April 6, 1965 A. G. BODOH ETAL 3,177,298

PROGRAM TIMER FOR BACKGROUND MUSIC SYSTEM

Filed Dec. 16, 1959 2 Sheets-Sheet 1

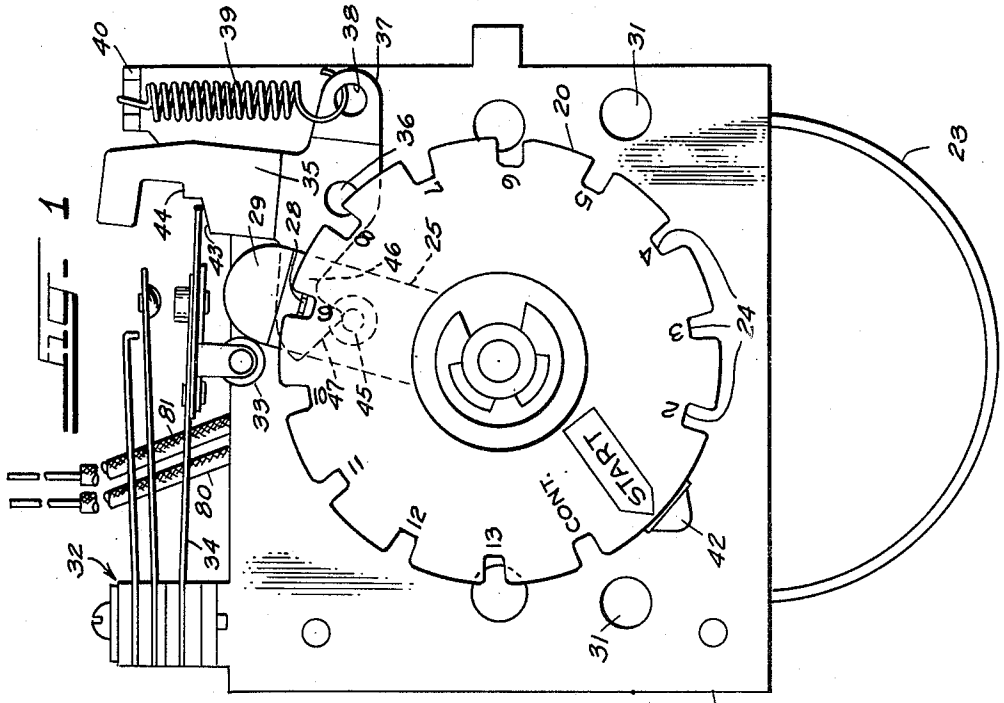


FIG. 1

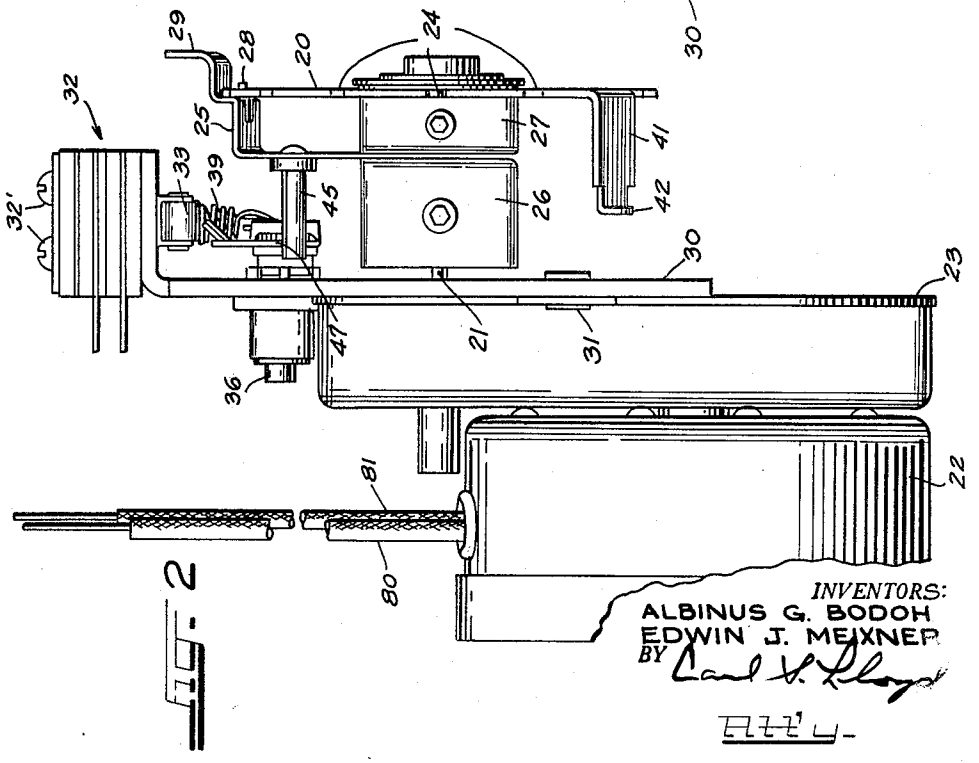


FIG. 2

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FIG. 3

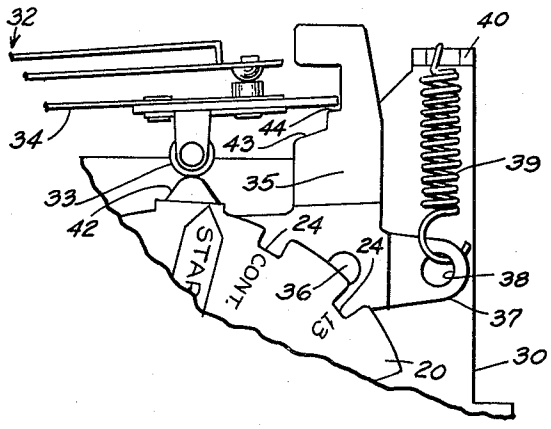
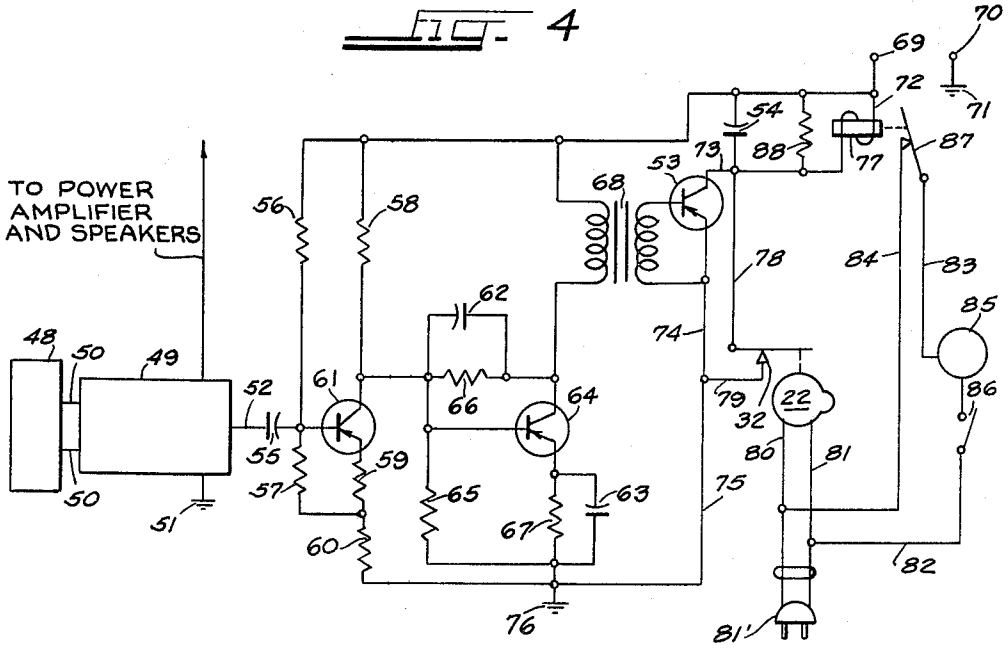


FIG. 4



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PROGRAM TIMER FOR BACKGROUND MUSIC SYSTEM

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4 Claims. (Cl. 179—100.1)

This invention relates to a program timer for use in conjunction with a background music system to effect cyclic programming of music whereby each repetitive cycle comprises a period of music of an approximately predetermined duration, followed by a period of silence for the remainder of the cycle.

More specifically, the invention relates to a program timer of this type which is sensitive to the presence of a musical signal and which will render the associated music system inoperative only after the completion of the musical portion of the last musical selection desired to be reproduced in a given cycle.

As a practical matter, it is not possible to regulate the number of musical selections to be reproduced within a given time by means which measure only time and are not responsive to the actual completion of a musical selection. Thus, if it were desirable to provide a basic cycle of 30 minutes which consisted of approximately 15 minutes of music and 15 minutes of silence, a timer which disconnected the music system after exactly 15 minutes had elapsed would often cause the discontinuance of the music during the playing of a selection. Consequently, it is necessary that the timing means be responsive not only to the passage of time, but also to the cessation of a musical signal. In other words, it is desirable to provide timing means which can sense the completion of a musical selection and which will prevent the music system from being rendered inoperative until such completion.

One method previously used to sense the end of a musical recording has been to record a particular signal at the end of each musical selection and to provide means responsive to said signal for disconnecting the phonograph. Thus, a signal having a frequency of 30 cycles per second can be recorded at the end of each selection, and means responsive to said signal can be utilized to disconnect the music system. However, there are several objections to such a method. For example, comparatively expensive equipment which is responsive only to the 30 cycle signal would be required; further expensive equipment in the music system would be required to prevent the 30 cycle signal from being transmitted to the amplifier and speaker; there is the burdensome requirement that the signal be recorded at the end of each musical selection; and there is the possibility that spurious 30 cycle signals would be produced in various ways during the operation of the music system.

Another method which has been previously used in conjunction with automatic phonographs has been to employ a timing device to open the main power switch after a predetermined time and to provide alternate means of supplying power to the phonograph until the completion of the record being reproduced. With such a method, the end of a record can be sensed mechanically, e.g., by sensing the movement of the phonograph tone arm. Such a method is not satisfactory for our purposes since it will not function properly when the records used have more than one selection recorded on each side thereof and it is desired that the music be stopped before the end of the record. Furthermore, such a method is restricted to use in conjunction with a record-playing phonograph and cannot be used with other program sources such as tapes or the like.

Therefore, one object of this invention is to provide

a program timer which is comparatively simple and inexpensive to manufacture and which is responsive both to the passage of time and the completion of a musical selection, so that it will render an associated phonograph, tape recorder or the like inoperative after a chosen number of recorded musical selections without interrupting the final selection.

Another of our objects is to provide a program timer which will be responsive to the cessation of the musical signal at the completion of a selection, but which will not be affected by brief periods of silence which occur during a musical selection.

A further object of the invention is to provide a program timer which will sense the existence of a musical signal and maintain the associated phonograph operative during the production of such a signal, but which will not be responsive to low magnitude or non-musical signals such as record scratch and the like.

A still further object of our invention is to provide a program timer for use in conjunction with a background music system whereby the timer can be set so that during a basic time cycle the music system will reproduce that number of selections necessary for continuous music or any desired lesser number of selections in such a manner that the basic cycle will be repeated and the chosen number of selections will be reproduced during each repetitive cycle with intervening periods of silence.

Still another of our objects is to provide a program timer which will control automatic phonographs independently of the number of musical selections recorded on each side of the records employed and which will function equally well with other types of program sources such as tapes or the like.

These and other objects and advantages of the invention will be apparent from the following description thereof, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevational view of the mechanical portion of the program timer together with a synchronous motor for operating the same;

FIG. 2 is a side elevational view of the apparatus of FIG. 1;

FIG. 3 is an elevational view, partly broken away, illustrating the relative position of certain elements of the apparatus of FIG. 1 at the beginning of a basic time cycle; and

FIG. 4 is a schematic wiring diagram.

Referring first to FIGS. 1 and 2, a timer dial **20** is fixedly mounted on a shaft **21**, said shaft being rotatably mounted in bearings (not shown). A synchronous motor **22**, having a gear box **23** as an integral part thereof, is provided for rotating the shaft **21** and the dial **20** mounted thereon. In this preferred embodiment, the gear box **23** is designed so that the dial **20** will be rotated one complete revolution in a clockwise direction every 30 minutes. Thus, a basic time cycle of 30 minutes is provided during which time a selectively predetermined number of recorded musical selections will be played by the background music system associated with the timer.

The timer dial **20** has thirteen circumferentially spaced notches **24** formed therein and twelve of these notches are numbered consecutively from 2 through 13, the last notch being marked "continuous" to indicate that this setting provides for uninterrupted music during the entire basic time cycle. (The recordings employed in conjunction with the embodiment of the invention being described are of such a type that 30 minutes are required to reproduce 14 musical selections.)

An indicator arm **25** is rotatably mounted on the dial shaft **21** between two spacers **26** and **27** in such a manner that the indicator arm can be rotated manually with respect to said dial shaft. The arm **25** has a locking finger

28 which is arranged to cooperate with the notches 24 in the timer dial so that by deflecting the arm 25 inwardly away from the dial it can be rotated to the desired setting and released, whereby the finger 28 will be locked within the selected notch. A protruding handle or fingerpiece 29 is provided on the arm 25 for deflecting and rotating said arm. It will be understood that as long as the finger 28 is positioned within any one of the notches 24, the indicator arm will be rotated along with the dial 20 when the motor 22 is in operation.

A mounting plate 30 is affixed to the gear box 23 by means of the fasteners 31 and a timer switch, indicated generally at 32, is mounted upon said plate by means of screws 32'. The switch 32 is biased to its open position as shown in FIG. 1 and a depending roller 33 is carried by its lower contact arm 34 so that upward movement of the arm 34 effected through said roller 33 as hereinafter described will effect the closing of said switch.

In order to maintain the timer switch 32 in its closed position during the musical portion of a basic time cycle, a locking lever 35, which is pivotally mounted on the plate 30 by means of a pin 36, is provided. An arm 37 extends outwardly the lower part of said locking lever 35 and a hole 38 is provided in said arm. One end of a tension spring 39 is hooked into the hole 38 in the arm 37 and the other end thereof is connected to a projection 40 on the mounting plate 30, so as to bias the locking lever 35 for rotation in a counterclockwise direction about the pin 36.

Referring again to the timer dial 20, it will be noted that there is a starting lever 41 (see FIG. 2) which forms a part of said dial and projects inwardly therefrom. On the end of the lever 41 there is a cam 42 which is arranged for cooperation with the roller 33 on the timer switch contact arm 34. As previously stated, the timer dial 20 is rotated in a clockwise direction by the motor 22. It will now be seen that at one point during each revolution of the dial 20, the cam 42 on the starting lever 41 will engage the roller 33 and displace the switch contact arm 34 upwardly to its closed position. When said contact arm 34 is in the open position (as shown in FIG. 1) it rests upon a surface 43 of the locking lever 35. However, when the contact arm 34 is raised to the closed position the locking lever 35 is rotated by the spring 39 to the position shown in FIG. 3; consequently, the contact arm 34 is maintained in its closed position by a ledge 44 on the lever 35.

Means are provided for opening the timer switch 32 during the reproduction of the last musical selection desired to be played during a 30 minute cycle. For this purpose a pin 45 is affixed to the indicator arm 25. The locking lever 35 has an arm 46 as an integral part thereof and a cam surface 47 is formed at the end of said arm to cooperate with the pin 45. As previously stated, the indicator arm 25 is rotated in a clockwise direction with the timer dial 20. It will now be seen that once during each such revolution the pin 45 will engage the cam surface 47 and rotate the locking lever 35 in a clockwise direction an amount sufficient to release the switch contact arm 34 from the ledge 44 and permit it to return to its open position.

Let us assume that the motor 22 is connected to a source of power and the timer dial, which is rotating in a clockwise direction at the rate of two revolutions per hour, is approaching the position shown in FIG. 3. When the starting lever 41 with its cam end 42 reaches the position of FIG. 3, the cam 42 actuates the roller 33 and the contact arm 34 is moved to its closed position in which it is locked by the lever 35. The timer switch 32 is thus closed and the operation of the associated music system is begun (as will be more fully described hereinafter).

If it is desired, for example, that seven musical selections be played and that such music be followed by a period of silence until the termination of the 30 minute cycle, then the indicator arm 25 is set at that notch 24 in the timer dial 20 which is marked "7." In such event, the rotating arm 25 will reach the position shown in FIG. 1 during the reproduction of the seventh musical selection, and at that time the pin 45 will actuate the locking lever 35 and effect the release of the switch contact arm 34 to its open position. Because the length of the various musical selections usually varies somewhat, it is not feasible by the means described above to provide for the opening of the timer switch 32 precisely at the termination of a particular musical selection.

However, the above-described means will effect the opening of said switch after a selectively predetermined length of time which will normally be during the reproduction of the recording corresponding numerically to the setting of the indicator arm 25, e.g., the seventh musical selection if the arm 25 is set at "7" as in the above example. It will be understood, however, that if one of the musical selections which is reproduced is unusually long as compared with the other selections, then the timer switch 32 might be opened during the reproduction of the sixth recording even though the arm 25 be set at "7." This, of course, is of no consequence since the object of the invention is to control the time during which music is played and not the actual number of selections, although normally the latter will be controlled as well. This matter is referred to only so it will be understood that in exceptional situations the setting of the arm 25 may not correspond to the number of selections which will be played. (Hereinafter in describing the instant invention it will be assumed that no such exceptional situation is being encountered.)

Obviously, it would not be desirable to have the music terminated during the reproduction of the last selection to be played. Consequently, additional means are provided to maintain the music system in operation after the opening of the timer switch 32 and until the conclusion of the musical selection being played at the time said switch is opened. The means whereby this purpose is accomplished will now be described.

It has previously been explained that the program timer being described herein is for use in conjunction with a background music system which may be taped music, an automatic phonograph, etc. One such system would be a phonograph capable of automatically reproducing a plurality of multi-selection records seriatim and one which is particularly well suited for use in conjunction with the instant invention is described in co-pending application Serial No. 825,291 (now Patent No. 3,020,050), which has been assigned to the assignee of the present invention.

The instant invention will be described hereinafter and in the appended claims in conjunction with an automatic phonograph but it will be understood that such description is merely illustrative and that the invention will function equally well when used to control other types of program sources.

Reference is now made to FIG. 4 in which the pickup and pickup amplifier for the background music system being controlled by our program timer are illustrated schematically at 48 and 49, respectively. Said pickup 48 and pickup amplifier 49 are connected by means of the leads 50 and the pickup amplifier 49 is grounded as indicated at 51. If the background music system were being used apart from the program timer, then the entire output of the pickup amplifier 49 would be transmitted to a power amplifier and then to the speakers (not shown). However, in the instant case a signal is tapped from the pickup amplifier 49 by the lead 52 and after amplification the signal is applied to a transistor 53 and thence to a condenser 54 which is charged thereby. The main purpose of the circuitry between the pickup amplifier 49 and the transistor 53 is simply to amplify or provide a gain in the signal which is tapped from said pickup amplifier.

In the embodiment of FIG. 4, a condenser 55, resistors 56, 57, 58, 59 and 60, and a transistor 61 are arranged

to provide a first stage of amplification of the signal. Two condensers 62 and 63, a transistor 64, and resistors 65, 66 and 67, together with the primary of a transformer 68, may generally be described as being for the purpose of providing a second stage of amplification of the signal from the pickup amplifier. It should be understood that the number of stages of amplification needed depends upon the amount of gain produced in each stage and if sufficient gain were provided by the first stage described above then the signal could be transmitted directly therefrom to the transistor 53.

The transistor 53 is employed, in effect, as a switch. In other words, if the signal applied to it from the secondary of the transformer 68 is of sufficient magnitude then the transistor 53 will conduct; but if no signal is being received from the pickup amplifier 49 or if the signal being received is below a predetermined magnitude, then said transistor 53 will not conduct except for an insignificant amount of current (as will be more fully explained hereinafter).

A source of voltage (20–30 volts), not shown, is connected to terminals 69 and 70, the latter being grounded at 71. Leads 72, 73, 74 and 75 complete an electrical circuit from terminal 69 to the transistor 53 and thence to a ground 76, and a relay 77 is placed in said circuit. It will now be understood that if a signal is being received from the pickup amplifier 49 and said signal, after being amplified by the circuitry provided between said pickup amplifier and the transistor 53, is of a magnitude sufficient to cause transistor 53 to conduct, then a closed circuit will be formed from the source of voltage at 69 through the transistor 53 to the ground 76, and relay 77 will be energized. If such a signal is not being received from the pickup amplifier then the relay 77 will not be energized in the manner described above.

Still referring to FIG. 4, it will be noted that if the timer switch 32 is closed then an alternate circuit which bypasses transistor 53 is completed between the terminal 69 and the ground 76, said circuit being formed by leads 72, 78, 79 and 75. Consequently, the relay 77 will be energized whenever the timer switch 32 is closed, and if said switch 32 is open the energization of the relay 77 will depend upon whether or not a musical signal is being tapped from the pickup amplifier 49.

Reference is now made to the synchronous motor 22 which, as previously described, serves to rotate the timer dial 20. Leads 80 and 81 and a plug 81′ connect said motor 22 to a source of power and normally this connection is maintained at all times. Leads 82, 83 and 84 comprise a circuit for connecting a phonograph motor 85 to said power source, the motor 85 being provided to operate the background music system which is used in conjunction with the program timer being described. A manually operable switch 86 permits the phonograph motor 85 to be disconnected when desired, and a second motor switch 87 is arranged to be opened and closed automatically by the relay 77.

The mechanism illustrated in FIGS. 1–3, as previously stated, may effect the opening of the timer switch 32 during the reproduction of the last musical selection desired to be played during a particular 30 minute cycle. For example, if we assume that repeated 30 minute cycles are desired with each such cycle comprising a musical portion consisting of seven musical selections and a quiet portion for the remainder of the 30 minutes, then the indicator arm 25 would be set at the notch marked "7" on the timer dial 20 and the switch 32 could be opened automatically during the playing of that selection. When the switch 32 is thus opened, current can no longer flow through the circuit 72–78–79–75. However, since a musical signal will still be received from the pickup amplifier 49, the transistor 53 will conduct and current will flow through the circuit 72–73–74–75 to keep the relay 77 energized and the phonograph motor switch 87 closed.

When the seventh musical selection is completed the transistor 53 will no longer receive a signal from the pickup amplifier and thus it will cease to conduct. Consequently, the relay 77 will be de-energized and the motor switch 87 will be opened to initiate the silence portion of the cycle. Thus, the transistor 53 and its associated circuitry is employed to disconnect the phonograph upon the cessation of a musical signal but such means are normally ineffective because of the presence of a by-pass circuit through the switch 32. Consequently, said normally ineffective means are conditioned for operation by the opening of the timer switch 32 which renders the by-pass circuit ineffective.

It will be noted that there are normally brief periods of silence during any recorded musical selection and thus it is important to maintain the energization of the relay 77 during such periods. The condenser 54 serves this function. As previously stated, after the signal from the pickup amplifier 49 is applied to the transistor 53, it is transmitted to condenser 54 which is charged thereby.

The charge on condenser 54 is substantially constant (as will be more fully explained hereinafter) and is, or may be, of such a magnitude that it will maintain the energization of the relay 77 for a period of about four seconds. Therefore, whenever there is a pause in the music which does not exceed four seconds, the condenser 54 will energize relay 77 and prevent the opening of the motor switch 87. However, when a period of silence in excess of four seconds occurs (and there is generally a ten second pause at the end of each musical selection), the relay 77 will be deenergized if the timer switch 32 has been previously opened. It should be noted that during the playing of any musical selection other than the final selection in a cycle, the timer switch 32 will be closed and the presence or absence of a musical signal at the transistor 53 will have no effect on the energization of the relay 77.

Reference is again made to the circuitry between the pickup amplifier 49 and the transistor 53, which circuitry may be generally referred to as comprising an audio amplifier. The audio amplifier is designed to provide a limiting effect on the amplification of the signal from the pickup amplifier. In other words, the signal applied to the transistor 53 will be of approximately the same magnitude for all musical signals tapped from the pickup amplifier, even though the latter signals themselves may vary appreciably in magnitude. Consequently, the charge on the condenser 54 will be substantially constant for all musical signals tapped from the pickup amplifier.

The condenser 54 and the associated circuitry are designed so that said charge will be approximately a four second charge, i.e. it will be sufficient to maintain the energization of the relay 77 for a period of four seconds after the musical signal has stopped. A resistor 88 is placed in parallel with the condenser 54 and by varying this resistance it is possible to adjust the time during which condenser 54 will maintain the relay 77 energized. In other words, the condenser 54, lead 72, relay 77 and resistor 88 are designed to provide a system time constant of four seconds, which constant can be varied by varying the resistor 88.

Another important feature of the audio amplifier circuit is that it is designed to filter out non-musical signals such as record noise and the like. Non-musical signals are of a lower order of magnitude than musical signals and the audio amplifier circuit is designed so that it will not provide any appreciable amplification of non-musical signals and thus the mere presence of record noise and the like will not cause the relay 77 to be energized. In other words, the audio amplifier circuit is essentially a band-pass amplifier and it has a threshold of operation. Non-musical signals will generally be below said threshold of operation and will have no appreciable effect on the system; but the presence of any musical signal will

have an effect which does not vary with the magnitude of said signal.

In describing the instant invention it is not believed necessary to further describe the audio amplifier circuit. Limiting amplifiers and band-pass amplifiers are well known to those skilled in the art. The above description of the purpose and function of said circuitry together with FIG. 4 of the drawings is believed to be sufficient to enable one skilled in the art to supply the necessary detailed design.

Operation

In order to condition the program timer and the associated music system for operation, the plug 81' is connected to a source of power and the phonograph motor switch 86 is closed. Whether the timer switch 32 is open or closed will depend upon the position of the dial 20. It will be assumed that the rotating dial 20 is approaching the start position and that the indicator arm 25 is set at the notch marked "7." Thus, as soon as the cam 42 engages the roller 33 the following sequence of operations will occur: The timer switch 32 will be closed; the relay 77 will be energized; and the motor switch 87 will be closed thus initiating the operation of the background music system.

After the music system has been in operation for a selectively predetermined time (which would normally end during the reproduction of the seventh musical selection where the arm 25 is set at "7"), the pin 45 will engage the cam 47 and cause the timer switch 32 to be opened. At this time the music will not necessarily be stopped because the transistor 53 will sense the presence of a musical signal and, if a selection is then being played, will permit current to flow therethrough so as to maintain the energization of the relay 77. If the musical signal stops for periods not in excess of four seconds the condenser 54 will keep the relay 77 energized.

Once the seventh musical selection is completed the musical signal will cease for a period in excess of four seconds and the relay 77 will be de-energized. The switch 87 will thus be opened and the background music system will be disconnected until the completion of the 30 minute cycle, i.e. until the cam 42 once again rotates to the start position where it will again engage roller 33 and begin the next cycle.

As previously noted if multi-selection records are being used the end of the musical portion of a cycle will not normally correspond to the end of a record. A certain number of dead grooves are generally provided at the end of the last musical selection on a record (usually enough to provide a ten second pause between selections when the phonograph is operating at full speed). Referring to the resulting pause at the end of the last musical selection in a cycle, a portion of this time will be required in order for the charge from condenser 54 to decrease to a level such that the relay 77 will be de-energized; a further portion of said pause will be required to allow the phonograph turntable (not shown) to come to rest; and the final portion will serve to permit the turntable to come to full speed before the musical portion of the next cycle is begun.

It will be noted that the power to the timer motor 22 is not interrupted by the main switch 86. Therefore, the beginning of the musical portion of each cycle can be synchronized with actual time so that music will be played at the same time each day. In this case additional timing means may be used in conjunction with the instant invention to close and open the main switch 86 at predetermined times each day.

This invention can, of course, be applied in various ways and the present description should, therefore, be regarded as disclosing only an illustrative embodiment of the invention from which no unnecessary limitations should be implied.

We claim:

1. A program timer for an electrically operable music player comprising:

(1) an electrical player control circuit including

(a) a main switch for connecting the player to a source of power, and

(b) an auxiliary switch;

(2) electrically energizable means for causing closing and opening of said main switch;

(3) a presettable device for causing closing and opening of said auxiliary switch cyclically and for maintaining the same closed for a selectively predetermined length of time, corresponding to the approximate time required for playing the number of music selections which it is desired to play in a given cycle of operation of the player, the opening of said auxiliary switch causing deenergization of said electrically energizable means and thus the opening of said main switch to disconnect the player from the source of power if the auxiliary switch is opened at or after the completion of the playing of the final musical selection to be played in such cycle; and

(4) means responsive to music signals and rendered effective by the opening of said auxiliary switch to keep said electrically energizable means energized and said main switch thus closed after such auxiliary switch is opened and until the end of the selection being played if said auxiliary switch is opened during the playing of a selection;

said program timer being thus subject to both time control and music signal control in such manner that the music player will be kept in operation by such time control for a selectively predetermined playing time independently of the music signals and thereafter by such music signal control until the completion of the final musical selection of a given cycle if such time control should become ineffective prior to the completion of such final selection.

2. The apparatus of claim 1, in combination with means for maintaining said electrically energizable means energized and the player thus in operation during short periods of silence in the playing of a musical selection while the player is operating under music signal control.

3. The apparatus of claim 2, including an audio amplifier circuit which has a threshold of operation such that non-music signals of low magnitude which are incident to the playing of musical selections are below such threshold and will therefore not affect the operation of the timer.

4. The apparatus of claim 2, in which the means for maintaining the electrically energizable means energized during short periods of silence is designed to have a constant energizing effect upon said electrically energizable means regardless of variations in magnitude of the music signals.

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