

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Tape Reeling Search System

5 We, RCA CORPORATION, (formerly Radio Corporation of America), a corporation organised under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, City and State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to tape player apparatus and more particularly to tape player apparatus adapted for use with endless loop tape cartridges.

15 In recent years there has been introduced for commercial use, tape player apparatus of the type designed to operate with an endless loop tape cartridge. In this type of apparatus, the innermost convolution of a spirally wound roll of tape contained in a cartridge is caused to be drawn out, passed into cooperative relationship with a transducer, and then wound around the outermost convolution of the tape roll.

25 One of the problems associated with this type of player-tape cartridge system is its lack of an effective means for hunting, i.e. the locating on the tape of the start of a particular pre-recorded selection or message, since, due to the operational nature of the system, the direction of tape travel cannot be reversed to repeat the recording or reproduction of a portion of the tape.

35 A suggested solution to the problem has been to provide the player apparatus with a fast forward reeling tape drive function, and in the cartridge to apply some marker means, such as a recorded burst of signal or conductive foil, on the tape at the end of each recorded selection or message. The marker would serve to signal a sensing means asso-

ciated with the fast forward operating control and cause the automatic disengagement thereof. Thus, the sensing means would detect the marker and cause the fast forward tape reeling to be stopped. However, due to the use of the marker, the large inventories of endless loop cartridges already in the field and lacking the special markings would not be compatible with the automatic disengaging feature of such a fast forward reeling system.

45 According to the present invention there is provided tape player apparatus including means for playing back information signals recorded in an endless spirally wound loop of tape incapable of reverse motion, including first control means operable to produce the advance of said tape at a slower speed proper to the playback of said recorded signals and second control means operable to initiate the advance of said tape at a faster speed in excess of said slower speed and including also means responsive to playback of said information signals during tape movement at said faster speed for maintaining said movement only in the presence of said signals.

50 In order to provide a clear understanding of the invention, it will now be described in connection with the accompanying drawings in which:

55 Figure 1 is a schematic circuit diagram in block form of a tape reeling search system in accordance with the present invention, and

60 Figure 2 is a schematic circuit diagram of a search amplifier suitable for use in the system of Figure 1.

75 Referring now to Figure 1, there is shown a block diagram of the fast forward search system of the present invention adapted for incorporation into an endless loop tape cartridge 10 — player apparatus 12 having a

[Price 5s. 0d.]

fast forward reeling drive function 14 of the type which is controlled and mechanically brought into operation by an electrically energized means, as for example a solenoid 16. It will be understood, however, that the block 14 may also include means for driving the tape 11 contained in the cartridge 10 at a normal reeling (play) speed and where the linkage between the fast forward drive and the normal drive is such that with a cartridge 10 inserted into the player apparatus 12, either the fast forward drive or the normal drive will be responsible for reeling of the tape. Such electromechanical arrangements are known in the art and will not be described herein. It will also be understood that the tape player apparatus 12 utilized includes one or more magnetic heads 18 for transducing a pre-recorded tape message into a corresponding electrical information message signal output.

The electrical signal output obtained from the player apparatus transducer(s) 18 is coupled to a preamplifier stage 20 for amplification. A variable resistance type volume control 22 for the tape player power amplifier stage 24 is normally located in this amplifier 20. As is conventional, the preamplified signal is coupled via the variable tap connection 26 on the volume control 22 to the power amplifier 24 wherein it is further amplified and then applied to a loudspeaker 28 for aural reproduction of the recorded message.

In accordance with a preferred embodiment of the present invention, connection is made from a signal output terminal 30 within the preamplifier 20 and prior to the tapped output terminal 26, for coupling of the pre-amplified transduced electrical message signal to the input of a search amplifier 32. Thus, in this manner, the level of the signal coupled from the preamplifier 20 to the search amplifier 32 is independent of the setting of the volume control.

The output of the search amplifier 32 is connected to a loading device which is illustrated as the coil 34 of a relay 36. The relay 36 has a movable arm 38 which is caused to shift between two fixed contacts 40 and 42 in response to a current flowing through the coil 34. The current gain of the search amplifier is such that the current caused to flow through the coil 34 due to a preamplified message signal applied to the search amplifier is of sufficient magnitude to energize the coil 34 and operate the relay 36. Connection is made from the relay contact 42 (normally open when the relay is unenergized) to the B+ operating potential input terminal 44 of the solenoid or electromechanical device 16. Connection is also made from the relay contact 40 (normally in a closed position when the relay is unenergized) to the B+ operating potential input terminal 46 of the tape

player power amplifier 24. The movable arm contact 38 is directly connected to a source of operating potential B+, indicated as a power supply 48, and to the B+ operating potential input terminal 50 of the preamplifier stage 20.

As shown in FIGURE 1, a pair of push button type switches, one 52 of which is normally open, and the other 54 of which is normally closed, are serially connected between the B+ operating potential source 48 and a B+ operating potential input terminal 56 of the search amplifier 32. A connection is also made from the junction of the switches 52 and 54 to the B+ operating potential input terminal 44 of the solenoid 16. Thus, when the relay 36 is energized or the skip button 52 is depressed, the B+ operating potential is applied to the solenoid 16 and the search amplifier 32.

Considering the tape player preamplifier and power amplifier stages 20 and 24 respectively, it will be seen that a B+ operating potential is directly applied to the preamplifier stage 20 and is indirectly applied via the movable arm 38 and contact 40 to the power amplifier stage 24 only when the relay 36 is unenergized. This provides an effective signal "squench" system for the power amplifier stage 24 during a fast forward reeling operation as will be hereinafter described.

The search system operates as follows. When it is desired to operate the tape player in the fast forward mode, the skip button 52 is momentarily depressed. This provides a direct current circuit path for the B+ operating potential to the electromechanical device or solenoid 16 thereby energizing same, operationally activating the fast forward drive, and causing a fast forward reeling operation to begin. In addition, depressing the skip button 52 also causes the B+ operating potential to be coupled to the search amplifier 32. If a message is present on the tape at this time, it will be picked up by the transducer 18 and converted into an electrical signal which in turn is amplified in the preamplifier stage 20 and then coupled to the search amplifier 32. With an operating potential applied to the search amplifier and a message signal input coupled thereto, sufficient current will be caused to flow through the coil 34 so as to energize and hold the relay 36, thereby shifting movable arm 38 from contact 40 to contact 42. With the movable arm on contact 42, a direct current circuit path for the B+ operating potential is provided from the power supply 48 via the arm 38 and contact 42 to the solenoid 16 and search amplifier 32 so as to maintain the fast forward reeling operation. At the same time, the B+ operating potential is removed from the power amplifier stage 24, thus squelching its audio output to the loudspeaker 28. As long as a sound message is present on the tape being reeled past the

transducer head 18, the relay 36 will remain energized, thus maintaining the fast forward reeling operation. When, on the tape being reeled, the end of a message portion is reached, or in the case of a musical selection, a break or pause in the music occurs, the hold current through the coil 34 will decay, thereby de-energizing the relay 36 and thus decoupling the B+ operating potential from the solenoid 16 and search amplifier 32 and stopping the fast forward reeling operation of the tape player apparatus. The response of the search amplifier, and thus the rate of decay of the relay holding current relative to the time duration of the music break will be determined by the time constants associated with the search amplifier circuitry, as will be hereinafter detailed. Alternatively, the fast forward reeling operation may be selectively halted by momentarily depressing the listen button 54. This breaks the B+ operating potential circuit path to the search amplifier thereby disabling same and de-energizing the relay 36. To again commence the fast forward reeling operation, an operator need only momentarily depress the skip button 52, and the above-described cycle of operation will be repeated.

It will be understood that instead of the relay 36, other holding circuit switching arrangements could be utilized to maintain the B+ operating potential circuit path to the search amplifier 32 and solenoid 16 in response to the search amplifier holding current.

A search amplifier suitable for use in the system of the present invention is illustrated schematically in FIGURE 2. Briefly described, the circuit operates as follows.

In the absence of an applied input message signal, transistors Q_1 and Q_2 are biased at or below cutoff and are therefore non-conducting. When a message signal is applied through the coupling capacitor C_1 across the base-to-emitter junction of transistor Q_1 , the transistor is turned on and conducts heavily, thereby causing its collector voltage to drop rapidly. A diode D_1 , connected between the collector electrode of transistor Q_1 and a capacitor C_2 , is poled in the direction to detect this voltage drop.

Initially, in the absence of an applied message signal, the capacitor C_2 is charged through the voltage dividing resistors R_4 and R_5 to a value slightly less than the collector voltage of transistor Q_1 . Thus, the diode D_1 is reverse biased. In the presence of signal, the change in collector voltage of transistor Q_1 is detected by the diode D_1 and coupled across the capacitor C_2 to discharge capacitor C_2 to a lower voltage. Since the capacitor C_2 is connected directly to the base electrode of transistor Q_2 , the drop in transistor Q_1 's collector voltage coupled to the capacitor C_2 will also be applied directly to the base of the

transistor Q_2 , thereby turning said transistor on. When transistor Q_2 is turned on, current is caused to flow through the loading device (relay 34) thereby energizing same and causing a continuance of the fast forward reeling operation.

If the applied message signal should now be interrupted due to a quiet passage such as that which occurs at the end of a music selection, the transistor Q_1 will be turned off and consequently its collector voltage will rise towards its initial non-conducting value. The capacitor C_2 will then charge up to its no signal steady state value as determined by the voltage dividing resistors R_4 and R_5 . The charge path for this action is through resistor R_4 . The time constant determining resistance is the parallel combination of resistors R_4 , R_5 , and the input impedance to the transistor Q_2 . As the capacitor C_2 charges, its rising voltage is directly coupled to the base electrode of the transistor Q_2 . This causes the collector current of transistor Q_2 to decrease slowly toward cut-off. During this action, the drop-out current value for the relay will be reached after which the relay will be de-energized causing a cessation of the fast forward tape reeling operation.

Representative component values are tabulated below. Depending upon the relay used, the gain of the search amplifier and the average level of an applied message signal input, the circuit time constant can be adjusted to provide for de-energization of the relay in response to a break in the message signal input of at least three seconds duration (measured at the normal tape reeling speed) thereby preventing a false triggering on low level messages or quiet passages in a music selection.

It will be understood that the tape player apparatus fast forward drive mechanism contemplated for use with the search system of the present invention may operate in a manner such that upon disengagement of a fast forward reeling function, a normal reeling (play) operating mode will be automatically initiated. With the system as above described, a fast forward reeling operation can be interrupted at any time in favor of the normal reeling operation by momentarily depressing the listen button 54.

R_1	1 megohm	
R_2	18K ohms	
R_3	82K ohms	
R_4	100K ohms	120
R_5	390K	
R_6	6.8K	
R_7	1.5K	
C_1	.056 microfarads	125
C_2	2 microfarads	
D_1	IN34	
D_2	IN34	

Q₁ Fairchild—SE4002
 Q₂ RCA—2N408
 B+ 28 volts DC
 5 Relay 36 1K ohms d.c. impedance relay with
 a pull in and drop out current of
 7.2ma and 1.5ma respectively.

WHAT WE CLAIM IS:—

1. Tape player apparatus including means
 for playing back information signals recorded
 10 in an endless spirally wound loop of tape in-
 capable of reverse motion, including first con-
 trol means operable to produce the advance
 of said tape at a slower speed proper to the
 15 playback of said recorded signals and second
 control means operable to initiate the ad-
 vance of said tape at a faster speed in excess
 of said slower speed and including also means
 responsive to playback of said information
 20 signals during tape movement at said faster
 speed for maintaining said movement only in
 the presence of said signals.

2. Apparatus according to claim 1, wherein
 said means responsive to playback of said in-
 formation signals comprises an amplifier for
 25 amplifying said information signals, and
 switching means actuated by the output of
 said amplifier when information signals are
 present from a first position to a second po-
 sition in which tape movement at said faster
 30 speed is maintained.

3. Apparatus according to claim 2, wherein
 said amplifier is initially energized only in
 response to said second control means and is
 then maintained energized by said switching
 35 means when held in its second position by
 said amplifier output until an interruption
 occurs in said amplifier output due to an in-
 terruption in said information signals.

4. Apparatus according to claim 2, wherein
 40 said means responsive to playback of said
 information signals further includes an elec-
 tromagnetic coupling means, activated by said
 switching means when said switching means
 is actuated from its first position to its second

position, for controlling the drive mechanism 45
 for said prerecorded tape to effect the fast
 forward reeling of said tape.

5. Apparatus according to claim 4, where-
 in said electromagnetic coupling means com-
 50 prises a solenoid.

6. Apparatus according to claim 1, wherein
 said second control means comprises a
 manually operable normally open momentary
 contact switch connected between a source
 of operating potential and said means re-
 55 sponsive to playback of said information sig-
 nals.

7. Apparatus according to claim 2, wherein
 said switching means comprises a relay hav-
 ing contacts adapted, when said relay is
 60 switched from its first position to its second
 position, to connect a source of operating
 potential both said amplifier for maintaining
 said amplifier energized and also to the drive
 mechanism for said tape for maintaining the
 65 advance of said tape at said faster speed.

8. Apparatus according to claim 7, where-
 in said relay includes normally closed con-
 tacts for connecting said source of operating
 potential to a power amplifier for said tape
 70 player apparatus only when said relay is in
 its first position.

9. Apparatus according to claim 3, where-
 in a manually operable normally closed
 switch is connected in series with a source of
 operating potential for said amplifier where-
 75 by, upon being manually opened, said switch
 disables said amplifier and causes said switch-
 ing means to revert back to its first position.

10. A tape player apparatus substantially 80
 as described with reference to Figure 1 of
 the accompanying drawings.

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Q₁ Fairchild—SE4002
 Q₂ RCA—2N408
 B+ 28 volts DC
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