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[33] **Germany**
[31] **P 16 22 051.2**

[54] **AUTOMATIC APPARATUS FOR SELECTIVELY PLAYING A PLURALITY OF TAPE CASSETTES**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **274/4 F,** 179/100.2 Z, 242/181, 242/191
[51] **Int. Cl.** **G11b 15/12,** G11b 31/00
[50] **Field of Search** ..... 274/4 F; 179/100.2 Z; 352/8, 123; 242/180, 181, 197–200; 353/15, 117

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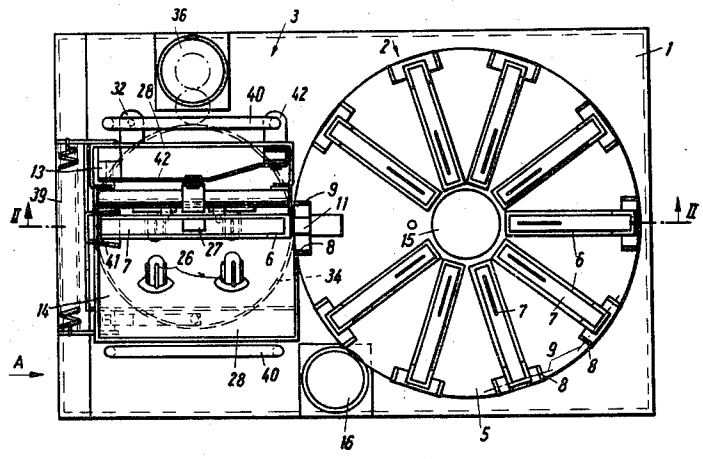
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ABSTRACT: Apparatus for playing tape recordings on a small reel-to-reel cartridges of the type commonly known as cassettes. A rotary magazine turnable about a vertical axis is provided, and the cassettes are held by holders on this magazine with their planes disposed radially of the magazine and their longer dimensions disposed vertically. The magazine is turned to bring a selected cassette to a tape-playing station, and the cassette and its holder are tipped substantially 90° out from storage position, extending radially out from the magazine. Either of two duplicate playing mechanisms then is shifted generally normal to the faces of the cassette into driving and playing engagement with the cassette, whereby to play either of the two bands of information recorded on the tape.



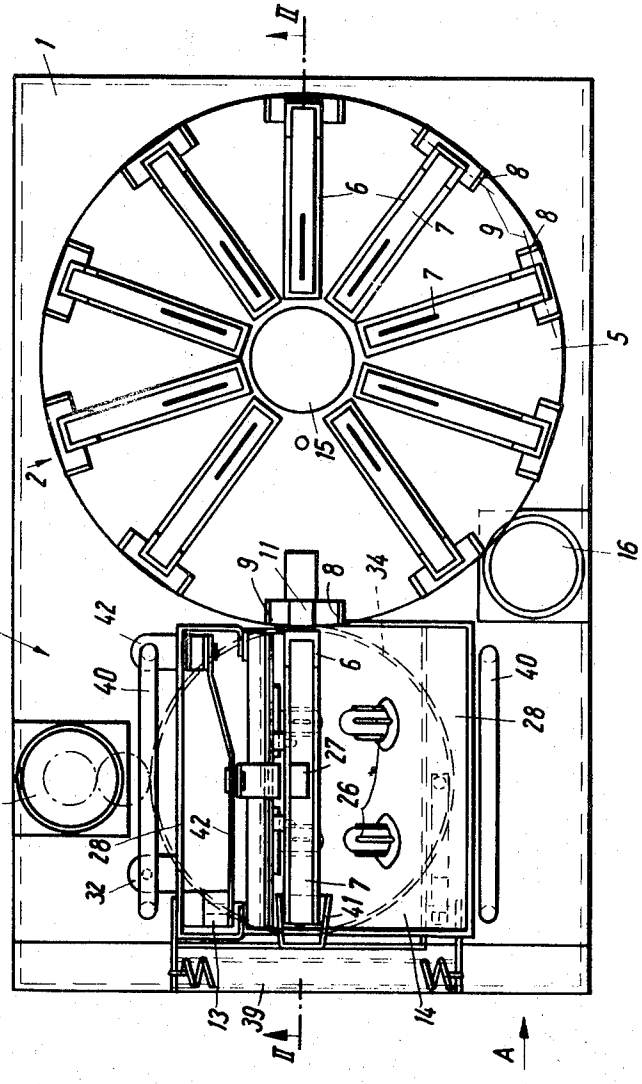


Fig. 1

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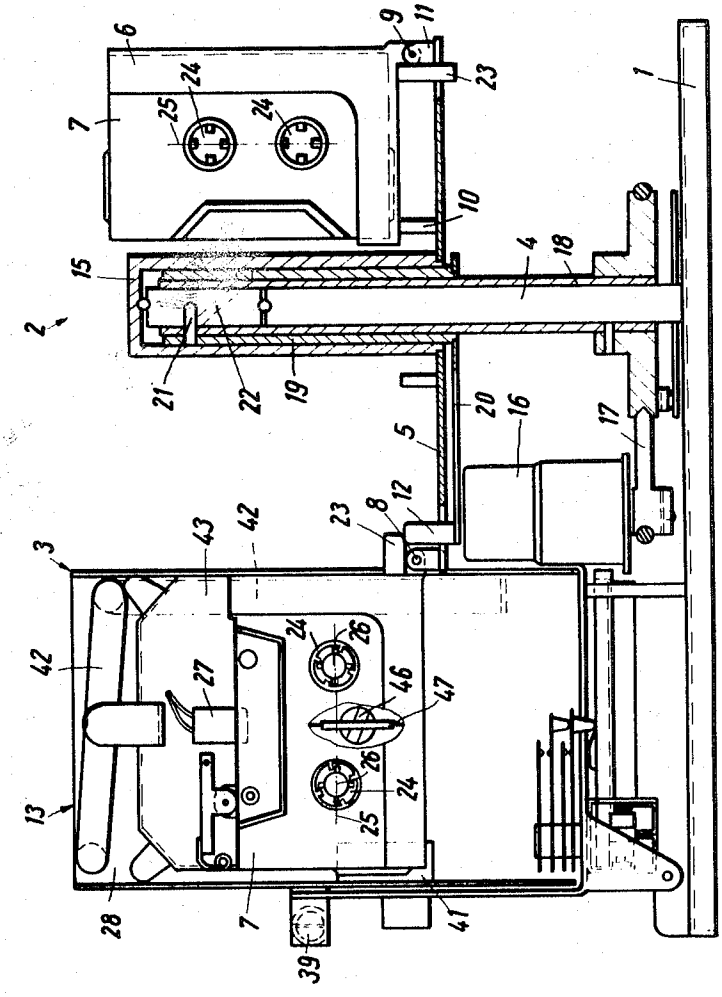
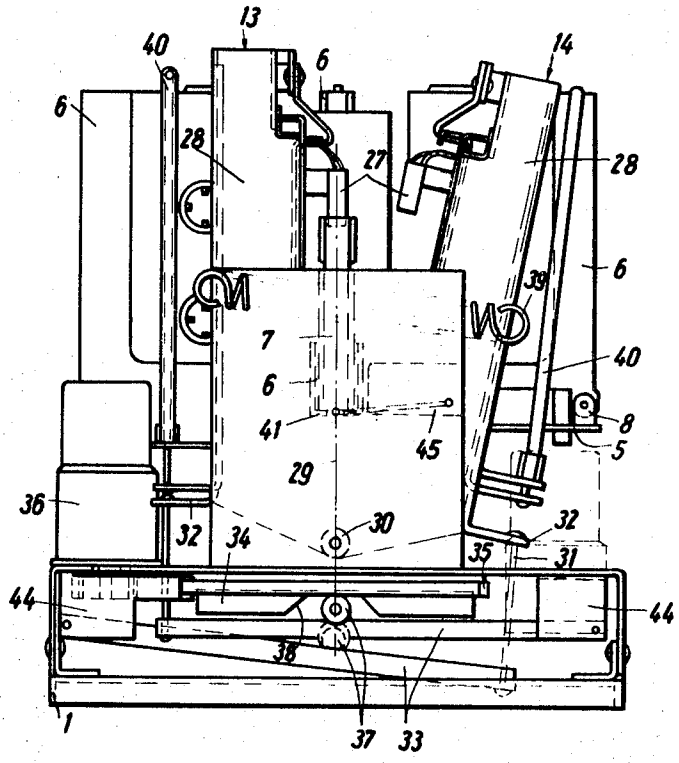


Fig. 2

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Fig.3



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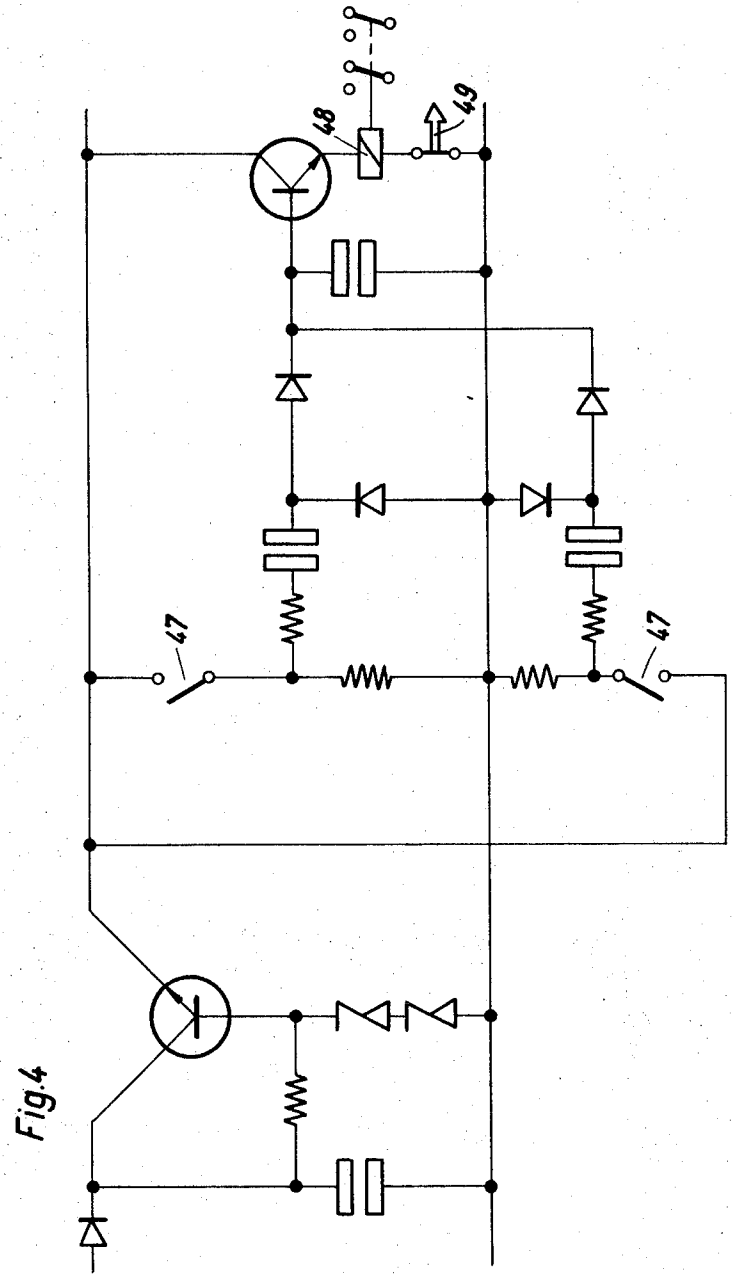


Fig.4

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AUTOMATIC APPARATUS FOR SELECTIVELY PLAYING A PLURALITY OF TAPE CASSETTES

The subject matter of the present invention comprises an instrument or apparatus for automatically playing a plurality of holders (cassettes) for tape recordings, which cassettes are stored in a magazine, and which, for playing, are moved into a scanning device.

It has been suggested to employ cassettes with recording tapes, upon which sound has been impressed, instead of the disc-shaped records commonly used in jukeboxes as the sound recordings. The present machine plays tape in small cartridges, commonly known as cassettes, with a narrow (one-eighth inch) recording tape which have been commercially available for some time and which were intended essentially for dictating machine use and for similar purposes. In prior art apparatus for playing a plurality of such cassettes for recorded tapes, the storage part for the cassettes resembles the vertical shaft known from vending machines in which a stack of packages or articles is stored, where the cassettes are stored flatly, one atop the other. Because only the lowest cassette can be removed from such a shaft and moved into the position in which the tape can be played, a free choice of the desired cassettes is not possible; thus, it is not possible to select individually or in sequence the music, etc., which one would like to hear.

This known construction illustrates the difficulties which arise when attempting to construct a playing instrument which exchanges the tape-records automatically as they are contained in cassettes, because the cassettes, due to their shape, are handled with a rather great difficulty and are troublesome to adjust with respect to a sound pickup part, in comparison to the disc-shaped records which commonly are used in such instruments and which are rather easily adjusted because they have a central symmetry. Thus the knowledge acquired in the construction of automatic phonographs or "jukeboxes" for disc-shaped records cannot simply be applied to the changing of cassettes with stored tape recordings.

According to the present invention, it is desired to maintain the apparatus for storing the cassettes and for playing the tape therein simple in construction and readily accessible for servicing. In accordance with the concepts of the present invention, this desired construction is achieved by moving the cassettes as little as possible between storage and playing position. This simplifies the transporting equipment, while leaving the cassettes in storage position and in playing position in simple, well-defined positions, respectively for storage and for facile engagement with playing equipment.

Structurally, the foregoing is attained by supporting each cassette in a more or less L-shaped holder, each of which can be tilted about an axis which is located on the magazine and passes through a corner of the holder. Thus, the holder remains in constant position relative to the cassette either in storage position or in playing position. All that is necessary is to limit the simple tilting motion to position the cassette correctly either in the magazine or in playing position. No. other sliding or translatory movement is needed, and hence the necessity for complicated and bulky transporting mechanisms is eliminated.

Preferably the aforesaid holders accommodating the cassettes are arranged in the shape of a star about a magazine disc which can be turned about a central vertical axis. These supports are located at the outer periphery of the disc, and each cassette in playing position is disposed essentially beyond the periphery of the disc, whereas it is located essentially within the periphery of the disc in storage position. As is known, the cassettes are of a relatively flat, rectangular configuration, principally due to the side-by-side disposition of the tape reels. In the storage position, the long dimensions of the cassettes are vertical, essentially parallel to the rotational axis of the magazine, with the reels lying one above the other. With a cassette tilted out to playing position, the reels are located side by side horizontally, and the long dimension of the cassette extends radially out from the magazine.

The simple tilting motion of the above is employed also for the playing mechanism. Duplicate, opposed playing mechanisms are provided in order to play the two tracks of the tape in opposite directions without the necessity of moving the cassettes other than with a simple tilting motion noted heretofore. As soon as a cassette has been tilted from the magazine into playing position at the playing station, the playing mechanism is tilted one way or the other to bring the spindles thereof respectively into inserted position in the corresponding center holes of the two reels. Simultaneously, centering studs or projections of the playing mechanism engage corresponding bores of the cassette housing to insure exact positioning of the cassette.

The takeup reel in each instance is driven, and there is also a capstan drive for the tape itself to insure constant playing speed. However, the reel from which the tape unwinds is not driven. Instead, the spindle engaging in the supply reel is driven by the supply reel as the tape unwinds therefrom. This driven spindle is provided with a permanent magnet, and a reed switch in close proximity to the permanent magnet is closed twice for each revolution of the spindle engaging in the supply reel. Thus, a series of pulses is produced, and the pulses are applied to an integrator which produces an output in accordance with the average value of the pulses produced by the periodic closing of the reed switch. As long as there is an output from the integrator, the playing mechanism continues to run. However, should the tape break, or should the tape reach the end, at which time the slip clutch in the driving mechanism simply slips, the supply reel will stop rotating, and there will be no further impulse from the reed switch to the integrator, and hence no output from the integrator. At this time the playing mechanism is switched off.

A preferred form of the invention will be better understood from a consideration of the following description in connection with the accompanying drawings wherein:

FIG. 1 is a plan view of an apparatus constructed in accordance with the present invention for selecting and playing tape in cassettes;

FIG. 2 is a vertical view taken substantially along the line II—II in FIG. 1;

FIG. 3 is an elevational view of the apparatus taken in the direction of the arrow A in FIG. 1; and

FIG. 4 is a schematic wiring diagram for the integrator circuit.

The apparatus includes a baseplate 1 on which is mounted a magazine 2 and the accompanying tape-playing mechanism 3. The magazine 2 comprises a disc 5 spaced above the base 2 and capable of turning about the vertical column 4. Holders 6 for the cassettes 7 are spaced about the disc and are connected to the circumference thereof for tipping radially out about bearings or supports 8. The axes 9 about which the holders 6 tilt are perpendicular to the central main plane of the respective cassettes 7. As will be seen, in the illustrative embodiment there are 10 cassettes and holders, but it is contemplated that greater or lesser numbers of cassettes could be handled.

The construction of the holders 6 may best be seen in FIG. 2. In this figure only the holder which has been tilted out into playing position and the one diametrically opposite to it had been shown, the others having been omitted for clarity of illustration. As will be seen, each holder is generally L-shaped, both legs of the L being U-shaped or of channel configuration in cross section. The short leg in each case is provided with a transverse end wall closing off the channel and retaining the cassette in position.

The holders are spring-tensioned to the upright position of the one shown at the right in FIG. 2, such as by coil springs about the pivot axes 9 in accordance with well-known mechanical principles. Limit stops or rests in the form of pegs 10 are provided upstanding from the disc 5 to limit the inward position of the cassettes, bearing in mind that the cassettes and holders are spaced above the disc 5 by tail pieces or protrusions receiving the pivots 9. The holder and cassette to be

played (at the left in FIG. 2) are tilted or tipped 90° into playing position by a cam 12 which engages the depending cam follower 23 of a respective holder.

As will be appreciated, the cassettes are arranged radially of the magazine in star fashion, with the long dimensions of the cassettes vertical. Two playback or scanning devices 13 and 14 are provided at a playing station adjacent the magazine (to the left in FIGS. 1 and 2), there being a space between the two devices 13 and 14 of sufficient size to accommodate a cassette and its holder. In order for any desired cassette 7 and its holder 6 to be moved into this position, the magazine disc 5 is rotated along with its bushing 15 overlying the center column 4 by means of an electric motor 16 and a belt drive 17 acting upon a hollow shaft 18 movable through a first movement and journaled on the center column 4. The aforesaid cam 12 is mounted on a lever 20 carried by an intermediate sheet or shaft 19 which is disposed between the bushing 15 and the hollow shaft 18. The intermediate sheet 19 is vertically moved by means of a peg 21 and an inclined or oblique slot 22 upon reversal of the direction of rotation of the motor 16 and concomitant second movement or reversal of the direction of rotation of the hollow shaft 18.

The cam 12 extends up through an opening in the disc 5, and the vertical upward motion thereof, as aforesaid, causes the selected holder 6 and cassette 7 held thereby to be tilted 90° into the playing position. In this position, the two tape reels of the cassettes (indicated by the shaft or spindle supports 24), the centers of which now lie on the horizontal line 25. A trough-shaped stop 41 limits the outward tilting motion of the holder 6 in playing position.

In order for the selected cassette to be played after it has been tilted out, the playing device 3 is tipped one way or the other whereby to bring one of the two scanning devices 13 and 14 into proper playing or scanning engagement with the selected cassette. In FIG. 3 it will be seen that the scanning device 13 has been tilted into playing position, while the scanning device 14 has been tilted away therefrom. The scanning or playing devices or mechanisms have not been shown in detail, since they are constructed in accordance with well-known principles, and may, for example, be those manufactured by N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland; for example, type ELZ 3302/90. Each scanning device includes pairs of driving shafts 26 and tape heads 27 mounted on levers or supporting pans 28 tiltable about the axis of the cassette 7 which is located in playing position in the central plane 29. Such tilting is about an axis 30 forming the pivot axis for the playing device 3. The particular scanning device (e.g. scanning device 13) is in vertical position when in playing engagement with the cassette, and as will be understood, either of the scanning devices 13 and 14 is tiltable to this vertical position or away therefrom.

Such tilting of the levers or supporting pans 28 is effected by means of tension wires 31 secured to flanges 32 on the respective levers or supporting pans 28, and to respective control levers 33 which are arranged approximately tangentially to a circular control disc 34. The control disc 34 is driven by means of a rim gear 35 and a corresponding pinion on the output shaft of an electric motor 36. An edge of the control disc 34 is bent vertically downwardly, and is provided with a cam recess 38. Rollers 37 attached to levers 33 ride on this downwardly bent periphery. This maintains the levers 33 in the position in which they are tilted downwardly, tensioning the respective wires 31 to tilt the levers or supporting pans 28 downwardly to rest or nonplaying position. However, upon turning of the control disc 34, one of the rollers 37 reaches the cam recess 38, allowing the corresponding lever 33 to move upwardly under the force of a spring 39 which is tensioned between the levers or supporting pans 28 of the two scanning devices 13 and 14.

As soon as the scanning device reaches the vertical position, it is arrested by a suitable stop (not shown); a Bowden cable 40 will move the corresponding tape head 27 into playing position adjacent the tape of the selected cassette 7. Movement of the Bowden cable 40 is transferred to a lever system 42 (FIG. 2) to move the head 27 into proper playing engagement with the tape in the cassette, the tape head being mounted on a plate 43 which is guided for vertical shifting on the lever or supporting pan 28.

The angular position of the control disc 34, and particularly of its cam cutout 38, will determine whether both scanning devices 13 and 14 are tilted around at the same time into their positions of rest, or if one or the other thereof is tilted into vertical playing position. Since there is only one cam recess 38, only one of the two scanning devices 13 and 14 can be tilted to vertical playing position at the same time. Which of the two scanning devices 13 and 14 is tipped up to vertical position is determined by the direction of rotation of the motor 36 which turns the cam-shaped recess 38 from its starting position to the position shown in FIG. 3 displaced 90° from the starting position. In the illustrative embodiment, the two control levers 33 lie on relatively opposite sides of the disc 34. In FIG. 3, the control lever for the scanning device 13 lies toward the front of the drawing and is pivotally connected at the right side to a flange 44, the roller 37 thereon cooperating with the visible edge of the control disc 34. Conversely, the control lever 33 associated with the scanning device 14 is pivotally connected at the left to a similar flange 44, and the roller 37 thereon cooperates with the diametrically opposite edge of the control disc 36.

As will be understood, selection of one of the two scanning devices 13 and 14 for movement to playing position determines which of the two tracks of the tape in the cassette will be played. The scanning devices 13 and 14 are located in identical positions, but are in mirror image relation to one another. The recording tape is scanned by the two scanning devices in different directions of tape transport, and this means that the music is heard from one or the other of the tracks in accordance with which scanning device is in playing or scanning position.

Selecting mechanisms for automatic phonographs or jukeboxes are well known in the art, and none is shown specifically herein. Functionally, it will be understood that the selecting mechanism is such that any one particular cassette can be chosen, and either or both tape tracks thereof can be played, or any combination of cassettes and tape tracks can be selected. As will be understood, the control is such that the magazine is first turned to the necessary position for playing of the first cassette selected, at which time the motor 16 reverses to cause the pin 21 and track 22 to raise the protuberance or cam 12 against the depending member 23 to pivot the cassette into playing position. The motor 16 is then deenergized, and the motor 36 is energized to turn the disc 34 one way or the other, and thereby to tip the selected one of the scanning devices 13 and 14 into playing position. Subsequently, the tape head 27 is moved into its playing or scanning position. The circuit to the motor 36 is started by a microswitch 41 which is closed only when the selected cassette has completely reached its playing position. If, after the termination or interruption of the playing of the track first selected, it is desired to play the other track in the same cassette, or if it is simply desired to return the tape to the first reel, then the control disc 34 is turned by 180 °, thereby bringing the other scanning device into playing position. After both tracks have been played, or, in accordance with the preferred manner of operation, the tape has been reeled back into its starting position, then the control disc 34 is turned so that both scanning devices are tilted away from playing position, and the cassette 7 and its holder 6 may be again tilted back into the storage position on the magazine 2. As will be understood, the return to storage position is effected by the spring tension on the holders upon lowering of the protrusion 23.

Only the takeup reel of the cassette is driven by the appropriate spindle 26, the supply reel being turned by the tape. A circuit is provided to prevent continued driving of the tape in the event that the tape should tear, or on reaching the end of the tape. Accordingly, each scanning device is provided

with a rotatably mounted permanent magnet 46 which is driven either directly or indirectly from the supply reel. Hence, it turns only when tape is being unwound from the supply reel, and comes to a stop if the tape jams, or tears, or stops at the end of the tape. (The driving spindle is driven through a slip clutch so that the tape will not be torn upon reaching the end.)

A reed switch 47 is mounted in alignment with the permanent magnet 46 in each instance, and is periodically closed by the turning of the permanent magnet 46; such closure occurring twice during each revolution of the part carrying the magnet 46.

Attention should now be directed to the schematic wiring diagram of FIG. 4 wherein the reed contacts 47 of the two scanning devices 13 and 14 are shown, forming a part of an integrator circuit which is located at the switching relay 48 for the driving motor 36 of the control disc 34. If during the operation of the playing of a tape one or the other of the two reed contacts 47 does not close and reopen periodically, then the relay will drop off, and the return of the cassette to its storage position will be initiated. Alternatively, the movement of the other of the two scanning devices 13 and 14 into playing position can be initiated. A reject key 49 also is provided for starting of the return motion arbitrarily at any time.

The invention is claimed as follows:

1. Apparatus for the playing of tapes in substantially flat containers each comprising a two-reel cassette with a tape travelling from one reel to the other and back and having at least two tracks thereon respectively playable in opposite directions of travel, said apparatus comprising a magazine rotatable about an axis thereof, means for supporting a plurality of such cassettes on said magazine respectively substantially radially of said axis, a playing station adjacent said magazine, means for rotating said magazine about said axis to bring a selected cassette into position adjacent said playing station, means for moving said selected cassette from its supported position on said magazine to playing position at said playing station, a pair of similar opposed tape-playing mechanisms at said playing station, each having a tape-driving means for respectively driving the tape in relatively opposite directions and each further having a playback head cooperable with a respective track on said tape, and means for relatively shifting one or the other of said tape-playing mechanisms toward the selected cassette to play a selected band on the tape therein.

2. Apparatus as set forth in claim 1, wherein the means for relatively moving one or the other of said playing mechanisms toward the selected cassette comprises means pivotally mounting said playing mechanisms for pivotal movement toward and away from a selected cartridge.

3. Apparatus as set forth in claim 1, wherein the playing station is disposed radially outwardly of the supported position of the cassettes on the magazine.

4. Apparatus as set forth in claim 3, wherein the means for supporting the cassettes comprises means for respectively tilting the cassettes from supported position to playing position.

5. Apparatus as set forth in claim 2, wherein said playing station is disposed radially outwardly of the supported position of said cassettes on said magazine.

6. Apparatus as set forth in claim 1, wherein each tape cassette comprises a takeup reel and a supply reel, the takeup reel being driven, a magnet rotatably driven by said supply reel whenever said supply reel rotates, switch means the state of which is reversed periodically by rotation of said magnet, and circuit means energized through said switch means and effective to terminate a playing operation when said supply spool stops turning.

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