Nov. 11, 1969 W. GREENWALD 3,478,345

AUDIO VISUAL PROGRAMMER

Filed June 20, 1967 2 Sheets-Sheet 1

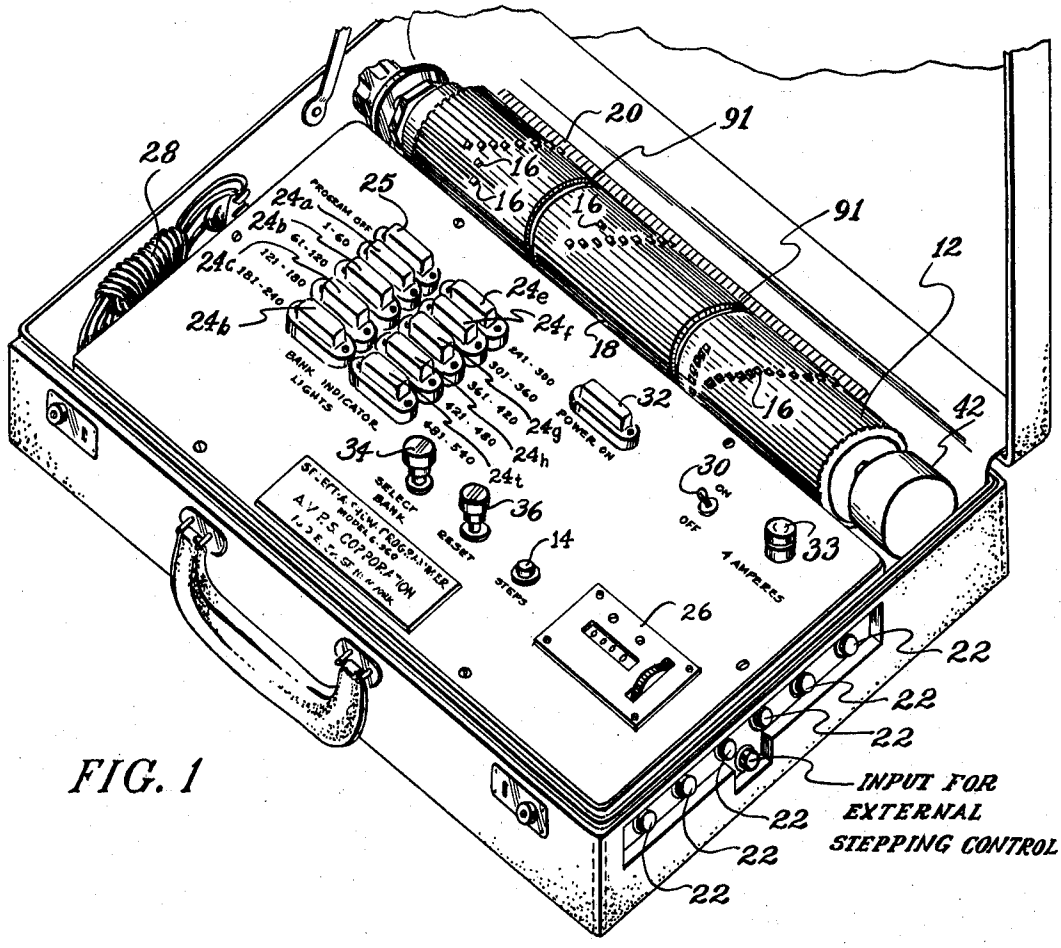


FIG. 1

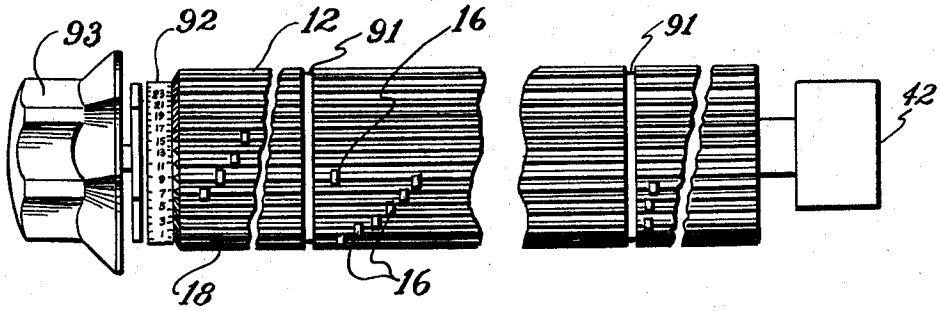


FIG. 2

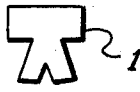


FIG. 4

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AUDIO VISUAL PROGRAMMER

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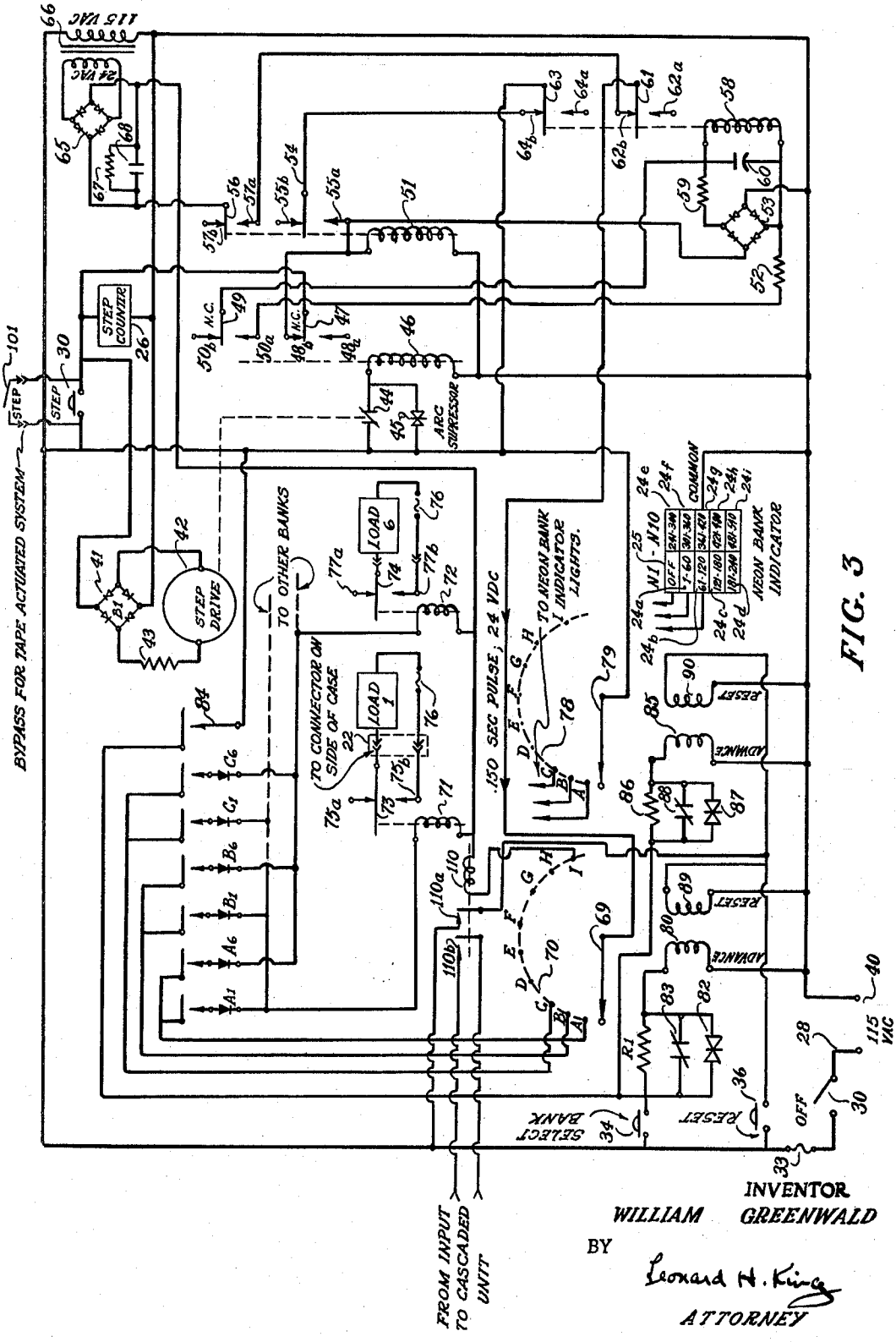


FIG. 3

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3,478,345

AUDIO VISUAL PROGRAMMER

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Int. Cl. G09b *13/00*
U.S. Cl. 340—338 2 Claims

ABSTRACT OF THE DISCLOSURE

A device for controlling the operation of a plurality of electrical apparatus in accordance with a prearranged cueing schedule by placing contacting cam pins in slots on a rotating drum switch wherever an instruction is to be given. A row of individual switches, each of which is connected to one of the electrical apparatus, are placed in physical contact to the cam pins. At the arrival of a subsequent cue, the drum switch rotates to the next slot contacting specifically preset cams with specific individual switches completing their electric circuits. A pulse is automatically sent through the system and places through those completed circuits energizing the apparatus. The individual switches are grouped into separate sections to permit commencing operation at any desired section. The drum can be rotated manually without initiating any pulses so the program can begin in the middle of a section.

This invention relates to a programming device and more particularly to an electrical device for controlling a plurality of electrical apparatus.

In the fields of advertising or education, a presentation in the form of a lecture or demonstration often requires the use of electrical apparatus. A speaker will frequently require the use of a slide film or a tape recorded to elaborate on the topic. In many instances, lights are also used at specific intervals to provide various effects. More complicated presentations may require the interspersed usage of slide projectors, sound film projectors, dissolver controls, tape recorders, lighting equipment, motors, electrically controlled curtains and draperies, etc. In producing a show the constant switching and controlling of equipment becomes a difficult and burdensome task.

Heretofore, the electrical apparatus used in a program was generally controlled manually. Predetermined cue sheets were arranged and trained personnel were required to switch on and off the necessary equipment at the desired moment. As the number of pieces of equipment increased, it was necessary to employ a number of men in a single program.

Automatic devices have been used in some cases but the mechanism involved and the limit of the control did not permit general usage of these items. The patent to A. P. Honey on a "Program Clock," Patent No. 1,237,517, presented a time-controlled unit for school bells which could be preset for a week according to a predetermined program. However, the device was based on a clock system and numerous mechanical gearing arrangements which resulted in a bulky and relatively slow device. More recently, faster devices have been developed such as the "Punch Card Control System" by L. L. Neidenberg et al., Patent No. 2,930,941. All these devices, however, require massive equipment, large systems, expensive material, and are all based on timing devices.

It is therefore an object of this invention to provide a control device for electrical apparatus which is small, lightweight and inexpensive.

A further object is to provide a device capable of controlling 6 pieces of equipment with 540 individual instructions to each piece of equipment.

A further object of the invention is to provide automatic control of electrical equipment according to a prearranged scheduled program.

Another object is to provide a programming device capable of being controlled by either a hand control pushbutton or by tape recorded signals.

Still a further object is to provide a control system for electrical apparatus which can be preset with ease according to a predetermined schedule and can at any time be changed or rearranged in the field.

Another object of this invention is to provide a programming control system which is broken up into units such that the system can be started at any section desired without disrupting the other sections.

Further objects and purposes of this invention will be apparent from the following description taken in conjunction with the accompanying figures in which:

FIG. 1 is a perspective drawing of the apparatus as described hereinafter and placed in an attache case for portability;

FIG. 2 is a one-dimensional view of the switching control unit;

FIG. 3 is a schematic diagram of the instant invention;

FIG. 4 is a drawing of a camming pin used in conjunction with this invention.

GENERAL DESCRIPTION

Before considering the details of the apparatus control, a brief description will be given of the general organization thereof.

A rotating drum switch **12** with sixty slots **18**, numbered consecutively at both ends, is controlled by step button **14** to advance a single slot for each step. Cam pins **16** (FIG. 4) are located in the slots of the drum. The cam pins can be preset as desired.

A row of contact switches **20** are spaced adjacent to the rotating drum and within contact of the camming pins. As the drum is caused to advance step-by-step, the presence of a camming pin contacts the adjacent contact switch to generate an electrical pulse signal.

The contact switches are grouped into nine banks with each bank containing six contact switches making a total of 54 contact switches. Six external plug-in connections **22** are provided within the unit. The same respective contact switches within each bank are interconnected and also connected to a single external plug-in connection. Thus, the first switch in each of the nine banks is interconnected and also connects to the first of the six plug-in connections. So, also, for the second contact switches of each bank, etc.

Only one of the nine banks is energized at a time. The step switch activates the drum for step-by-step rotation for its sixty positions. During any set of sixty positions, a single bank is in operation. As the drum begins its sixty-first step, the nevt bank is energized. For each of the nine banks there are sixty steps of rotation providing 540 individual switching steps.

As each bank is energized, a corresponding neon bulb **24** is lit to indicate its activation. The neon will remain lit through sixty steps. Thus neon **24***a* is lit through steps 1–60, neon **24***b* through steps 61–120 and finally, neon **24***i* through steps 481–540. A step counter **26** counts the individual step advances for correspondence with a predetermined cueing sheet. At the conclusion of a particular program, after 540 steps or other intermediate point, the "program off" neon **25** can be made to light up by providing a switch triggered by a cam and the same switch can be used to reset the drum to the initial starting point.

Line **28** is connected to an A.C. source. Switch **30** controls the on-off power of the device through fuse **33** with neon **32** being lit when the power is on. Switch **34** can select a particular bank. Should it be desired to

begin at step 181, which is the beginning of bank four, selector **34** is advanced to bank four and the first three banks will be skipped. Reset **36** can at any time reset the bank selector to its initial position at step one, the standby position. The drum can now be manually set to any position. Alternatively, automatic reset means can be provided, as will be disclosed hereinafter.

The device is used in the following manner: When a show or program is being prepared, it is decided what electrical apparatus is to be used. A cueing sheet is set up indicating at exactly what point lights should go on or off; the curtain should go up or down; the slides should advance; the tape recording should play; etc. Cam pins are then placed onto the rotating drum to correspond with the cueing sheet. For example, assume a spotlight is connected to the first external plug-in, a curtain motor to the second, a slide projector to the third, and a tape recorder to the fourth. At the first cue it is desired for the curtain to go up and the spotlight to go on. A cam pin would be placed on in the first slot adjacent to contact switches **1** and **2**. At the next cue the slide projector should project another slide. A cam pin would then be placed on step 2 adjacent to switch three. The entire show is thus preset with cam pins in accordance with the predetermined cueing sheet. It is then possible for a single individual, and often the speaker himself, to control all the equipment properly and exactly on schedule. As the next cue appears, the step button is depressed and all appropriate equipment reacts as desired.

If the program director desires to leave out part of the show or to begin the show in the middle, the bank selector can automatically select a particular section as a starting point.

The device is small, portable and light enough to be easily hand carried. It is compact enough to fit into an attaché case as shown in FIG. 1. By way of example, the device disclosed herein can handle 540 cues. Obviously, a greater number of banks can be provided. After the last cue a signal may be generated to trigger a second unit to extend operation to 1080 cues, and a final pulse can be derived from this unit to trigger a third unit and so on to further units if required.

DETAILED DESCRIPTION

Referring to FIG. 3, a detailed description of the necessary circuitry of the device will be presented.

An A.C. source **40** is provided through cable **28**. Switch **30** in series with a fuse **33** are in series with the voltage source. Switch **30** is placed in "ON" position for operation of the device.

Rectifier circuit **41**, in the form of a diode bridge, has its input connected between the A.C. source and an end of push button step switch **30**. A step drive control mechanism such as a Ledex stepping relay is connected in series with a resistor **43** to the output side of rectifier **41**. The step drive **42** is mechanically connected to an interrupter contact **44** which is in parallel with arc suppressor **45**. When step drive **42** is energized, contact **44** is opened to deenergize solenoid **46** to leave certain circuits in an energized condition. This permits manual rotation of the drum **20** without actuating external devices, as will be explained hereinafter. One end of the parallel combination is connected directly to the A.C. line and the other end is connected to the coil **46** of a double pole double throw relay. The other end of relay **46** is attached to the opposite side of the A.C. source. Relay **46** is thus normally energized with blade **47** connected to contact **48***b* and blade **49** in contact with contact **50***a*. Contact **48***a* is a dummy contact; contact **48***b* is connected to one side of relay **51**, the other end of which is connected to the A.C. source. Contact **50***b* is a dummy contact. Contact **50***a* is connected to a capacitor leakage resistor **52**.

Relay coil **51** controls a double pole double throw switch with blades **54**, **56**. Contact **55***b* is a dummy contact. Contact **55***a* connects to the input side of rectifier diode bridge **53**, the other side of which is connected to the A.C. source. The output of diode bridge **53** feeds relay coil **58** through a high pass circuit of series resistor **59** and parallel capacitor **60**. Capacitor **60** is connected to the end of resistor **52**.

Relay coil **58** energizes a double pole, double throw switch with blades **61**, **63**. Blade **63** is normally connected to contact **64***b* which connects to one side of the A.C. source. Contact **64***a* is a dummy contact. Blade **61** normally connects to contact **62***b* which connects to contact **57***a* of relay switch **56**. Contact **62***a* is a dummy contact.

Contact **57***b* of relay switch **56** connects to one side of the output of rectifier diode bridge **65**. The input is fed from the A.C. source through stepdown transformer **66**. A filter circuit of resistor **67** and capacitor **68** is connected in parallel across the output of diode **65**.

Switch **61** is connected to the contact pointer **69** of dial contact **70**. Nine contact points A, B, C . . . I are available on the dial corresponding to the nine banks of switch contacts hereinbefore described. (For simplicity only three banks, A, B, C, will be explained in the following description.)

The dial contacts lead to a series of contact switches. Each bank can make contact to six switches. Bank A has switches A_1, A_2, A_3 . . . A_6. Similarly, bank B has switches B_1, B_2, B_3 . . .B. (For simplicity only switches **1** and **6** are shown.) Contact A leads to switches A_1, A_6; contact B to switches B_1, B_6 and contact C to switches C_1, C_6.

The end of all switches with a subscript **1** are connected to one end of relay coil **71**. The end of switches with the subscript **6** are connected to relay coil **72**. Similarly the other switches would be connected to relay coils.

The relay coils **71**, **72** . . . control single pole double throw switches **73**, **74**, respectively. Switch **73** is in an open state when connected to contact **75***a*. When relay **71** is energized, relay switch **73** closes onto contact **75***b* to complete the flow of current to a load **1** and energizes it. In series with load **1** is an A.C. supply **76** and one of the external plug-in connections **22** on the side of the unit (see FIG. 1).

When relay **72** is energized, switch **74** closes from its normally open connection at **77***a* onto **77***b* energizing load **6**.

The other end of relays **71**, **72** are connected to the output of diode bridge **65**.

A second set of dial contacts **78** is provided in conjunction with **70**. The two decks can be geared together or connected onto one deck with a double set of contacts. The contacts A, B, . . . I, on dial **78**, are connected to the neon lights **24***a*, **24***b* . . . **24***i*, hereinbefore described. The end of the pointer **79** is connected to the A.C. source.

A step counter **26** is connected between the step button **30** and the A.C. source.

The stepper bank switch **34** connects to relay coil **80** which is coupled to arm **69** which wipes the contacts of switch **70**. A filter circuit comprising resistor **81**, diode arc suppressor **82**, and capacitor **83**, is in series with the relay **80**. Similarly, switch **84** is closed each time the rotating drum switch **20** (FIG. 1) makes 60 steps. The closing of switch **84** energizes relay **85** through resistor **86** in parallel with diode arc suppressor **87** and capacitor **88**. Relay **85** is coupled to arm **79** to advance it over the contacts of switch **78**.

Reset button **36** when closed energizes relays **89**, **90**, which control arms **69**, **79** to return them to their initial start positions.

Referring to FIGS. 2 and 4, the setting of the rotating switch will now be explained. Cam pins **16** are placed into the slots **18** of the rotating drum switch **12**. Drum switch **12** has numerous undercuts **91** along the length thereof to facilitate placing the camming pins into their respective positions. At both ends of the drum are consecutively

numbered markings **92**, to locate the number of the step. The numbers go from 1 through 60. A knob **93** on one end permits manual advancement of the drum. The step drive **42** is connected to the drums for automatic operation of the system.

After the camming pins have been put in their proper position, the step button **30** is depressed for each cue. Depressing button **30** sends current through the step counter to advance the count by one. Rectifier circuit **41** is energized to activate the Ledex step drive and advance the drum switch. The presence of a cam contacts the adjacent switches $A_1 \ldots A_6$. At the same time, the Ledex system interrupts the current through relay **46** to deenergize it. Blades **47** and **49** close to positions **48***b* and **50***b*, respectively. Relay **51** is energized by blade **47** causing blades **54**, **56** to close onto contacts **55***a*, **57***a*, respectively.

Blade **56** completes the circuit at the output of rectifier **65** sending a D.C. pulse through blade **61** and contact **62***b*, the pointer **69** and the bank contact A to which every switch $A_1 \ldots A_6$ has been physically contacted by a camming pin. Transformer **66** steps down the 115 v. A.C. line potential to 24 v. A.C. and rectifier **65** changes it to a 24 v. D.C. potential.

Blade **54** through contact **55***a* energizes rectifier **53**. A voltage is built up across capacitor **60** which gradually energizes relay coil **58**. Resistor **59** and capacitor **60** provide a delay action to the energizing of relay **58**.

When relay **58** is fully energized, switches **61**, **63**, close contacts **62***a*, **64***a*, respectively. Blade **61** opens the circuit of the 24 v. D.C. being sent to the switches $A_1 \ldots A_6$. By selecting resistor **59** to be 1800Ω and capacitor **60** of 50 μf., we obtain a .150 sec pulse of 24 v. D.C. sent to switches $A_1 \ldots A_6$. This pulse energizes the electrical apparatus connected to it. In the case of a slide projector, a single pulse will cause the advancement of the next slide. In the case of lights, relays **71**, **72**, would be a holding relay which would remain closed until the appearance of a next pulse a few steps later which would be the instruction for extinguishing the lights. To handle heavy loads an intermediate external relay may be interposed between relays **71**, **72** and the load.

When blade **63** closes onto **64***a*, the rectifier becomes deenergized. The current on capacitor **60** is permitted to dissipate through resistor **52**, contact **50***a*, switch **49**.

This process continues for 60 advances of the rotating drum switch. At the 61st step, switch **84** closes energizing coils **80**, **85**, and advancing the step switches **70**, **78**, to the next contact, which introduces the next bank.

The system as described has been limited to usage with six apparatus since the corresponding switches of each bank, A, B, C, . . . have been interconnected. This resulted in sixty times 9 or 540 possible commands for each device. However, since there are 54 individual switches, it is possible to connect 54 individual apparatus and have sixty available commands for each apparatus. After the ninth bank has been traversed, the stepper advances to contact I and relay **110** closes contact **110***a* to complete a circuit to the reset bus to return the arm to the starting position. The same relay **110** will close contact **110***b* to actuate an external like cascade unit to provide another 540 cue capacity. In turn the cascaded unit can be used to turn on a successive cascaded unit, and so on.

Manual turning of the rotating drums can be accomplished. If the drum is manually rotated by means of knob **93**, the camming pins are caused to contact the switches $A_1 \ldots A_6$. However, no pulse will be sent through the system since relay **46** will not be interrupted. This permits the programmer to manually turn the knob to being at a specific cue member wihtin a particular bank and still not affect the program or the apparatus.

Although the system, as described, was controlled manually by means of the step button, the system can also be controlled completely automatically. Bypass switch **101** is included to bypass the manual button and connect an electrical apparatus for conducting the stepping operation. A pulse timer or clock timer can be used if the cues are set on a specific time-controlled arrangement. A tape recorder can be also used where automatic signals are sent at specified cue points.

The drum can be secured in the equipment by openable latching means such as the latching means used in removably securing the platen in typewriters. This permits the storage of preprogrammed drums for future use or for extending the capability of a unit.

What I claim as new and desire to secure by Letters Patent is:

1. A programmed device for controlling the operation of external electrical apparatus, comprising:

(a) a rotating drum switch having a plurality of slots;

(b) contacting pins for insertion into said slots at desired positions;

(c) a series of individual switches set to physically contact said contacting pins and each electrically conneted to one of said electrical apparatus, said series of individual switches being grouped into *"n"* banks each having *"n"* consecutively numbered switches within it, wherein corresponding numbered switches of each bank are connected to the identical external apparatus;

(d) controlling means set to rotate said drum switch at single slot intervals whereby at each interval said inserted pins contact adjacent ones of said individual switches forming a closed electric path;

(e) a timing relay device for sending a timed pulse through said closed electric path thus energizing the external electrical apparatus; and

(f) a section selector switch with connections to each of said *"n"* banks of switches, *"n"* visual indicators each representing the activization of a corresponding one of said *"n"* banks, and an advance contact switch whereby at the conclusion of a complete rotation of said drum switch the next adjacent bank is automatically energized.

2. A device as in claim **1** further including a manual advance knob connected to said section selector switch for manually selecting a specific bank for activization.

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U.S. Cl. X.R.

340—309.5, 366; 200—38