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[54] **TAPE-CARTRIDGE-POSITIONING APPARATUS**
 9 Claims, 10 Drawing Figs.

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 242/55.19 A
 [51] Int. Cl. G11b 23/04
 [50] Field of Search 179/100.2 Z;
 274/4 B, 11 B, 4 C, 11 C; 242/55.19, 55.19 A,
 197, 199, 200; 226/174

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ABSTRACT: A tape-cartridge-positioning apparatus for endless magnetic tape cartridge player, including a reciprocating lever member slidably supported on a deck in a player housing and biased by a tension spring in one direction, a stopper means retaining the reciprocating lever member at a first position, and a guide means guiding the cartridge.

The stopper means is operated by the cartridge which is laterally inserted in the player housing to release retention of the reciprocating lever member whereby the latter is moved from the first position to a second position by the bias of the spring. When the reciprocating lever member is moved from the first position to the second position, a portion of the reciprocating lever urges the rear edge of the cartridge to allow the cartridge is thus guided by the guide means and moved to positioned at the playing position.

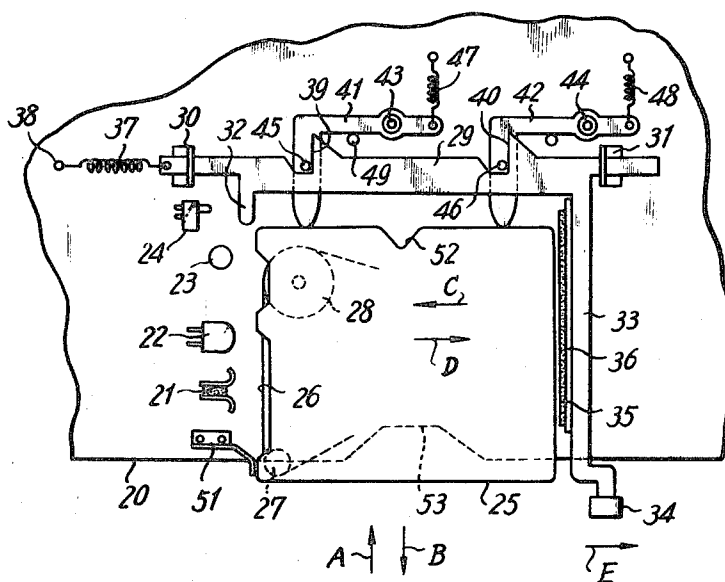


FIG. 1

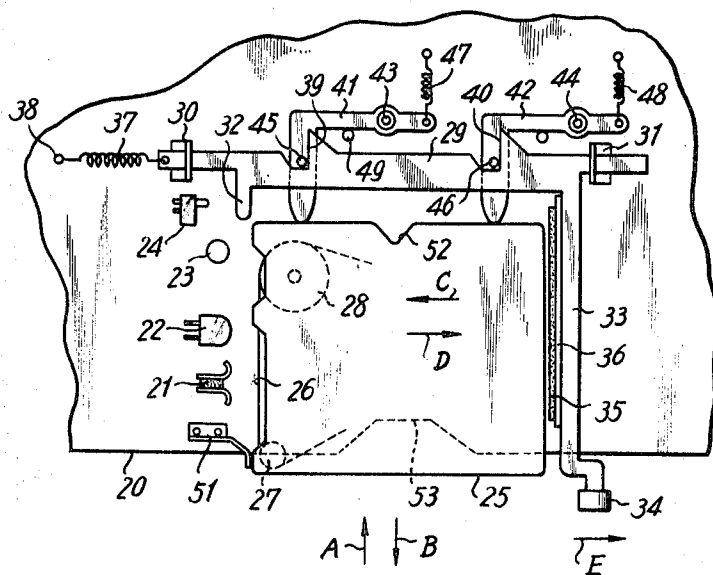


FIG. 2

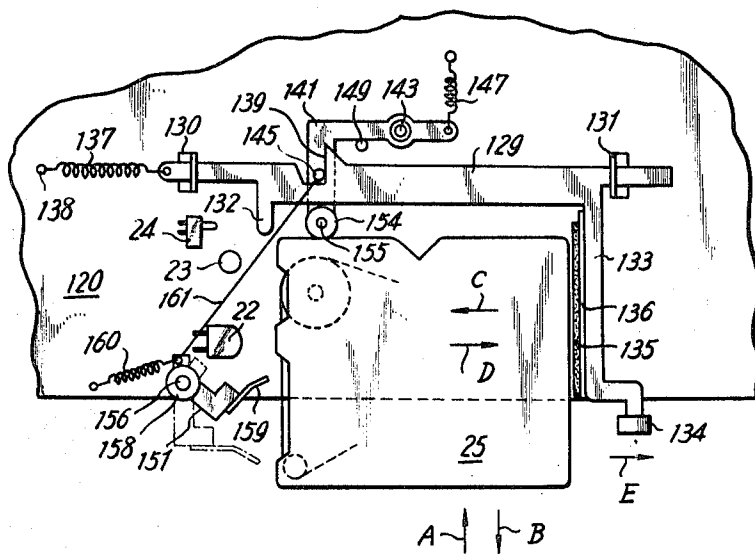


FIG. 3

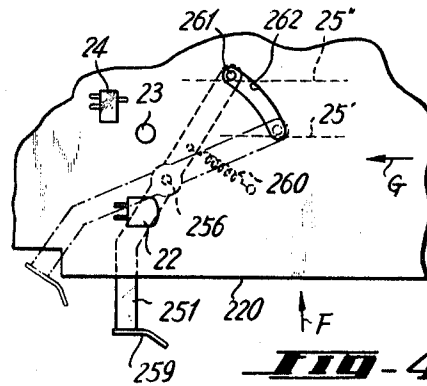
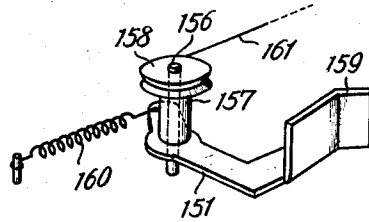


FIG. 5

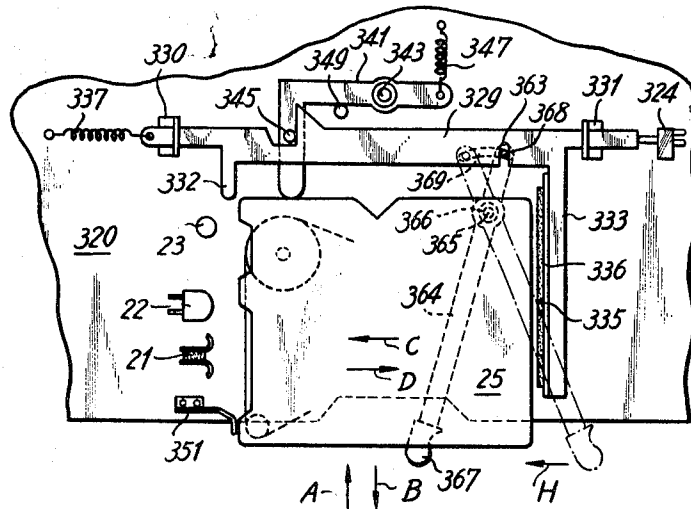


FIG. 4

FIG. 6

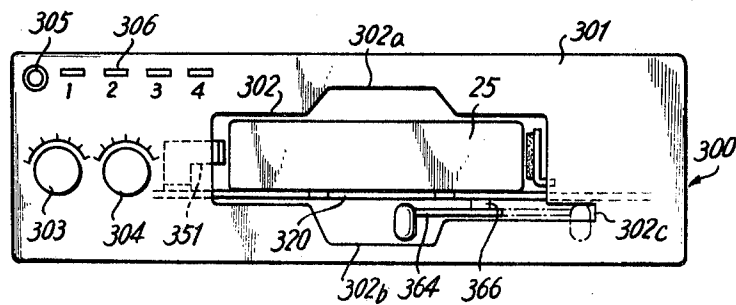


FIG. 7

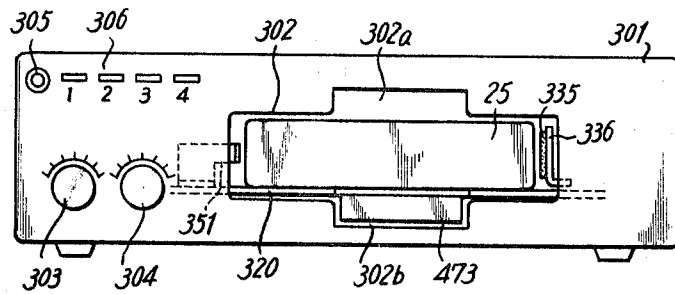
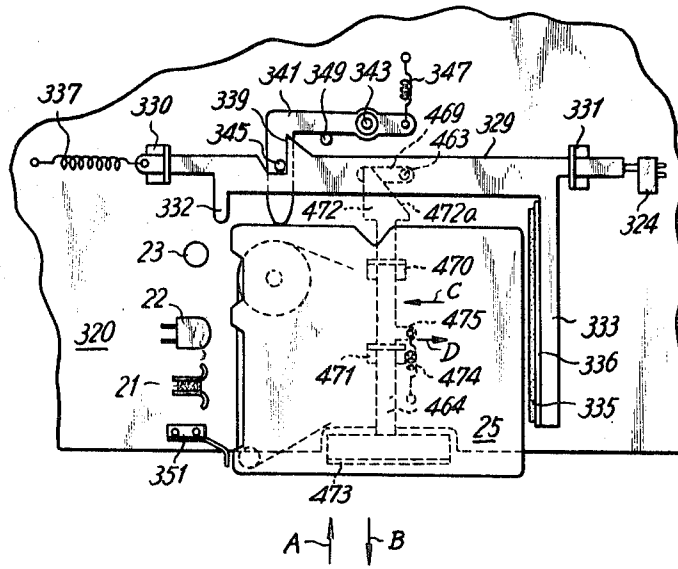


FIG. 8

FIG. 9

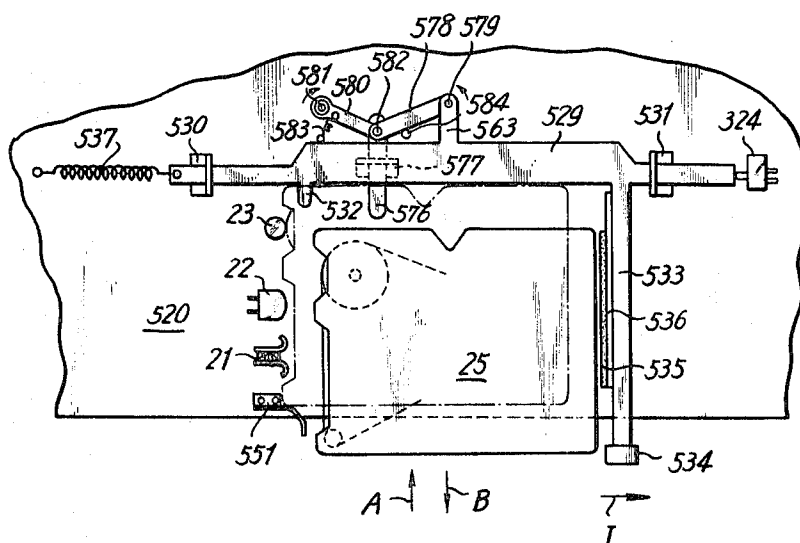
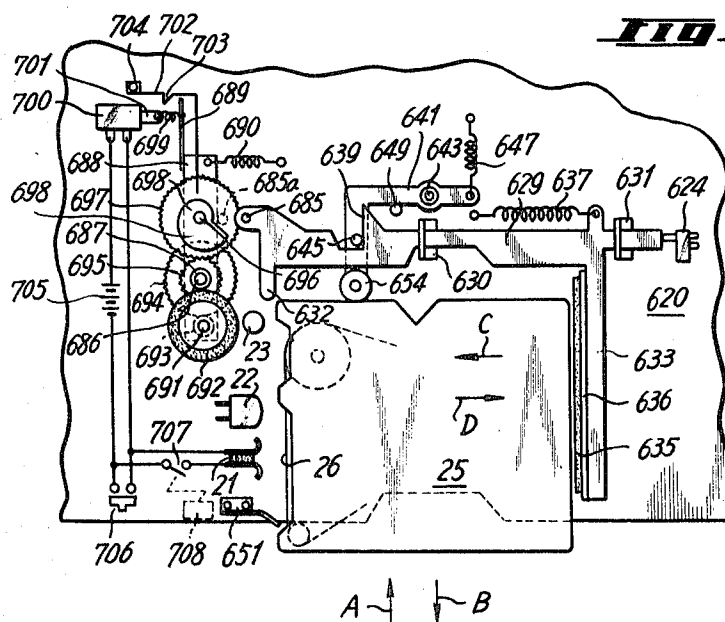


FIG. 10



TAPE-CARTRIDGE-POSITIONING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to an endless magnetic tape-cartridge player, and more particularly to a novel tape-cartridge-positioning apparatus for positioning an endless magnetic tape cartridge insertable in the player in the "play" position.

Heretofore, various means have been proposed so that the tape cartridge is positioned at the playing position in the player. Much of means are so provided that the leading edge of the cartridge is inserted ahead of the other edges thereof in the player housing and an engage portion (for instance, a notch formed on the sidewall of the cartridge) is engaged with an engage member (for instance, a retention roller provided on the free end of the leaf spring one end of which is fixed to the deck) on the deck in the housing whereby the cartridge is positioned at the playing position. Accordingly, in the past, the cartridge to be played by the player is limited to such one that a specific engage portion is provided in a certain position. If the cartridge having different engage position is desired to be played, it is required to use the player provided with the engage member so as to match such different engage portion. This is very inconvenient for the user with respect to its convertibility. Further, if the position where the engage portion is formed is out of order or the position to which the engage member is fixed is not proper, a relative position between the cartridge and the capstan for drivingly transporting the tape is not appropriate to result in lack of stability of the tape-running speed to produce wow-flutter deteriorating reproduced tone quality. In view thereof, high accuracy is required of the position to which the engage member is fixed. In addition, according to the conventional arrangement, the cartridge is longitudinally inserted in the player housing to cause the magnetic head to be positioned at the innermost position so that cleaning of the magnetic head is hardly made.

SUMMARY OF THE INVENTION

It is an object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player wherein in the tape cartridge laterally inserted is automatically moved to and positioned at the playing position.

By lateral insertion of the cartridge, the magnetic head of the player could be disposed adjacent to an opening formed in the player housing to receive the cartridge so that it is convenient to clean the magnetic head.

A further object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player, for bringing the tape cartridge to the playing position without providing a specific engage portion for the cartridge.

Another object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player, wherein by inserting the cartridge in the player housing, the rear edge of the tape cartridge is pushed by a reciprocating lever member reciprocable in the direction in which the cartridge is inserted and is moved to and positioned at the playing position.

Still another object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player, wherein in relation to insertion of the tape cartridge in the player housing retention of the reciprocating lever member is released and the lever member is moved by the bias of a tension spring to the direction in which the tape cartridge is positioned at the playing position.

Still further object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player, wherein the reciprocating lever member is moved against the bias of the tension spring to push the front edge of the tape cartridge moving the tape cartridge to the nonplaying position and the cartridge is depressed in the

direction in which it is out of the player housing by a stopper lever for returning the lever member to the position for retention.

Yet another object of the invention is to provide a tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player, wherein by use of rotational force of a capstan for drivingly feeding the tape in the tape cartridge the reciprocating lever member is moved to shift the cartridge from the playing position to the nonplay position.

Further objects and numerous additional advantages of the invention will become apparent from the following detailed description and annexed drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of one embodiment of a tape-cartridge-positioning apparatus according to the present invention,

FIG. 2 is a representation schematically showing another embodiment of the tape-cartridge-positioning apparatus,

FIG. 3 is an enlarged perspective view of the cartridge guide member,

FIG. 4 is a schematic view showing a modified tape guide member similar to the tape guide member in its structure and performing the same object,

FIG. 5 is a representation of still another embodiment of the tape-cartridge-positioning apparatus of the invention.

FIG. 6 is a front view of an endless magnetic tape cartridge player to which the tape-cartridge-positioning apparatus shown in FIG. 5 is applied,

FIG. 7 is a representation schematically showing further embodiment of the tape-cartridge-positioning apparatus.

FIG. 8 is a front view of an endless magnetic tape cartridge player to which the tape-cartridge-positioning apparatus in FIG. 7,

FIGS. 9 and 10 are schematic views of yet further embodiment of modified tape-cartridge-positioning apparatus,

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows an endless magnetic tape cartridge player with one embodiment of a tape-cartridge-positioning apparatus according to the present invention, which is also provided with a housing (not shown) wherein a horizontal deck 20 is mounted. Much of the mechanism disposed beneath the deck 20 is omitted since it forms no part of the present invention. However, there shown on the deck 20 are an end-mark detection or search means 21, magnetic head 22, rotational capstan 23, and a door switch 24. As will later be described, the capstan 23 is adapted to be rotatably driven by an electrical motor (not shown) which is energized in relation to the closing of the door switch 24. Laid on the deck 10 is an endless magnetic tape cartridge 25 which is inserted in the housing through an opening (not shown) formed in a frontal wall (not shown) of the housing of the player. The tape cartridge 25 includes a generally rectangular container with a centrally disposed reel assembly (not shown) on which an endless magnetic tape 26 is wound and unwound in conventional manner. The tape 26 passes over a guide 27 and a pinch roller 28. The guide 27 and the pinch roller 28 are disposed adjacent the leading edge of the cartridge whereat the cartridge sidewall is cut away or disposed with and the tape 26 is extended from the center of the hub of the reel (not shown) about the guide 27 and thence about the pinch roller 28 back to the outer periphery of a roll formed by the tape wound about the hub.

In the conventional endless magnetic tape cartridge player, the tape cartridge is inserted in a manner that the front edge thereof is pushed in the longitudinal axis of the cartridge. To the contrary, in accordance with the present invention, the cartridge could be inserted in a manner that one of the side edges is pushed in the transverse axis of the cartridge. Accordingly, the opening in the housing (not shown) is of dimension enough the receive and match the length of the side edge of the cartridge. A lever member 29 is slidably supported by

guides 30, 31 fixed to the deck 20. The lever member 29 is provided for moving the cartridge which is inserted in the housing from the direction of arrow A and is laid on the deck 20 toward the "play" position where the pinch roller 28 in the cartridge abuts against the capstan 23. The lever member 29 is provided adjacent its opposite ends with a relatively shorter arm 32 and a relatively longer arm or second arm 33 which project from the lever member normal to its slide direction. The free end of the second arm 33 extends from the opening of the housing and projects forwardly of the housing, and rigidly carries a knob 34 which may be grasped with a finger for moving the lever member 29. A pushing member 35 of rubber sheet or the like adheres to a laterally extending flange 36 to engage the rear edge of the cartridge 25.

A comparatively heavy spring 37 is provided to extend between one portion of the lever member 29 and a pin 38 mounted on the deck 20 to normally urge the lever member 29 leftward. The lever member 29 when the cartridge 25 is not inserted or assumes the position shown in FIG. 1 is retained in a first position shown in FIG. 1 since latch pins 45, 46 on substantially L-shaped stopper levers 41, 42 pivoted by shafts 43, 44 on the deck 20 engage hook-stepped portions 39, 40 formed of the lever member. The stopper levers 41, 42 are biased in the counterclockwise direction by springs 47, 48 but inward movement of the stopper levers are limited by stopper pins 49, 50 on the deck 20. One end each of the stopper levers 41, 42 vertically and outwardly extends and passes between the deck 20 and the lever member 29.

The mode of operation of the tape-cartridge-positioning apparatus in FIG. 2 will be readily understood from the following description.

The cartridge 25 which has been forcedly inserted by finger in the direction of arrow A to the position shown in FIG. 2 is further pressedly inserted. As a result, the stopper levers 41, 42 is depressed by the side edges of the cartridge and thus clockwise rotated against the elastic force of the springs 47, 48. When the cartridge is inserted to the extent that the side edges thereof is close to the lever member 29, the pins 45, 46 are released from the hook portions 39, 40 whereby the lever member 29 is moved from the first position to the leftward direction by the elastic force of the tension spring 37. Leftward movement of the lever member 29 urges the pushing member 35 against the rear edge of the cartridge 25 to move the cartridge 25 along with a guide member 51 on the deck 20 in the direction of arrow C. The pinch roller 28 in the cartridge 25 abuts against the capstan 23 to thereby limit movement of the lever member 29 and the cartridge 25 by the tension spring 39 retaining the lever member 29 in a second position. Where the lever member 29 is moved to the second position, the cartridge 25 assures abutment of the pinch roller 28 with the capstan 23 in aid of the elastic force of the tension spring 37 while a relative position as to the capstan 28, magnetic head 27 is immovably maintained so that the cartridge is precisely disposed in the "play" position. Movement of the lever 29 to the second position allows the arm 32 to actuate and close the door switch 24 and in association with closing of the door switch the capstan 23 rotatably driven. Accordingly, the cartridge 25 in the "play" position is played in a manner that the tape 26 passes through the capstan 23, the pinch roller 28 and is drivingly transported with abutting against the magnetic head 27.

In order to move the cartridge 25 from the "play" position to "nonplay" position, the knob 34 is grasped by fingers and moved in the direction of arrow E to move the lever member 29 in the rightward from the second position against the bias of the tension spring 37 urging the arm 32 against the front edge of the cartridge 25 thereby moving the cartridge 25 in the direction of arrow D from the "play" position. Movement of the lever member 29 nearly to the first position pushes the edge of the cartridge 25 by the stopper levers 41, 42 which are given counterclockwise rotational force under the influence of the springs 47, 48 whereby the cartridge 25 is escaped from the housing and moved in the direction of arrow B to the position

shown in FIG. 1. Thereafter, even if the knob 34 is free from the finger, the lever member 29 is prevented from its movement by the tension spring 37 and maintained in the first position since the hookpins 45, 46 engage the stepped portions 39, 40. In response to movement of the lever member 29 from the second position to the first position, the door switch 24 is opened and in association with this rotation of the capstan is suspended. In order to facilitate escapement of the cartridge which is moved to the "nonplay" position from the player, a notch 52 is formed in the front edge of the deck 20 at a portion thereof.

The cartridge positioning apparatus shown in FIG. 1 is provided with two stopper levers, however, may be one to this end. Advantage derived from the use of the two stopper levers is that the cartridge 25 will not initiate its movement in the direction of arrow C till the cartridge is inserted into a predetermined position at full length without unbalance. Normally, engagement of the lever member 29 with the stopper lever is not released unless force applied to the cartridge when inserted in the direction of A is bilaterally equal. On the contrary, in case of the one stopper lever, the cartridge should be always inserted in a parallel manner. If the number of the stopper lever to be used is limited to the one, the stopper lever positioned forwardly, for example, indicated by numeral 41 may be preferable since the cartridge in the "play" position is securely and alignedly held by the stopper lever 41 and the guide member 31 at opposite sides of the cartridge to assure positioning of the cartridge.

As set forth in the above, according to the tape-positioning apparatus of the present invention, the cartridge could be readily and slightly inserted and automatically disposed in the "play" position without depending upon a specific latching portion like a side depression or recess 53. Accordingly, convertibility of the cartridge may be improved and simplification of arrangement may be obtained without any trouble.

Another embodiment of the tape-cartridge-positioning apparatus according to the present invention is shown in FIG. 2.

Similar numerals are used to illustrate like parts in FIG. 1. The embodiment in FIG. 2 is such that a portion of the cartridge 25 is projected to a considerable extent from the front edge of the deck 20 but the cartridge is disposed in the "play" position. With this arrangement, the player body is compactly fabricated since the spare for projected portion is not required and extraction of the cartridge is more readily made.

A lever member 129 is reciprocally and slidably mounted by guides 130, 131 on a deck 120 and normally biased by means of a tension spring 137 in the leftward direction. The lever member 129 includes a hook-stepped portion 139, an arm 132, and an arm 133 with a knob 134 at one end thereof. The hook-stepped portion 139 is adapted to be engaged with a hookpin 145 on a stopper lever 141 pivoted to a shaft 143 on the deck 120. The arm 132 is designed to engage the front edge of the cartridge 25 when retracted from the "play" position. The secondary arm 133 comprises a laterally extending flange 136 thereon and a pushing member 135 of rubber sheet or the like which is attached thereto and engageable with the rear edge of the cartridge. The stopper lever 141 is biased in the counterclockwise direction by a spring 147 but inward movement of the lever is limited by a stopper pin 149 on the deck 120. A relatively thin roller 154 is rotatably mounted by an axis 155 on the lever on the stopper lever 141 at one end thereof and adapted to engage the side edge of the cartridge 25 when pressedly inserted in the direction of arrow A. When the stopper lever 141 is clockwise rotated upon depression of the cartridge 25 from the position shown in FIG. 2 in the direction of arrow A, the roller 154 with the shaft 155 is received by and put between the deck 120 and the lever member 129 but not engaged therewith. As minutely illustrated in FIG. 3, a guide member 151 similar to the guide member 51 (FIG. 1) and a pulley 158 are rotatably mounted by a sleeve 157 on a shaft 156 on the deck 120. The guide member 151 is provided with a guide portion 159 upwardly extending therefrom and having a curved portion at one end

thereof to facilitate receipt of the cartridge 25 which is moved in the direction of arrow C. The guide member 151 is given a counterclockwise rotational force under the influence of a spring 160 but inward movement of the guide member is controlled by the stopper lever 141 over a stringy member 161 of nylon thread or the like of which one end is wound to the pulley 158 and the other end is attached to the hookpin 145 on the stopper lever 141. When the stopper lever 141 assumes the position shown in FIG. 2 whereas the guide member 151 is in the position indicated by the solid line.

When the cartridge 25 in the position shown in FIG. 2 is manually depressed in the direction of arrow A, the roller 154 is pushed by the side edge of the cartridge to clockwise rotate the stopper lever 141 against the bias of the spring 147 thereby clockwise rotating the guide member 151 through the stringy member 161 against the elastic force of the spring 160. Rotation of the guide member 151 to reach the position shown by the dotted line release the hookpin 145 from the stepped portion 139. As a result, the lever member 129 is moved leftward by the bias of the tension spring 137 to move the cartridge 25 in the direction of arrow C. In movement of the cartridge 25 in the direction of arrow C, the one corner thereof is affected by the guide member 151 to precisely be in the "play" position. In relation to manual return of the lever member 129 over the knob 134, the cartridge 25 is moved in the direction of arrow D and the stopper lever 141 is returned to urge the cartridge in the direction of arrow B while the guide member 151 is restored to the position shown by the solid line.

As noted, the guide member 151 is rotated by rotation of the stopper lever 141, however, there is shown in FIG. 4 a guide member 251 which is rotated in relation to insertion of the cartridge. Similar numerals are used to illustrate like parts in FIG. 2.

The guide member 251 is rotatably mounted by a shaft 256 on a deck 220 thereunder. A guide portion 259 angularly extends from the guide member 251 at one end thereof and a pin 261 is carried by the guide member at the other end thereof. The pin 261 extends from the guide member and passes through an arc-shaped slot 262 bored through the deck 220. The guide member 251 is normally biased in the clockwise direction by a spring 260 and is caused to engage the one end of the slot as shown by the dot-and-dash line. A portion of the deck 220 is notched so as not to engage the front edge of the cartridge with the guide portion 259 when the guide member 251 is in the dot-and-dash position. When the cartridge is inserted in the direction of arrow F to allow the side edge thereof to come to position 25' shown by the dotted line, the rear edge of the cartridge engages the pin 261. Further depression of the cartridge urges the pin 261 to counterclockwise rotate the guide member 251 against the bias of the spring. Then the cartridge is pressed to attain the position, for instance, indicated at 25'' where the cartridge initiates its movement in the direction of arrow G by the lever member for instance, indicated by numeral 129 in FIG. 2, the guide member 259 is moved to the position shown by the solid line to guide the cartridge which is moved in the direction of arrow G. It will be readily understood that the guide member 259 may be returned to the position shown by the dot-and-dash line in relation to retraction of the cartridge from the "play" position.

FIGS. 5 and 6 show a modified tape player including another embodiment of the tape-cartridge-positioning apparatus according to the present invention. In the Figures, similar numerals are used to illustrate like parts in FIGS. 1 and 2.

The player is shown generally at 300 in FIG. 6, and includes a player housing 301 having an opening 302 into which an endless magnetic tape cartridge 25 is readily inserted for play. Central knob sets 303, 304 are used to operate the tape player, and for volume and stereo balance settings. Track or channel selection knob 305 is provided to allow the channel to be changed and each time it is depressed and released a new

track or channel will be selected. A track or channel indicator 306 is to show the selected track or channel when the knob 305 is pushed. As thus incorporated in this player, the indicator 306 includes pilot elements which correspond to four channels and are capable of selectively lighting. A deck 320 is horizontally mounted within the housing 301 to carry the cartridge 25 which is inserted from the opening 302. As shown in FIG. 5, a reciprocating lever member 329 is slidably mounted by guides 330, 331 on the deck 320. The reciprocating lever member 329 includes a hook-stepped portion 339, and arm 332, a secondary arm on which a laterally extending flange 336 is mounted, and a notch 363 as will be described later. The hook-stepped portion 339 is adapted to engage a hookpin 345 formed on a stopper lever 341 pivoted to a shaft 343 on the deck 320. The arm 332 is designed to engage the front edge of the cartridge 25 when retracted from the "play" position. A pushing member 335 adheres to the flange 336 to come into contact with the rear edge of the cartridge. A tension spring 337 is provided to bias the lever member 329 in the leftward direction. The stopper lever 341 is biased in the counterclockwise direction by a spring 347 but inward movement of the lever is limited by a stopper pin 349 on the deck 320. A guide member 351 is rigidly mounted on the deck 320 for guiding the cartridge 25 to the "play" position. A return lever 364 is mounted on a shaft 365 over a sleeve 366 on the under of the deck 320. One end of the return lever 364 passes through the opening 302 and projects forwardly of the housing 301. A knob 367 which may be grasped with a finger for moving the lever member 329 is mounted on the return lever 364 at one end thereof and a pin 368 is formed at the other end thereof. The pin 368 upwardly extends from the return lever at the other end thereof and passes through an arc-shaped slot 369 bored through the deck 320 to engage the notch 363 in the lever member 329. The return lever 364 is in a position indicated by the dotted line when the lever member 329 is in a first position as shown and assumes in a position shown by the dot-and-dash line when the lever member 329 is moved to a second position for positioning the cartridge 25 in the "play" position. An electrical switch 324 similar to the door switch 24 (FIGS. 1 and 2) is mounted on the deck 320 and adapted to be actuated by the lever member 329 where in the first position. The switch 324 is maintained opened when actuated by the lever member 329 and is closed upon deactuation of the lever member. That is, in relation to manual insertion of the cartridge 25 in the direction of arrow A, the lever member 329 is released from the stopper lever 341 and caused to be leftwardly moved to move the cartridge to the "play" position closing the switch 324. Consequently, the switch 324 is closed to energize the motor (not shown) for rotatably drive the capstan 23. Since the return lever 364 is in the position shown by the dot-and-dash line when the cartridge 25 is disposed in the "play" position, the lever 364 is manually moved by the knob 367 in the direction of arrow H to move the lever member 329 against the elastic force of the tension spring 337 in aid of the pin 368 and the notch 363. Movement of the lever member 329 from the second position to the first position actuates and open the switch 324 and in association therewith rotation of the capstan is suspended while the cartridge 25 is pushed out in the direction of arrow B upon return of the stopper lever 341 under the influence of the elastic force of the spring 347. The slot 320 of the housing 301 is provided with enlarged portions 302a, 302b at upper and under sides thereof to readily receive fingers for facilitating extraction of the cartridge 25 from the housing. The slot 320 is also provided with a enlarged portion 302c whereat the return lever 364 is moved.

According to the embodiment shown in FIGS. 5 and 6, in order to retract the cartridge 25 from the "play" position the return lever 364 is admitted to be swung whereby the lever member 329 is returned from the second position to the first position. On the other hand, in FIGS. 7 and 8 there is shown an embodiment wherein the lever member 329 is returned by depressing the return lever. The embodiment shown in FIGS. 7 and 8 is of almost similar structure as that in FIGS. 5 and 6,

and suffice it to explain different parts. As usual, similar numerals are used to illustrate like parts in FIGS. 5 and 6. A pin 463 is mounted on the lever member 329 thereunder and passes through a slot 469 on the deck 320 to project therefrom. A return lever 464 is slidably mounted by guides 470, 471 on the deck 320 thereunder. The return lever 464 includes at one end thereof a rectangular hook portion 472 and at the other end a substantially rectangular pushing portion 473 which is integrally formed with the lever 464 and upwardly extends therefrom. The pushing portion 473 is disposed to oppose to an enlarged portion 302b formed under the slot 302. The return lever 464 is urged by a spring 474 forwardly of the housing 301 but inward movement of the lever 464 is limited by abutment of the projection 475 of the lever 464 with the guide 471. It will be understood that with respect to pressedly insertion of the cartridge 25 in the direction of arrow A, the reciprocating lever member 329 is released from the stopper lever 341 and moved from the first position to the second position to bring the cartridge 25 into the "play" position. When the lever member 329 is moved to the second position, the pin 463 is close to and positioned at a diagonal portion 472a of the hook portion 472 of the return lever 464. In retraction of the cartridge 25 from the "play" position, the pushing portion 473 is depressed against the bias of the spring 474 to abut the diagonal portion 472a against the pin 463 on the lever member 329 whereby the latter is moved from the second position against the bias of the spring 337. At a point where the lever member 329 is returned to the first position, depression upon the pushing portion 473 is released to cause the return lever 464 to be returned to the original position by the bias of the spring 474 while the lever member 329 is retained by the stopper lever 341.

FIG. 9 shows further embodiment of the invention in which a different manner of engagement of the reciprocating lever member for moving the tape cartridge is provided. Similar numerals are used to illustrate like parts in FIGS. 1, 2, 5, and 7. A reciprocating lever member 529 is slidably mounted by guides 530, 531 on a deck 520 horizontally provided within the housing (not shown) of the tape player. The reciprocating lever member 529 includes an arm 532, a secondary arm 533, and a third arm 563, and is biased by a tension spring 537 in the leftward direction. First mentioned arm 532 is adapted to engage the front edge of the cartridge 25 when retracted from the "play" position. The arm 553 carries a laterally extending flange 536 to which a pushing member 535 adheres for abutting against the rear edge of the cartridge 25. Last mentioned arm 563 is integrally formed of the lever member 529 and projects therefrom at opposite side from the arms 532 and 533. A stopping mechanism for the lever member 529 comprises a slide lever 576 which is slidably supported by a guide 577 on the deck 520 and disposed between the deck 520 and the lever member 529 at about right angles thereto. A first lever 578 is swingably mounted by a pin 579 on the arm 563 of the lever member 529 and a second lever 580 is also swingably mounted by a pin 581 on the deck 520. The first and second levers 578, 580 are pivoted at free ends thereof to a pin 582 mounted on the slide lever 576. The slide lever 576, first lever 578, and second lever 580 are connected by the pin 582 to one another. A spring 583 extends between the second lever 580 and a portion of the deck 520 whereby the first and second levers are given a rotational force in the direction of arrow. Rotational force of the first and second levers 578, 580 is arrested by abutting the first lever against a stopper pin 584 mounted on the deck 520. Abutment of the first lever 578 with the stopper pin 584 also prevents movable force of the lever member 529 by the bias of the tension spring 537 to retain the lever member 529 at a first position. Now, upon manual depression of the cartridge 25 in the direction of arrow A, the slide lever 576 is pushed by the cartridge 25 and thus slid. With slide movement of the slide lever 576, the first and second levers 578, 580 are rotated against the elastic force of the spring 583. Then, when the first lever 578 is cooperated with the second lever 580 so as to form a V-shape,

straight line, and reversed V-shape, the lever member 529 is moved from the first position to the left by the tension spring 537 since the tension spring 537 has more elastic force than that of the spring 583. It will be understood that by leftward movement of the lever member 529, the cartridge 25 is guided by a guide 551 along therewith and moved to the "play" position shown by the dot-and-dash line. A knob 534 mounted on the arm 533 at one end thereof is manually moved in the direction of arrow I and the lever member 529 is retracted from a second position where the cartridge 25 is disposed at the "play" position and to such a position where the first lever 578 and second lever 580 form straight line, and whereupon the knob 534 is left from the finger. Hence, the first and second levers 578, 580 are rotated in the direction of arrow by the elastic force of the spring 583 to abut the lever 578 against the stopper pin 584 whereby the lever member 529 engages the first position. Simultaneously with return of the lever member 529 to the first position the slide lever 576 is also returned to the position as shown to push the cartridge 25 away in the direction of arrow B.

Each embodiment shown in FIGS. 1 to 9 provides that the reciprocating-lever member is manually moved when the tape cartridge is moved from the "play" position to the "nonplay" position, however, FIG. 10 shows an embodiment wherein the reciprocating-lever member is moved by the mechanical use of rotational force of the capstan. In FIG. 10, similar numerals are used to illustrate like parts in FIGS. 1 to 9. A reciprocating-lever member 629 is slidably mounted by guides 630, 631 on a deck 620 horizontally provided within the housing (not shown) of the tape player. The reciprocation lever member 629 includes an arm 632, a secondary arm 633, a pin 685, and a latch stepped portion 639, and is leftward biased by a comparatively heavy tension spring 637. The arm 632 is adapted to engage the front edge of the carriage 25 when retracted from the "play" position. The second arm 633 carries a laterally extending flange 636 to which a pushing member 635 adheres for abutting against the rear edge of the cartridge. The pin 685 is disposed at one end of the lever member 629 adjacent to the arm 632. The stepped portion 639 is designed to engage a hookpin 645 fixed to a stopper lever 641 swingably provided on a shaft 643 on the deck 620. The stopper lever 641 is provided at one end thereof with a roller as similar to the stopper lever 241 (FIG. 2) and is given a counterclockwise rotational force by a spring 647 but inward movement of the stopper lever is limited by a stopper pin 649 on the deck 620. Manual depression of the tape cartridge 25 in the direction of arrow A follows that the stopper lever 641 is rotated against the bias of the spring 647 to release the hookpin 649 from the stepped portion 639 so that the lever member 629 is moved by the elastic force of the spring 637 from a first position as shown to the leftward direction. With movement of the lever member 629, the cartridge 25 is moved in the direction of arrow C to the "play" position. The lever member 629 is moved from the first position to a second position where the cartridge 25 is brought to to the "play" position whereby a door switch 624 (similar to the door switch 324 in FIG. 5) is closed to energize a motor (not shown) for rotatably drive the capstan 23 thus rotating the latter.

A mechanism for moving the lever member 629 from the second position to the first position includes a swing lever 688 swingably mounted by a sleeve 687 on a shaft 686 on the deck 620. The swing lever 688 is provided at a portion thereof with a leaf spring 689 and is urged in the clockwise direction by a tension spring 690. A rubber-covered frictional wheel 692 and a gear 693 connected to each other are rotatably supported on an axis 691 on the swing lever 688. The frictional wheel 692 as will be described later is caused to abut against the capstan 23 by rotation of the swing lever 688 from the position as shown to the counterclockwise direction and is rotatably driven by the capstan 23. Integrally formed gears 694 and 695 are rotatably provided about the sleeve 687. The gear 694 is adapted to mesh with the gear 693. Rotatably mounted on an axis 696 on the swing lever 688 are a gear 697 and a cam 698

which are connected with each other, with the gear 697 meshing with the gear 695. The gears 693, 694, 695 and 697 constitute a reduction gearing and rotation of the frictional wheel 692 is reduced to be imparted to the cam 698. A spring 699 is stretched between the leaf spring 689 and an actuator 701 of an electromagnetic plunger 700. When a pulse of current is supplied to the plunger 700, the swing lever 688 is rotated counterclockwise against the bias of the spring 690. This causes the frictional wheel 692 to abut with the capstan 23 to initiate rotation of the cam 698. At this moment, the one end of the leaf spring 789 is engaged by a bent portion 703 integrally formed in a substantially L-shaped leaf spring 702 which is pivoted on a pin 704. With this arrangement, after the plunger 700 is deenergized, the swing lever 688 is held in its position against the bias of the spring 690 so that the cam 698 keeps rotating. Prior to rotation, the cam 698 is in the position as shown while the pin 685 on the reciprocating lever member 629 which is moving to the second position is close to and positioned at minimum deformed portion of the cam 698 as indicated at 685a shown by the dotted line. When the cam 698 initiates its rotation in the direction of arrow J, the cam 698 comes into contact with the pin 685. As the cam is rotated, the reciprocating lever member 629 is moved against the bias of the tension spring 637. Reaction derived from that the cam 698 depresses the lever member 629 provides a counterclockwise rotational force for the swing lever 688 so that the frictional wheel 692 is intensely pressed by the capstan 23 thereby ensuring power transmission with increase of the load. Rotation of the cam 698 about 180° allows the cam to slidably come into contact with the one end of the leaf spring 702 to depress the same whereby the bent portion 703 of the leaf spring 702 is moved out of engagement with the leaf spring 689 so that the swing lever 688 is urged clockwise to its normal position. On the other hand, the cam 698 abuts against the pin 685 so that the swing lever 688 will not be returned to its normal position while abutment of the frictional wheel 692 with the capstan 23 is maintained to keep rotation of the cam 698. When the cam 698 makes about one rotation and its maximum deformed portion engages the pin 685, the reciprocating lever member 629 is moved to the first position 629 and retained by the stopper lever 641. Movement of the lever member 629 to the first position opens the door switch 624 to deenergize the motor (not shown) for rotatably drive the capstan 23 but the capstan may be rotated for a short period even after the door switch 624 has opened due to the inertia of the motor. During rotation of the capstan 23 by the inertia of the motor, the maximum deformed portion of the cam 697 is away from the pin 685 to release abutment of the cam 697 with the pin 685. Accordingly, the swing lever 688 is clockwise rotated by the elastic force of the spring 690 and returned to its normal position. As mentioned in the above, the lever member 629 is automatically returned by rotational force of the capstan 23 from the second position to the first position. At this interval, the cartridge 25 is moved in the direction of arrow D and shifted from the "play" position to the "nonplay" position.

A control circuit for the electromagnetic plunger 700, as shown, comprises an electrical source 705, a pushbutton switch 706, a switch 707 and the end-mark detector or search means 22. Upon operation of the pushbutton switch 706, the plunger 700 is energized by the source 705 to initiate return of the lever member 629 as previously described. The switch 707 is incorporated in a variable resistor 708 (shown by the dotted line) for adjusting volume, which is provided in the reproducing circuit of the player. The switch 707 is adapted to be closed when the variable resistor 708 is operated to minimize volume. After the switch 707 has been closed, volume output from the player is off while the magnetic tape 26 keeps its running. If two contacts of the search means 22 are shorted by an end mark (not shown) of conductive piece formed on the tape 26, the plunger 700 is energized by the source 705. As a result, return of the lever member 629 is automatically initiated. In relation to detection by the end mark detector 22 of

the end mark on the tape 26, the cartridge moved from the "play" position to the "nonplay" position may reproduce the beginning of the music or the like recorded on the cartridge is next played.

The invention and its attendant advantages will be understood from the foregoing description. It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A tape cartridge positioning apparatus for an endless magnetic tape cartridge player, said tape player having a housing in which there is provided a capstan for drivingly feed an endless magnetic tape in the cartridge and a tape playing circuit with a magnetic head, comprising:

a deck mounted within said housing, said capstan and said magnetic head being located on said deck; an opening formed on said housing, said opening being of dimension to receive at least the laterally oriented cartridge, said cartridge laterally passing through said opening and being inserted in said housing, disposed on said deck;

a reciprocating-lever member slidably mounted on said deck in the direction normal to the direction in which said cartridge is inserted, said lever member having a first arm in opposition to the front edge of said cartridge inserted in said housing and an arm in opposition to the rear edge of said cartridge, said lever member being biased by a heavy tension spring in one direction;

a stopper means retaining said reciprocating-lever member in a first position where said cartridge is disposed between the first and second arms, said stopper means having a movable lever urged by the side edge of said cartridge inserted in said housing, said movable lever being biased by a spring so as to normally engage said reciprocating-lever member, in relation to depression of said movable lever by said cartridge against the bias of said spring said stopper means releasing retention of said reciprocating-lever member, in response to disengagement of said stopper means with said reciprocating-lever member said second arm of said reciprocating lever member urging the rear edge of said cartridge by the bias of said tension spring and thus being moved;

cartridge guide means guiding said cartridge which is moved to the edge direction with movement of said reciprocating-lever member and bringing said cartridge to a playing position where said tape is drivingly fed by said capstan and abuts against said magnetic head, in relation to movement of said cartridge to said playing position said reciprocating-lever member being prevented from its movement to a second position, the rear edge of said cartridge being urged by said second arm of said reciprocating-lever member moved to said second position due to the bias of said tension spring thereby maintaining positioning of said cartridge in the playing position;

means returning said reciprocating-lever member from said second position to said first position, said first arm urging the front edge of said cartridge to retract said cartridge from said playing position when said reciprocating-lever member is moved by said means to a first position, said movable lever being returned to its initial position by the bias of said spring to urge said cartridge outwardly of said housing when said reciprocating-lever member is returned to said first position.

2. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 1 wherein said means for returning said reciprocating-lever member from said second position to said first position is swingably mounted on said deck, said means further including a manually operated return lever free end of which projects from said opening outwardly of said housing and a pin provided at the other free end of said return lever and engageable with said reciprocating-lever member at a portion thereof.

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3. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 1 wherein said means for returning said reciprocating-lever member from said second position to said first position is slidably mounted on said deck, said means further having at one end thereof a pushing portion in opposition to said opening of said housing and at the other end thereof a return lever including a hook portion with a diagonal portion, a spring biasing said return lever forwardly of said housing, and a pin mounted on said reciprocating-lever member, said hook portion abutting against said pin upon finger depression of said pushing portion said reciprocating-lever member being moved from said second position to said first position affected by said diagonal portion upon abutment of said hook portion with said pin.

4. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 1 wherein said means for returning said reciprocating-lever member from said second position to said first position is a knob fixed to the one end of said second arm of said reciprocating-lever member, said reciprocating-lever member being moved by hand through said knob against the bias of said tension spring.

5. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 4 wherein said cartridge guide means having a guide portion abutting against the front edge of said cartridge at one corner thereof, said cartridge guide means being swingably mounted on said deck and normally biased by a spring to a position where said guide portion does not guide said cartridge, said cartridge guide means being rotated against the bias of said spring to project said guide portion at least forwardly of said deck and move the same to the position in relation to insertion of said cartridge in said housing.

6. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 4 wherein said stopper lever comprises a first lever of which one end is pivoted to said reciprocating-lever member and the other end is pivoted to a pin provided in said movable lever, a second lever of which one end is pivoted to said deck and the other end is pivoted to said pin, a spring providing oppositely rotational force for said first and second levers, and a stopper pin mounted on said deck for preventing rotation of said first and second levers by the bias of said spring, a relative angle between said first lever and said second lever being immovably maintained when they are prevented from their rotational force due to said spring by said stopper pin, said reciprocating-lever member being retained at a first position, the relative angle between said first lever and said second lever being varied when said movable lever is urged by said

cartridge, said relative angle being further varied by said tension spring to release retention of said reciprocating-lever member.

7. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 1 wherein said means for returning said reciprocating-lever member from said second position to said first position comprises a swing lever rotatably mounted on said deck, a frictional wheel rotatably mounted on said swing lever, a cam rotatably provided on said swing lever, a speed-reducing device provided between said frictional wheel and said cam, a spring biasing said swing lever to a normal position, an electromagnetic plunger rotating said swing lever against the bias of said spring when said plunger is energized to a position where said frictional wheel abuts against said capstan, a control circuit for said electromagnetic plunger, a retainer member retaining said swing lever at a position where said frictional wheel abuts against said capstan, and a pin on said reciprocating-lever member to engage said cam, rotation of said capstan being transmitted to said cam through said frictional wheel, said speed-reducing device, with rotation of said cam said reciprocating-lever member being moved by said pin from said second position to said first position, said retainer member being actuated by said cam to release retention of said swing lever until the maximum deformed portion of said cam abutment of said cam with said pin being further maintained, by reaction derived from such abutment said frictional wheel keeps its abutment with said capstan, said reciprocating-lever member being returned to said first position before said maximum deformed portion of said cam is away from a position to abut against said pin, said swing lever being returned to the normal position by the bias of said spring when said maximum deformed portion of said cam has been away from last-mentioned position thereby releasing abutment of said frictional wheel with said capstan.

8. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 7 wherein said control circuit includes an electrical source connected in series with said electromagnetic plunger and a manually operated pushbutton switch.

9. A tape-cartridge-positioning apparatus for an endless magnetic tape cartridge player in accordance with claim 7 wherein said control circuit further includes an electrical source connected in series with said electromagnetic plunger, a switch incorporated in the variable resistor for adjusting volume in said playing circuit and closed when said variable resistor is adjusted to minimize volume, and an end-mark detector on said deck having two insulated contacts, said insulated contacts being shorted by a conductive foil mounted on said endless magnetic tape.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,603,743

Dated September 7, 1971

Inventor(s) ITSUKI BAN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading on the Title Page, insert
--Claims Priority November 27, 1968, December 4, 1968,
December 4, 1968 and December 18, 1968 from Japanese
Patent Applications 1968-86346, 1968-105220,
1968-105221 and 1968-109983--.

Signed and sealed this 14th day of March 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents