

United States Patent
Marcinkus

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[54] CASSETTE LOWERING AND RELEASE
MECHANISM

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274/4 D
[51] Int. Cl. G11b 23/12
[58] Field of Search 40/28.1; 353/15; 352/8, 123;
179/100.2 Z; 242/197-200; 274/4 F, 4 C, 4 B, 4 E,
11 C, 11 B

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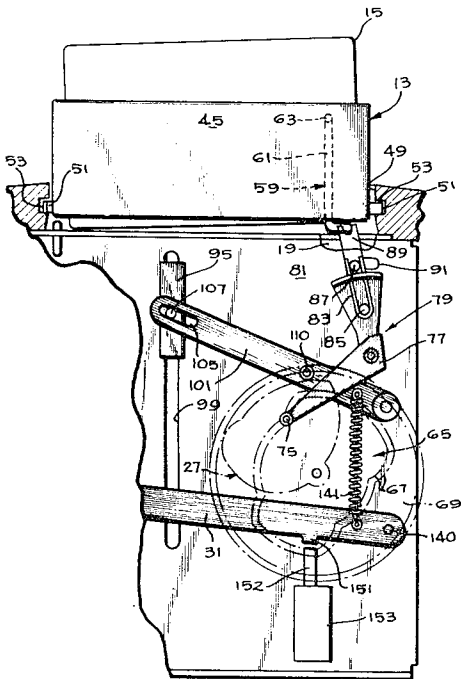
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[57] ABSTRACT

Cassettes are transported from a magazine to an operative position for playback or recording by a movable chassis which is smoothly and evenly driven by means including a small motor to the operative position. The cassette is also held at the operative position, released for movement from the operative position and returned to the magazine without jarring.

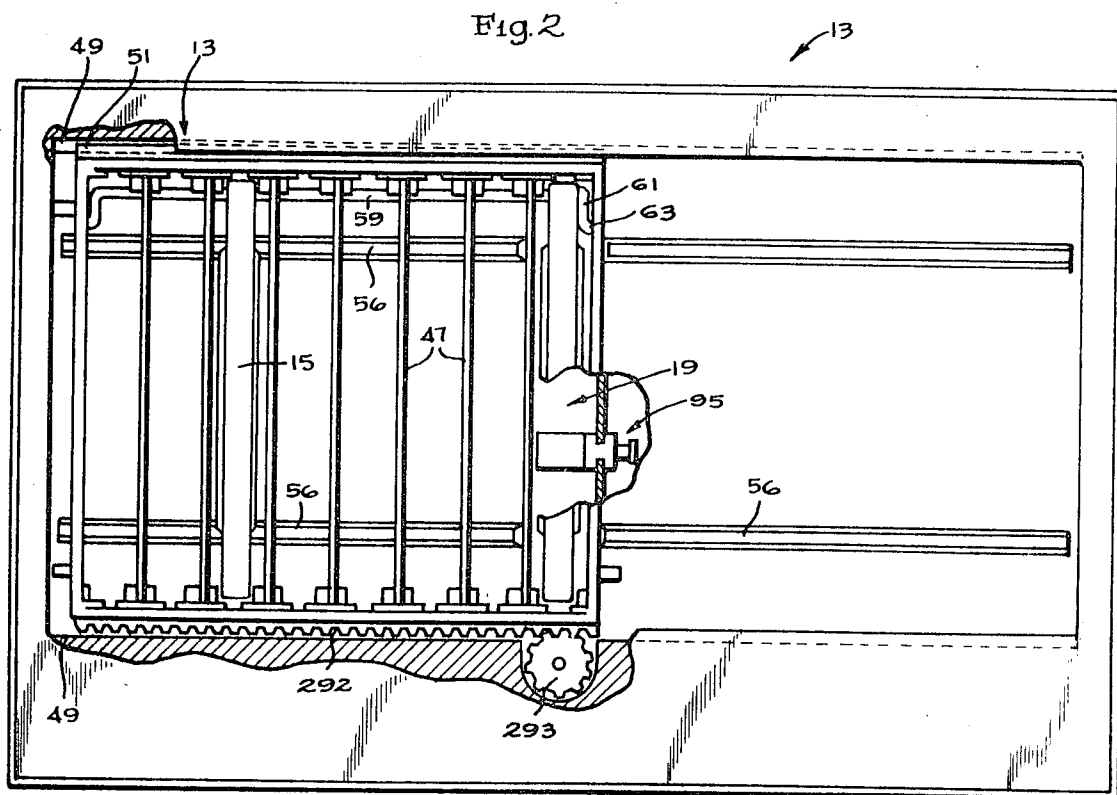
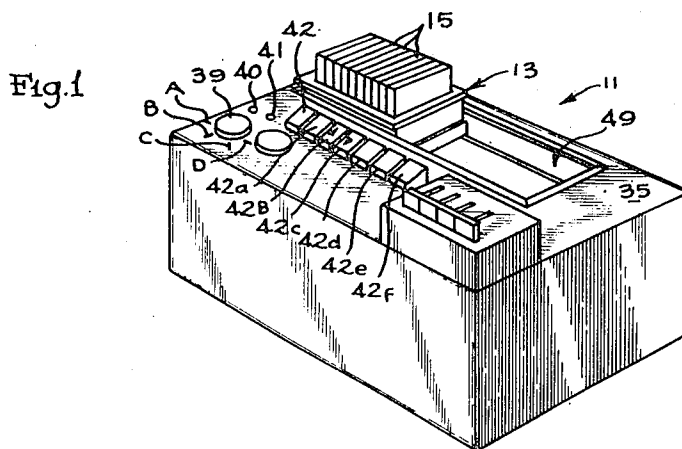
4 Claims, 26 Drawing Figures



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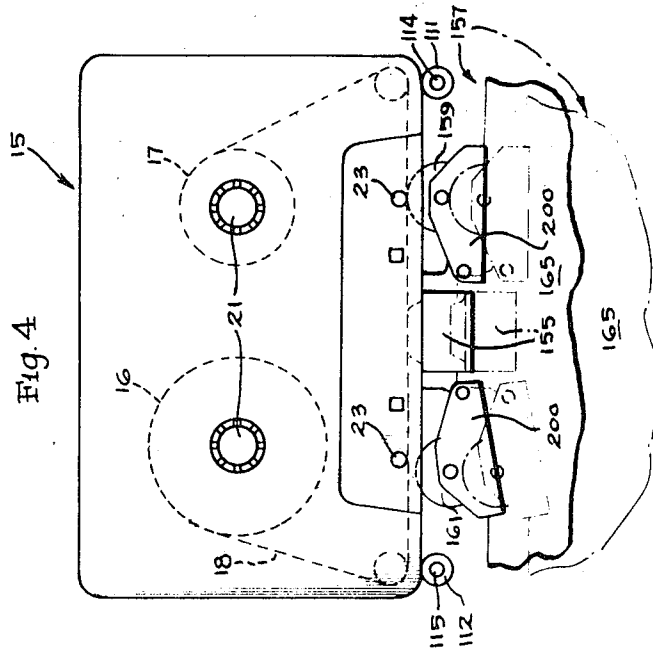
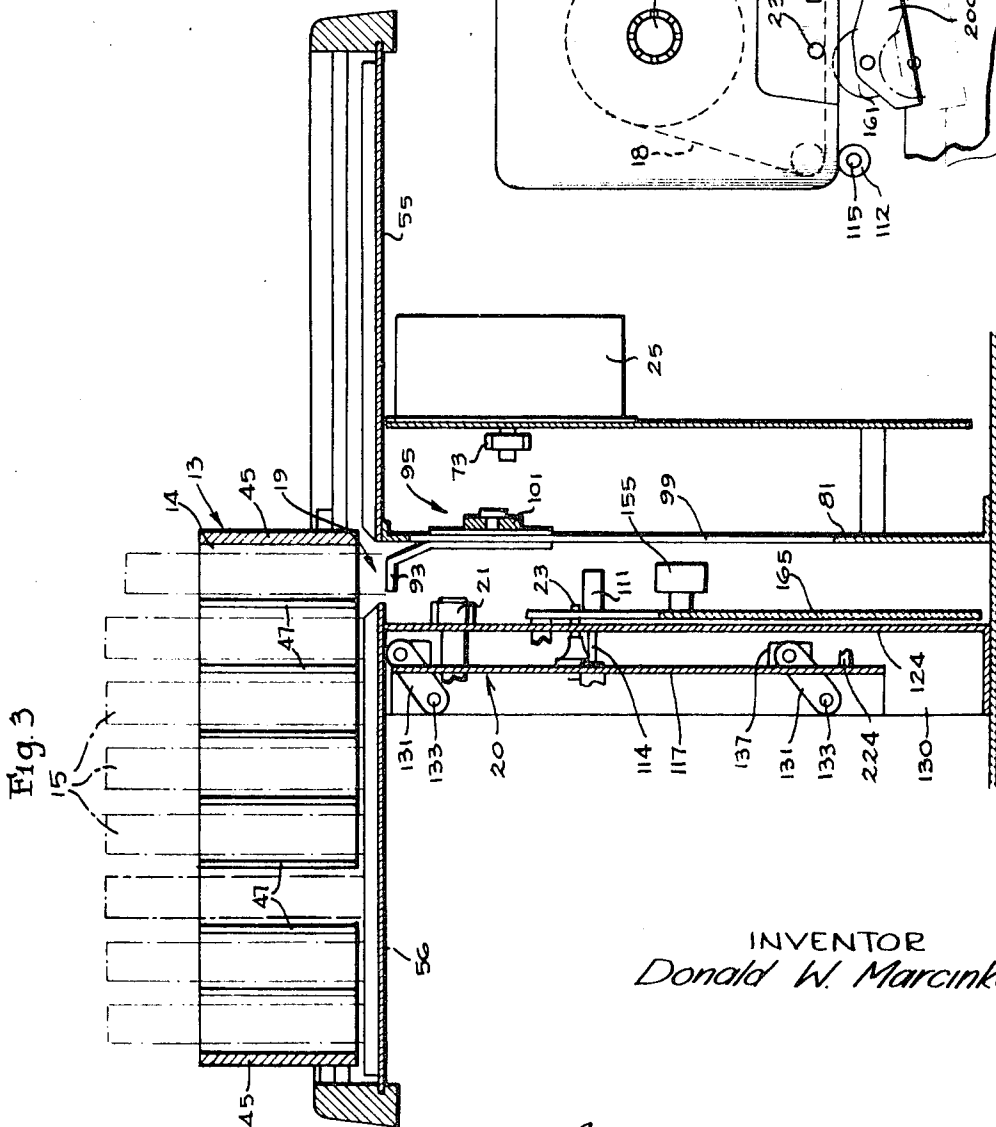
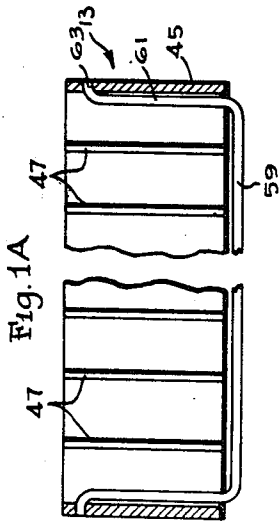
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12 Sheets-Sheet 1



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Fig. 5

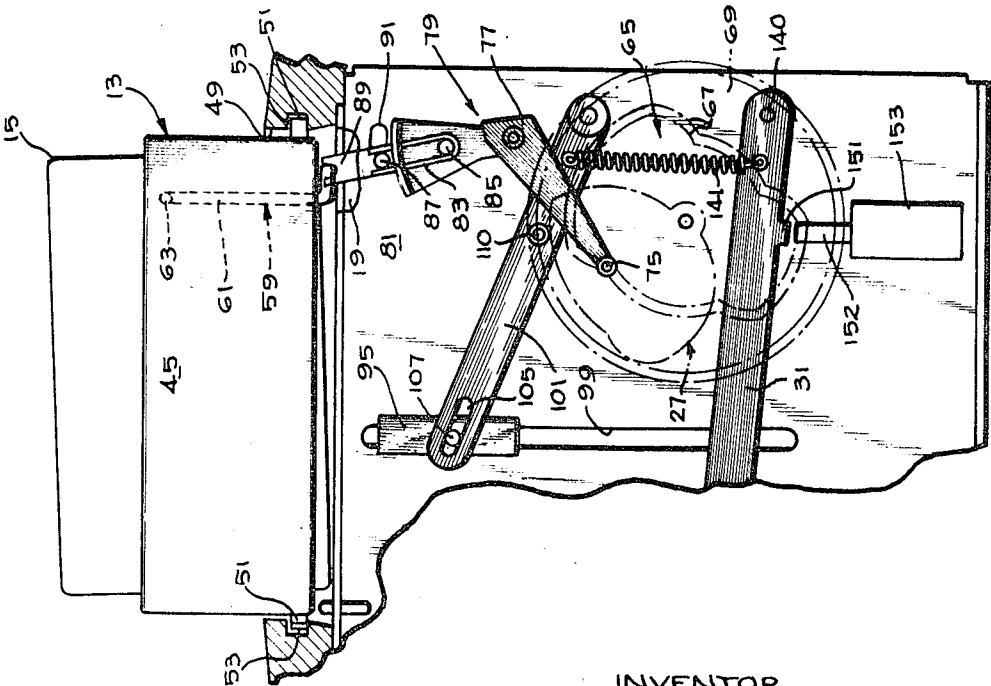
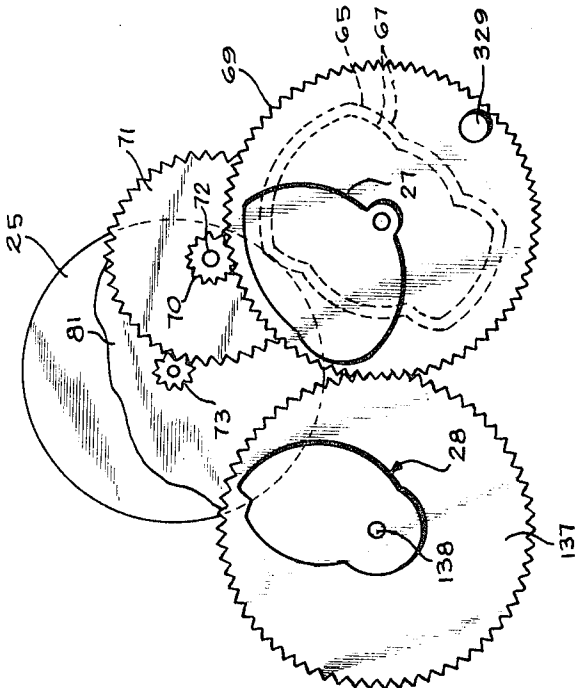


Fig. 6



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Fig. 7

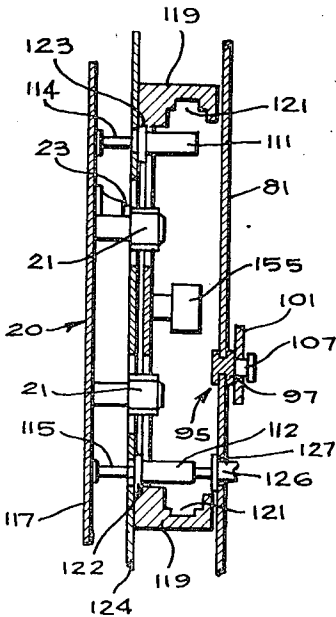
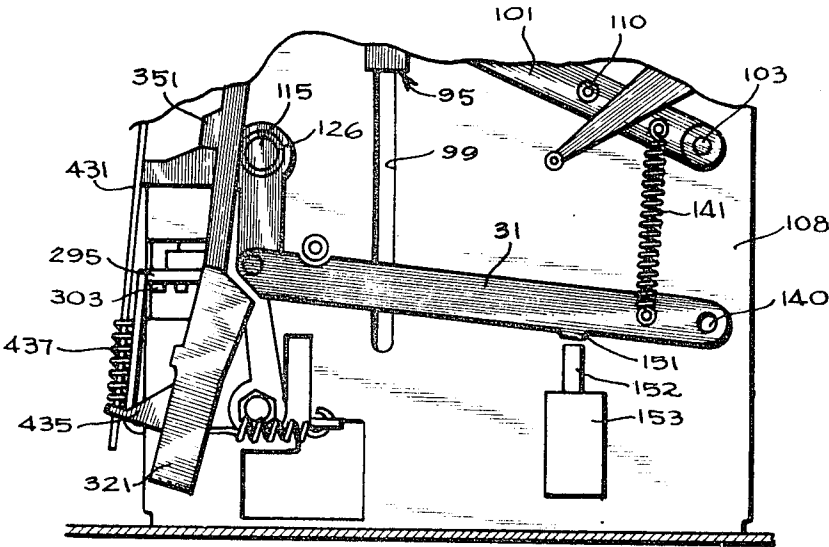


Fig. 8



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Fig. 9

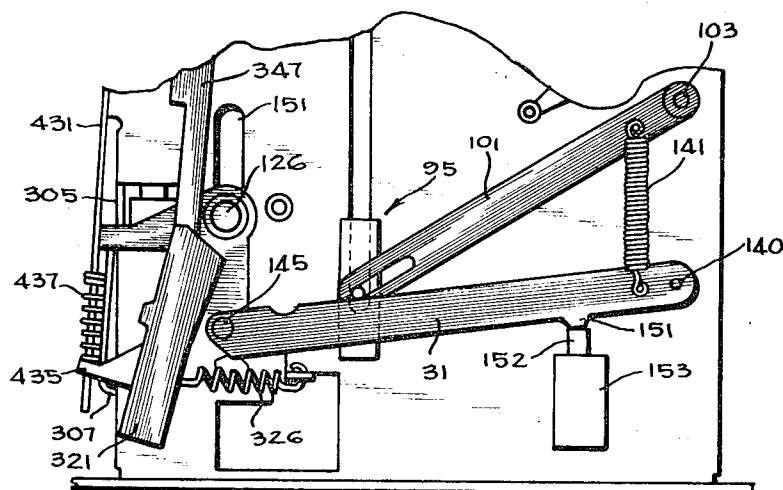
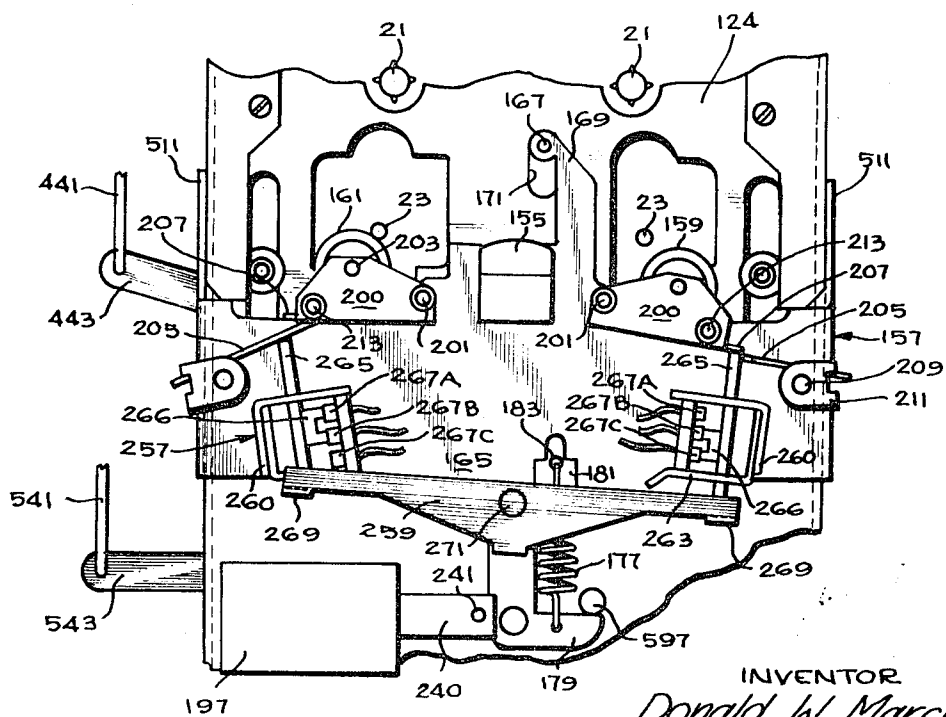
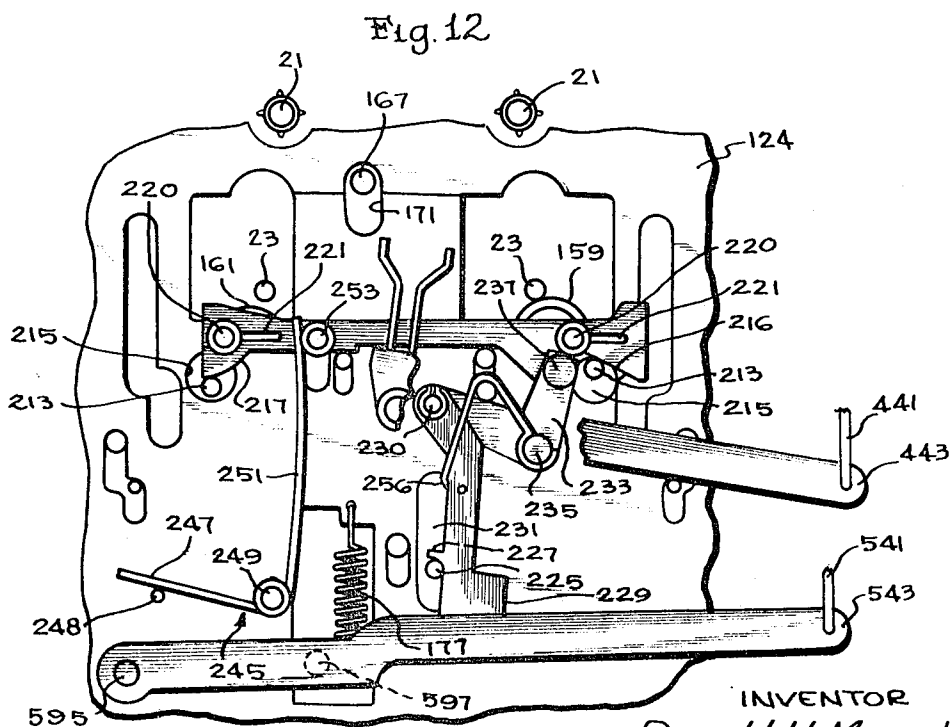
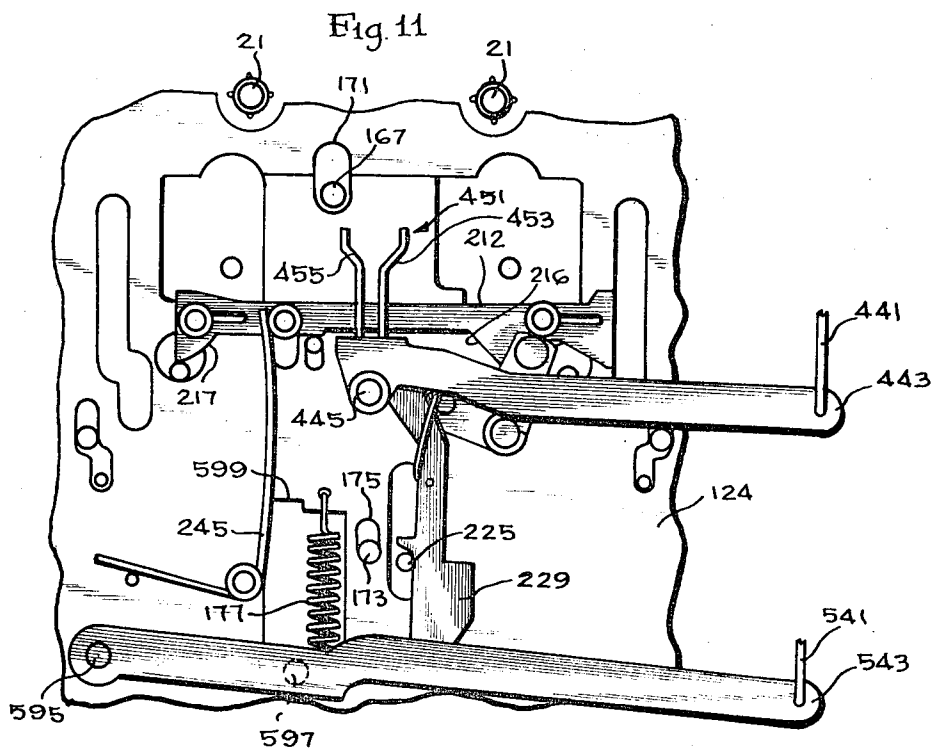


Fig. 10



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Fig. 13

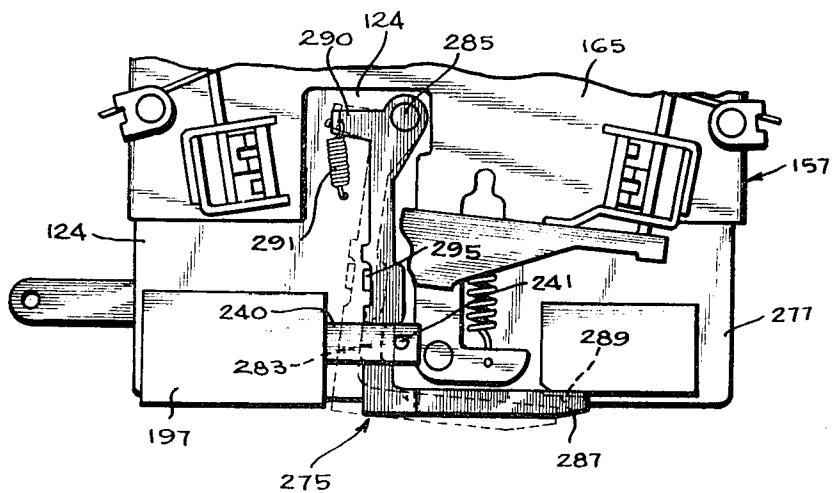
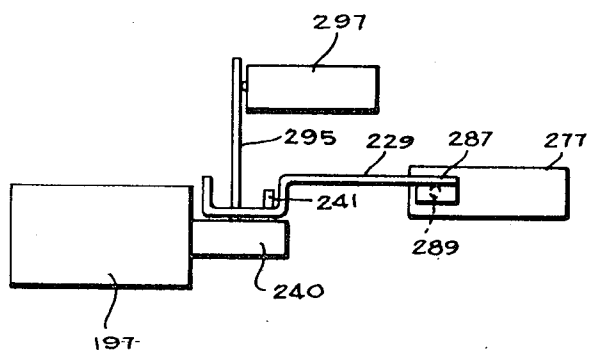


Fig. 14



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Fig. 17

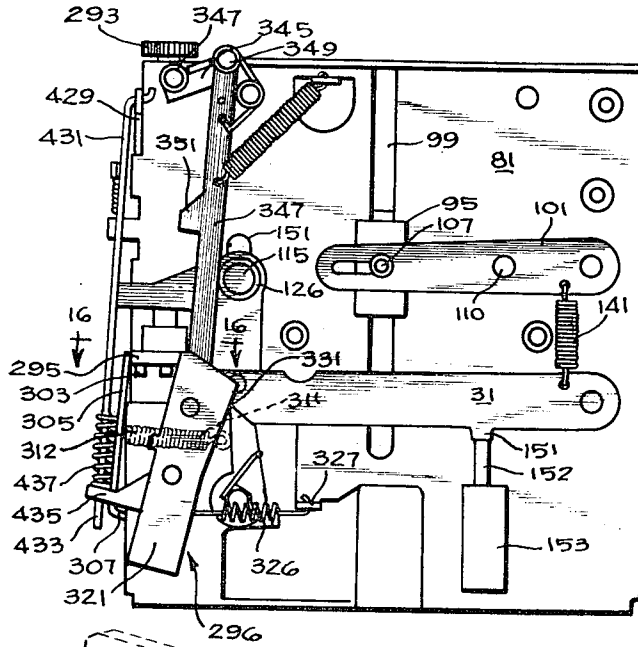


Fig. 15

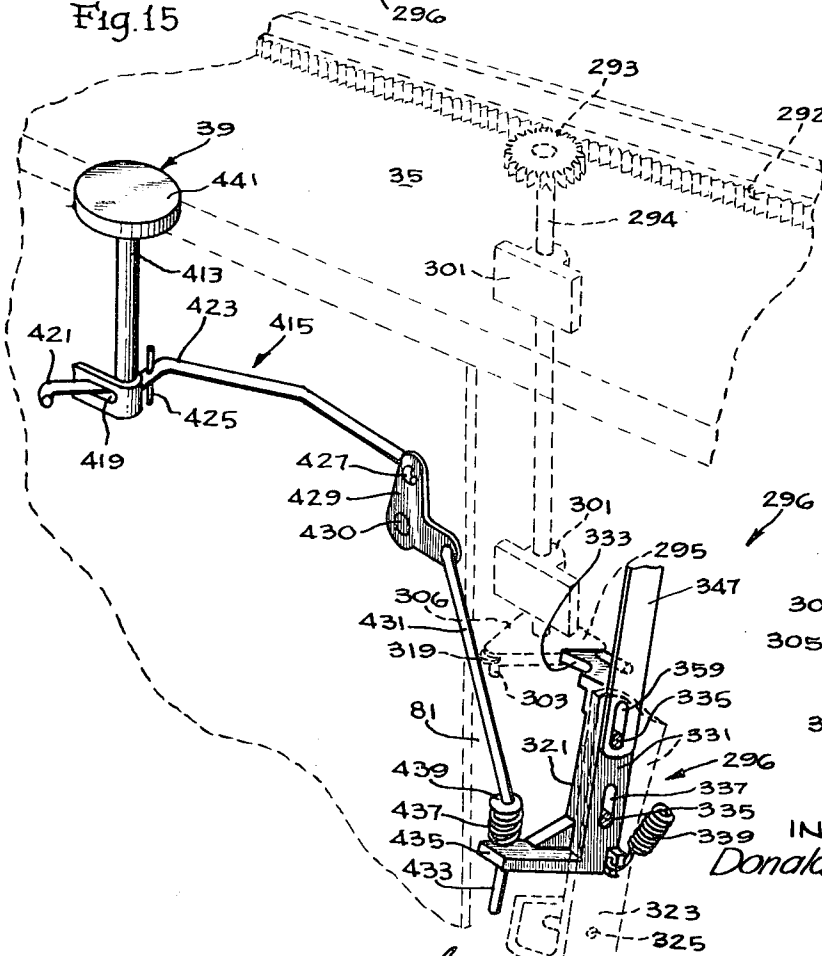
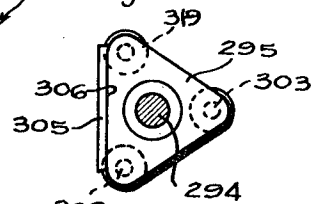


Fig. 16



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Fig. 18

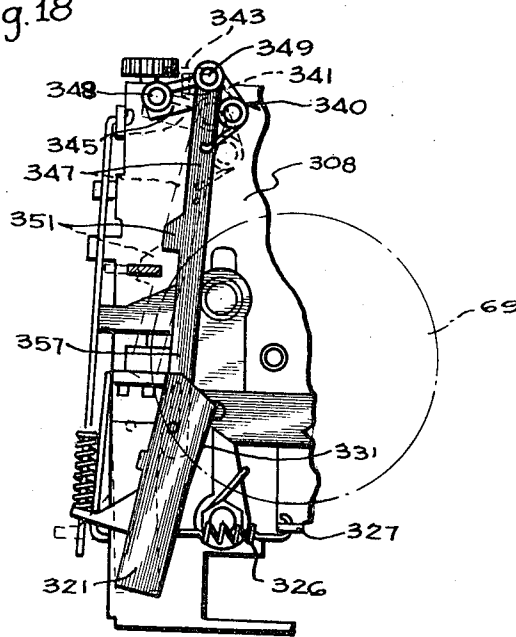
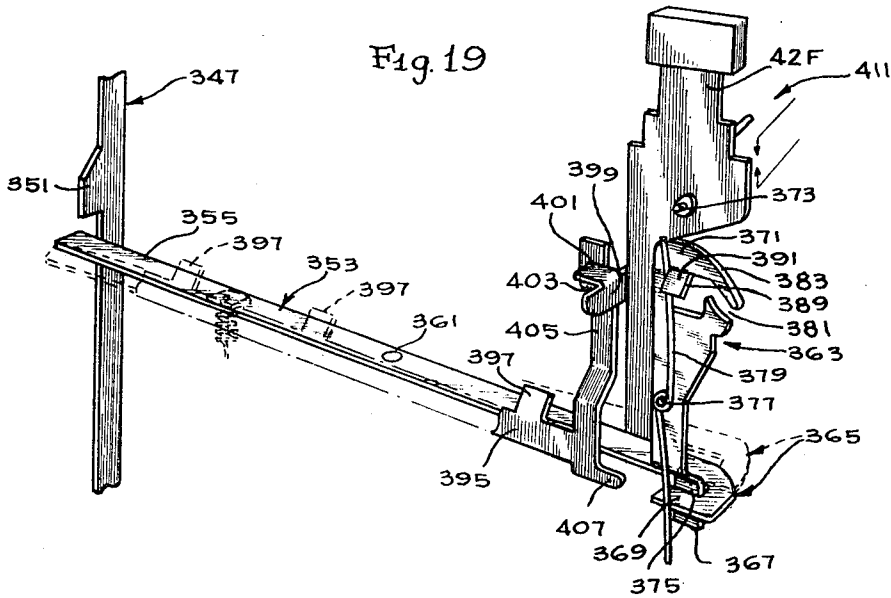


Fig. 19



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Fig. 20

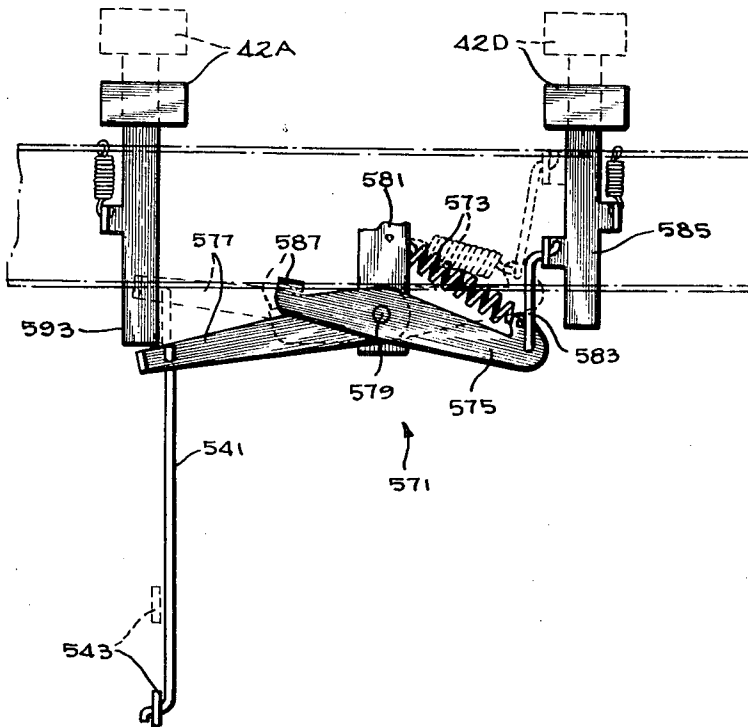
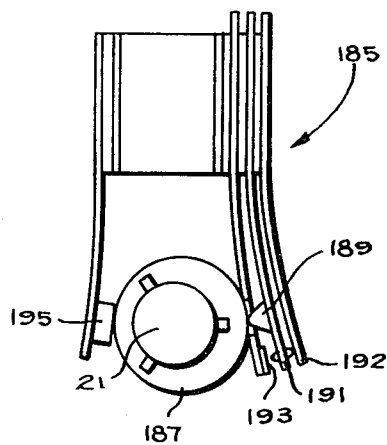
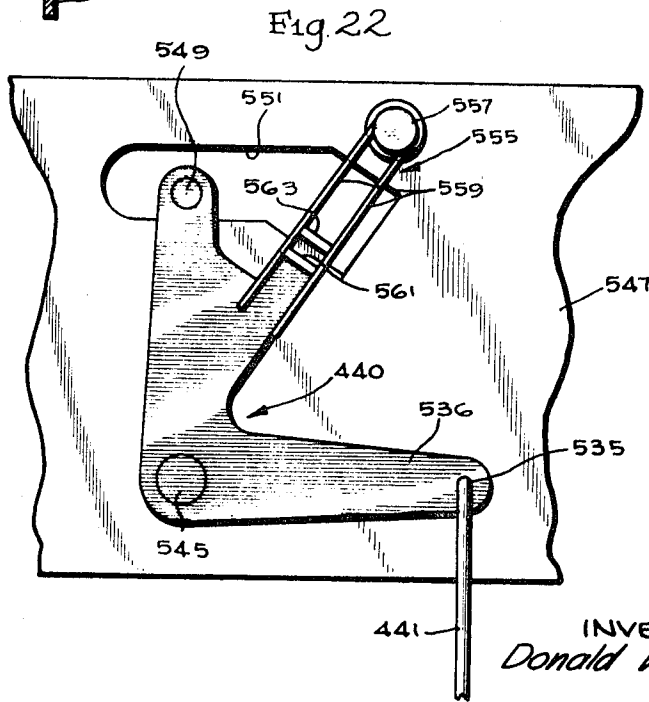
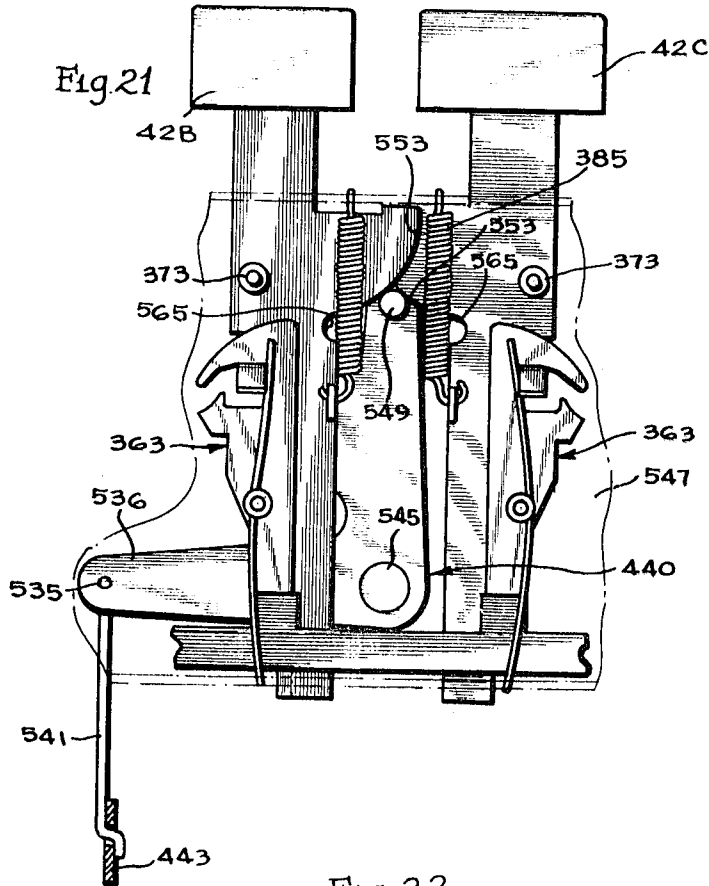


Fig. 20A



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Fig. 23

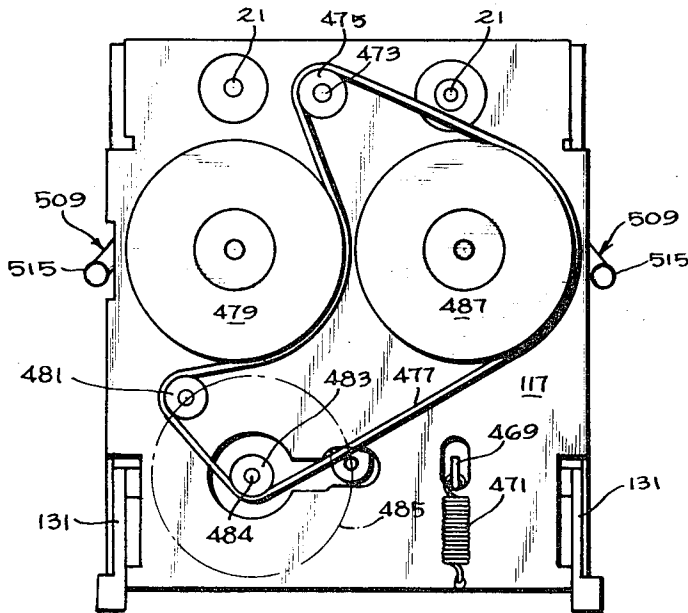
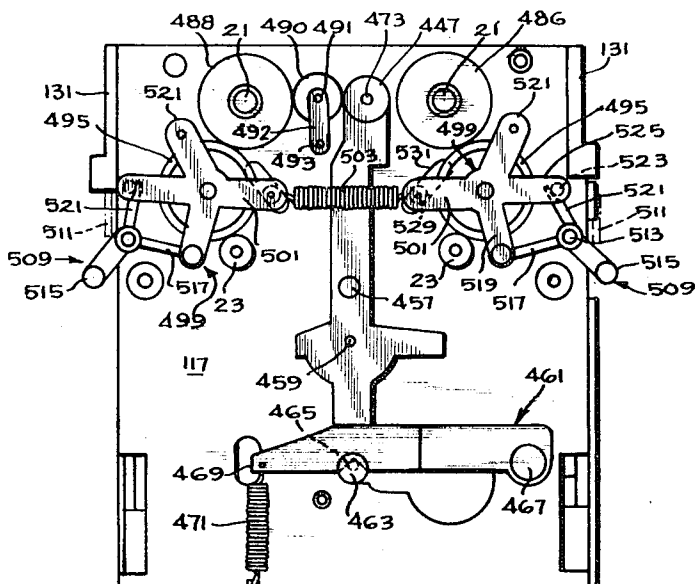


Fig. 24



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CASSETTE LOWERING AND RELEASE MECHANISM

This invention relates to a cassette changer having a magazine for storing cassettes which are movable by a transport from a storage position within a magazine to an operative playback recording position at which a sound system and tape drive are effective and, more particularly, to the transport itself.

In a known cassette changer, the cassette transport comprises a movable chassis which lowers the cassette to the playing position while inserting tape drive spindles into tape reels of the cassette and tape engaging capstans into engagement with the tape. The movable chassis is driven downwardly by a cam which stretches a pair of long centering springs attached to the movable chassis. During the terminal portion of lower movement, the movable chassis abuts and flexes a leaf spring beneath the movable chassis. The leaf spring is compressed as the movable chassis is driven toward the operative position at which the movable chassis is held by a latch against the urging of the centering and leaf springs. The stretching of these centering and leaf springs requires a considerable motor torque to drive the movable chassis and cassette to the operative position. Additionally, the movable chassis was driven to a position beneath the latch and then released for a slight return travel until caught by the latch. Such release and catching jars the mechanisms and the urging of the centering and leaf springs apply such forces that the movable chassis is difficult to unlatch for return movement.

Accordingly, a general object of the invention is to provide a simple and positive drive, as contrasted with the prior art, for a cassette movable chassis of the foregoing kind.

Other objects and advantages of the invention will become apparent from a detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a cassette changer apparatus embodying the invention;

FIG. 1A is a fragmentary, longitudinal cross-sectional view of the cassette storing magazine;

FIG. 2 is an enlarged partially broken away plan view of the cassette changer;

FIG. 3 is a partial, longitudinal sectional view showing the cassette storing magazine and the cyclically operable means for transferring cassettes to and from the playback or recording station;

FIG. 4 is a diagrammatic view of a cassette and pause carrier;

FIG. 5 is a fragmentary, diagrammatic view of means for moving a cassette holding bail;

FIG. 6 is a fragmentary, longitudinal cross-sectional view of the cassette storing magazine;

FIG. 7 is a cross-sectional view showing a movable chassis for receiving a cassette;

FIG. 8 is a fragmentary view of a mechanism for driving a movable chassis;

FIG. 9 illustrates the mechanism of FIG. 8 in another position;

FIG. 10 is a fragmentary view of a pause carrier;

FIGS. 11 and 12 illustrate two positions for a fast wind control lever and a pause control lever;

FIG. 13 is a diagrammatic view of a solenoid control switch lever and mechanism for causing a return of a cassette to the magazine;

FIG. 14 illustrates the positions of the switches controlled by the mechanism of FIG. 13;

FIG. 15 illustrates a pawl mechanism for moving the cassette storage magazine;

FIG. 16 is a fragmentary view of a triangular shaped cam member;

FIG. 17 illustrates the pawl mechanism and an automatic shut-off mechanism for the cassette changer;

FIG. 18 illustrates the automatic shut-off mechanism of FIG. 17 in an operated position;

FIG. 19 illustrates means for releasing push button selectors by the shut-off mechanism of FIG. 18;

FIG. 20 illustrates a play/record and pause control mechanism;

FIG. 20A illustrates a tape sensing means;

FIG. 21 illustrates a forward fast wind selector and a reverse fast wind selector;

FIG. 22 illustrates a lever controlled by the fast wind selectors of FIG. 21;

FIG. 23 illustrates a fly wheel and a motor drive for the tape capstans and tape spindles; and

FIG. 24 illustrates a power roller for fast wind tape transport.

As shown in the drawings for purposes of illustration, the invention is embodied in a cassette changer 11 having a magazine 13 in which are stored a series of tape cartridges 15 of the cassette kind each having a pair of reels 16 and 17 (FIG. 4) between which is wound and unwound a tape 18. Each of the cassettes is carried by the magazine 13 into a transfer position for transferring from the magazine through a slot 19 (FIG. 3) to a movable chassis 20 which carries a pair of rotatable spindles 21 for penetrating the reels 16 and 17 and drive capstans 23 for engaging the tape.

In accordance with the present invention, the movable chassis 20 is driven downwardly by a motor drive means comprising a motor 25 (FIGS. 5 and 6) and a first cam 28 which causes a lever 31 to shift the movable chassis from the storage position in the magazine to the playing position. Means in the form of a switch 153 is provided for sensing the positioning of the movable chassis 20 at the operational position and for stopping further movement of the movable chassis 20 by disabling the motor drive means. As will be explained, the movable chassis is moved downwardly smoothly and evenly to the position for playback or recording without compressing a return spring as in the prior art and it is the cam 28 itself which lifts the movable chassis from its lowermost position rather than a return spring as in the prior art. That is, when the motor drive means is again operated, it positively drives the movable chassis and cassette upwardly to the magazine rather than unlatching a return spring force to lift the chassis initially.

Referring now in greater detail to the individual elements of the invention, the cassette changer includes a main frame having a top plate 35 on which are disposed a number of selector switches for conditioning the cassette player in the desired mode of operation. In this embodiment of the invention, a first selector switch 39 is in the form of a rotary knob which may be turned to positions as follows: a repeat position A which results in a cassette being repeated; an "auto" position B in which each cassette in the magazine is played and both sides or tracks of the tape are played; a "side one" position C in which the changer is conditioned to play only the first side or track of each of the cassettes in the magazine; and a "side 2" position D in which the changer is conditioned for playing only the second side or track of the cassettes in the magazine.

To indicate which side or track of the tape is being played, a first "side one" lamp 40 or a second "side two" lamp 41 is lit on the control panel 35. As will be explained, these lamps 40 and 41 signify which side of the tape is being played and in which direction the tape is moving.

To control other functions of the record changer, there are provided other operator controls or selectors in the form of push buttons on the control panel 35. A first push button 42 is a "record" push button which, when depressed, places the changer in the mode for recording on the magnetic tape 18. The next push button 42A is labeled "pause" and it may be operated to interrupt playback during any particular portion of a playback or recording operation. The next buttons 42B and 42C will, when operated, result in a fast wind of the tape in the direction indicated by the arrows thereon at a speed faster than the normal operational speed. A reject button 42E is provided which, when operated, causes the cassette 15 to be immediately ejected and returned from the operational position to the storage position in the magazine 13. A play/record button 42D must be depressed to cause either a playback or recording operation. The next push button 42F operates an

"off"/on" switch which, when depressed, is in the "on" position for connecting the electrical power source to the motor drives for the cassette changer.

The magazine 13 for shifting each of the various cassettes 15 placed therein into the transfer position over the slot 19 is in the form of an open tray having vertical side walls 45. A plurality of compartments are formed within the tray by vertically disposed rib partitions 47 formed in the longitudinal side walls. The cassettes are inserted into the compartments and are spaced by the rib partitions 47 with the tape 18 facing downwardly.

The magazine 13 is disposed for sliding along and between a pair of longitudinally extending walls 49 defining opposite sides of an open magazine receiving chamber and is guided by projecting tongues 51 fixed to the outer and lower edges of the longitudinal magazine side walls 45 and projected into grooves 53 in the stationary frame of the changer. The tongues 51 rest on the lower edges of the grooves and slide freely thereon to guide the magazine for straight line travel along a path during which each of the compartments therein will be aligned with the transfer slot 19 in a stationary, horizontally disposed plate 55 beneath the movable tray. The bottom of the magazine 13 is also open and allows the lower edges of the cassettes to rest on a pair of parallel support rails 56 which are fixed to the plate 55 and extend longitudinally beneath the magazine throughout its length of travel except for the openings which interrupt the rails 56 at the transfer slot 19.

For the purpose of selectively releasing each cassette for transfer through the slot 19, the cassettes 15 are releasably supported at one lower edge, as best seen in FIG. 5, by a support bail 59 which is pivoted from its supporting position to a release position in which it is spaced laterally from the cassettes 15 and permits the cassette to drop through the slot 19. The cassette support bail 59 is pivotally mounted by upwardly extending arms 61 disposed along the vertical sides of the cassette changer having inwardly bent arms or ends 63 pivotally mounted in sockets formed in the interior of end side walls 45 of the magazine. The support bail 59 is located at the interruption in the parallel support rails 56, i.e., at the transfer slot 19, so that pivoting of the support bail results in the bottom of the cassette being unsupported and falling freely downwardly.

To release the cassette 15 at the appropriate time and to return the support bail 59 to its support position to prevent an operator from inserting and superimposing a second cassette through the vacated compartment and against the inserted cassette, the support bail 59 is driven from its support position to its release position and then returned by means driven by a bail control cam 65, which is best seen in FIG. 5. The bail control cam 65 is formed as a groove defined by opposite side walls 67 on a rearward, i.e., facing the magazine, side of a gear 69 driven through a small gear 70 and a large gear 71 fixed to a common shaft 72 with the large gear 71 being driven by a pinion 73 of the motor 25. As the gear 69 and its cam 65 turn, the latter displaces a cam follower in the form of a roller 75 (FIG. 5) carried on a lower arm 77 of a bellcrank lever 79 pivoted on a horizontal shaft fixed to a vertical plate 81. The bellcrank carries a bifurcated leaf spring 83 which is attached at a post 85 to the upper arm of the bellcrank to move therewith. The bifurcated ends of the spring 83 straddle a pin 87 fixed to an actuating lever 89 which is pivoted to its lower end to the inner, rear side of the vertical wall 81. The pin 87 projects through an arcuate slot 91 in the wall for arcuate travel in response to the yielding force applied thereto by the spring 83. The upper end of the lever 89 has a fork which receives the support bail 59 and forces the latter to pivot about its upper intumed ends 63 between cassette supporting and release positions. To release the cassette, a turning of the cam 65 forces the cam follower 75 to pivot the lower arm of the bellcrank 79 upwardly and cause the spring 83 to urge the pin 87 and lever 89 to turn in a clockwise direction as viewed in FIG. 5 with the result that the support bail 59 pivots to release the cassette for dropping downwardly. After a dwell period, the cam 65 will cause the support bail to pivot back to

a position beneath the vacated compartment to prevent any one from accidentally inserting a second cassette into the transfer slot 19 through the vacated magazine compartment.

The cassette being transferred drops but a short distance from the support bail 59 and into abutment with a laterally projecting foot 93 of a slider elevator 95 which lowers the cassette during this portion of the cassette changer operation and, as will be explained later, serves to return and lift the cassette to return the same to its storage position within the magazine 13 at the end of a changer cycle. The elevator slider 95 is guided for translatory vertical movement by means of vertically disposed webs 97 (FIG. 5) thereon which are disposed for sliding on opposite sides of the transverse vertical wall 81 in which is formed a vertical slot 99. A portion of the elevator slider 95 projects through the slot. The elevator is driven by means of a cam operated lever 101 which is pivoted at one end on a pivot pin 103, as best seen in FIG. 5, fixed to the vertical wall 81 and which has an elongated slot 105 formed in its other end for receiving a connecting pin 107 fixed to the elevator slider. At this connection, the pivotal movement of the elevator lever 101 is converted into vertical reciprocating motion of the slider 95 without binding. The elevator lever 101 is pivoted in response to turning of cam 27 fixed to a forward face of the gear 69. More specifically, the elevator lever 101 is biased by a spring 141 to urge a cam follower roller 110 against the top surface of the rotatable cam 27.

During the initial portion of the cycle of the cam 27, the elevator slider 95 and the cassette resting thereon move downwardly and the cassette is lowered onto a pair of support tubes 111 and 112 which telescope on horizontally disposed rods 114 and 115 fastened to a vertically disposed main plate 117 of the movable chassis 20. During this downward movement, the cassette is also held against lateral shifting relative to the support tubes 111 and 112 by means of a pair of side guides 119, as best seen in FIG. 7, which have vertically extending grooves 121 to receive and limit any tilting or pivoting movement of the cassette from a substantially straight vertical plane. Also as best seen in FIG. 7, the support tubes 111 and 112 are cylindrical in shape with a circular flange 122 formed thereon at one end. The circular flanges are inserted into vertical guide slots 123 formed in the guides 119 adjacent a stationary, vertically disposed support wall 124. As will be explained in greater detail, the support rod 115 projects beyond the support tube 112 and spans the cassette receiving space to a connection with a vertically slidable pin 126 guided for vertical translation in a slot 127 in the wall 81.

The cassette 15 is thus supported on the support tubes 111 and 112 of the movable chassis 20 for downward movement therewith while the tape feed spindles 21 penetrate into the openings in the reels 16 and 17 and the capstans 23 penetrate the cassette adjacent the tape 18. To achieve these ends, the movable chassis 20 is articulated to the main cassette changer frame side plates 130, as best seen in FIG. 3, by a parallelogram linkage formed by two sets of vertically spaced links 131 disposed on opposite sides of the movable chassis main plate 117. The links 131 are pivotally mounted on studs 133 at their lower ends and angularly upward to pivot pins 135 fixed to side brackets 137 fastened to the vertical side edges of movable chassis main plate 117. As the movable chassis 20 moves downwardly, the links pivot in the clockwise direction, as viewed in FIG. 3, and cause the spindles 21 and the tape capstans 23 on the movable chassis to project through openings in the stationary wall and to approach the plane of the cassette 15 and penetrate the cassette while descending at the same rate as the cassette resting on the support tubes 111 and 112.

The movable chassis 20 and the cassette 15 thereon are smoothly and quietly driven to and positioned in its final operative playing position by the drive means which includes the cam 28 and the lever 31 driven thereby. The cam 28 is fixed to a large gear 137 (FIG. 6) which is meshed with and driven by the gear 69 which, it will be recalled, is driven through a gear train by the motor 25. The gear 137 and the cam 28 are mounted for rotation about a mounting shaft 138

fixed to the vertically disposed frame plate 81. The chassis moving cam 28 controls the pivotal movement of a chassis actuator lever 31 which is pivoted at one end on a post 140 fixed to the frame plate 81 and is biased upwardly by a contractile spring 141 hooked thereto at its lower end and hooked at its upper end to the elevator actuator lever 101. A cam follower roller 143 (FIG. 8) projects laterally from the lever 31 to engage the periphery of the cam 28 at a point beneath the cam. The outer end of the lever 31 carries a laterally projecting drive pin 145 fastened to the lower end of a vertically disposed slider link 149 to which is fastened to the sleeve 126 into which projects the rod 115 of the movable chassis. The sleeve is disposed within and constrained for vertical sliding by a vertically elongated slot 151 in the wall 81. During the initial downward pivoting of the lever 31, a lost motion movement occurs as the drive pin 145 slides down within the lower elongated slot 147 without a concurrent movement of the link 149 until such time as the drive pin abuts the bottom of the lower slot 147 and pulls the link 147 down. Simultaneously, the link 149 pulls the slidable sleeve 126 and rod 115 down and thereby causes the movable chassis 20 to descend by pivoting on the parallelogram linkage. This pivoting motion swings the movable chassis toward the plane of the cassette and inserts the spindles 21 into the cassette reels 16 and 17 and the tape capstans 23 into the tape cassette 15.

The movable chassis 20 continues to descend to a position at which the lever 31 brings a switch actuator foot 151 into operative engagement with a plunger 152 of a switch 153 which is operated thereby to open the drive circuit for the motor 25. The motor 25 stops turning the cam 28 and movable chassis stops descending and is in its operational position.

With the movable chassis 20 in the operational position, the cassette 15 is positioned for playback or recording with feeding of the tape 18 past a transducer head 155 carried on a pause carrier 157 which forms a tape feed nip with the capstan 23 on the movable chassis. Also as will be explained in greater detail, a reverse feed pinch roller 161 is mounted on the pause carrier 157 to form a nip with the other capstan 23 for feeding the tape in the reverse direction. The pinch rollers 159 and 161 are so controlled that only one of the pinch rollers and only one of the two tape drive spindles 21 is in driving engagement for feeding the tape at one time. In this instance, the forward drive of the tape is accompanied by the spindle 21 driving the cassette reel 16 to take up tape unwound from the reel 17 and feed the pinch roller 159 and capstan 23 past the transducer head 155.

The pause carrier 157 is mounted for sliding movement in the vertical direction between the operational position in which one of the pinch rollers 159 or 161 is in driving engagement with the tape and the sound transducer head 155 engages the tape, as shown in solid lines in FIG. 4, and the pause or inoperative position in which tape transport is stopped since the pinch rolls 159 and 161 are spaced from the tape, as shown in the dotted line position in FIG. 4. The pause carrier 157 includes a vertically disposed plate 165 which has a central flat portion disposed adjacent and parallel and closely adjacent the vertical wall 124, as best seen in FIGS. 3 and 10. The pause plate 165 is guided for sliding vertical movement on the stationary wall 124 and is accurately located relative to the cassette by means of guide roller means including an upper guide roller 167 (FIG. 10) projecting laterally from an upper finger 169 on the pause plate 165 and positioned thereon sliding within a vertically elongated aperture 171 in the fixed wall 124. As best seen in FIG. 11, lower guide roller 173 is fastened to the pause plate 165 and is inserted into and constrained for sliding in a lower vertically elongated slot 175 in the fixed wall 124. Thus, the pause carrier is guided along a straight line vertical path and is limited in its upward or downward movement by the guide rollers 167 and 173 abutting the ends of the vertically elongated slots 171 and 175.

The pause carrier 157 is preferably biased to the operative play/record position by means of a contractile spring 177 which is fastened at its lower end in a spring retainer opening

in a laterally extending foot 179 on the lower end of the pause carrier plate 165. The return spring 177 is positioned within an opening 181 in the pause carrier plate with its upper end extending laterally and hooked in a hole 183 in the wall 124. Thus, the pause carrier plate is biased to move upwardly into its operational position by the contractile spring. As will be explained hereinafter, the forward drive pinch roller 159 is positioned to form a nip with its associated capstan 23 to cause track one of the tape to be driven past the sound transducer head 155.

A tape sensing means 185 (FIG. 20A) functions to detect when one side or track of the tape 18 is completely played and operate a circuit to cause a reverse feed of the tape and a playing of the second side of the tape in the usual mode of operation. More specifically, the preferred tape reels 16 and 17 have the tape 18 anchored to the respective reels so that when the play out reel slows down or completely stops by virtue of one unwinding all the tape therefrom, the motion of the tape reel and the drive thereof is sensed by the sensing means 185. In this instance, the drive between the spindles 21 and the reels 16 and 17 is through a friction clutch so that arrest of the tape reel by the tape slows down the spindle 21 and an eccentric cam 187 fixed to the drive spindle for rotation therewith. When the eccentric cam 187 is rotating with the spindle, it engages a contact swinger cam 189 on a swinger contact 191 and causes a circuit to be made first with one contact 191 and then with another contact 192. Engaging the opposite side of the eccentric cam 187 and counterbalancing the effect of the swing cam is a brake member 195. As the eccentric rotates it operates the contact swinger to alternately make and break the sets of contacts which are connected in a suitable circuit such as disclosed in copending application entitled "Control Circuit for a Bi-directional Recorder," U.S. Serial No. 875,209 filed Nov. 10, 1969, which is hereby incorporated by reference as if fully reproduced herein.

During each rotation of the cam 187, capacitors (not shown) connected to the set of contacts 191, 192 and 191, 193 are charged and discharged and hence do not come up to a sufficiently high voltage to operate a switching system for reversing the tape feed. However, when the tape spindle stops at the end of the rotation or slows down sufficiently, the capacitors have sufficient time to come up to a voltage which will cause operation of a circuit to energize a solenoid 197 and to cause a shifting of the circuits for the transducer head 155. As will be explained, operation of the solenoid 197 causes the pinch roller 159 to shift downward to an inoperative position and the reverse feed to shift pinch roller 161 to shift up into operative engagement with the tape 18 and form a tape feeding nip with the other capstan 23 of the cassette 15.

Turning now more specifically to the construction and the operation of the pinch roller 159 and 161, they are similar in construction and in operation and are both mounted for pivoting from an operative tape feeding position to an operative non-feed position. As best seen in FIG. 10, the pinch rollers are carried in channel-shaped brackets 200 which are pivotally mounted on the posts 201 which are fixed at their inner ends to the pause carrier plate 165. The pinch roller brackets 200 have a pair of vertically extending side walls which are apertured to receive and journal pinch roller axles 203 for the pinch rollers which freely rotate about the axles when engaging with the tape. The pinch rollers project partially into the open channels and partially thereabove to be in position for engagement with the tape 18. The respective pinch roller brackets 200 are biased toward the tape by biasing means in the form of coil torsion springs having an elongated leaf or end 205 extending to the underside of a pad 207 formed on the outer end of the respective pinch roller brackets 200. The coiled torsion springs are wound about posts 209 fixed to the pause carrier plate 165 and having a smaller short end which is inserted into an opening and bears against a top wall of a spring support bracket 211 which is also suitably attached to the pause plate 165.

The pinch rollers 159 and 161 are selectively positioned into the operative tape feeding position by means of a cam slider 212, as best seen in FIGS. 11 and 12, carried on the reverse side of the stationary vertical wall 124. Each of the pinch roller brackets 200 is provided with a cam follower pin 213 which projects through the pause plate 165 and also through circular openings 215 in the wall 124 for selective and operable engagement with opposed cam surfaces 216 and 217 on opposite ends of the cam slider 212. The cam slider is preferably in the form of an elongated slider which is constrained for generally horizontal translation by means of stationary pins 220 fixed to the wall 124 and each projecting into one of a pair of spaced, elongated and generally horizontally extending slots 221 in the cam slider 212. Suitable washer-like members hold the cam slider from moving longitudinally along and off the pins 220.

In the illustrated embodiment shown in FIG. 12, the cam 217 is abutting and holding downwardly the cam follower to space the forward drive pinch roller 159 from the tape and the opposite cam 216 is to the right of its follower 213 attached to the pinch roller bracket for the reverse drive pinch roller 161 so that the spring 205 may raise it as indicated by the upper position of the cam follower 213 adjacent the inclined cam 216. Thus, a reverse tape drive will be taking place as best seen in FIG. 10 with the pinch roller 161 disposed to define a nip with the capstan 23 to drive the tape past the transducer head. By shifting the cam slide 212 to the left as viewed in FIG. 12, the cam 216 will force the follower 213 attached to the reverse drive bracket to pivot it down and space the reverse feed pinch roller 161 from the tape 18 while the inclined cam 217 moves to the left and allows the spring 205 to pivot the forward pinch roller 159 upwardly.

From the above, it will be seen that the positioning of the cam slider 212 controls which of the tape tracks is driven past the sound transducer head 155, and the means for shifting of the cam slider 212 will now be explained in detail. During the downward movement of the movable chassis 20, a pin 225 (FIGS. 3 and 12) projecting from and fixed to the movable chassis plate 117 was brought into engagement with the upper side of a tooth 227 of a pawl 229 and forced the pawl downwardly while the pin moved down within an open slot 231 in the stationary wall 124. The upper end of the pawl 229 is pivotally mounted on a stud 230 carried on an arm of a bellcrank 233, and through the stud 230 the pawl pulls the bellcrank to pivot counterclockwise about a stud 235 fixed to the wall 124. The upper end of the bellcrank 233 is connected at a pin 237 to the cam slider 212 to force the same to the left as viewed in FIG. 12, when the pawl 229 is driven down so that the cam 217 is positioned to the left of the cam follower 213 for the pinch roller 159. Thus, the forward feed pinch roller 159 will be lifted into its upper feeding position under the influence of its biasing spring 205. Also at this time, the cam surface 216 will be abutting the follower 213 for the bracket containing the reverse feed pinch roller 161 and the latter will be cammed downwardly away from the tape 18. This position remains throughout the feeding of the first side of the tape until the tape sensor means 185 operates the solenoid 197 to reverse tape feeding directions and to cause a change of read out portions on the tape transducer head 155 so that the second track will be read.

As previously explained, the solenoid 197 is operated in response to the tape sensing means 185 indicating that the tape has been played through the first track. With operation of the solenoid 197, as best seen in FIGS. 13 and 14, the solenoid retracts its plunger 240 and an operating pin 241 on the plunger projecting toward the wall 124 abuts and pivots the pawl 229 (FIGS. 11 and 12) away from the pin 225, that is, in a counterclockwise direction as seen in FIG. 12, to a position in which the pawl 229 is unlatched from the pin and the tooth 227 is spaced laterally of the pin 225. The pawl is immediately raised above the pin 225 by a biasing means in the form of a wound torsion spring 245 acting on the cam slide 212 and through the bellcrank 233 to the connected upper end of the

pawl 229 pivoted thereto at the pivot stud 230. More specifically, the cam slider 212 is slid to the right as viewed in FIG. 12 to pivot the bellcrank 233 in a clockwise direction to lift the upper end of the attached pawl 229. The torsion spring 245 for shifting the cam slider has one end 247 held against the top side of a pin 248 secured to the wall 124 and a center coil about a stud 249 fixed to the wall 124 and has an upstanding end 251 abutting the left side of a roller 253 carried on the cam slider 212. It will be recalled that the coiled torsion spring 245 was compressed when the cam slider was moved to the left as a result of the pin 225 on the movable chassis engaging the pawl 229 and forcing it down. The pawl 229 is returned into alignment with the slot 231 to be in position for engagement with the driving pin 225 on the next lowering of a cassette during a subsequent cycle by a hairspring 254 which has one end fastened to the stud 235 and another end 256 hooked into the pawl 229.

The shifting of the tape feed means to feed the tape in reverse direction is accompanied by a switching of the sound transducer head circuitry, which is disclosed in copending application entitled "Track Selector System For a Cassette Playback Device," Ser. No. 877,971, filed Nov. 19, 1969, which is hereby incorporated by reference as if fully reproduced herein. As best seen in FIG. 10, means in the form of a rocker arm 259 and switches 255 and 257 operate the electrical circuitry to render active the portion of the transducer head for side two. Also as will be explained in connection with a pause operation, the switches 255 and 257 retain their respective positions during movement of the pause carrier 157 to and from the operational position and the remote pause position. The mutually exclusive operation of the switches 255 and 257 is assured by the rocker arm 259 which mechanically moves the switches 255 and 257 in opposite directions.

The switches 255 and 257 are directional control switches in that each switch operates an associated sound system circuit path and also causes the forward or reverse indicator lamps 40 and 41 on the upper panel 35 of the cassette changer to indicate the direction of tape drive to the operator. These switches are generally similar, as best seen in FIG. 10, in that each is formed with a U-shaped bracket formed by a pair of angular shaped members having abutted vertically disposed legs 260 and spaced horizontally extending legs 263. The latter legs have vertically aligned slots therein through which project a vertical extending switch slider 265 which is movable vertically from a first (upper) position in which a U-shaped bus bar 266 thereon interconnects upper stationary switch contact 267a and intermediate switch contact 267b carried by the fixed brackets when its associated pinch roller is in a tape feeding position. The switch slider 265 is also movable to and from a second (lower) position in which the bus bar 266 thereon is connecting the intermediate contact 267b with a lower contact 267c.

The upper end of each switch slider 265 projects upwardly to the pad 207 of its associated pinch roller bracket 200 and has its lower end extending downwardly into engagement with a pad 269 disposed therebeneath and attached to the rocker arm 259. When the pinch roller bracket pivots downwardly towards the inoperative position, its pad 207 abutting the upper end of its associated switch slider 265 forces the slider downwardly relative to the fixed switch bracket and the lower end of the slider pivots its adjacent end of the switch reversing rocker arm 259 downwardly about the rocker arm's pivot post 271 which is fixed to the pause plate 165. The preferred form of rocker arm 259 is formed with generally horizontally extending lever arms so that as one arm goes down, the arm goes up and forces the other switch slider upwardly to the operative position to connect an upper contact 267a and intermediate contact 267b. Since there are no springs associated with either the switch sliders 265, the directional control contacts will remain in the same positions as the pause carrier 157 shifts between the operative and pause positions. Thus, the pinch rollers and switches 255 and 257 retain the previous direction

of tape feed and keep the proper tape feed direction lamp 40 or 41 lit, in the pause position, so that whenever the operator resumes operation, the tape transport will continue in the same direction with the circuits for the transducer properly conditioned to prevent magnetization thereof.

When track two is finished in the cassette with the tape wound on the reel 17, the tape sensing means 185 will detect the failure of the tape to continue movement and actuate the solenoid 197 for the second time to initiate a return of the cassette to its storage compartment. As will be explained, the solenoid 197 will close a circuit to start the motor 25 and cause the first cam 28 and the cam operated lever 31 to lift the movable chassis 20 to return the cassette 15 upwardly toward the magazine. More particularly, the pulsing of the solenoid 197 for the second time causes it to retract its plunger 240 and through its pin 241 pivot a switch actuating lever 275 (FIG. 13) from its solid to its dotted line position to cause operation of several electrical switches including a first switch 277. The switch actuating lever 275 has a clearance notch 283 for the solenoid plunger pin 241 so that during the first retraction of the solenoid plunger which released the pawl 229, the pin moved into the notch 283 and the switch lever 275 remained stationary. However, on the second solenoid operation, the pin 241 abuts the lever 275 and swings the same about its upper pivotal mounting post 285 which is fixed to the wall 124. On the lower end of the lever is a laterally and generally horizontally extending leg 287 which normally forces a switch operating button 289 of the first switch 277 upwardly into its housing. The lever leg 287 is biased against the switch housing by a contractile spring 291 which is connected at a lower end in an aperture in the wall 124 and which is connected at its upper end by a hook to a generally horizontally disposed arm 290 of the switch actuating lever 275.

When the solenoid 197 causes the lever 275 to pivot to the dotted line position, the switch button 289 moves to protrude from the switch housing and operate switch contacts to cause completion of a circuit for the motor 25. With the motor 25 energized and turning the cam 28, the latter causes the cam follower lever 31 (FIG. 8) to pivot upwardly with switch contact actuator 151 lifting from the operator 152 for the switch 153 which changes contacts to close a holding operating circuit for the circuit for the motor 25.

The switch actuator lever 275 is provided with additional switch actuator 295 (as best seen in FIGS. 13 and 14) which projects at right angles relative to the plane of pivotal movement of the switch actuator lever 275 and across the cassette receiving slot to operate a further switch 297 on the vertical wall 81 to close another holding circuit path for the motor 25. Thus, the holding circuit for the motor 25 is completed when the leg 287 of the switch actuating lever 275 returns to the solid line position shown in FIG. 13 and returns the button 289 into the switch housing and places the motor start switch 277 in an open condition.

With the motor 25 turning the cam 28, the latter pivots the lever 31 to cause the movable chassis 20 to rise and lift the cassette 15 resting on the support tubes 111 and 112. As the movable chassis rises, the parallelogram links 131 simultaneously retract the movable chassis plate 117 thereby retracting spindles 21 from the tape reels 16 and 17 and retracting the capstans 23 from the cassette so that the cassette is free for further lifting by the elevator 95 to the magazine 13.

Slightly after the movable chassis 20 returns to its upper position, the elevator lug 93 is brought into engagement with the underside of the cassette 15 by means of the upward movement of its lever 101 which is being pivoted upwardly by the cam 27 being turned by the motor 25 through appropriate gears. The elevator lug is driven through an upper stroke sufficient that the cassette 15 is lifted upwardly through the transfer slot 19 and above the cassette support bail 59 into one of the compartments 14. It will be recalled that during the time of playing, the cassette support bail 59 was blocking the transfer slot 19 to prevent an operator's superposing another cassette 15 onto the cassette which was playing. The cassette

support bail 59 is pivoted to uncover the transfer slot 19 by means of the bail control cam 65 which turns the bellcrank 79 to pivot the bail about its upper ends 63 on the cassette tray. Prior to a return down movement of the elevator, the bail control cam causes the cassette support bail 59 to swing under the now returned cassette 15. Then, the cam 27 lowers the elevator lug to position below the cassette and magazine path of travel while the returned cassette is held at one end by the bail 59 within its compartment in the magazine.

After return of one cassette 15 and the withdrawal of the elevator lug 93 from the magazine, the magazine 13 is automatically stepped forward to position its next compartment 14 and a cassette therein, if any, over the transfer slot 19. It will be recalled that the magazine has longitudinally extending tongues 51 mounted for sliding in grooves 53 in the changer top wall. On the front side of the magazine adjacent one of the tongues is disposed a longitudinally extending rack 292 (FIG. 2) which is meshed with a rotatable drive gear 293 secured to an upper end of a vertical shaft 294 which has on its lower end a triangular member 295, as best seen in FIG. 15, adapted to be driven by a pawl mechanism 296. As will be explained, the cassette magazine travels through the exact distance of one compartment spacing with the turning of the triangular member through 120° by the pawl mechanism.

To assure that the triangular member 295 is to move the triangular member through at least 60° and that a centering spring arrangement including biasing member 305 bearing against a flat side 306 of the triangular member become operative to complete and to limit the turning to 120° to prevent misalignment of a magazine compartment 14 with the transfer slot 19. In the preferred spring biasing arrangement, the biasing member 305 is in the form of a lever which is pivotally mounted at its lower end by a pair of inturned integral projections 307 inserted into openings of a lower side wall 308. The biasing member 305 is urged against a flat side 306 of the triangular member 295 by means of a spring 311 having an upper end hooked in an aperture 312 in the biasing member 305 and extending downwardly and inwardly to a post fastened to stationary wall 81 of the cassette changer. To facilitate turning of corners of the triangular member 295 past the biasing member, rollers 319 are journaled at each of the corners of the triangular shaped member. These rollers reduce frictional retarding forces as the biasing member 305 is forced outwardly against the urging of the spring 311.

The preferred pawl mechanism 296 for turning the triangular member 295 includes a vertically disposed pawl 321 which is carried on a pawl carrier 323 which is pivoted at a lower U-shaped end thereof on a post 325 fixed to the stationary wall 81. The pawl carrier is normally biased to a position spaced from the triangular shaped member 295 by means of a spring 326 (FIG. 17) which is hooked at one end to the carrier and hooked at its opposite end to a bent tab 327 on the stationary wall 81. The pawl carrier is pivoted toward the triangular member when a cylindrical cam pin 329 formed on the gear 69, as best seen in FIGS. 6 and 18, engages an upwardly inclined cam surface 331 on the side of the pawl carrier and pivots it about its pivot post 325 against the urging of the spring 326 and swings the pawl thereon to abut a laterally extending pawl tooth 333 with the nib 303 positioned in front of the pawl tooth. The pivotal movement of the pawl carrier and pawl tooth is sufficient to turn the triangular member 295 through at least 60° to move a roller 319 to force the biasing member 305 outwardly from a flat side 306 of the triangular member with the roller moving past a dead center position with respect to the biasing member 305 whereby it then exerts a force to continue turning of the triangular member through the 120° and to limit the turning to exactly 120°.

The preferred form of feed pawl 321 is mounted for sliding vertical movement on the pawl carrier 323 from its normal operative position for engagement with the nibs 303 of the triangular member to a lower non-feeding position in which the pawl tooth 333 moves in a plane beneath the nibs 303. The feed pawl 321 is slidably mounted on the pawl carrier by a pair

of pins 335 which are fixed to the carrier and inserted into vertically elongated openings 337 in the pawl. The pawl is biased upwardly into the feeding position by means of a contractile spring 339 which is hooked at its lower end to a bracket portion of the pawl 321 and at its upper end to a laterally extending lug on the pawl carrier. Thus, the pawl is urged upward to seat the lower ends of the elongated slots 337 on guide pins 335 carried by the pawl carrier 323.

In the usual mode of operation, the magazine 13 is moved step by step by the 120° turnings of the gear 293 to shift each of the successive cassette storage compartments over the transfer slot 19. Movement of the magazine to position the last compartment at the transfer station conditions an automatic shut-off mechanism 340 (FIG. 18) to terminate operation of the cassette changer and then after the return of this last cassette to the last of the magazine chambers, the cassette changer operation is terminated.

Referring now to FIG. 18, the illustrated shut-off mechanism is conditioned by means of a depending cam 341 fixed to the underside of the tray-like magazine 13. The depending cam is preferably in the form of a vertically disposed pin fixed to one end of a leaf spring 343 fastened to the underside of the magazine. The cam pin is carried by the magazine when shifting its last compartment to the transfer station to a position to strike the upper side of a pivotally mounted conditioning lever 345 which is journaled on a post 348 fixed to the stationary vertical wall 308 of the cassette changer. As the cam pin strikes the upper side of the conditioning lever, the latter pivots downwardly in a clockwise direction as viewed in FIG. 18 about its pivot post and swings downwardly a conditioning link or driver 347 which is pivotally connected thereto by a pivot pin 349.

Formed generally centrally of the elongated conditioning driver 347 is a laterally extending drive lug 351 which is normally disposed in a plane above the adjacent end of an automatic shut-off lever 353 for non-engaging travel above the shut-off lever until the driver 347 is shifted downwardly by the cam pin 341. More specifically, when the conditioning lever 345 is pivoted downwardly by the cam pin, the driver lug 351 on the driver is lowered into a horizontal plane for subsequently engaging and pivoting an end 355 of the shut-off lever, as best seen in FIG. 19.

The conditioned driver 347 is driven laterally to pivot the shut-off lever to a position, shown in phantom lines in FIG. 19, by the pawl mechanism 296 which normally functions to step the magazine forwardly to position the next magazine compartment at the transfer station. The pawl mechanism, however, is disabled from turning the gear 293 by a pin 357 carried by the driver 347 into engagement with the top of the feed pawl 321 and forcing the feed pawl down to an inoperative position. As best seen in FIG. 15, the lower end of the driver 347 is disposed intermediate the feed pawl 321 and pawl carrier 323 and the lower end of the driver has an elongated slot 359 which receives an upper one of the extending pins 335 fixed to the pawl carrier and projecting laterally into vertically elongated slots 337 in the pawl 321. Thus, the pawl carrier acts through upper pin 335 which is in the slot 359 of the driver 347 to swing the lower end of the driver clockwise, as viewed in FIG. 15, WITH THE result that the driving lug 351 on the driver abuts and swings the end 355 of the shut-off lever 353 about vertically disposed, pivotal mounting post 361 (FIG. 19) therefor in a direction to release a latch pawl 363 holding the on/off push button selector 42F in a depressed actuated position. More specifically, the automatic shut-off lever 353 is formed with a hook 365 receiving a depending foot 367 on the latch pawl 363 to pivot the same. In this instance, the hook 365 moves in a horizontal plane which is substantially normal to the plane of the latch pawl 363 and the hook partakes of a substantial movement to bring a distal end 369 of the hook against the foot of the latch pawl and thereby pivot an upper head 371 of the latch pawl outwardly whereby a locking pin 373 on the push button selector 42F is free to rise from the latch pawl head. As will be more fully explained, a

slight depression and then release of the selector 42F also acts to shift the latch pawl 363 and release the same. An opening 375 in the hook 365 accommodates this amount of movement which is quite small in comparison to the movement of the hook by the automatic shut-off lever 353. Thus, the automatic shut-off lever is always in position for operating, but yet does not interfere with normal operation and release of the latch pawl 363 by a slight depression of the push button selector.

Most of the remaining push button selectors 42A, 42B, etc., are latched by a latch pawl similar to the illustrated latch pawl 363 and are pivotally mounted adjacent to their respective selectors on horizontally disposed pivot pins similar to an illustrated pivot pin 377 on which is mounted a return spring 379 for the latch pawl. Thus, a description of the on/off push button selector 42F and its latch pawl 363 will provide an understanding of the other push button selectors and their respective latch pawls. The upper head 371 of the latch pawl is formed with a hook-shaped opening or mouth 381 and with a top curved surface 383 to be engaged during a downward movement by the pin 373. Downward movement of the pin 373 against curved surface 383 cams the latch pawl counterclockwise as viewed in FIG. 19 until the pin 373 is aligned to enter the opening 381 whereby the flexed upper end of the torsion spring 379 pivots the pawl clockwise to capture the push button pin 373 and hold the push button against the upward pull of a contractile return spring 385 (FIG. 21) fastened at one end of the push button selector 42F and at another end to a stationary member 387. In this latched position, the pin 373 abuts a side 389 of a downwardly and forwardly inclined tab 391 on the latch pawl to limit the clockwise turning thereof until the push button selector is depressed for release, at which time the pin 373 moves down from engagement with the inclined tab allowing the torsion spring 379 to turn the latch pawl clockwise slightly to a position beneath the inclined tab whereupon the return spring 385 lifts the selector 42F with the pin 373 pivoting the latch pawl outwardly to its release position.

For the purpose of resetting the other push button selectors 42A, 42B, etc., which may have been operated at the time of automatic shut-off, the on/off selector 42F is provided with a release cam 393 which cams a release lever 395 which has a plurality of upstanding lugs 397 for pivoting to engage and rock each of the latch pawls to a release position to assure that its push button selector is released and returned by its return spring 385.

In this instance, the release cam 393 on the selector 42F includes an integral bent forward portion 399 from which extends a lateral tab 401 for engaging an inclined cam surface 403 on an upstanding finger 405 of the release lever 395. As the push button selector 42F rises, its lateral tab 401 abuts the inclined cam surface 403 and forces it rearwardly thereby pivoting the release lever 395 about a pivotal axis through a pair of pivot ears 407 thereon. As the release lever pivots rearwardly, the lugs 397 abut the feet of the associated latch pawls and pivot the lower ends thereof inwardly which results in the upper ends pivoting outwardly from the push button selectors. Thus, push button selectors such as the on/off push button selector 42F are simultaneously released and reset. Reset of the on/off selector 42F operates electrical contacts 409 to disconnect electrical power to the cassette changer which is thereby shut off.

It will be recalled that a repeat play of a cassette 15 may be instituted upon turning the rotatable selector switch 39 to position A on the control panel of the cassette changer. As will be explained in detail, turning of the selector switch to the repeat position disables the magazine feed mechanism and permits a repetitive cyclic playing of the cassette until the repeat selector switch is returned to its non-repeat position. That is, the magazine remains stationary while the cassette transfer mechanism including the elevator 93 moves through its usual and complete cycle of returning the cassette to its magazine compartment but, instead of feeding the magazine forwardly and extracting the next cassette, the previously played cassette

is again extracted and lowered to the tape transducer head 155 for another playback. When the repeat selector switch is returned to a non-repeat position B, C or D, the magazine feed means is enabled to shift the magazine and bring the next compartment and the next cassette into the transfer station.

The selector switch 39 includes a manually turnable knob 411 (FIG. 15) projecting above the top plate 35 of the cassette changer and a vertically disposed shaft 413 which is attached to the knob and journaled for turning in the top plate. The shaft 413 extends below the top plate and operates a linkage 415 to shift the feed pawl 321 down to the disabled position in which the magazine will remain stationary when the feed pawl 321 is actuated. On the lower end of the selector shaft 413 is a selector arm 417 which is provided with a lost motion connection to the linkage 415 so that the selector arm operates the linkage only when the selector is shifted to position A for a repeat operation. The lost motion connection is constituted by an elongated slot 419 through which projects an end 421 of a selector link 423 which is in the form of an elongated bent wire with an offset end inserted through the elongated slot 419 in the selector arm. When the selector arm is turned by the knob 411 between ones of several arm is turned by the knob 411 between ones of several non-repeat positions B, C or D, the selector link 423 remains stationary as the arm slides along the link at the slot. When the selector switch 39 is turned to the "repeat" position A, the selector arm 417 abuts a cross pin 425 fixed to and extending laterally from the selector link 423 and forces the selector link to the right as viewed in FIG. 15. The right end of the selector link is in the form of a hook 427 inserted into an opening of a bellcrank 429, the latter being pivotally mounted on a post 430 to convert horizontal movement of the selector link into a vertical movement of an attached repeat link 431 which is also in the form of an elongated wire having an upper end hooked to a lower arm of the bellcrank. A lower end 433 of the repeat link is inserted through an aperture in a horizontally extending foot 435 on the feed pawl 321, and a coiled spring 437 is seated atop of this foot and extends upwardly to abut a stop or washer-like member 439 which encircles the repeat link. The member 439 is limited in its upward travel on the link by a swaged portion on the link having a larger dimension than the dimension of the hole in the washer. Therefore, a downward movement of the repeat link 431 acts through the member 439 and spring 437 to force the feed pawl 321 to slide downwardly on a pawl carrier 323 to position the pawl tooth 333 beneath the nibs 303 on the triangular member 295. Thus, the magazine will remain stationary for each cycle of the cassette changer with the same cassette being returned to the magazine, lowered and replayed until the selector switch 39 is turned from the repeat position A. Such a turning of the selector switch 39 from the repeat position allows the compressed spring 437 and the pawl return spring 339 to act to force the repeat link 431 upwardly to pivot the bellcrank 429 and thereby return the link 423 to the left. Hence, the feed pawl 321 is in position to step the magazine upon the termination of the play of the cassette 15 in the cassette changer.

A fast wind of the tape may be initiated by operation of either the forward fast wind push button 42B for causing a high speed forward movement of the tape causing it to be wound on the reel 17 or a reverse fast wind push button 42C for causing the tape to be wound on the reverse reel 16. The fast wind push buttons 42B and 42C are interlocked with a play/record push button 42D so that immediately upon operation of one of the fast wind push buttons, the play/record operation at the lower speed is terminated and the pinch rollers 159 and 161 and transducer head 155 are shifted from the tape into the "pause" or standby mode prior to initiation of the high speed winding operation. If the pause carrier 157 is already in the pause, standby mode, the depression of a fast wind push button results in an immediate fast wind tape feeding operation. A fast wind operation terminates when the tape is completely wound on a reel or the operated push button 42B or 42C is returned to its unoperated position.

As best seen in FIGS. 21 and 22, each of the fast wind buttons 42B and 42C is operative to turn a bellcrank 440 to move vertically a link 441 which extends downwardly and is pivotally connected at its lower end to a fast wind lever 443, FIGS. 11 and 12. The fast wind lever is disposed generally horizontally and is pivoted on an outwardly, horizontally projecting pivot pin 445 fixed to a vertical stationary frame plate 124. The fast wind lever functions to swing a power roll 447 (FIG. 24) to drive the spindle 21 for the forward tape reel 16 or for the reverse tape reel 17. The fast wind lever is movable from a central idle or inoperative position, such as illustrated in FIG. 11, in which the power roll 447 is not effective to an upper forward position in which the power roll is shifted to drive the forward reel 16 or to a lower reverse position, such as illustrated in FIG. 12, in which the power roll is shifted to drive the reverse tape reel 17. As will be explained, the power roll 447 is carried on the upper end of a rocker arm or lever 449 (FIG. 24) carried on the outer side of movable chassis plate 117 of the movable chassis 20. It will be recalled that the movable chassis plate 117 is mounted by the parallelogram linkage including the links 131 (FIG. 3) to simultaneously lower the cassette as the chassis plate moves toward the plane of the stationary frame plate 124 carrying the fast wind lever 443.

To provide a yieldable interconnection between the fast wind lever 443 and the rocker arm 449, the fast wind lever carries a forked spring 451 (FIG. 11) having upper widely spaced ends 453 and 455 into the fork of which projects a pointed pin 457 (FIG. 24) fastened to the rocker arm when the chassis plate 117 carrying the rocker arm moves closely adjacent the stationary frame plate supporting the fast wind lever. Thus, the pointed pin 457 may be inserted and centered between the spring ends 453 and 455 and be engaged and turned by them to pivot rocker arm and thereby swing the power roll 447 from its centered idle position. The forked spring ends provide a non-positive and only a limited amount of force for urging the power roll into engagement with one of the reels, and this prevents generation of excessive lateral forces by the power roll which could not be overcome and which would result in a failure to achieve a high speed tape transport, as will be explained.

As best seen in FIG. 24, the rocker arm 449 for the power roll 447 is pivoted on a stud 459 fixed to the movable chassis plate 117 and is centered in the idle, non-driving position by a centering means which includes a spring biased centering lever 461. More specifically, the rocker arm is connected to the centering lever at the lower portion thereof which carries a turnable eccentric stud 463 which projects into a downwardly extending V-shaped notch 465 in the centering lever 461. The preferred V-shaped notch 465 is formed in the lower edge of the centering lever 461 with walls disposed at 45° to the vertical. The centering lever is pivotally mounted at one end on a pivot stud 467 fixed to the movable chassis plate 117 and its opposite end is bent to provide a laterally projecting hook 469 which projects at right angles to the plate 117 and through an elongated slot therein. As best seen in FIG. 23, the projecting hook 469 of the centering lever 461 is attached to the upper end of a vertically disposed contractile spring 471 which is hooked at its lower end to the movable chassis plate 117. The spring 471 is of sufficient strength to center the rocker arm 447 but yields readily when the forked spring 451 pivots the rocker arm pin 457. Upon release of the fast wind lever, the centering spring 461 returns the power roll 449 and rocker arm 449 to the centered, non-driving idle position. This idle position is maintained and precisely located by turning the eccentric stud 463 relative to the V-shaped groove in the centering lever 461 which thereby pivots the rocker arm to carry the power roll to the desired adjusted idle position.

In its preferred form, the power roll 447 has an outer small rubber tire and it is fixed to one end of an axle 473 which projects into and is journaled in a bearing disposed within an elongated bearing housing fastened to the upper end of the rocker arm 449. The bearing housing projects rearwardly through a

horizontally elongated opening in the movable chassis plate 117 for pivotal movement relative to the chassis plate with the rocker arm. The axle 473 carries at its other and opposite end an idler sheave 475 (FIG. 23) which is fixed to the axle to rotate it and the power roll and which receives a power input from a drive belt 477.

From the idler sheave 475, the drive belt 477 extends downwardly along the lower inside quadrant of a first fly wheel 479 fixed to the forward feed capstan 23 and about an idler roller 481 mounted for rotation on a shaft fixed to the plate 117 and then to the underside of a drive sheave 483 attached to a motor shaft 484 driven by an electric motor 485. The belt 477 is driven by the motor and moves about a flywheel 487 fixed to the reverse tape feed capstan 23. As the motor 485 turns, the large diameter flywheels and the capstans attached thereto rotate through significantly few revolutions per minute than does the sheave 475 for turning the axle 473 carrying the power roller 447.

The power roll 447 is in a common plane with and closely adjacent to a first turntable 486, FIG. 24, to engage and drive the same in the direction to drive its spindle 21 and wind the tape on the cassette reel 17 driven by the spindle 21. A second left-hand turntable 488 is driven in a reverse direction from that of the first turntable 486 through a pivotally mounted idler wheel or roller 490 which also has a rubber tired peripheral surface for frictionally engaging and drive the second turntable. More particularly, the idler is journaled for free turning on an axle 491 carried by bifurcated ends of an idler arm 492 pivotally mounted at its lower end on a pivot pin 493 fixed to the movable chassis plate 117. When the power roll 447 is held in its idle position, the idler wheel may engage it but the opposite side of the idler wheel will be spaced from the second turntable. It is only when the rocker arm 449 swings the power roll toward the second turntable that the torque from the power roll is transmitted and there is a reverse directional rotation of the left-hand spindle 21 from that imparted to the right-hand spindle 21.

Turning now to the feeding of the tape at conventional speeds during a playback or a recording operation during which the power roll 447 is in its idle position, one of the turntables is being driven at a slower speed by means of an intermediate roller 495 which is journaled on an axle 497 on a multi-armed carrier 499 mounted on the movable chassis plate 117. Each of the intermediate rollers 495 is disposed for shifting into engagement with a capstan 23 to be driven thereby and, in turn, to drive in its associated turntable. Inwardly directed arms 501 of the carrier 499 are connected to opposite ends of a spring 503 which pulls the carriers 499 toward each other and into driving relationship between a pair of capstans and the turntables.

To assure that the intermediate rollers 495 are thrown off from the turntables to allow them to travel at a speed faster than the speed of the capstans 23, throw-off means are provided in the form of a pair of levers 509 which are adapted to be engaged and pivoted by wing-like portions 511 of the pause carrier 157 (FIG. 10) as the latter moves to its pause position. If the pause carrier is already at the pause position, the pause carrier portions 511 will be holding the throw-off levers 509 in positions at which the intermediate rollers 495 are spaced from the turntables. The throw-off levers 509 are pivotally mounted on studs 513 fixed to the plate 117 adjacent the vertical sides thereof with a first arm 515 projecting beyond the side of the plate 117 into the path of movement of the wing-like portions 511 of the pause carrier. A second arm 517 on each throw-off lever extends to and is pivotally connected to a downwardly extending arm 519 of its adjacent, intermediate roller carrier 499. A third arm 521 on each throw-off lever extends upwardly inwardly from its pivot stud 513 to abut the inner side of inwardly projecting pin 523 carried on an outwardly extending arm 525 of its intermediate roller carrier 499. Thus, the throw-off levers each have a pair of arms 517 and 521 connected to a pair of arms of an associated intermediate roller carrier 499 to shift the same laterally from a

turntable. To assist in guiding the carriers 499 outward movement each carrier has a guide pin 529 fixed to its inwardly projecting arm 501. The guide pins 529 are constrained to travel within a slot 531 in the chassis plate and in an upward and outward direction as caused by the throw-off lever arms 517 and 521. The slot 531 is also slightly curved to prevent binding between the pin and slot as the carrier moves out and up along an arcuate path. The pause carrier wing portions 511 are returned to positions above the throw-off levers with movement of the pause carrier 157 to its operative position in which tape should be fed at the slower operational speed. When the pause carrier wing portions rise above and release the throw-off levers, the centering springs 503 pull the carriers 499 toward each to engage the intermediate rollers 495 causing the arms 515 of the throw levers to extend beyond the sides of the plate to await the next shifting of the pause carrier to the pause position.

It will be recalled that the operation of the fast wind lever 443 by the forward and reverse fast wind push buttons 42B and 42C moves the link 441 vertically and swings the fast wind lever 443 from a central intermediate position to either an upper or lower position with a resultant swinging of the rocker arm 449 and the power roll 447 into driving relationship with one of the respective reel turntables 486 and 488. As best seen in FIG. 11, the link 441 is hooked at its lower end in an aperture 535 in the fast wind lever and at its upper end to a generally horizontally extending arm 536 of the bellcrank 440 which is operated by the respective push buttons 42B and 42C.

As previously explained, the push buttons 42B and 42C are so related to the bellcrank 440 that they pivot it in opposite directions to pull up or push down on the link 441 to cause either a forward or reverse fast wind tape transport. To these ends, the bellcrank 440 is pivotally mounted on a support post 545 fixed to a vertically extending bracket 547 in which are mounted the push buttons 42B and 42C. A generally vertically extending arm for the bellcrank 440 is provided with a cam follower 549 in the form of a cylindrical pin which projects through an opening 551 in the control bracket 547 to a position intermediate a pair of generally curved cam surfaces 553 on the respective push buttons 42B and 42C. As best seen in FIG. 21, depression of the push button 42C causes its cam 553 to force the follower 549 to the right to pivot the bellcrank 440 clockwise causing the horizontally disposed arm 536 to pull upwardly on the link 441 and the fast wind lever 443 to pivot the latter to its upward position. On the other hand, a depression of the reverse feed push button 42B causes its cam 553 to pivot the cam follower and bellcrank 440 in the counterclockwise direction forcing the horizontal bellcrank arm 536 and attached link 441 down to pivot the fast wind lever downwardly to cause the power roller 447 to swing into position for reverse feeding. The bellcrank 440 is centered by a hairpin configured spring 555 which has a central coiled portion fixed to a pin 557 secured on the bracket 547 and a pair of generally straight legs 559 which extend along opposite sides of a central tab 561 on the bellcrank 440 positioned between the spring legs 559. Closely adjacent to the bellcrank tab 561 is a bent stop 563 formed by bending a portion of the stationary bracket 547. Thus, as the bellcrank pivots and flexes one of the spring legs 559 in the direction the bellcrank is turning, the opposite leg bears against the stop 563 so that the flexed leg will exert a returning force to the bellcrank when it is released by a push button.

An interlock means is provided to assure that only one of the fast wind push buttons 42B or 42C may be operated at a time. To this end, each of the push buttons is provided with an arcuately shaped locking notch 565 which is located immediately beneath the cam surface 553 for receiving therein the cam follower pin 549 on the bellcrank 440. As the bellcrank is held against pivoting its cam follower pin 549 downwardly, the latter, in turn, holds the push button against downward movement. For example, the depression of the reverse feed push button 42C causes the cam follower pin 549

to move into the locking notch 565 for the push button and prevents a downward movement of the push button 42B until the cam follower pin is removed from the locking notch in the push button 42B.

Each of the fast wind push buttons 42B and 42C is mounted for sliding vertical movement within the bracket 547 and is biased upwardly by return springs 385 and are held or latched in a depressed, actuated position by latching pawls 363 which receives and holds the pins 373 on the push buttons and releases the pins 373 in the same manner as described above in connection with the on/off push button 42F shown in FIG. 19.

Preferably, only a simple manipulation of the pause push button 42A is required to interrupt a playback or recording operation and then to reinstitute the same operation. More specifically, a control means 571 (FIG. 20) interconnects the pause push button 42A and a play/record push button 42D in a manner that a playback or recording operation may be interrupted merely by depressing the pause push button and then reinstituted by merely releasing the pause push button. Thus, there is no need to also operate the play/record push button. Yet, the control means 571 functions to shift the pause carrier to the operative position with depression of the play/record push button 42E and to shift the pause carrier 157 to the pause position with return of the play/record push button to its upper inactive position. With this type of operation, the pause position is established as the normal position for the cassette changer when the play/record push button is released. Consequently, a fast wind of the tape may be instituted by depression of a fast wind push button without first moving into a pause position and then instituting a fast wind of the tape.

For the purpose of shifting the pause carrier 157 to its pause position, at which the return spring 177 for the pause carrier is stretched, the control means 571 has a stronger, overriding control spring 573 (FIG. 20) which acts through a play lever 575 and a position control lever 577 to force a link 541 downwardly thereby pivoting the pause control lever 543 to a position at which the pause control lever holds the pause carrier in the standby mode.

The play lever 575 is pivotally mounted intermediate its ends on a horizontal post 579 on a stationary bracket 581 with a first end disposed adjacent the play/record push button 42D and connected thereto by a stiff wire link 583. The link 583 has a lower end formed with an offset hook inserted into the play lever and an upper offset hook inserted into an aperture in a stem 585 on the play/record push button 42D so that the play lever is turned about the pivot post 579 with vertical movement of the play/record push button. When the latter is in its non-operated upper position, shown in dotted lines in FIG. 20, the play lever 575 is held by the overriding spring 573 in the illustrated dotted line position in which a laterally extending tab 587 thereon abuts the top side of a control lever 577 and holds the same in its lowered position, as illustrated in solid lines in FIG. 20, with a link 541 holding a pause lever 543 down. More particularly, the control lever 577 is also pivotally mounted on the post 579 and has an aperture receiving an offset hook end 589 formed on the upper end of the vertically disposed link 541. The control lever 577 is formed with a laterally extending offset 591 which is positioned beneath a lower end of a stem 593 of the pause push button 42A for engagement and downward movement thereby when the control lever 577 is in the upper position shown in phantom lines in FIG. 20. More specifically, should the pause push button 42A be depressed and the control lever 577 be in the upper phantom line position, its stem 593 will abut the offset 591 and force the control lever down and thereby cause the link 541 and pause lever 543 to also go down and place the pause carrier 157 in the pause position. As best seen in FIGS. 10, 11 and 12, the pause lever 543 is pivotally mounted at one end on a pivot post 595 fixed to the stationary wall 124 with a cylindrical driver 597 projecting laterally therefrom through an opening 599 in the wall 124 and the opening 181 in the pause carrier to overlie the foot 179 of the pause carrier. The driver 597

abuts the foot 179 adjacent the return spring 177 and stretches this spring as the pause lever moves down to the pause position.

As stated above, when the cassette changer is at rest with both the push buttons 42A and 42D in their upper non-operated positions, the play lever 575 will be urged by its strong overriding spring 573 to abut its tab 587 on the control lever 577 and force the latter downward thereby forcing the link 541 and pause lever 543 down with the result that the pause carrier is placed in the standby position. While not shown in FIG. 20, it is to be understood that the push buttons 42A and 42D are each latched in a depressed position by a latch pawl similar to the latch pawls 363 previously described and return springs 385 lift the unlatched push buttons to the upper positions shown in FIG. 20.

When it is desired to commence playing or recording, a depression of the play/record push button 42D acts through its attached link 583 to pivot the play lever to lift its tab 587 from the control lever 577 whereby the pause carrier return spring may lift the pause carrier and act through the pause carrier lever 543 and link 541 to pivot the control lever 577 upwardly to the phantom line position illustrated in FIG. 20 in which the pause lever 543 will also be in the upper dotted line position.

From the foregoing it will be seen that the cassette changer has an improved transport for moving the cassettes from the storage magazine and into the operative position for playback or recording on the tape.

While a preferred embodiment has been shown and described, it will be understood that there is no intent to limit the invention by such disclosure but, rather, it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a cassette changer for cassettes having a pair of tape reels between which a tape is wound and unwound, a magazine having compartments for storing a series of cassettes and positioning each of said cassettes at a transfer station for movement to an operating station, means including a movable chassis for transferring a cassette from said transfer station to said operating station and for returning said cassette to said magazine, a pair of spindles on said movable chassis for penetration into said tape reels during transfer of said cassette to an operating position at said operating station, spindle motor drive means on said movable chassis for driving said spindles, a forward tape transport capstan for penetrating the cassette and a cooperable pinch member for transporting said tape in a forward direction, a reverse tape capstan for penetrating the cassette and a cooperable pinch member for transporting said capstan in a reverse direction, a changer motor drive means for driving said chassis to said operating station including a pivotally mounted lever connected to said movable chassis and a cam for pivoting said lever to drive said movable chassis to said operating position, said lever and cam holding the same at said operating position during a playback or recording operation, a first switch means operable with positioning of said movable chassis at said operating position to disable the drive of said chassis by said changer motor drive means at said operating station, means including a solenoid movable to a first position to reverse tape transport and movable to a second position to cause operation of said change motor drive means, said solenoid disabling the forward tape transport by said forward tape transport capstan and pinch member and enabling reverse tape transport by said reverse tape transport capstan and pinch member to transport said tape in the reverse direction, a second switch means actuated by movement of said solenoid to said second position after termination of reverse tape transport for operating said changer motor drive means to turn said cam and pivot said lever to drive said movable chassis in a return direction while said spindles and capstans are being withdrawn from said cassette being returned to its compartment in said magazine, and stepping means to step automatically said magazine to posi-

tion another one of said compartments in said magazine and another cassette therein at said transfer station for transfer to said movable chassis for movement therewith to said operating position at which said first switch means again disables said changer motor drive means.

2. A changer in accordance with claim 1 in which a sound transducer head is provided for engagement with said tape, a pause carrier for said transducer head and said pinch members is mounted for slidable movement, and means are connected to said carrier to shift it to carry said transducer head and one of said pinch members into operative engagement with said tape for playback or recording and to retain said carrier in said operating station for each of the cassettes being sequentially played or recorded upon.

3. A changer in accordance with claim 2 in which means are operable by said solenoid to shift said forward drive pinch member to an inoperative position from said tape and to shift said reverse drive pinch member to engage said tape, said pinch members on said pause carrier retaining their respective operative and inoperative positions with shifting of the carrier to and from said tape.

4. A cassette changer in accordance with claim 1 in which said second switch means includes a first switch for causing said changer motor drive means to turn said cam and pivot said lever to drive said movable chassis to said operating position, and a second switch for establishing a holding circuit to cause said return movement of said movable chassis.

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