United States Patent [19]

Kozu et al.

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[45] **Nov. 27, 1973**

[54] **AUTOMATIC CASSETTE CHANGER**

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[21] Appl. No.: **140,761**

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May 6, 1970 Japan 45/38780

[52] **U.S. Cl.** ..... **274/4 F,** 352/123

[51] **Int. Cl.** **G11b 5/00**

[58] **Field of Search** ..... 274/4 F; 353/25, 353/15, 19; 352/8–10, 123; 179/100.2 Z; 242/198

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Primary Examiner—Leonard D. Christian
Attorney—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

An automatic cassette changer has a rotary tray for storing a plurality of cassettes, a tape deck for playback of the cassettes, and tray driving means for rotating the rotary tray. Index means is provided for restricting the rotation of the rotary tray so as to position a selected single cassette at a first position. Cassette exchanging means transports the single cassette from the first position to an operative position to engage the single cassette with the tape deck. A motor drives the tray driving means and the cassette exchanging means, and clutch means is provided which is responsive to the index means upon restriction of the rotary tray by the index means so as to disengage the motor from the tray driving means and to couple the motor with the cassette exchanging means.

4 Claims, 18 Drawing Figures

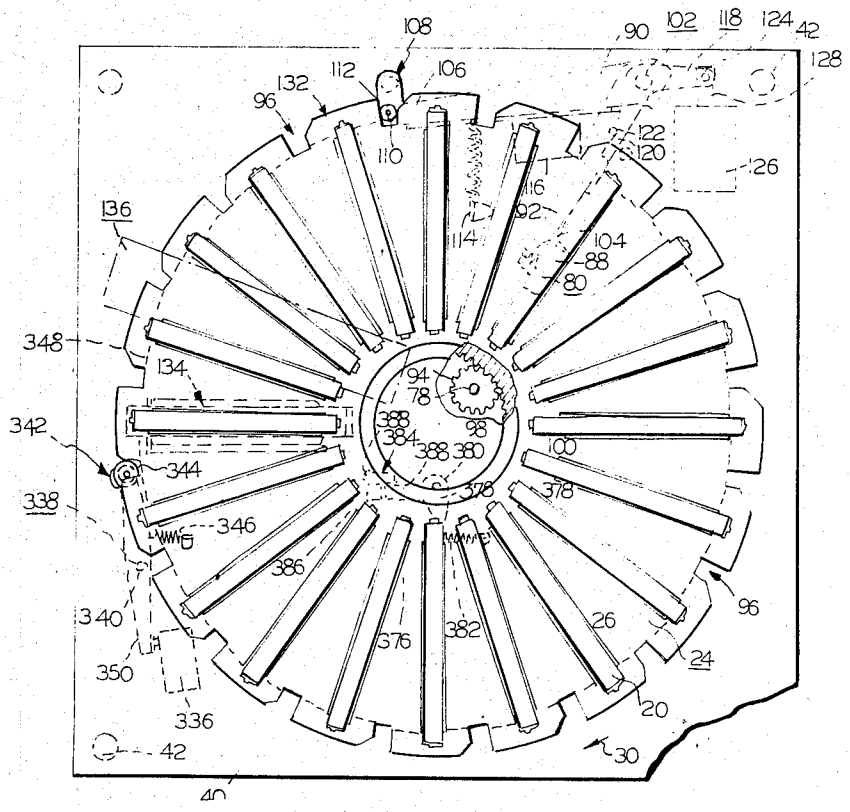
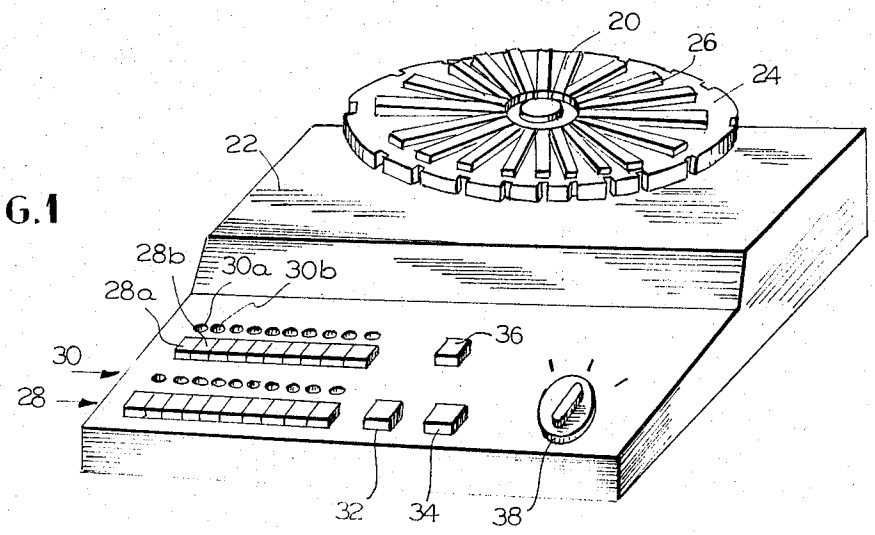


FIG.1



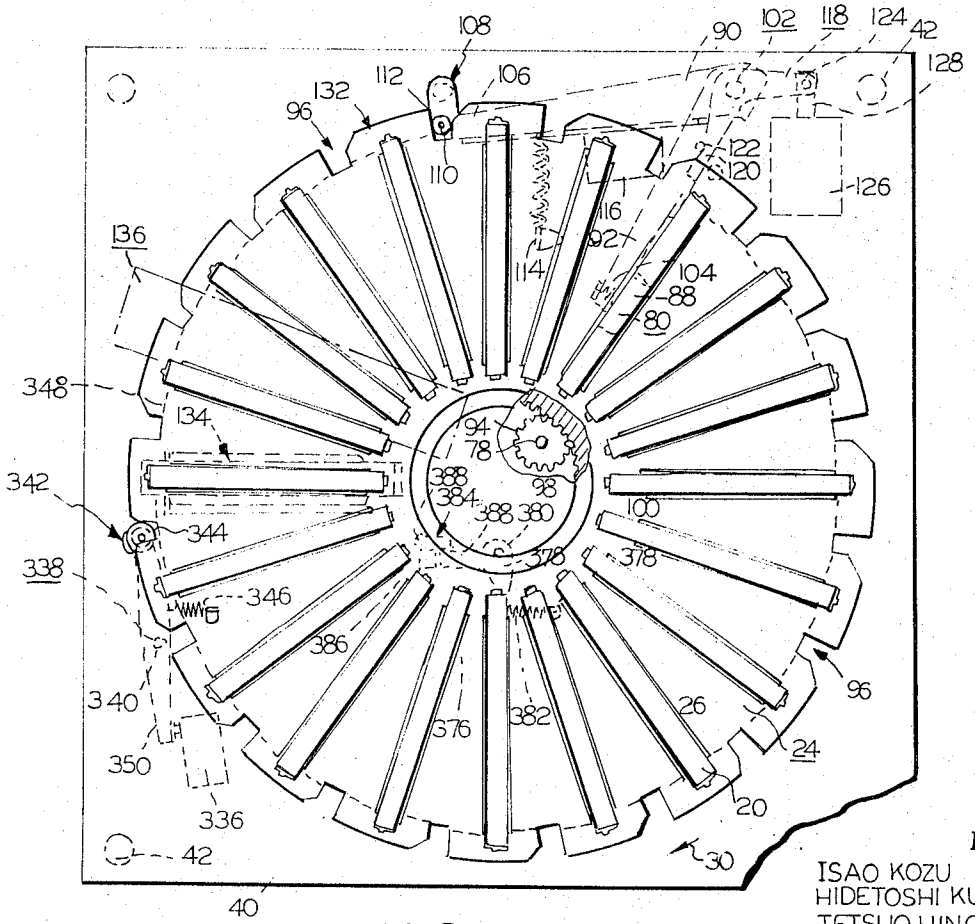


FIG.2

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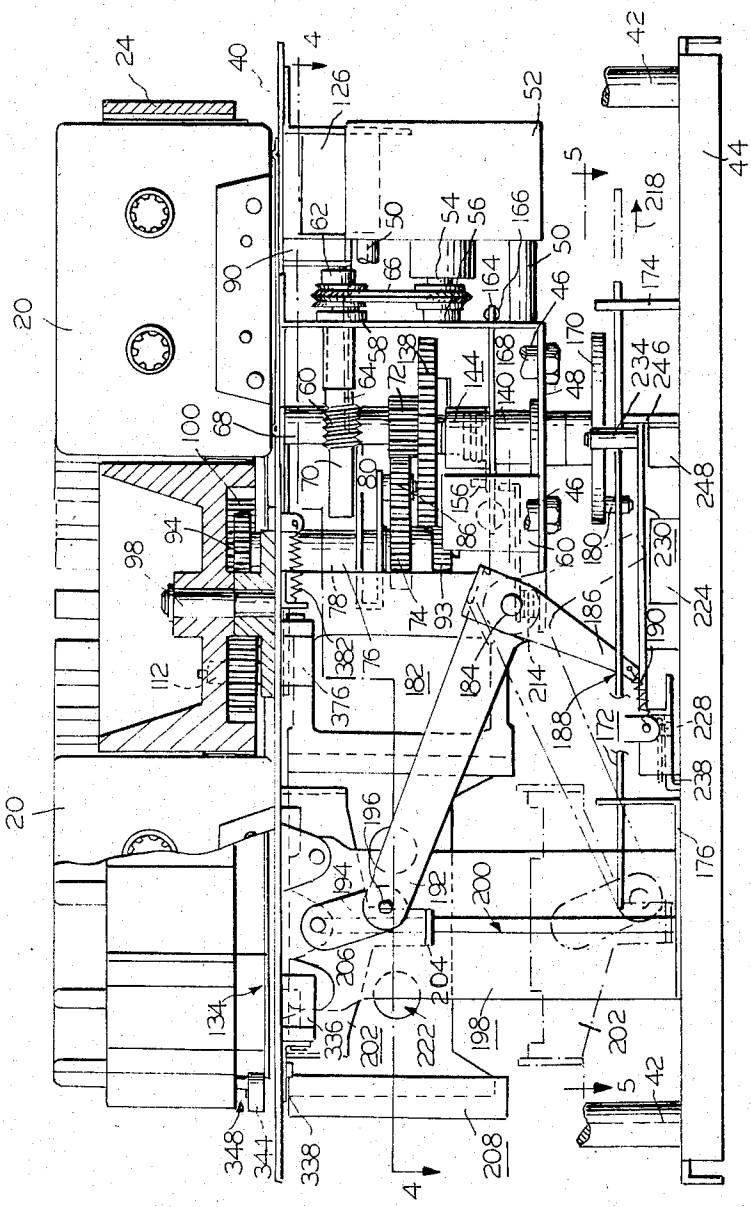

FIG. 3

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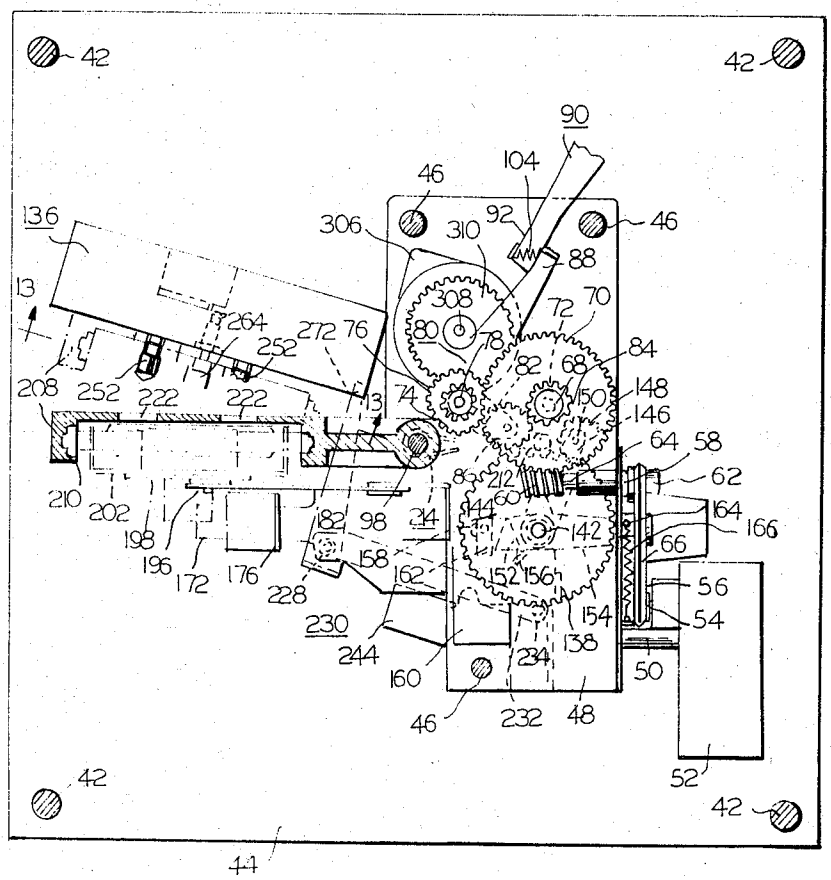

FIG. 4

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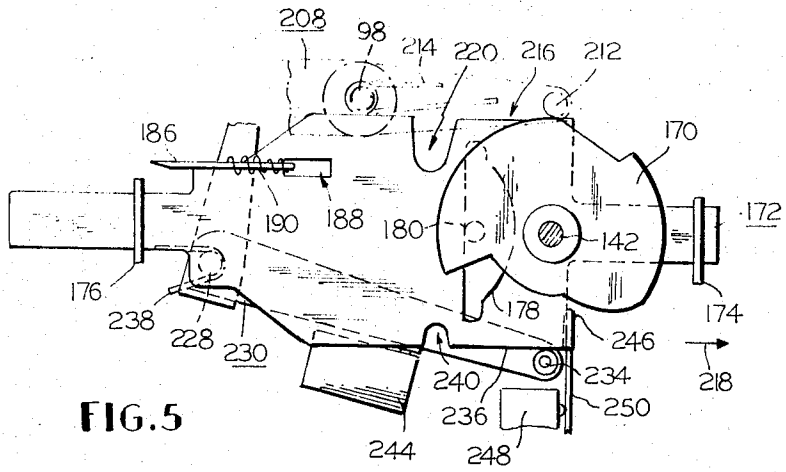

FIG.5

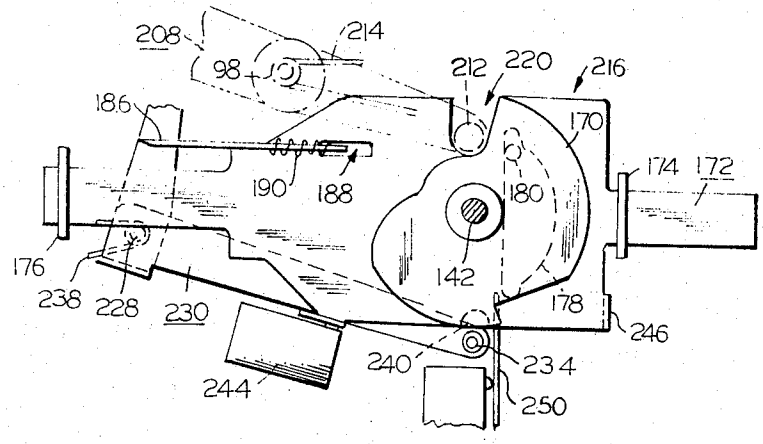

FIG.6

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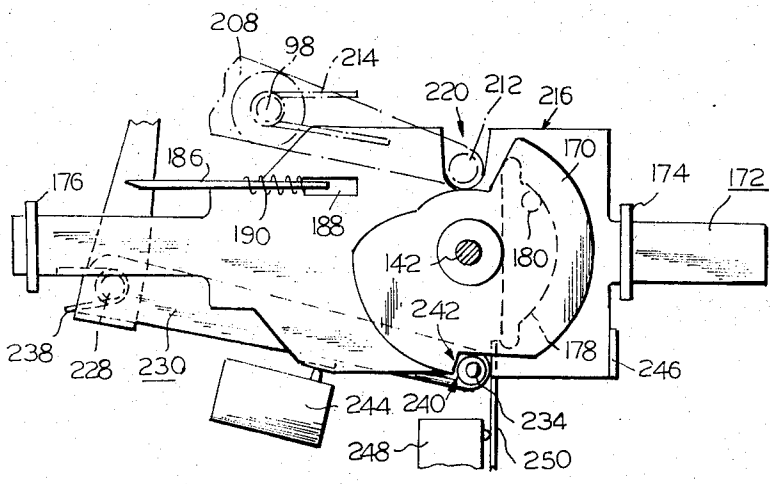

FIG.7

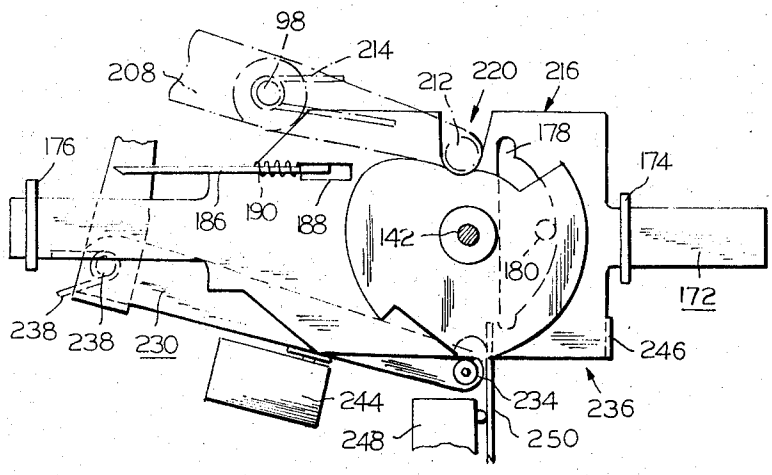

FIG.8

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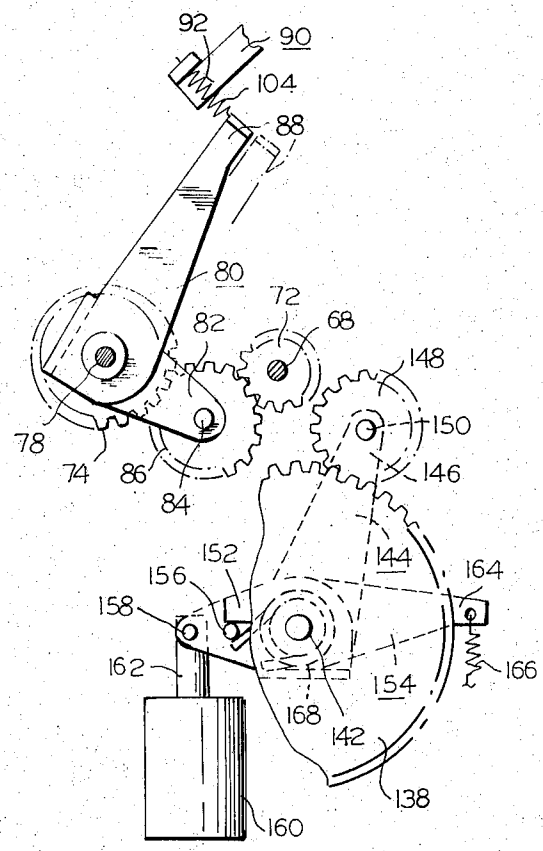
FIG.9



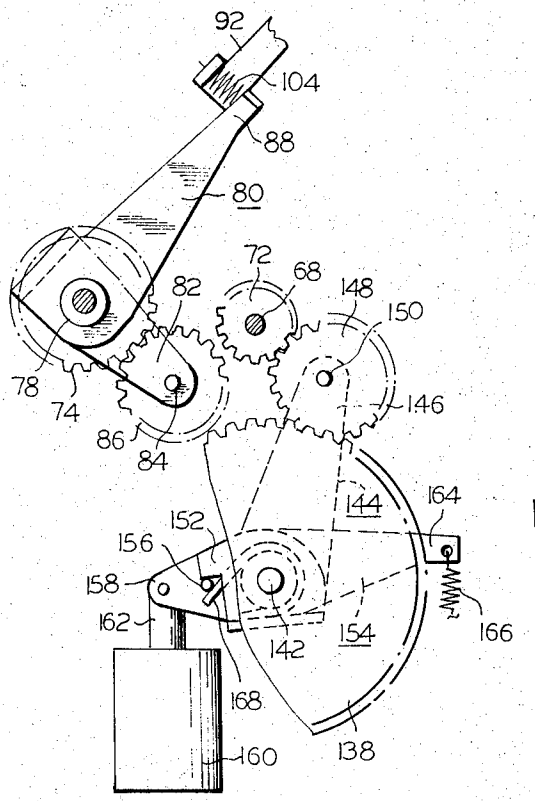


FIG.10

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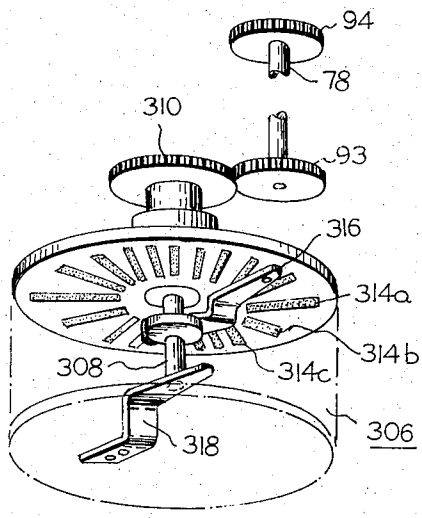

FIG.11

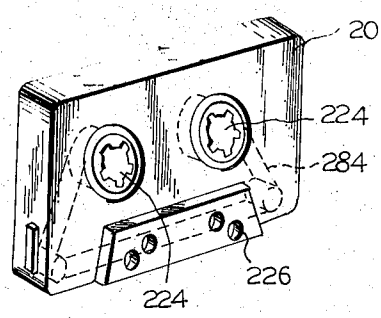

FIG.12

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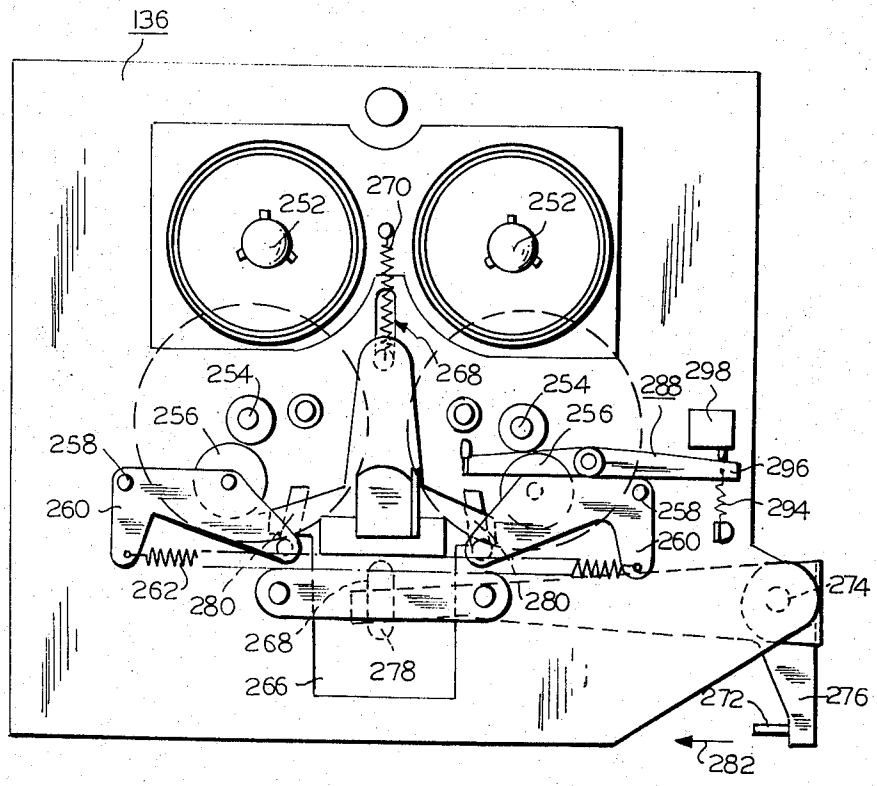

FIG.13

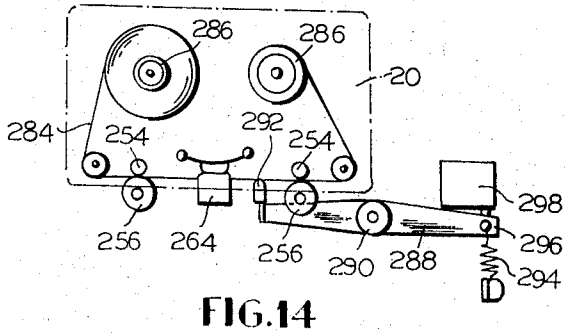

FIG.14

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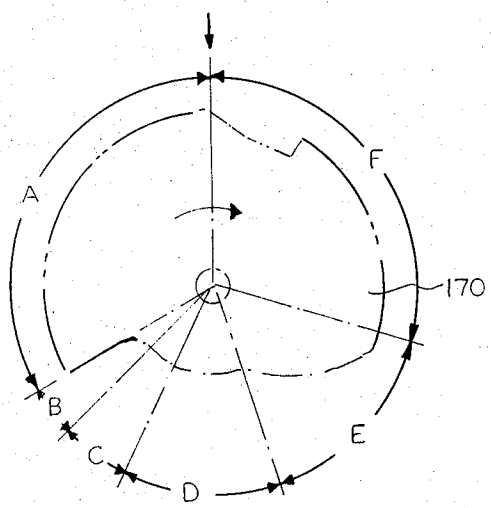
FIG.15



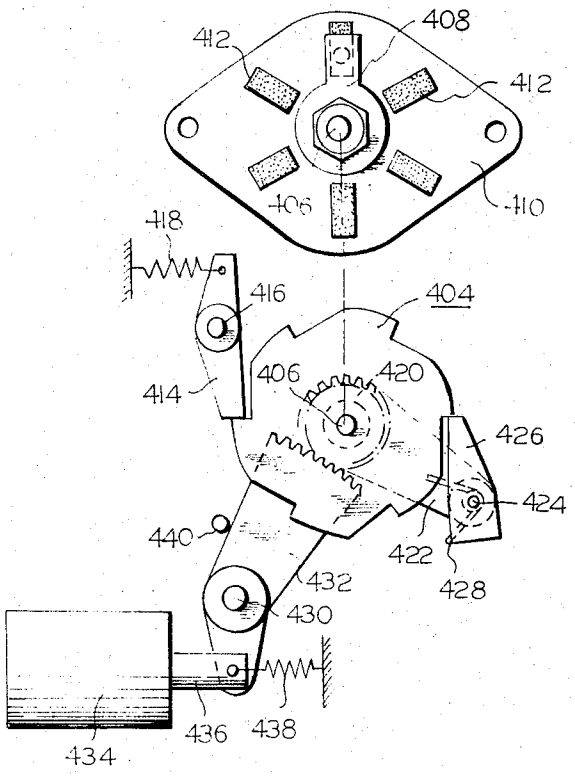


FIG.16

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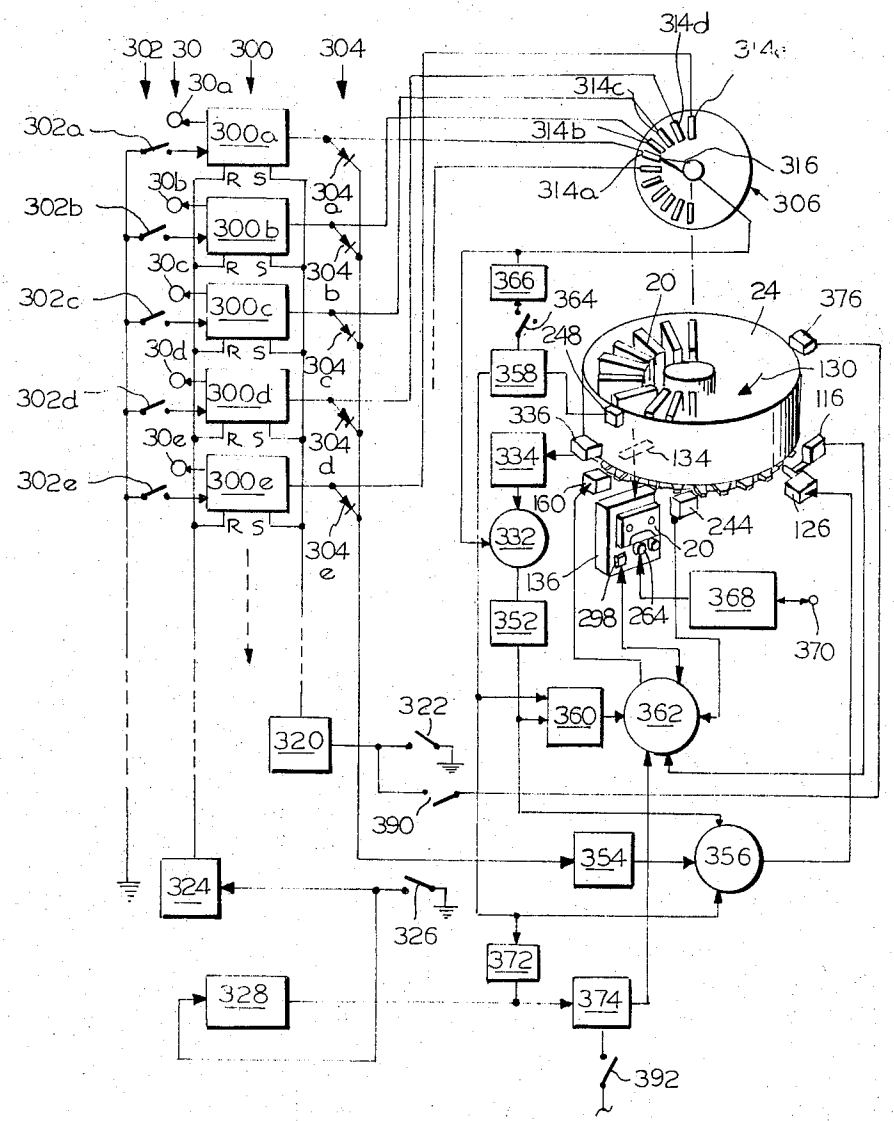

FIG.17

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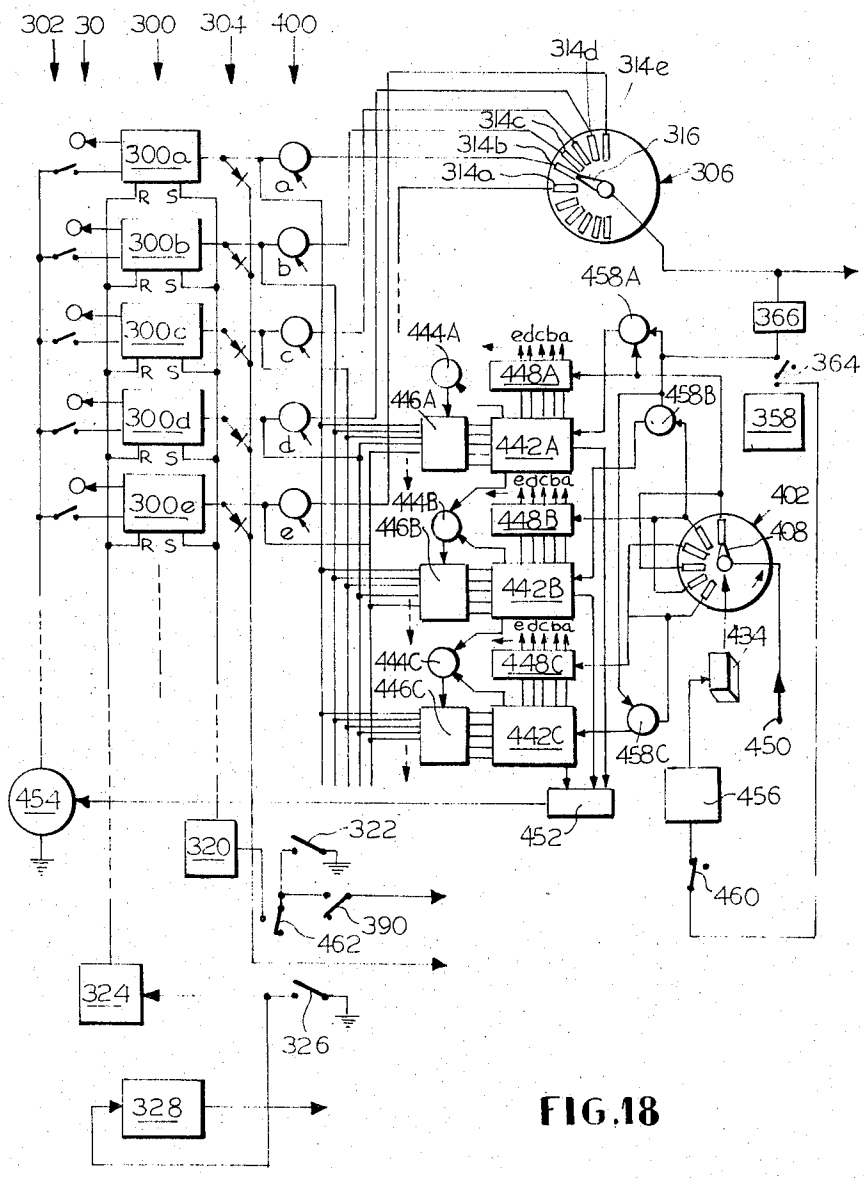

FIG.18

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AUTOMATIC CASSETTE CHANGER

This invention relates to an automatic cassette changer, and more particularly to a cassette changer capable of successively and selectively playing back a plurality of cassettes automatically.

One well known apparatus for selective playback of music is a juke box in which a plurality of disc records are used. However, such a conventional apparatus has a complex construction and is quite expensive so that it is only used in coffee shops and restaurants for commercial purposes. Recently, cassettes and endless-tape cartridges having music recorded thereon have become readily available in the market. It is desired to develop an automatic changer for such cassettes for home use which is inexpensive to produce and easy to operate.

The general object of the present invention is to provide a new and improved cassette changer capable of successively and selectively engaging a plurality of cassettes from a rotary tray with the tape deck.

Another object of the present invention is to provide an improved cassette changer having novel clutch means through which the driving force of the motor is transmitted to tray driving means and cassette exchanging means.

Still another object of the present invention is to provide an improved cassette changer having novel cassette exchanging means which includes an elevator movable up and down to transport the single cassette from the rotary tray to a position facing the tape deck.

Still another object of the present invention is to provide an improved cassette changer wherein a compartment in the rotary tray skips over the opening for introducing the cassette into the tape deck, if a cassette is not stored in said compartment.

Still another object of the present invention is to provide an improved cassette changer having novel control circuits which include unique memory devices for memorizing instructions to play back the cassettes successively and endlessly.

Still another object of the present invention is to provide an improved cassette changer having novel control circuits which include unique memory devices for memorizing instructions to play back the cassettes in a selected order.

These objects are achieved by providing an automatic cassette changer according to the present invention which comprises a chassis, a rotary tray which is rotatably mounted on said chassis and is provided with a plurality of compartments for storing a plurality of cassettes respectively, a tape deck which is mounted on said chassis and includes a magnetic head and tape moving elements for playback of said cassettes tray driving means for rotating said rotary tray to transfer said cassettes in a circular path, index means for restricting the rotation of said rotary tray so as to position a selected compartment of said rotary tray at a first position from which a single cassette in said selected compartment can be moved toward said tape deck, cassette exchanging means for transporting said single cassette from said first position to an operative position to engage said single cassette with said tape deck so that said single cassette is played back by said magnetic head, a motor for driving said tray driving means and said cassette exchanging means, and clutch means responsive to said index means upon restriction of said rotary tray by said index means so as to disengage said motor from said tray driving means and to couple the motor with said cassette exchanging means so that said single cassette is transported from said first position to said operative position by said cassette exchanging means.

Said cassette changer can be controlled by control circuits which comprise a plurality of first memory devices, each of which corresponds to one of said compartments of said rotary tray to memorize instructions to play back a single cassette in the corresponding compartment, a plurality of selection devices each of which corresponds to one of said first memory devices and which is capable of setting said first memory devices selectively to memorize said instructions, control means for controlling said tray driving means and said index means so that said tray driving means rotates said rotary tray and said index means restricts the rotation of said rotary tray so as to bring the single cassette in the compartment corresponding to the set first memory device to said first position when at least one of said first memory devices is set by the corresponding selection device, and resetting means for resetting the set first memory device corresponding to the played single cassette in every exchanging cycle of said cassette exchanging means.

Said cassette changer also can be controlled by another group of control circuits which comprise a plurality of first memory devices, each of which corresponds to one of said compartments of said rotary tray to memorize instructions to play back single cassette in the corresponding compartment, a plurality of selection devices, each of which corresponds to one of said first memory devices and which is capable of setting said first memory devices selectively to memorize said instructions, a plurality of second memory devices for memorizing the order in which said first memory devices are selected, each of said second memory devices being controlled by switching of a memory step switch in every exchanging cycle of said cassette exchanging means so as to allow only one of the set first memory devices corresponding to the number memorized by the second memory device to initiate said index means, and control means for controlling said tray driving means and said index means so that said tray driving means rotates said rotary tray and said index means restricts the rotation of said rotary tray so as to bring the single cassette in the compartment corresponding to the set first memory device to said first position when at least one of said first and second memory devices is set by the corresponding selection device whereby said cassettes are played back in the order in which said first memory devices are selected.

Further objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of an automatic cassette charger embodying the invention;

FIG. 2 is a top plan view of the automatic cassette changer of FIG. 1 with the cabinet removed for clarity;

FIG. 3 is a side view of the automatic cassette changer of FIG. 2 with certain parts broken away to provide a clear illustration;

FIG. 4 is a sectional view taken substantially along the irregular line 4—4 in FIG. 3;

FIGS. 5–8 are fragmentary sectional views of a part of the changer taken along the line 5—5 of FIG. 3 showing the parts in different positions;

FIGS. 9 and 10 are fragmentary plan views of clutch means used in this automatic cassette changer;

FIG. 11 is a perspective view of a tray rotary switch used in this automatic cassette changer;

FIG. 12 is a perspective view of a cassette used in this automatic cassette changer;

FIG. 13 is a sectional view of the tape deck taken along the line 13—13 of FIG. 4;

FIG. 14 is a fragmentary elevational view of a tape end detecting device used in this automatic cassette changer;

FIG. 15 is a diagrammatic view of a cam of the cassette exchanging means used in this automatic cassette changer;

FIG. 16 is a fragmentary view of a memory step switch used in this automatic cassette changer;

FIG. 17 is a diagrammatic illustration of one embodiment of the electrical control circuits in this automatic cassette changer; and

FIG. 18 is a diagrammatic illustration of another embodiment of the electrical control circuits in this automatic cassette changer.

Referring now to the drawings, there will be explained one embodiment of an automatic cassette changer according to the present invention.

This automatic cassette changer is constructed so as to be useful for handling a reel-to-reel type cartridge, especially a cassette as shown in FIG. 12. However, the present invention is not limited to use only for a cassette as shown in FIG. 12, but it is also useful for another type of cartridge, such as an endless tape cartridge.

With reference to FIG. 1, a plurality of cassettes 20 are stored in a plurality of radially extending compartments 26 which are provided in a rotary tray 24 rotatably mounted on a cabinet 22. On a panel surface of said cabinet 22 there are provided rows 28 of a plurality of selection buttons 28*a*, 28*b* . . . as selection devices and rows 30 of plurality of indicating lamps 30*a*, 30*b* . . . which correspond to said compartments 26, respectively. For the purpose of control of this cassette changer there are also provided on the panel surface of the cabinet 22 a reject button 32, a stop button 34, a simultaneous setting button 36 for setting the first memory devices, and a switch knob 38 for switching the playback mode of the cassette changer.

Referring to FIGS. 2 and 3, an upper chassis 40 is secured to a lower chassis 44 by stay rods 42, and a middle chassis 48 is fixedly suspended from upper chassis 40 by stay rods 46. A motor 52 is attached to an upstanding portion of said middle chassis 48 by two support poles 50. Said motor 52 has a pulley 56 secured to an output shaft 54 thereof. A worm 60 formed at one end of a shaft 64 is rotatably journalled in a bearing 58 which is attached to the upstanding portion of said middle chassis 48. A pulley 62 is fixed at the other end of said shaft 64. A belt 66 is disposed around said pulley 56 and said pulley 62 so that said motor 52 drives said worm 60 through said belt 66.

Referring to FIGS. 3 and 4, a worm wheel 70 and a gear 72 integral with said worm wheel 70 are rotatably mounted on a shaft 68 which is fixedly attached to the lower surface of the upper chassis 40. Said worm wheel 70 meshes with the worm 60. The driving force of said motor 52 is transmitted to a tray driving means through a clutch means which will be described hereinafter. A gear 74 is fixed to a shaft 78 rotatably supported in a bearing 76 which is permanently affixed to the upper chassis 40. an L-shaped lever 80 (see also FIG. 9) is swingably mounted on the bearing 76 and a gear 86 is rotatably supported on a shaft 84 which is secured to one end 82 of said lever 80. The other end 88 of said lever 80 is engageable with an end 92 of an L-shaped lever 90 which will be described later.

Said gear 86 is constantly in mesh with the gear 74, and is brought into mesh with the gear 72 when the lever 80 swings counterclockwise about the shaft 78 as shown in FIG. 9. Upon rotation of the motor 52, said worm wheel 70 is rotated clockwise by the worm 60 so that the shaft 78 rotates clockwise through the gear 74 when the gear 86 is meshed with the gear 72. As shown in FIG. 3, said shaft 78 has a gear 93 secured to the lower end thereof, and has a pinion 94 secured to the upper end thereof. Said gear 93 and said pinion 94 rotate together with the gear 74.

Referring to FIGS. 2 and 3, the rotary tray 24 has a plurality of recesses 96 at the periphery thereof, each of which corresponds to one of the compartments 26. Said rotary tray 24 is rotatably mounted on a shaft 98 which is secured to the upper surface of the upper chassis 40. The rotary tray 24 has an internal gear 100 formed at a central portion thereof which meshes with the pinion 94. Said rotary tray 24 is restricted in its rotation by index means which will be described hereinafter. The lever 90 is pivotally mounted on a shaft 102 which is secured to the upper chassis 40. The end 92 of the lever 90 is pressed against the end 88 of the lever 80 by a tension spring 104. The other end 106 of the lever 90 has a shaft 110 fixed thereto which extends upwardly through an opening 108 in the upper chassis 40 and which has a roller 112 rotatably mounted thereon. When this cassette changer is in the stopped state, the roller 112 is forced into one of the recesses 96 in the rotary tray 24 under the biasing force of a tension spring 114 which is attached to said lever 90, as shown in FIG. 2, and said lever 90 actuates a micro switch 116. An L-shaped lever 118 is pivotally mounted on the shaft 102. One end 120 of said lever 118 is engageable with a pin 122 on the lever 90, and the other end 124 of said lever 118 is linked to a plunger 128 of a solenoid 126 which is attached to the upper chassis 40. Said lever 90, said lever 118 and said solenoid 126 constitute index means for restricting the rotation of the rotary tray 24. Upon energization of the solenoid 126 the plunger 128 pulls the lever 118 to swing it clockwise. The end 120 of said lever 118 pushes the pin 122 to swing the lever 90 in the same direction. Therefore, the roller 112 is swung out of engagement with the recess 96 of the rotary tray 24 so that the restriction on the movement of the rotary tray 24 is released. At the same time, the end 92 of the lever 90 swings the lever 80 in FIG. 4 counterclockwise through the tension spring 104. Accordingly, as shown in FIG. 9, the gear 86 meshes with the gear 72 under the biasing force of said tension spring 104. Since the gear 72 rotates clockwise according to the rotation of the motor 52 as stated above, the pinion 94 transmits rotation force from the gear 72 and drives the rotary tray 24 in the direction of the arrow 130 in FIG. 2. When the solenoid 126 is deenergized during the rotation of the rotary tray 24, the lever 90 is swung counterclockwise by the tension spring 114 so that the roller 112 is pressed against outer periphery 132 of the rotary tray 24. When one of the cassettes 20 is brought to a first position where the cassette 20 is positioned just above an opening 134 which is provided in the upper chassis 40, one of the recesses

96 of the rotary tray 24 is opposite the roller 112 so that the roller 112 drops into the recess 96 to restrict the rotation of the rotary tray 24. On the other hand, with the swinging motion of the lever 90, the lever 80 swings clockwise about the shaft 78 to disengage the gear 86 from the gear 72 as shown in FIG. 10. Therefore, the rotary tray 24 is disengaged from the motor 52.

A tape deck 136 is provided under the upper chassis 40 as shown in FIGS. 2 and 4. Upon restriction of the movement of the rotary tray 24 by the index means, a single cassette 20 at the first position is transported from the rotary tray 24 through the opening 134 of the upper chassis 40 toward the tape deck 136 by cassette exchanging means which is driven by the motor 52 through a clutch means which will be described in detail hereinafter.

With reference to FIGS. 3, 4 and 9, a gear 138 is fixed to a shaft 142 which is rotatably supported in a bearing 140 secured to the middle chassis 48. A gear 148 is rotatably supported on a shaft 150 fixed to one end 146 of an L-shaped lever 144 which is pivotally mounted around said bearing 140. The other end 152 of said lever 144 is engaged with a pin 156 secured to a lever 154 which is pivotally mounted on said bearing 140. One end 158 of the lever 154 is linked with a plunger 162 of a solenoid 160, and the other end 164 of the lever 154 is provided with a tension spring 166. The end 152 of the lever 144 is pressed against the pin 156 by a torsion spring 168 which is provided between the lever 144 and the lever 154. The gear 148 meshes with the gear 138 and can rotate along the periphery of said gear 138 according to the counterclockwise swing motion of the lever 144 so as to mesh with the gear 72. When this cassette changer is stopped, said gear 148 is not meshed with the gear 72, as shown in FIG. 9.

Upon energization of the solenoid 160, the plunger 162 swings the lever 154 counterclockwise about the shaft 142 so that the pin 156 pushes one end of the torsion spring 168. Through said torsion spring 168, the lever 144 swings counterclockwise to move the gear 148 into mesh with the gear 72, as shown in FIG. 10. Since the gear 72 is rotating clockwise according to the rotation of the motor 52 as stated above, the rotating force of the gear 72 is transmitted to the shaft 142 through the gears 148 and 138.

As shown in FIGS. 3 and 5, a cam 170 is fixed to a lower portion of said shaft 142. A slide plate 172 is slidably mounted on the lower chassis 44 for movement in guide members 174 and 176 which are attached to the lower chassis 44. A pin 180 affixed to the lower surface of said cam 170 is inserted into a cam slot 178 which is provided in the central portion of the slide plate 172. On the other hand, an L-shaped lever 182 is pivotally mounted on a horizontal shaft 184 which is fixed to the middle chassis 48. One end 186 of said lever 182 extends downward through an opening 188 in the slide plate 172 and is tensioned by a tension spring 190 which is connected between the slide plate 172 and said end 186. The other end 192 of said lever 182 is linked with a connecting plate 194 by a pin 196. An elevator 202 is linked with said connecting plate 194 by a pin 196. An elevator 202 is linked with said connecting plate 194 by a pin 206. Said pin 206 and a bent tab 204 extend into an elongated vertical slot 200 formed in a guide plate 198 which is fixedly mounted between the upper chassis 40 and the lower chassis 44. Accordingly, upon swinging motion of the lever 182, the elevator 202 moves up and down.

When this cassette changer is stopped, said elevator 202 is in the uppermost position of its stroke, as shown in FIG. 3, so that the cassette 20 in the first position just above the opening 134 is supported by said elevator 202.

Referring to FIGS. 3 and 4, a holder 208 is pivotally mounted on a lower portion of the shaft 98, on which the rotary tray 24 is rotatably mounted. Said holder 208 is provided with a compartment 210 for receiving the single cassette 20 and a rotatable roller 212, and is biased clockwise in FIG. 4 about the shaft 98 by a torsion spring 214. When this cassette changer is stopped, the roller 212 is engaged with a side edge portion 216 of the slide plate 172 and the outer profile of the cam 170, as shown in FIG. 5. In this state, the compartment 210 of the holder 208 is in a second position just under the opening 134 so that the single cassette 20 can pass through said opening between the rotary tray 24 and the holder 208.

When the shaft 142 starts to rotate clockwise from the position in FIG. 5 and the cam 170 rotates through the A-phase as shown in FIG. 15, the slide plate 172 moves in the direction of the arrow 218 during the rotation of the pin 180 so as to swing the lever 182 counterclockwise (in FIG. 3) about the shaft 184. Therefore, the elevator 202 starts to move downward and occupies a position indicated by dot-dash lines, as shown in FIG. 3, so that the single cassette 20 on the elevator 202 passes through the opening 134 in the upper chassis 40 and is supported by the compartment 210 of the holder 208 at the second position where said single cassette 20 faces said tape deck 136.

During B-phase rotation of the cam 170, as shown in FIG. 15, the roller 212 on the holder 208 drops into a cutaway portion 220 of the slide plate 172 upon the movement of the slide plate 172 as shown in FIG. 6. The holder 208 swings clockwise about the shaft 98 under the biasing force of the torsion spring 214. Accordingly, the compartment 210 of the holder 208 is pressed against the tape deck 136 as indicated by dot-dash lines in FIG. 4 so that the single cassette 20 is shifted to an operative position to engage with the tape deck 136. Tape moving elements, such as a capstan and reel shafts which will be described in detail later, are inserted into corresponding holes of the single cassette 30 (see FIG. 12), through openings 222 in the compartment 210. Thus, the engagement of the single cassette 20 with the tape deck 136 is completely achieved.

Referring to FIGS. 3 and 4, a lever 230 is pivotally mounted on a shaft 228 which is secured to the lower chassis 44. One end 232 of said lever 230 is provided with a roller 234 which is pressed against a side edge portion 236 of the slide plate 172 by a torsion spring 238 as shown in FIG. 5. When the cam 170 rotates through the B-phase, as shown in FIG. 15, the roller 234 is opposite a cutaway portion 240 in the slide plate 172, but is prevented from dropping into the cutaway portion 240 by the outer profile of the cam 170.

With C-phase rotation of the cam 170, as shown in FIG. 15, a step portion 242 of the cam 170 is brought to a position facing the roller 234 so that the roller 234 drops into the cutaway portion 240 of the slide plate 172 by the torsion spring 238. Therefore, the lever 230 swings counterclockwise about the shaft 228 so as to

operate the tape deck **136** in a manner which will be described in detail later.

Upon counterclockwise swinging motion of the lever **230**, said lever **230** switches a switch **244** provided on the lower chassis **44** so as to de-energize the solenoid **160** through control circuits which will be described in detail later. Accordingly, the gear **148** is disengaged from the gear **72**, as shown in FIG. **9**, so that the cassette exchanging means is disengaged from the motor **52**. The cam **170** stops temporarily at the end of the C-phase rotation, while the single cassette **20** in the operative position is played back by the tape deck **136**. Upon termination of playback of said single cassette **20**, the solenoid **160** is energized again by the control circuits to initiate the cassette exchanging means. Such operation of the control circuits will be described in detail later.

When the cam **170** rotates through the D-phase in FIG. **15**, the outer profile of the cam **170** drives the roller **234** so as to swing the lever **230** clockwise, as shown in FIG. **8**. When the cam **170** moves the roller **234** outside of the side edge portion of the slide plate **172**, the lever **230** actuates the switch **244**.

When the cam **170** rotates through the E-phase, as shown in FIG. **15**, the outer profile of the cam **170** drives the roller **212** to swing the holder **208** counterclockwise from the position in FIG. **8**. Then the cassette **20** is removed from the tape deck **136** and occupies the second position indicated by dot-dash lines in FIG. **4**. While the cam **170** is rotating through the D-phase and the E-phase, the pin **180** of the cam **170** rotates along a circular portion of the cam slot **178** of the slide plate **172** so that said slide plate **172** does not move. Accordingly, the elevator **202** remains at its lowermost extremity until the single cassette **20** is returned from the operative position to the second position where said cassette **20** is positioned just above the elevator **202**.

After the cam **170** has driven the **212** of the holder **208** outside of the side edge portion **216** of the slide plate **172**, the cam **170** rotates through the F-phase, as shown in FIG. **15**, and the pin **180** of the cam **170** moves the slide plate **172** in the opposite direction to the arrow **218**. In FIG. **3**, the lever **182** swings clockwise about the horizontal shaft **184** under the action of the spring **190** upon said movement of the slide plate **172** so that the elevator **202** moves upward carrying the cassette **20** thereon.

When the cam **170** terminates its one rotation and returns to the initial position, as shown in FIG. **5**, the elevator **202** shifts the cassette **20** completely up to the first position above the upper chassis **40** so as to restore said cassette **20** to the compartment **26** of the rotary tray **24**. When the slide plate **172** returns to its initial position, as shown in FIG. **5**, a bent portion **246** of the slide plate **172** actuates an actuator **250** of a switch **248** so as to deenergize the solenoid **160** through the control circuits which will be described later. Accordingly, as shown in FIG. **9**, the lever **154** rotates clockwise by means of the tension spring **166** so as to disengage the gear **148** from the gear **72**. As a result, said cam **170** is disengaged from the motor **52**.

Now the detailed construction of the tape deck will be described.

With reference to FIG. **13**, the tape deck **136** is provided with tape moving elements such as two reel shafts **252**, two capstans **254** and two pinch rollers **256**. Said two capstans **254** are rotated in the same direction at a predetermined speed by a motor (not shown), and are also rotated in the opposite direction upon reversal of the rotation of said motor. The reel shaft **253** on the takeup side is driven through a friction drive mechansim which is widely known in the prior art. Said two pinch rollers **256** are rotatably mounted on pinch roller arms **260**, respectively, which are pivotally mounted on shafts **258**, respectively. Said arms **260** have a rotation force toward said capstans **254** imparted thereto by a tension spring **262**. Since conventional means can be used for such tape moving elements, a detailed description of their specific construction is omitted here.

A slide member **266** on which a magnetic head **264** is supported is slidably mounted on the tape deck **136** and is quided by slots **268** for movement up and down. Said slide member **266** is biased upward by a tension spring **270**. When this cassette changer is in the stopped state, one end **272** of the lever **230** swings a lever **276**, which is pivotally mounted on a shaft **274** elements. on the tape deck **136** counterclockwise, as shown in FIG. **13**. The other end of said lever **276** depressed a pin **278** secured to the slide member **266** so that said slide member **266** is kept in a lowermost position. Protruding portions **280** swing pinch roller arms **260** so as to separate the pinch rollers **256** from the capstans **254**. The magnetic head **264** is also positioned in a lowermost position with said slide member **266**. Therefore, said pinch rollers **256** and said magnetic head **264** do not cause the engagement of the cassette **20** with the tape moving elements.

Referring to FIG. **4**, after the single cassette **20** has been engaged with the tape deck **136**, the lever **230** swings counterclockwise with the rotation of the cam **170** as stated above so that the end **272** of the lever **230** moves in the direction of the arrow **282** in FIG. **13**. The slide member **266** moves upward under the force of the tension spring **270** so that the two pinch rollers **256** are pressed against the two capstans **254** by the tension spring **262** and the magnetic head **264** engages with a magnetic tape **284** in the cassette **20**. The capstans **254** and the reel shafts **252** rotate in one direction by the rotation of the motor provided in the tape deck **136** so as to play back one side of the cassette **20**.

It is desirable that the direction of tape movement be automatically reversed for the playback of the other track of the tape in the cassette after termination of the playback of one track of the tape. If the tape deck can play back only one track of the tape, the cassette must be turned over by hand for the playback of the other track of the tape. For this purpose, the direction of the rotation of the motor for the tape drive can be reversed upon detection of the tape end. For detecting of the tape end, a conventional method can be applied, such as the detection of a conductive foil adhered to the tape end, the detection of an increase in tape tension at the tape end, and so on,

Upon reversing of the motor, the capstans **254** and the reel shafts **252** begin to rotate in the reverse direction so that the magnetic tape **284** moves in the opposite direction. At the same time, the magnetic head **264** is switched to the other track of the tape **284** for the successive playback of the other track of the cassette **20**.

Since both tape ends are fixed to reel hubs **286**, respectively, tape tension increases at the tape end after termination of the playback of the other track of the

tape. The tape deck **136** is provided with a detecting lever **288**, FIG. **14**, for detecting said increase in tape tension. Said detecting lever **288** is pivotally mounted on a shaft **290** secured to the tape deck **136**. A detecting edge **292** provided at one end of said lever **288** is biased clockwise by a tension spring **294** so as to engage with the tape **284** in the cassette **20**. When the tape tension increases, as shown in FIG. **14**, said detecting lever **288** is swung counterclockwise by the tape **284** so that the other end **296** of the lever **288** actuates a switch **298** attached to the tape deck **136**. Upon switching of said switch **298**, the soleniod **160** is energized through the control circuits so as to couple the motor **52** with the cassette exchanging means. Upon rotation of the cam **170** through the D-phase, the lever **230** is swung clockwise (in FIG. **4**) by the cam **170** so that the end **272** of said lever **230** moves in the opposite direction from the arrow **282** in FIG. **13**. Therefore, the lever **230** swings counterclockwise to depress the slide member **266** downward so as to separate the pinch rollers **256** from the capstans **254**. Then the cassette **20** is disengaged from the tape deck **136** and is restored to the compartment **26** of the rotary tray **24** by the cassette exchanging means, as described above.

The control circuits for controlling refrnce operation of this cassette changer will be described with reference to FIG. **17**.

First memory means is provided in order to memorize instructions to select a desired single cassette **20** from a plurality of cassettes in the rotary tray **24** and to play back said single cassette. Said first memory means consists of a plurality **300** of first memory devices **300***a*, **300***b*, **300***c* . . . each of which is composed of a flip-flop and corresponds to one of the compartments **26** of the rotary tray **24**. This means that the number of first memory devices **300** is the same as the number of the cassettes **30** which can be stored in the rotary tray **24**. An operator can set any one of the first memory devices **300** corresponding to the desired cassette by operation of selection devices. As such selection devices, this cassette changer is provided with a plurality **302** of selection switches which are operated by a plurality of selection buttons **28** as shown in FIG. **1**, respectively. A plurality of indicating lamps **30** are connected to said first memory devices **300**, respectively, to indicate the set condition of the first memory devices **300** by whether the corresponding lamps **30** are illuminated. The selection switches **302** and the indicating lamps **30** are associated with corresponding first memory devices **300** as indicated by suffixes *a*, *b*, *c* . . . . Start operation detecting diodes **304** are connected to the output terminals of the first memory devices **300**, respectively, as indicated by suffixes *a*, *b*, *c* . . . . When one of the selection switches **302** is actuated by the corresponding selection button **28**, rotation. corresponding first memory device **300** is set and the corresponding lamp **30** **314** illuminated. When said one of the selection switches **302** is actuated again, the corresponding first memory device **300** is reset and the corresponding lamp **30** is turned off. Said first memory devices **300** can be set by an odd number of operations of the selection buttons **28** and can be reset by an even number of operations of the selection buttons **28** because of the flip-flop action of the first memory devices **300**. Each of the output terminals of said first memory devices **300** is also connected to a tray rotary switch **306**. Referring to FIGS. **4** and **11**, said tray rotary switch **306** is mounted on the middle chassis **48**. A rotary shaft **308** of said switch **306** has a gear **310** secured thereto which meshes with the gear **93** affixed to the lower end of the shaft **78** of the pinion **94**. While said pinion **94** is rotating the rotary tray **24**, said rotary shaft **308** also rotates in association with the rotation of the rotary tray **24**. When the rotary tray **24** makes a full rotation, said rotary shaft **308** also makes a full rotation. The tray rotary switch **306** has a plurality of radially extending contacts **314***a*, **314***b*, **314***c* . . . inside thereof, as shown in FIG. **11**. The number of said contacts **314** is the same as that of the compartments **26** of the rotary tray **24**. Said rotary shaft **308** has a rotary brush **316** secured thereto, which can make contact with each of said contacts **314** one by one. A slip contact **318** is constantly pressed against a lower edge portion of the rotary shaft **308** which acts as a common contact. As shown in FIG. **17**, each of said contacts **314** is connected to a corresponding output terminal of one of the first memory devices **300**.

The first memory devices **300** can be set only only by said selection devices, but by simultaneous setting means which will be described hereinafter. **320** is a simultaneous setting circuit for setting all of the first memory devices **300** at one time through each of the S terminals of said devices **300**. Said simultaneous setting circuit **320** is actuated by a simultaneous setting switch **322** which can be operated by depression of the simultaneous setting button **36** in FIG. **1**. The first memory devices **300** can also be reset by stop means which will be explained hereinafter. **324** is a resetting circuit for resetting all of the first memory devices **300** at one time therough the R terminals of said devices **300**. Said resetting circuit **324** is actuated by a stop switch **326** which can be operated by depression of the stop button **34** in FIG. **1**. **328** is a stop memory which is composed of a flip-flop and memorizes the fact that said stop swtich **326** is operated. A start set detecting gate **332** is supplied with the output of the first memory device **300** which is connected to the contact **314** which is contacted by the rotary brush **316**.

This cassette changer is provided with cassette detecting means for detecting the presence of the single cassette **20** in a compartment **26** of the rotary tray **24**. **334** is a cassette detecting device which is controlled by a cassette detecting switch **336**. As shown in FIGS. **2** and **3**, said switch **336** is mounted on the lower surface of the upper chassis **40**. A cassette detecting lever **338** for actuating said switch **336** is pivotally mounted on a shaft **340** secured to the upper chassis **40**. Said lever **338** has a roller **344** rotatably mounted at one end thereof which extends upward through an opening **342** in the upper chassis **40**. Said roller **344** is inserted into an annular groove **348** formed in the lower periphery of the rotary tray **24** under the biasing force of a tension spring **346** which is attached to said cassette detecting lever **338**. Said roller **344** engages the cassettes **20** stored in the compartments **36** during rotation of the rotary tray **24** and is pushed out from the annular groove **348**. This causes the cassette detecting lever **338** to swing counterclockwise so that the end **350** of said lever **338** actuates the switch **336**.

As shown in FIG. **2**, since said roller **344** is disposed adjacent the opening **134** and the rotary tray **24** rotates in the direction of the arrow **130**, said roller **344** detects the existance of a cassette **20** in the compartment **26** which is one pitch prior to the opening **134**, while said compartment is brought to the first position just

above the opening **134.** When the existance of the cassette **20** is detected by said roller **344** and the switch **336** is actuated, the cassette detecting device **334** acts on the start set detecting gate **332** so as to send the output of the memory device **300** to a pulse shaper **352** through said gate **332.** On the other hand, said start operation detecting diodes **304** are connected to a tray initiating controller **354.** The output of said controller **354** is sent to a tray initiating gate **356.**

The output terminal of said tray initiating gate **356** is connected to the solenoid **126.** Said solenoid **126** is attached to the lower surface of the upper chassis **40** as shown in FIGS. **2** and **3.** Upon energization of the soleniod **126,** said solenoid **126** acts as a clutch to release the restriction of the movement of the rotary tray **24** by the index means and cause engagement of the motor **52** with the tray driving means. On the other hand, the output of said pulse shaper **352** closes the tray initiating gate **356** so as to interrupt the passing of the output of the tray initiating controller **354** through said gate **356.** The output of the pulse shaper **352** is delivered to an elevator initiating device **360** and is sent to an elevator initiating gate **362** from said device **360.** The output terminal of single csstte **20** elevator initiating gate **362** is connected to the solenoid **160.** Said solenoid **160** is attached to the middle chassis **48,** as shown in FIGS. **3** and **4.** Upon energization of said solenoid **160,** the cam **170** is coupled with the motor **52** so as to initiate operation of the cassette exchanging means. Said elevator initiating gate **362** is connected to the switch **116** (in FIG. **2**) which can be actuated by the lever **90.** When the switch **116** is actuated by the lever **90** upon de-energization of the solenoid **126,** the output of the elevator initiating device **360** is allowed to pass through the gate **362.** Said gate **362** is also connected to the switch **244** for detecting when a single cassette **20** is completely engaged with the tape deck **136.** Said switch **244** is actuated by the lever **230** in FIG. **4** upon clockwise swinging motion of the lever **230** after the single cassette **20** has been engaged with the tape deck **136.** At that time, the elevator initiating gate **362** interrupts the passing of the output of the elevator initiating device **360.** In spite of this condition, said gate **362** allows the output of said device **360** to pass through the gate **362** when the switch **298,** FIG. **14,** is actuated by detection of the tape end.

The output of the detector **358** is connected through a change-over switch **364** to a switching circuit **366** which works as resetting means for resetting the first memory devices **300.** The output of said switching circuit **366** is connected to the rotary brush **316.**

When the single cassette **20** is played back and returned to the rotary tray **24,** the switch **248** is actuated, as stated above. Accordingly, the output of the detector **358** is sent to the switching circuit **366** so as to reset only one of the first memory devices **300** corresponding to the played single cassette **20** through the tray rotary switch **306.**

When the operator depresses the simultaneous setting button **36** after all of the compartments **26** of the rotary tray **24** are filled up with the cassettes **20,** the simultaneous setting switch **322** is closed to set all of the first memory devices **300.** At that time, the output terminals of the first memory devices **300** are changed from zero voltage to a positive voltage, and actuate the tray initiating controller **354** through the start operation detecting diodes **304.** Then the tray initiating controller **354** energizes the solenoid **126** through the tray initiating gate **356.** Upon energization of said solenoid **126,** the tray driving means rotates the rotary tray **24** in the direction of the arrow **130.** At the same time, the lever **90** in FIG. **2** rotates clockwise to change the switch **116.** Therefore, the elevator initiating gate **362** in FIG. **17** is closed to disengage the motor from the cassette exchanging means. If a single cassette **20** is stored in the compartment **26** which is being transferred to the first position just above the opening **134,** said single cassette **20** actuates the switch **336** during rotation of said rotary tray **24** so that said swtich **336** triggers the cassette detecting device **334** to produce a pulse of the required time length which makes the start set detecting gate **332** open. On the other hand, the rotary brush **316** of the tray rotary switch **306** is rotated until it contacts the contact **314** which is connected to the output of the first memory device **300** corresponding to the compartment **26** which is transferred to the first position just above the opening **134** during rotation of the rotary tray **24.** Since all of the first memory devices **300** are set as stated above, the positive voltage which is the output of one of the first memory devices **300** is sent to the pulse shaper **352** through the start set detecting gate **332** so as to produce an instruction pulse if the single cassette **20** is stored in the compartment **26** corresponding to one of said first memory devices **300.** This instruction pulse is added to the tray initiating gate **356** as a trigger signal so as to cut off the current for the solenoid **126.** Referring to FIG. **2,** the lever **90** swings counterclockwise under the action of the tension spring **114** so that the roller **112** drops into the recess **96** of the rotary tray **24** so as to restrict the rotation of the rotary tray **24.** At that time, the single cassette **20,** the existance of which has been detected, occupies the first position just above the opening **134.** At the same time, with the swinging motion of said lever **90,** the tray driving means is disengaged from the motor and the switch **116** is actuated by the lever **90** so as to open the elevator initiating gate **362** in FIG. **17.** Accordingly, the instruction pulse from the pulse shaper **352** is added to the elevator initiating device **360** and through the elevator initiating gate **362** energizes the solenoid **160** in FIGS. **4** and **10.** Upon energization of said solenoid **160,** the cassette exchanging means is coupled with the motor and the cam **170** rotates through the A-phase , B-phase and C-phase. With rotation of said cam **170,** the cassette exchanging means transports the single cassette **20** from the rotary tray **24** and engages said single cassette **20** with the tape deck **136.**

When the single cassette **20** is completely engaged with the tape deck **136,** the lever **230** changes the switch **244** as shown in FIG. **7.** Said switch **244** closes the gate **362** in FIG. **17** to deenergize the solenoid **160** so as to stop the operation of the cassette exchanging means.

The magnetic tape **284** in the single cassette **20,** which is engaged with the tape deck **136** is moved by the tape moving elements and is played back by the magnetic head **264.** The output of said head **264** is amplified by an amplifier **368** and sent to an output terminal **370.**

After the termination of the playback of said single cassette **20,** the switch **298** for detection of the tape end imparts a trigger signal to the gate **362** so as to open said gate **362.** Thus, the solenoid **160** is energized

to initiate the cassette exchanging means. When the cam 170 starts to rotate, as shown in FIG. 8, the switch 244 keeps the gate 362 in FIG. 17 open so that the cassette exchanging means transports the single cassette 20 upward to store it in the corresponding compartment 26 of the rotary tray 24. At that time, the resetting means in this cassette changer resets only the first memory device 300 corresponding to the played single cassette 20. When the single cassette 20 is returned to the rotary tray 24, the slide plate 172 actuates the switch 248 as shown in FIG. 5 so as to trigger the detector 358 in FIG. 17 so that the switching circuit 366 resets the flip-flop of the corresponding first memory device 300 which is connected to said switching circuit 366 through the tray rotary switch 306. Said detector 358 also resets the elevator initiating device 360 so as to deenergize the solenoid 160. Therefore, conditio, cassette exchanging means is added34 Since the output of said detector 358 is also added to the tray initiating gate 356 to change said gate 356 to the open condition, the solenoid 126 is energized again to initiate the rotation of the rotary tray 24. At the same time, the swtich 116 makes the elevator initiaiting tate 362 close to stop the operation of the cassette exchanging means. On the other hand, the output of said detector 358 reset the stop memory 328 through a switching circuit 372 at each termination of said operation of the cassette exchanging means.

The cassettes 20 in the rotary tray 24 are automatically and successively played back by repetition of the abovementioned operation cycle. In every said operation cycle, the flip-flop of the first memory device 300 corresponding to the played cassette 20 is reset and the indicating lamps 30 are turned off one by one. After the rotary tray 24 has made a full rotation and the last cassette 20 has been returned to the rotary tray 24, all of the first memory devices 300 are reset so that no instructions for a start operation are produced through the diodes 304. Therefore, the driving force of the motor 52 can be transmitted neither to the tray driving means nor to the cassette exchanging means, so that this cassette changer is brought to a stopped state.

Besides the above operation, this cassette changer has other functions which will be described hereinafter. Referring to FIG. 1, the operator can selectively set some of the first memory devices 300 by depressing the desired selection buttons 28. The operator can also selectively reset some of the first memory devices 300 corresponding to the cassettes 20 which the operator does not want to play back after setting all of the first memory devices 300 by depressing the simultaneous setting button 36. When the single cassette 20 in the compartment 26 corresponding to the first set memory device 300 is transferred to the first position just above the opening 134, said single cassette 20 is played back, as described above. However, even when the compartment 26 corresponding to the first memory device 300, which is not set, is transferred to said first position, the pulse shaper 352 does not have imparted thereto any variation of voltage level through the start set detecting gate 332, because the output voltage of the flip-flop of the corresponding first memory device 300 is zero. Accordingly, the rotary tray 24 continues its rotation so that said compartment 26 skips over the first poisiton. As a result, the single cassette 20 in said compartment 26 is not played back. If a single cassette 20 is not stored in the compartment 26, the switch 336 will not be actuated so that the cassette detecting device 334 does not open the start set detecting gate 332. At that time, even if the flip-flop of the corresponding first memory device 300 is set, the rotary tray 24 continues its rotation so that said compartment 26 skips over the first position.

By depression of the stop button 34 during the playback of the single cassette 20, the cassette changer can be brought to a stopped condition that will be described in more detail hereinafter. Said stop button 34 closes the stop switch 326 in FIG. 17 so that the resetting circuit 324 resets all of the set first memory devices 300 through their resetting terminals R. Therefore, no positive voltage is supplied to the tray initiating controller 354 through the start operation detecting diodes 304. At the same time, the stop memory 328 is set by said stop switch 326. The output of said stop memory 328 is led to a stop controller 374. Upon setting the stop memory 328, said stop controller 374 opens the elevator initiating gate 362 so as to energize the solenoid 160. Then, the cassette exchanging means is initiated to return the single cassette 20 from the operative position to the first position in the rotary tray 24. At the end of said operation, the switch 248 triggers the detector 358 so that the switching circuit 372 resets the stop memory 328. At the same time, said detector 358 also resets the elevator initiating device 360. As a result, all of the first memory devices 300, the stop memory, and the elevator initiating device 360 are reset, and the tray initiating controller 354 stops its operation. Thus, the rotation of the rotary tray 24 and the exchanging operation of the cassette exchanging means are stopped completely.

This cassette changer can also play back all of the cassettes 20 stored in the rotary tray 24 endlessly, as will be described hereinafter.

This cassette changer is provided with actuating means for witch all of the first memory devices 300 at one time in association with the rotation of the rotary tray 24 at least once during one rotation of said rotary tray 24. With reference to FIGS. 2 and 3, a switch 376 is attached to the lower surface of the upper chassis 40 in the vicinity of the central portion of the rotary tray 24. A switch lever 378 is pivotally mounted on a shaft 380 secured to the upper chassis 40 and is swung counterclockwise by a tension spring 382. Therefore, said switch lever 378 does not usually actuate said swtich 376. Said switch lever 378 has a bent portion 386 formed at one end thereof which extends upwardly through an opening 384 of the upper chassis 40. Said bent portion 386 can be engaged with two pins 388 which are secured to the lower surface of the rotary tray 24 during the rotation of said rotary tray 24. Said pins 388 swing the switch lever 378 clockwise so as to actuate said switch 376.

If the operator wants to play back the cassettes endlessly, the operator turns the switch knob 38 in FIG. 1 to change a switch 390 in FIG. 17 before operation of this cassette changer so that the switch 376 is connected to the simultaneous setting circuit 320. Upon operation of the simultaneous setting switch 322, the cassette changer starts to play back the cassettes 20 successively. As stated above, the flip-flops of the first memory devices 300 are reset one by one in every cassette exchanging cycle. Before all of the first memory devices 300 are reset during one rotation of the rotary tray 24, the pins 388 secured to the lower surface of the

rotary tray **24** actuate the switch **376** at least once during one rotation of the rotary tray **24.** At that time, all of the first memory devices **300** are set through the simultaneous setting circuit **320.** Accordingly, the rotary tray **24** does not stop after one rotation thereof and continues its rotation for successive playback of the cassettes **20** endlessly. In this case, the indicating lamps **30** are turned off one by one according to the reset of the corresponding first memory devices **300.** Therefore, the operator can recognize the cassette **20** played back by watching the lamps **30.**

On the other hand, another method to achieve endless playback of the cassettes is to open the changeover switch **364.** Since the signal from the detector **358** is not added to the switching circuit **366,** the respective first memory devices **300** are not reset after the termination of the playback of the corresponding single cassette **20** so that all cassettes **20** are played back endlessly. In this case, only the desired cassettes **20** corresponding to the first memory devices **300** which are set by the selection switches **302** can be endlessly played back. The operator can stop endless playback of the cassette **20** by resetting the corresponding first memory devices **300** by depression of the selection buttons **28.**

By depression of the reject button **32** in FIG. **1** during the playback of a single cassette **20,** said single cassette is returned to the rotary tray **24** and the next single cassette is engaged with the tape deck **136.** Said reject button **32** closes a switch **392** in FIG. **17** to actuate the stop controller **374** so as to open the elevator initiating gate **362.** Therefore, the solenoid **160** is energized to inititate the cassette exchanging means. The single cassette **20** is immediately returned to the rotary tray **24** and the next single cassette **20** corresponding to the set first memory device **300** is transferred to the first position and is introduced to the operative position for the playback of said next single cassette **20.**

With reference to FIG. **18,** another embodiment of the control circuits for the cassette changer will be described hereinafter. In this embodiment, the desired cassettes **20** are played back in a selected order. Since the basic construction of the embodiment in FIG. **18** is substantially the same as that in FIG. **17,** only the added structure and operation will be explained.

A plurality of selection order instruction gates **400** is provided between the first memory devices **300** and the corresponding contacts **314** of the tray rotary switch **306.** A memory step switch **402,** the construction of which is as shown in FIG. **16,** is also provided. A ratchet wheel **404** is fixed to a rotatable shaft **406** to which a rotary brush **408** is also attached. Said rotary brush **408** can engage with each of a plurality of contacts **412** which are formed on a wafer **410.** A latch member **414** is pivotally mounted on a shaft **416** and is biased clockwise by a tension spring **418.** Said latch member **414** restricts the clockwise rotation of the ratchet wheel **404.** A lever **422** having a gear **420** secured thereto is rotatably mounted on said shaft **406.** A claw **426** is pivotally mounted on a shaft **424** which is secured to one end of the lever **422.** Said claw **426** is engaged with the periphery of the ratchet wheel **404** under the counterclockwise biasing force of a torsion spring **428.** Said gear **420** meshes with a sector gear **432** which is pivotally mounted on a shaft **430.** One end of said sector gear **432** ad linked with a plunger **436** of a solenoid **434.** Said sector gear **432** is biased counterclockwise by a tension spring **438** so as to be pressed against a pin **440.** Upon energization of the solenoid **434,** the plunger **436** is pulled to rotate the sector gear **432** clockwise. Therefore, the lever **422** swings counterclockwise so that the claw **426** drives the ratchet wheel **404** counterclockwise one pitch thereof. This rotation of the ratchet wheel **404** causes the rotary brush **408** to index one pitch thereof so as to contact the next contact **412.** Upon deenergization of the solenoid **434,** the sector gear **432** is rotated counterclockwise by the tension spring **438** to return to its initial position. Accordingly, the lever **422** rotates clockwise to return to its initial position. Thus, the rachet wheel **404** is intermittently rotated by one pitch upon every energization of the solenoid **434** and the rotary brush **408** is rotated so as to contact with each of the contacts **412** one by one.

In FIG. **18,** second memory devices **442** are provided which consist of three series **442A, 442B** and **442C** in this embodiment. Selection order memory gates **444** and input gates **446** are also provided, each of which can set a corresponding second memory device **442** to memorize a code corresponding to the number of the selectively set first memory devices **300.** These input gates **446** are designated by a suffix A, B or C corresponding to the second memory devices **442.** Diode matrixes **448** are provided which make the number of the cassette which is memorized by the second memory device **442** to correspond to one of the first memory devices **300.** The output of each of the diode matrixes **448A, 448B** and **448C** is connected to each of the selection order instruction gates **400.** A positive voltage is supplied to the rotary brush **408** of the memory step switch **402** from an input terminal **450. 452** is a detector for detecting whether all of the second memory devices **442** are set or not. When the second memory devices **442** are all set, an overflow check gate **454** prevents the first memory devices **300** from being reset by the output of the detector **452.** The solenoid **434** is energized by a driving circuit **456. 458** is a gate for resetting said second memory devices **442.** The control circuits of this embodiment can be changed from a successive operation mode, as shown in FIG. **17,** to a random selecting operation mode, as shown in FIG. **18,** by switches **460** and **462,** which are operated by turning of the switch knob **38** in FIG. **1.**

Before operation of this cassette changer, the rotary brush **408** of the memory step switch **402** is placed in the position as shown in FIG. **18** so as to connect the input terminal **450** to the diode matrix **448A** associated with the second memory device **442A.** The selection order memory gate **444A** is open when the second memory device **442A** is not set so that the input gate **446A** is also opened through said gate **444A.** If one of the first memory devices **300** is set by operation of the selection switch **302,** the output of said first memory device **300** is added to the second memory device **442A** through the input gate **446A** so that said second memory device **442A** memorizes a code corresponding to a number of the selected first memory device **300.** Upon setting of the first memory device **300,** the positive voltage is supplied to the tray initiating controller **354** (see FIG. **17**) through the diode **304** so that selected cassette **20** is played back.

When the second memory device **442A** is set and the second memory device **442B** is not set, the selection order memory gate **444 B** is open so as to open the input gate **446B.** When another one of the first memory

devices **300** is set by operation of the selection switch **302,** the output of said first memory device **300** is added to the second memory device **442B** through the input gate **446B** so that said second memory device **442B** memorizes another code corresponding to said another one of the selected first memory device **300.** In this manner, the second memory devices **442** can be set one by one under control of the selection order memory gates **444.** When all of the second memory devices **442** are set, the overflow check gate **454** invalidates the operation of the selection switch **302** so that the first memory devices **300** will not be set any more.

Since the rotary brush **408** of the memory step switch **402** is supplied with positive voltage from the terminal **450,** the voltage of one terminal of the second memory device **442** corresponding to the number of the cassette which is memorized by said second memory device **442** is changed so as to be positive so that one of the selection order instruction gates **400** corresponding to the selected cassette is open. Since the first memory device **300** corresponding to said open gate **400** has been necessarily set, the output of said first memory device **300** is added to the start set detecting gate **332** (in FIG. **17**) through the tray rotary switch **306.** The single cassette **20** corresponding to said set first memory device **300** is now played back. However, the output of other set first memory devices **300** cannot be added to said gate **332.**

After the playback of said signal cassette **20,** the detector **358** is actuated as described above so as to reset the flip-flop of said first memory device **300** which is connected to the switching circuit **366** through the tray rotary switch **306** and the selection order instruction gate **400,** if the changeover switch **364** is closed. At the same time, the second memory device **442A** is reset by the detector **358** through the opened gate **458A** which is supplied with positive voltage from the memory step switch **402.** The output of the detector **358** is added to the driving circuit **456** through the switch **460.** Then, the solenoid **434** is energized to shift the rotary brush **408** of the memory step switch **402** to a position indicated by B. Thus, the next second memory device **442B** is connected to the input terminal **450** through the memory step switch **402.** Accordingly, the next selected cassette **20** corresponding to said second memory device **442B** is played back. In such a manner, the cassettes **20** are automatically played back in a selected order by depression of the selection buttons **28.**

When the second memory devices **442** are reset, the selection order memory gates **444** are opened so as to allow the reset second memory devices **442** to be set in a new selection order through input gates **446.**

When all of the first memory devices **300** and all of the second memory devices **442** are reset, this cassette changer stops its operation.

In the above described embodiment of the automatic cassette changer, a plurality of cassettes are played back successively and selectively. By adding a recording amplifier which can be connected to the magnetic head of the tape deck, a plurality of cassettes can be recorded automatically. These modifications can be easily achieved in the automatic cassette changer according to the present invention.

It is apparent that various modifications may be made without departing from the substantial properties in the invention. The above described specific examples are intended merely to illustrate the various inventive facts in certain selective embodiments of the invention, the scope of which it is intended shall be limited only by the following claims.

What is claimed is:

1. An automatc cassette changer comprising:

a chassis;

a rotary tray which is rotatably mounted on said chassis and which has a plurality of compartments for storing a plurality of cassettes and a plurality of recesses therein corresponding respectively to said compartments;

a tape deck mounted on said chassis and having a magnetic head and tape moving means for playback of said cassettes;

tray driving means coupled to said rotary tray for rotating said rotary tray to transfer said cassettes along a circular path;

index means movable to be forced into one of said recesses of said rotary tray for restricting the rotation of said rotary tray so as to position a selected compartment of said rotary tray at a first position where a single cassette in said selected compartment can be introduced toward said tape deck;

cassette exchanging means on said chassis at said first position and movable for transporting said single cassette from said first position to an operative position to engage said single cassette with said tape deck so that said single cassette is played back by said magnetic head;

a single motor for driving said tray driving means and said cassette exchanging means; and

clutch means selectively connecting the rotational force of said single motor to said tray driving means and said cassette exchanging means and coupled to said index means and responsive to the restricting movement of said index means into one of the recesses of said rotary tray so as to disengage said motor from said tray driving means and to engage said motor with said cassette exchanging means so that said single cassette is transported from said first position to said operative position by said cassette exchanging means.

2. An automatic cassette changer as claimed in claim **1** wherein said clutch means includes a switch responsive to said restricting movement of said index means, a solenoid coupled to said switch and energized through said switch upon restriction of said rotary tray by said index means, and clutch elements connected to said solenoid for engaging the motor with said cassette exchanging means upon energization of said solenoid.

3. An automatic cassette changer as claimed in claim **1** wherein said cassette exchanging means includes:

a holder for receiving said single cassette at a second position where said single cassette faces said tape deck;

an elevator which is movable up and down in said holder to transport said signle cassette from said first position to said second position;

holder driving elements connected to said holder for moving said holder horizontally toward said tape deck after said single cassette is transported to said second position by said elevator **42** posityon to shift said single cassette horizontally from said second position to said operative position; and

elevator driving means connected to said elevator for driving said elevator and stopping it at its lowermost position during the horizontal movement of

said holder between said second position and said operative position by said holder driving elements.

4. An automatic cassette changer as claimed in claim 1 further comprising cassette detecting means adjacent said rotary tray for detecting the existence of a single cassette in a compartment before said single cassette is transferred to said first position by said rotary tray, said detecting means being coupled to said index means for actuating said index means to stop the rotation of said rotary tray only when said detected single cassette is positioned at said first position, said index means not stopping the rotation of said rotary tray if a single cassette is not stored in said compartment so that said compartment skips over said first position.

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