

[54] **SWITCHING SYSTEM FOR TAPE REWIND**

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 242/57, 199, 200, 198, 197, 210; 274/4 E, 4 C, 4 D,
 11 D, 11 C

[57] **ABSTRACT**

A switching system for a tape rewind operation is described as including a pair of switches in a rewind motor circuit. Both switches are connected in series relationship with the motor so that the motor attains a shut off condition when either switch is in the open position.

[56] **References Cited**

1 Claims, 7 Drawing Figures

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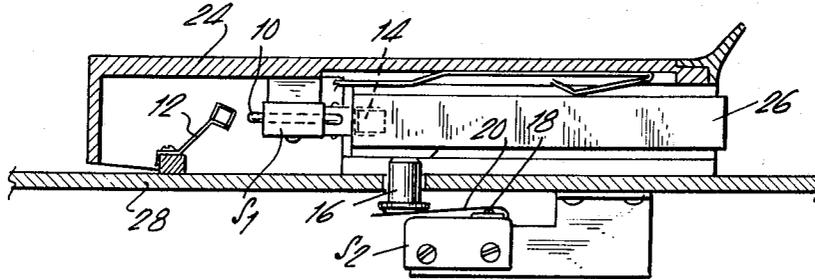


FIG. 3

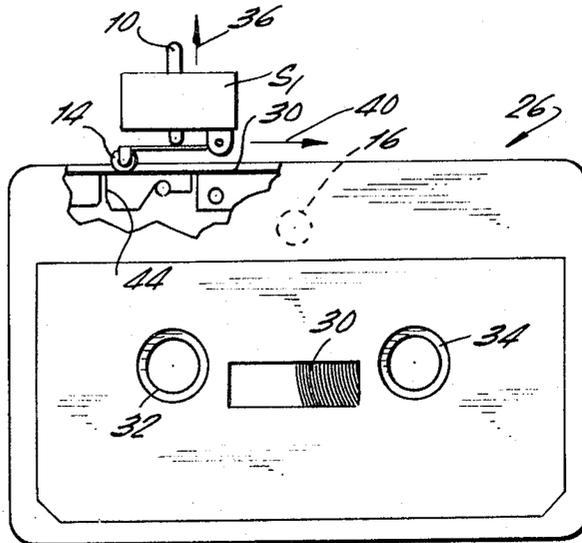


FIG. 4

OPERATION	CASSETTE RECEIVING MODULE POSITION	CASSETTE	SWITCHES		
			S ₁	S ₂	STATE
<u>A</u> AT REST	PARALLEL TO PANEL	OUT	S ₁		CLOSED NOT RESET
			S ₂		OPEN
<u>B</u> LOADING	ANGULARIZED	INSERTED	S ₁		CLOSED RESET
			S ₂		OPEN
<u>C</u> REWIND	PARALLEL	INSERTED	S ₁		CLOSED RESET
			S ₂		CLOSED
<u>D</u> STOP	PARALLEL	INSERTED	S ₁		OPEN NOT RESET
			S ₂		CLOSED
<u>E</u> UNLOADING	ANGULARIZED	OUT	S ₁		CLOSED RESET
			S ₂		OPEN
<u>F</u> AT REST	PARALLEL	OUT	S ₁		CLOSED RESET
			S ₂		OPEN

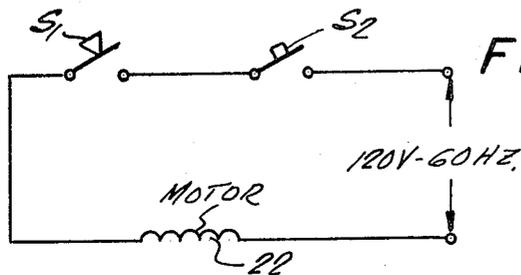


FIG. 5

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SWITCHING SYSTEM FOR TAPE REWIND

This invention relates primarily to tape rewinding and more particularly to a switching system therefor which is connected to the rewind motor and constructed such that the rewind motor is automatically shut off at the end of a rewind cycle.

The present invention is particularly useful with an apparatus and method for the preparation and transmission of audio information from an origin location to a first remote location (normally a library or other convenient depository), and then, in multiple copies of such audio information, the dissemination thereof to a plurality of further remote locations. To more particularly describe this method of information flow, the contemplated origin location is a recording studio with the necessary recording equipment for reproducing audio information on master tapes. The audio information which is recorded may be in the form of a lecturer reading from a written manuscript, or the like. Following the recording of individual master tapes at the recording studio, the tapes are packaged in protective cassettes and placed in a convenient depository (such as a library) to reproduce the information of the master tapes onto so-called "slave" tapes. A recording system capable of accommodating at least one, and preferably more "slave" tapes in cassettes is provided for recording the program of a selected master tape at the depository (library). Such a system enables wide dissemination of audio information. The "slave" recordings are produced in cassettes and may then be reproduced or played back at further remote locations.

The invention, as described herein, is particularly useful in a recording system for producing multiple "slave" tape recordings from a master at the library location. It is important at such a location to have not only a recording capability, but also a rewinding capability for the "slave" tape cassette. Such rewinding prepares the "slave" tape cassettes for reuse. In conjunction with the rewinding capability, it is also important, during a high speed rewind cycle, that the operator need not concern himself with constant visual inspection to determine when the tape has been completely rewound. Furthermore, to depend on the system operator to stop the rewind motor might involve some damage to the tape. For instance, in such high speed rewind systems, if the rewind motor continues operation after the tape has been completely unwound from one spindle of the tape cassette, a tape damaging force on the tape will occur instantaneously as this condition is attained.

Accordingly, a primary object of the present invention is to provide an efficient and reliable means by which the rewind motor during a rewind cycle in a tape recording system may be stopped promptly at the completion of rewinding of the tape from one tape spindle to the other in a tape cassette.

A further object of the present invention is to provide a completely automatic switching system, depending for its operation, not on human control, but on the attainment of certain preestablished conditions in the rewinding mechanism.

These and other objects of the present invention are accomplished in accordance with one illustrative embodiment of the present invention by a switching system including a pair of switches in series connection with each other and with the rewind motor. The first switch is a double acting, normally closed switch operable by the tape in the tape cassette attaining a condition and position which occurs only after the tape has been completely rewound from one tape spindle to the other in the tape cassette. The other switch is a plunger activated, spring loaded, normally open switch which is open at all times except when a cassette is inserted to the rewind tape cassette-receiving module and the module is in a parallel position with respect to the rewind system operational panel.

The above brief description, as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of the preferred, but nonetheless illustrative embodiment when taken in conjunction with the accompanying drawings, wherein:

FIGS. 1A through 1C are side sectional views illustrating various positions and conditions of a rewind tape cassette-

receiving module before, during, and after loading of the tape cassette therein, those figures also illustrating the operation of a pair of switches according to the present invention in response to those positions and conditions;

5 FIG. 2 is a top view of a tape cassette usable with the present invention and an illustration of the interaction of tape in the cassette with a first switch according to the present invention, during a rewind operation;

10 FIG. 3 is a view of the cassette and switch of FIG. 2 in the rewind shut off position;

FIG. 4 is a chart denoting the condition of a pair of switches according to the present invention during various positions and conditions of the cassette-receiving module and the cassette before, during, and after the rewind operation; and

15 FIG. 5 is a schematic circuit diagram of a rewind shut off circuit according to the present invention.

Referring to the drawings and in particular FIGS. 1A through 3, a switching system according to the present invention is shown as including a first switch S_1 , and associated therewith a first switch plunger 10, a switch resetting member 12 and a tape contact roller 14. The switching system also includes a second switch S_2 and associated therewith a second switch activator 16, second switch plunger 18 and a plunger activating spring 20. The first switch S_1 is a double acting switch without spring loading and is normally closed, to be opened only after it is reset. The second switch S_2 is a plunger activated, spring loaded, normally open switch, activated to a closed position only by depression of its plunger 18.

20 The two switches are arranged as shown in FIG. 5 in series relationship with each other and with a rewind motor 22 for the tape recorder. This arrangement enables activation and operation of the rewind motor 22 only when both switches S_1 , S_2 are in the closed position. The position of the switches S_1 , S_2 is dependent on the attainment of various positions and conditions of a cassette-receiving module 24 and whether or not a cassette 26 is inserted to said module. The cassette-receiving module 24 is attached to a rewind system operational panel 28 such that it may attain a position parallel to that panel (shown in FIG. 1C) or an angularized position with respect to the panel 28 (shown in FIG. 1B). Furthermore, the cassette 26 may be inserted or not inserted to the cassette-receiving module 24 in either of the module's aforementioned positions. It is desired that the closed position of the two switches S_1 , S_2 be attained upon two conditions: firstly, that the cassette-receiving module is in a horizontal and parallel relationship to the operational panel 28, and secondly, that the cassette 26 is inserted to the cassette-receiving module 24. In this way, operation of the rewind motor 22 is enabled only when the rewind system is in a position for operation. Furthermore, in accordance with the objects of the present invention, it is necessary that upon completion of rewind that the motor be in a shut off condition. Therefore, the cassette 26 is arranged (as shown in FIGS. 2 and 3) such that all of the tape 30 is wound about spindle 32 of the tape cassette at the beginning of and during the rewind operation and all of the tape 30 is wound about the spindle 34 upon completion of the rewind operation. The accomplishment of the automatic shut off objective is attained by use of a construction such that the roller 14 indents the tape 30 during the rewind operation and upon completion of the rewind operation, the tape 30 becomes taut and therefore throws the roller 14 in a direction denoted by the arrow 36 (FIG. 3) such that the first switch plunger 10 is similarly thrust in the same direction. Such action opens the switch S_1 and thereby prevents further operation of the high speed rewind motor from damaging the tape by continuing to pull the tape 30 in direction 40 (FIG. 3), which could damage the tape by pulling it from its anchorage on spindle 32. Alternatively, a reel drive clutch (not shown) could be used to prevent this damage.

25 The switch S_1 is so opened only while in a reset condition attainable by action of the switch resetting member 12 upon angularization of the cassette-receiving module 24. That is, in the position shown in FIG. 1B, the angularization of the cas-

sette-receiving module 24 has caused the switch resetting member 12 to thrust the plunger 10 in direction 38 as shown in FIG. 1B. This motion of the plunger 10 causes a resetting of the switch S₁ so that upon attainment of the taut condition of the tape after operation in the positions of the elements of the structure shown in FIG. 1C, the switch S₁ attains an open condition.

The position of the roller 14 in FIG. 2 is enabled by the construction of a cassette such that it defines a window and recess 44 for facilitating the depression of the tape 30 therein by action of the roller 14.

To enable a more complete understanding of the present invention, a typical sequence of operations and the positions and conditions of the cassette-receiving module, the cassette, and the pair of switches associated therewith will now be described by reference to the chart of FIG. 4, in particular, and the other figures of the drawings. Assuming an initial position where the rewind motor is OFF and the cassette-receiving module is as shown in FIG. 1A, positions and conditions A on the chart of FIG. 4 will apply. That is, the cassette-receiving module is parallel to the rewind operational panel, the cassette 26 is not in its inserted position to the cassette-receiving module 24, switch S₁ is closed (and not reset) and switch S₂ is open. The condition of switch S₂ indicates the OFF condition of the motor 22.

The loading operation, denoted B on the chart of FIG. 4, is shown in FIG. 1B wherein the cassette-receiving module is angularized, the cassette is being inserted, and the switches are as they were in operation A, with S₁ closed and S₂ open. The angularized position of the cassette-receiving module 24 in operation B indicates that switch S₁ has attained reset condition by action of the switch resetting member 12 on the plunger 10.

Operation C, shown in FIG. 1C and on the chart of FIG. 4, indicates that the rewind operation takes place with the cassette-receiving module 24 again parallel to the rewind system operational panel 28 and with the cassette 26 fully inserted thereto. Switch S₁ is still closed but reset. However, switch S₂ has now been closed by pressure from the cassette 26 on second switch activator 16. The action of second switch activator 16 depresses the plunger 18 and thereby enables the closed position of switch S₂ shown in FIG. 1C.

Operation D of FIG. 4 obtains when the tape 30 has been completely rewound from spindle 32 to spindle 34 (FIGS. 2 and 3). As shown in FIG. 3, the tape 30 becomes taut upon the

completion of unwinding from spindle 32 thereby forcing the roller 14 in direction 36, which depresses the plunger 10 and thereby opens the switch S₁. Therefore, even though the switch S₂ is still closed, the open position of switch S₁ immediately stops the operation of motor 22 by virtue of the circuit relationship shown in FIG. 5.

The unloading operation E (also illustrated by FIG. 1B) opens switch S₂ because of the removal of pressure from the cassette 26 on second switch activator 16 due to the angularization of the cassette-receiving module 24 to which the cassette 26 is inserted. Also, operation E performs the function of resetting switch S₁ in the same way described previously herein by action of switch resetting member 12. At the conclusion of operation E, the entire cycle can be repeated from operation B through operation E by reloading another cassette into module 24. Alternatively, operation F may be performed by moving the cassette-receiving module 24 to the parallel position with respect to the rewind system operational panel 28 without reloading of another cassette.

In accordance with the above description, the rewind system switching arrangement is provided for automatically stopping the rewind motor upon completion of a rewind operation.

What is claimed is:

1. A tape system for moving a tape in a predetermined operation sequence comprising a tape cassette including first and second spindles in which cassette said tape is wound about said first spindle at the initiation of said sequence, a cassette-receiving module into which said cassette is insertable, a base panel to which said module is rotatably mounted, said cassette defining a tape window for exposing said tape and said module being rotatably movable between a first position parallel to said base panel and a second position at an angle to said base panel, said system further including a first resettable switch which is opened upon completion of said sequence, a first switch plunger proximate said first switch and said tape window for actuating said first switch to an opened position upon said tape completely unwinding from said first spindle, a second switch, a second switch activator upstanding from said base panel and operable to close said second switch upon said module assuming said parallel position with said cassette inserted thereto, said first and second switches being connected in series with a motor for unwinding said tape from said first spindle.

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