes a tape recorder and the control system includes a first bistable relay through which the sound system is energized and deenergized and a second bistable relay through which the sound system is energized and deenergized. The first bistable relay is operated periodically by a timer to energize the sound system and, each time the sound system is energized, by signals produced by the tape recorder to deenergize the sound system. The first bistable relay is preferably controlled by a monostable relay which is operated either by the signals produced by the tape recorder or by signals produced by operating a control switch. The second bistable relay is a power-failure relay arranged to open circuit the sound system when power is reapplied a predetermined time after there is a power failure. The time period is determined by a resistor-capacitor network. When the capacitor is fully discharged after the time period and power is reapplied, the charging current for the capacitor is sufficient to operate the second bistable relay.

9 Claims, 2 Drawing Figures



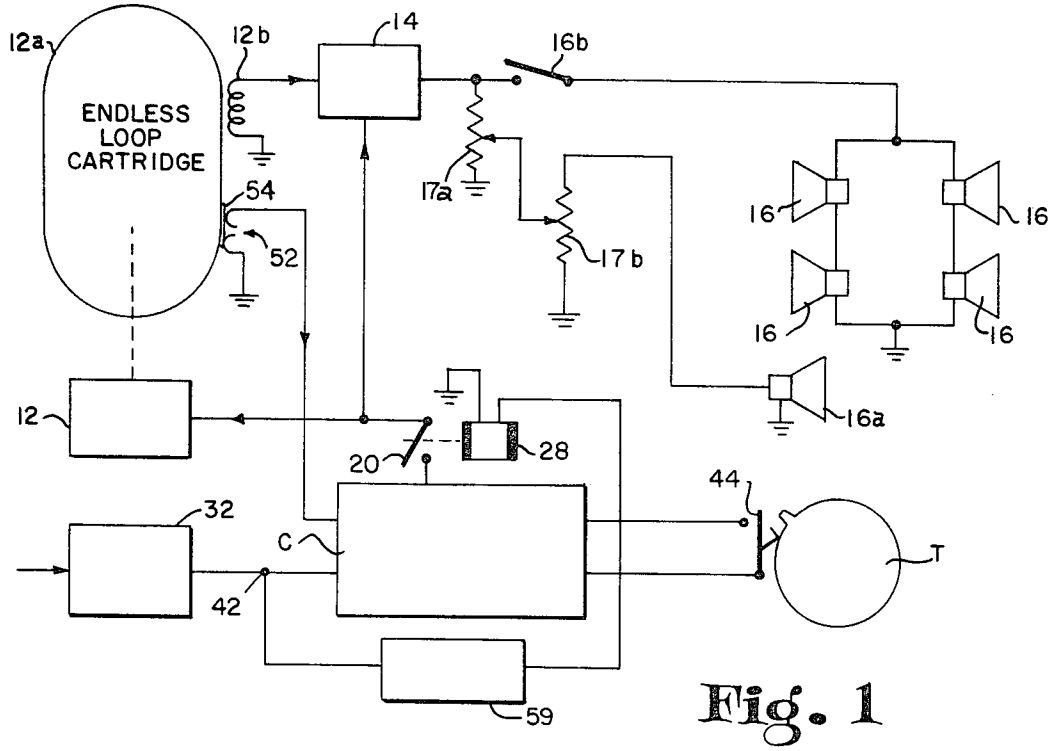


Fig. 1

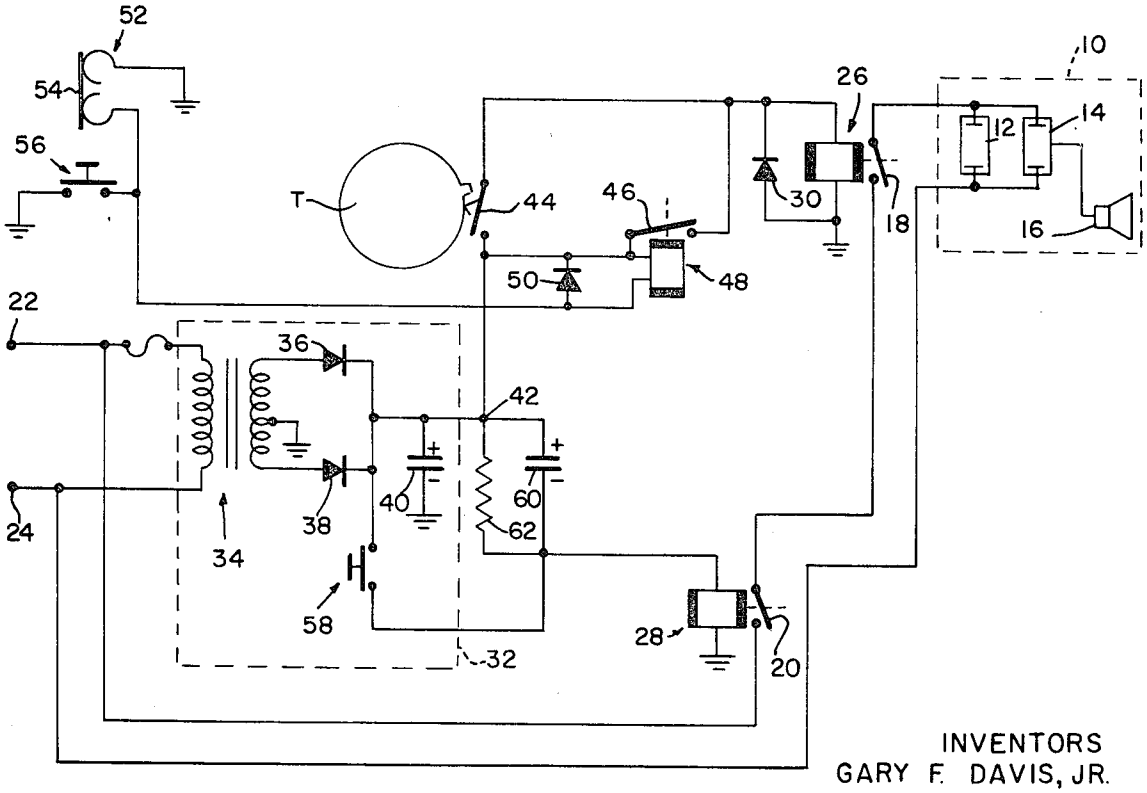


Fig. 2

INVENTORS
GARY F. DAVIS, JR.
NOLAN KEITH MAUS
BY
Hood, Gust, Irish & Lundy
ATTORNEY

TIMED CONTROL SYSTEM FOR AUDIO REPRODUCTION WITH A BISTABLE RELAY

It is a primary object of our invention to provide a time-controlled audio system which is inexpensive, but which is reliable and effective for the purpose intended. Our audio system is particularly suited for use in chime systems and automatic carillons for churches, schools, banks and the like.

Our system, which utilizes means for reproducing and amplifying sound, includes a control system which will automatically operate the sound system at particular times. Our control system is particularly advantageous because it includes means for deenergizing the sound system and keeping it deenergized if there is a power failure which lasts for a period of time greater than, for instance, 5 minutes. Our system will not be bothered by short duration power failures, i.e., durations under, for instance, 5 minutes, and it does not require a battery or other auxiliary power source for use in establishing an electrical condition after there is a main power failure.

Our system includes timer means for periodically energizing the sound system. The sound system preferably includes a tape recorder which is adapted to provide, at predetermined points in time while the sound system is operating, electrical signals which can be used for control purposes. We prefer to accomplish this by providing conductive segments on the tape and then to provide feeler contacts which engage these segments. We use the signals provided by these conductive segments to deenergize the sound system. In normal operation, therefore, our timer means provides short duration pulses which energize the sound system and the sound system itself provides pulses which are processed in such a manner as to deenergize the sound system.

Thus, our audio system comprises first means for reproducing and amplifying sound, the first means including second means for providing electrical signals at predetermined points in time while the first means is energized. We then provide third means for controlling the first means, the third means including first bistable switch means for energizing and deenergizing the first means, timer means for periodically operating the first bistable switch means to energize the first means, and fourth means for operatively connecting the first bistable switch means to the second means so as to operate the switch means to deenergize the first means when the second means provides such electrical signals. Our above-discussed power failure means includes second bistable switch means for energizing and deenergizing the first means, and circuit means for connecting the second bistable switch means to a power source. This circuit means includes fifth means effective, a predetermined time after such a power source initially fails, to establish a circuit condition such that, when power is reapplied, the second bistable switch means is operated to keep the first means deenergized until steps are taken manually to start the system.

We prefer to use bistable relays as the bistable switch means and a monostable relay as the monostable switch means. These relays are conventional.

Other objects and features of the present invention will become apparent as this description progresses.

To the accomplishment of the above and related objects, our invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is a block diagram of an audio system incorporating our control system; and

FIG. 2 is a schematic showing the details of our control system.

Referring first to FIG. 2, it will be seen that we have indicated a music or sound system, which may be a chime system, at 10, the system including a tape recorder 12, amplifier 14 and speakers 16, only one of which is shown in FIG. 2. The music system 10 is operated by alternating current flowing through relay-operated switches 18, 20, the alternating current source being applied across terminals 22, 24. Thus, the operation of the music system 10 depends upon the positions of the switches 18, 20.

The switch 18 is a bistable switch operated by the relay indicated at 26. That is, the switch 18 is part of a conventional, bistable relay 26. Each time the coil of the relay 26 is energized or pulsed, the switch 18 moves to its opposite position. The switch 18 is either in its open position or its closed position. If it is open and the field coil of the relay 26 is pulsed, the switch moves to its closed position. If it is closed and the field coil is pulsed, the switch moves to its open position.

We also use a power failure relay 28 which is a conventional bistable relay for operating the switch 20. When the power failure relay 28 coil is pulsed, the switch 20 moves to the other of its two positions, i.e., from its closed position to its open position or vice versa.

We show a diode 30 connected across the field coil of the relay 26. This diode 30 is a noise cancelling diode.

We show a power supply 32 including a conventional transformer 34, to the secondary coil of which is connected a pair of diodes 36, 38 and capacitor 40. The diodes 36, 38 and capacitor 40 are connected in a conventional manner to provide a direct current potential at the terminal which we have indicated at 42.

The coil of the relay 26 is connected to the terminal 42 through a switch 44 which is operated by a timer T. Thus, when the switch 44 is closed, the field coil of the relay 26 is pulsed to move the switch 18 from its position at that time to its opposite position. Generally, when the timer T closes the switch 44, the switch 18 will be in its open position. The field coil of the relay 26 is also connected to the point 42 through a switch 46 which is operated by a conventional monostable relay 48 which we call the cycle relay. We show a noise cancelling diode 50 connected across the field coil of the relay 48. This field coil of relay 48 is pulsed by signals produced in a tape-sensing head 52 past which conductive segments of tape, such as indicated at 54, moves. We place conductive segments 54 of tape at intervals on the tape deck 12 to provide these pulses which operate the cycle relay 48, thereby to operate the relay 26.

In our system, the relay 26 is pulsed to operate the music system 10 when the timer T closes the switch 44 to pulse the field coil of the relay. The timer T keeps the switch 44 closed only for a period of time approximating 4 seconds. The music system 10 is deenergized each time by the pulsing interval, i.e., conductive segment 54, placed on the tape deck as the segment 54 passes sensing head 52. In effect, the pulsing interval grounds the field coil of replay 48 momentarily to close its switch 46, thereby to pulse relay 26.

We show a manual start switch 56 which is arranged to connect the field coil of the relay 48 to ground to pulse the relay 48 momentarily to close its switch 46. When the switch 56 is closed, current can flow from the terminal 42 through the field coil of the relay 48 and then to the ground terminal side of the switch 56.

One problem with clock-controlled chime systems is that a power failure for a significant length of time will, when the clock or timer T, starts up, restart the system out of time. Thus, there may be chimes at the wrong times. We have placed a power failure control system within the control system C. This power failure control system includes means for pulsing the relay 28 so as to move its switch 20. Assume that the switch 20 stays in its normally closed position. The power failure control system includes a 500 microfarad capacitor 60 which is connected in parallel with a 100 KΩ resistor 62 between the terminal 42 and one side of the field coil of the relay 28. The capacitor 60 charges it up to its desired voltage level when the system, i.e., power supply 32, is turned on and, in the case of a power failure, the capacitor 60 discharges through the resistor 62. There is a time constant involved of about, for instance, 5 minutes. Thus, if there is a power failure for more than 5 minutes, all of the charge on the

capacitor **60** will flow through the resistor **62**. When power is reapplied, the charging current for the capacitor **60** is sufficient to trip the relay **28** to open the switch **20** to keep the system off. In order to get the switch **20** closed again, it is necessary to operate a power reset switch **58** which we have illustrated. The reset switch **58** pulses bistable relay **28** each time the switch **58** is closed.

Referring now to FIG. **1**, it will be seen that, in the illustrative and preferred embodiment, the tape recorder system **12** includes an endless loop cartridge **12***a* and a pickup head **12***b* to which the amplifier **14** is connected. In FIG. **1**, we show four speakers **16** connected to the amplifier **14** by means of a manually controlled switch **16***b*. These four speakers **16**, or for that matter, any number of speakers, may be mounted in church towers, belfries, spires, and the like. We show another speaker **16***a* which is connected to the amplifier **14** through potentiometers **17***a*, **17***b*. This speaker **16***a*, the output of which is adjustable by the potentiometers **17***a*, **17***b*, is usable to monitor the output of the system **10**, even when the switch **16***b* is open.

In the block diagram of FIG. **1**, we show most of the control system C in block form, i.e., the control system including the monostable relay **48** and the bistable relay **26**. Also, in FIG. **1**, we show a block **59** representing the timing circuitry, i.e., capacitor **60** and resistor **62**, for operating the relay **28** to open the switch **20** a predetermined time after the power supply **32** fails. It will be appreciated that our illustrated and preferred power failure circuitry does not include an auxiliary power source, such as a battery.

We prefer to use a timer or timer means T which can be programmed to close the switch **44** at desired times during each day of each week. The timer T which we have used and which we have found to be suitable is a Paragon–2 Circuit Program Instrument manufactured and sold by Paragon Electric Company. The manner in which such timers are constructed and the manner in which they may be programmed are well known and need not be discussed, in detail, in this description.

The following component values and characteristics are provided and deemed to be illustrative:

Diodes **30**, **60**—G.E. 1N60
Diodes **36**, **38**—G.E. 504A
Capacitor **40**—150 microfarads, 50 volts
Capacitor **60**—500 microfarads, 50 volts
Resistor **62**—100,000 ohms
Potentiometer **17***a*—7.5 ohms, 25 watts
Potentiometer **17***b*—8 ohms

The tape recorder **12**, amplifier **14** and speakers **16**, **16***a* are conventional and need not be discussed, in detail, in this description.

What is claimed is:

1. A time-controlled audio system comprising first means for sound reproduction, said first means including second means for providing electrical signals at predetermined points in time while the first means is energized, and third means for controlling said first means, said third means including bistable switch means having alternate states respectively for energizing and deenergizing said first means, said bistable switch means being responsive to pulses of current to change its state and arranged to maintain the state to which it is pulsed without further application of current until it receives another pulse, timer means for periodically supplying such pulses of current to said bistable switch means to change its state to energize said first means, and fourth means for supplying such pulses of current to said bistable switch means to change its state to deenergize said first means, said fourth means being operatively connected to said second means and responsive to such electrical signals to supply such a pulse each time said second second means provides such an electrical signal.

2. The invention of claim **1** in which said bistable switch bistable relay and in which said fourth means includes monostable switch means for momentarily connecting said points in switch means to the power source for said audio signals prefer to engage these segments. We use the signals provided by these conductive segments to provides short

3. The invention of claim **1** in which said fourth means includes monostable switch means for momentarily connecting said bistable switch means to a current source for said audio system, thereby to deenergize said first means, said monostable switch means being a monostable relay connected to said second means to be energized by such electrical signals provided thereby.

4. The invention of claim **3** including manually operated switch means for selectively providing operating current to said monostable switch means, thereby to operate said bistable switch means to energize and deenergize said first means.

5. The invention of claim **1** including second bistable switch means having alternate states respectively for energizing and deenergizing said first means, said second bistable switch means being responsive to pulses of current to change its state and arranged to maintain the state to which it is pulsed without further application of current until it receives another pulse, and circuit means for connecting said second bistable switch means to the power source for said audio system, said circuit means including fifth means for establishing, a predetermined time after such a power source initially fails, a circuit condition such that, when such a power source is again operative, said second bistable switch means is pulsed to keep said first means deenergized.

6. The invention of claim **5** in which said fifth means includes a resistor-capacitor network defining said predetermined time period.

7. The invention of claim **6** in which said resistor-capacitor network includes a capacitor which is charged to a predetermined level by such a power source when it is operating and a resistor through which said capacitor is discharged when such a power source fails to operate, whereby when power is reapplied, the current applied to said capacitor in its discharged state is sufficient to operate said second bistable switch means.

8. The invention of claim **7** in which said fourth means includes monostable switch means for momentarily connecting said first-mentioned bistable switch means to a current source for said audio system, thereby to deenergize said first means, said monostable switch means being connected to said second means to be energized by such electrical signals provided thereby.

9. The invention of claim **8** in which each of said bistable switch means includes a bistable relay, in which said monostable switch means includes a monostable relay, in which said first means includes tape-recorded sound reproducing means for use with elongated tapes and in which said second means includes wipers for engaging conductive segments of such a tape and pulsing the monostable switch means.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,636,272 Dated January 18, 1972

Inventor(s) Gary F. Davis, Jr., et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 51, "replay" should be -- relay --; same column, line 70, cancel "it"

Column 4, line 8, cancel beginning with "2. The invention of" to and including "provides short" in line 13, and insert the following claim:

-- 2. The invention of claim 1 in which said bistable switch means includes a bistable relay and in which said fourth means includes monostable switch means for momentarily connecting said bistable switch means to the power source for said audio system.

Signed and sealed this 3rd day of October 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents