

[54] TAPE RECORDER FOR ENDLESS TAPE CARTRIDGES

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[58] Field of Search 274/4 F; 353/15, 353/19; 242/197-200, 180, 181, 55.19 R, 55.19 A; 352/8-10, 123; 179/100.2 Z

[56] References Cited
UNITED STATES PATENTS

3,139,788	7/1964	Hughes.....	274/4 F
3,353,443	11/1967	Hall.....	274/4 F
3,359,665	12/1967	Gerry.....	274/4 F
3,383,156	5/1968	Fried.....	274/4 F
3,484,055	12/1969	Raine.....	274/4 F
3,494,622	2/1970	Zeigler.....	274/4 F
3,512,785	5/1970	Ban.....	274/4 F
3,599,986	8/1971	Ban.....	274/4 F
3,599,987	8/1971	Ban.....	274/4 F
3,682,480	8/1972	Ban.....	274/4 F

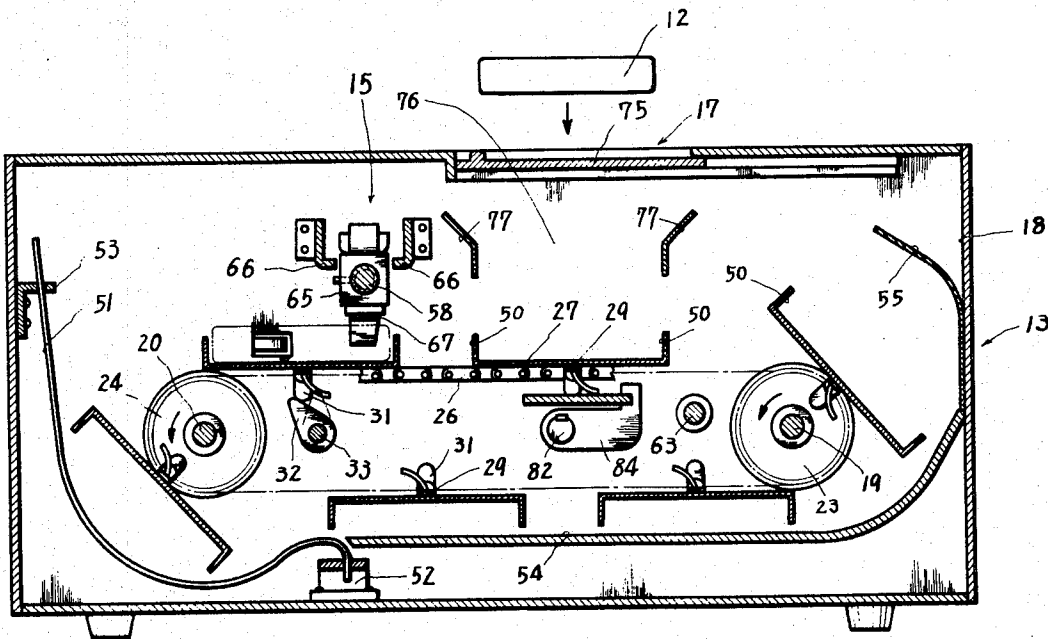
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[57] ABSTRACT

A tape recorder for plurality of endless tape cartridges comprises storing means for storing a plurality of endless tape cartridges, playing means for reproducing the sound of the tape cartridge, carrying means for carrying the cartridge from the storing means to the playing means and from the playing means to the storing means, and control means for controlling the storing means, the playing means and the feeding means electrically and corelatively.

Said storing means is provided with a plurality of cases attached to rotatable endless chain means so as to move with the chain means, each of said cartridges being stored in the appropriate case so as to move along transverse direction against advancing direction of the case for feeding the cartridge to the playing means by the aid of carrying means, whereby selection of the desired cartridge from the stored caridges, conveyance and feed of the selected cartidge to the playing means, reproduction and return of the cartridge can be automatically performed.

3 Claims, 10 Drawing Figures



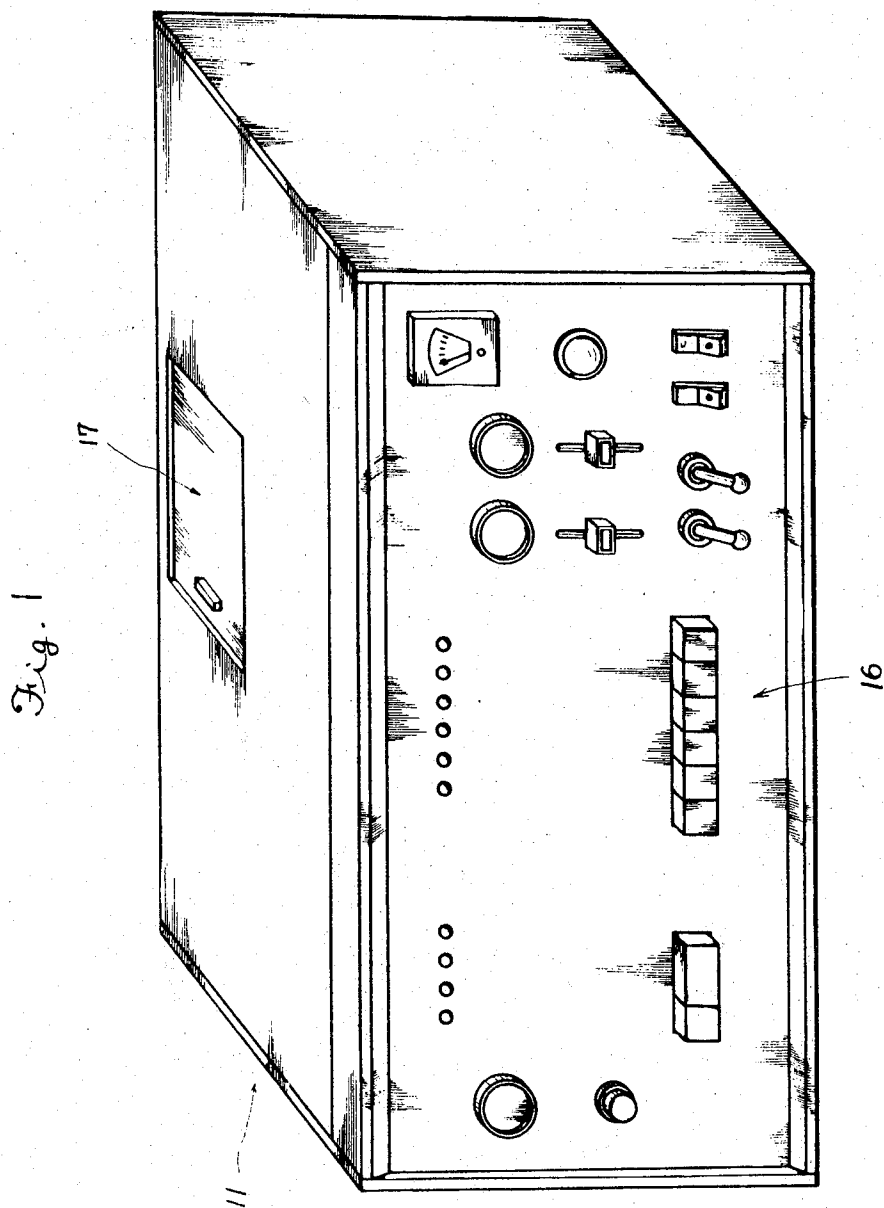


Fig. 2

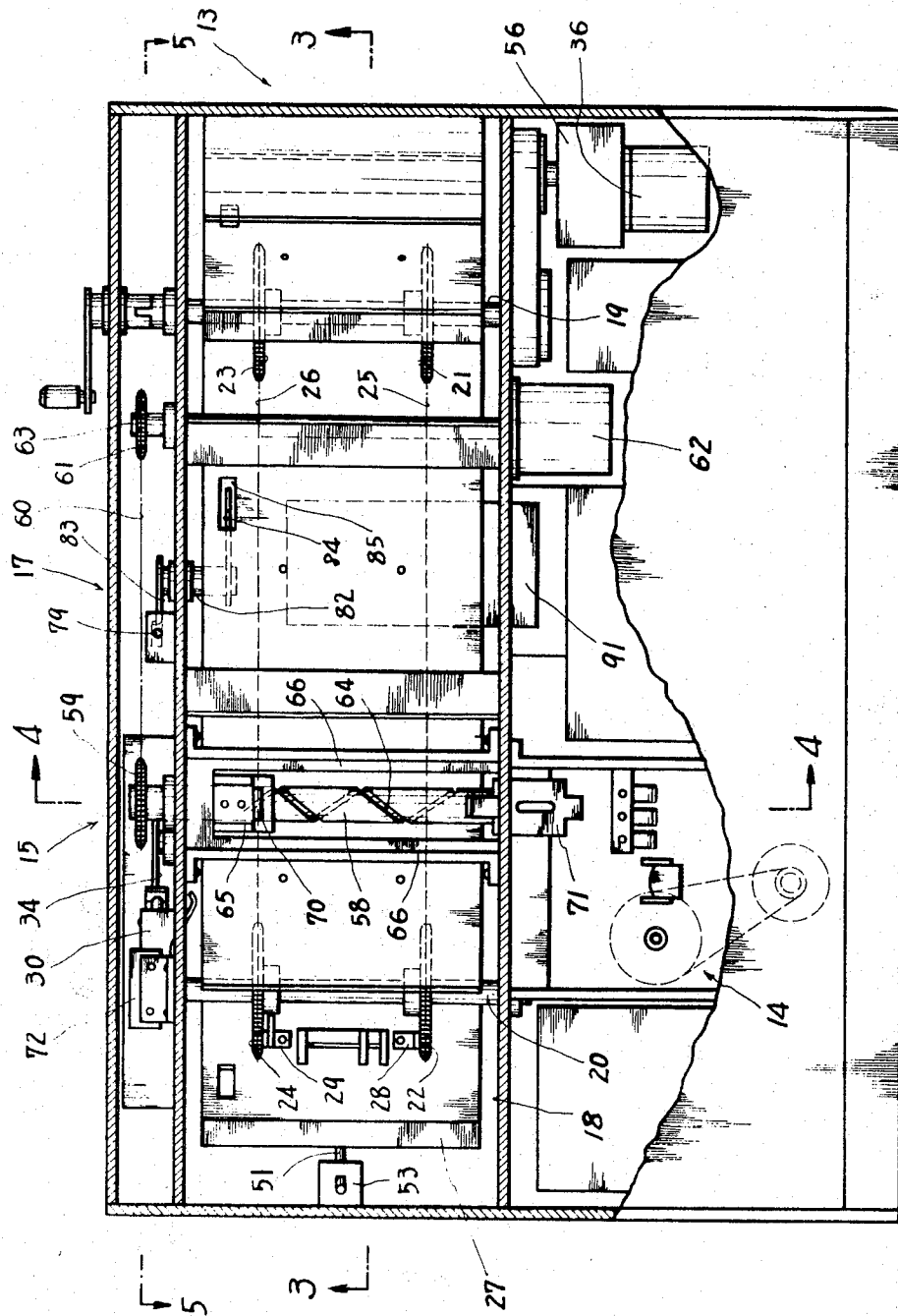
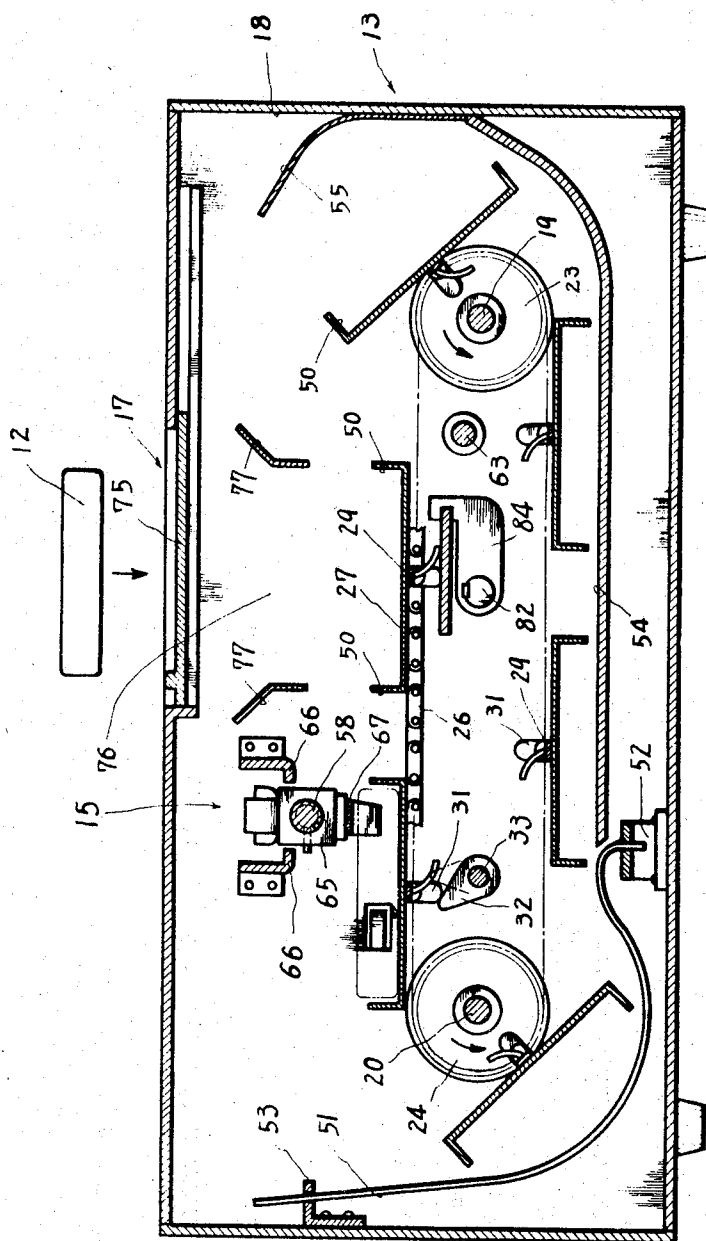


Fig. 3



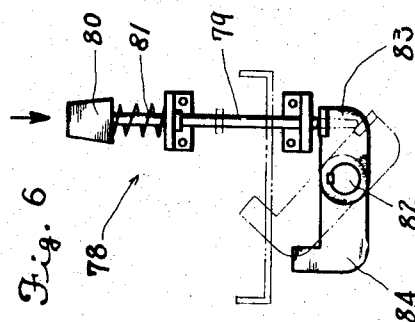
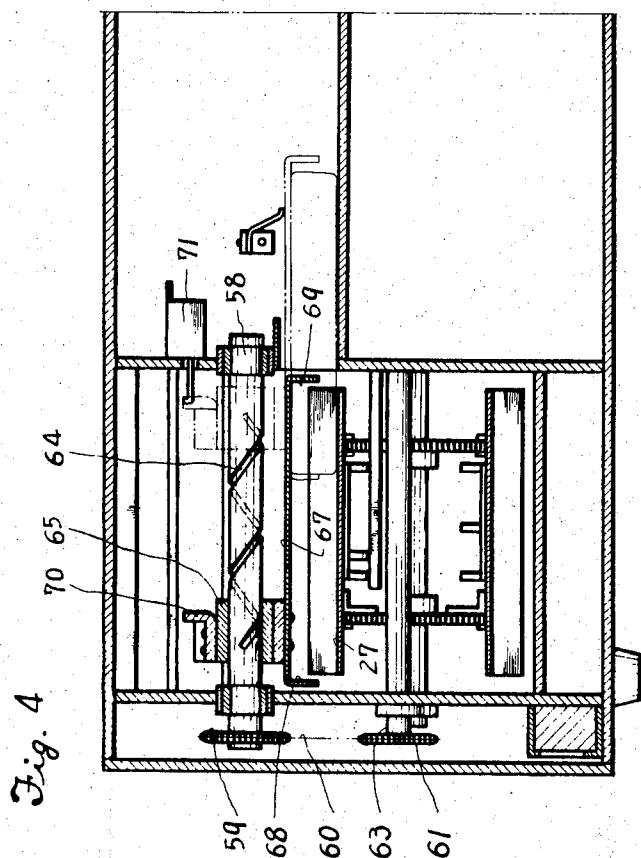
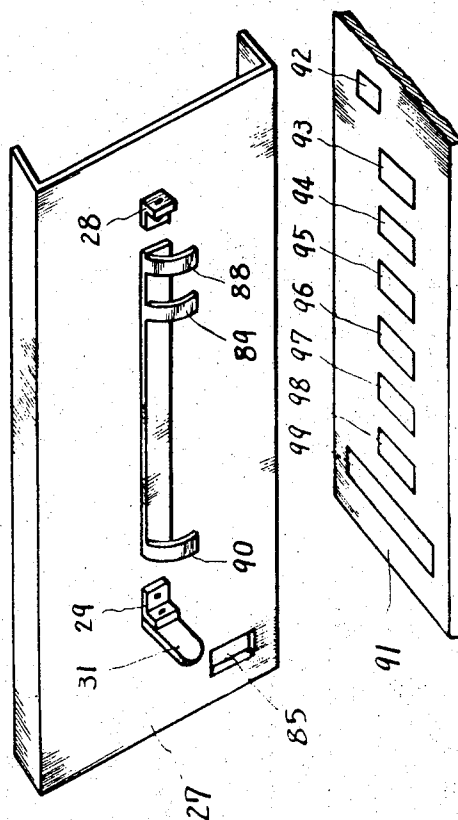


Fig. 7



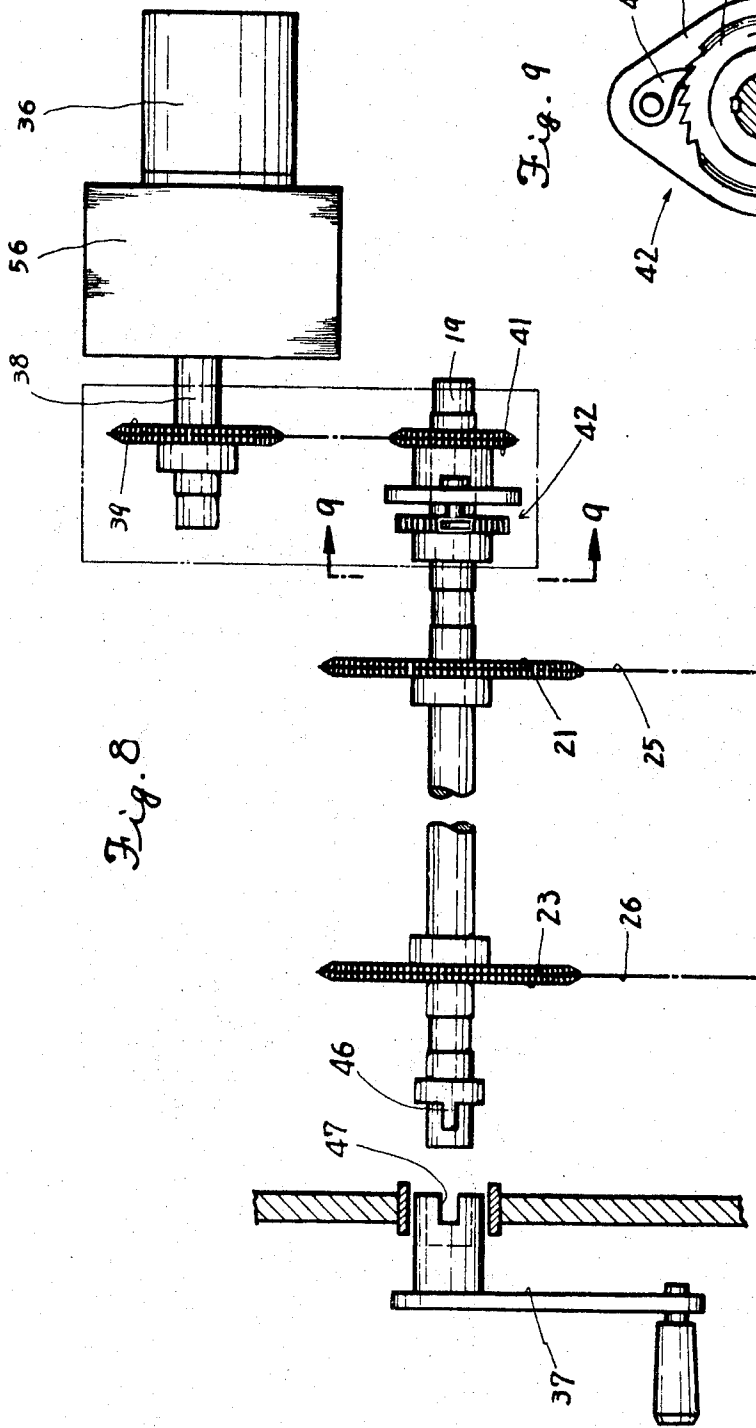


Fig. 9

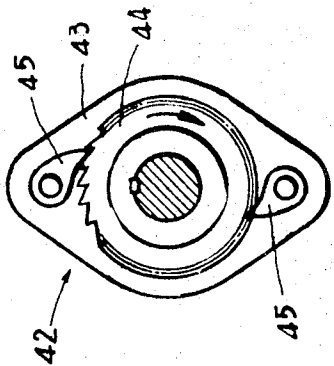
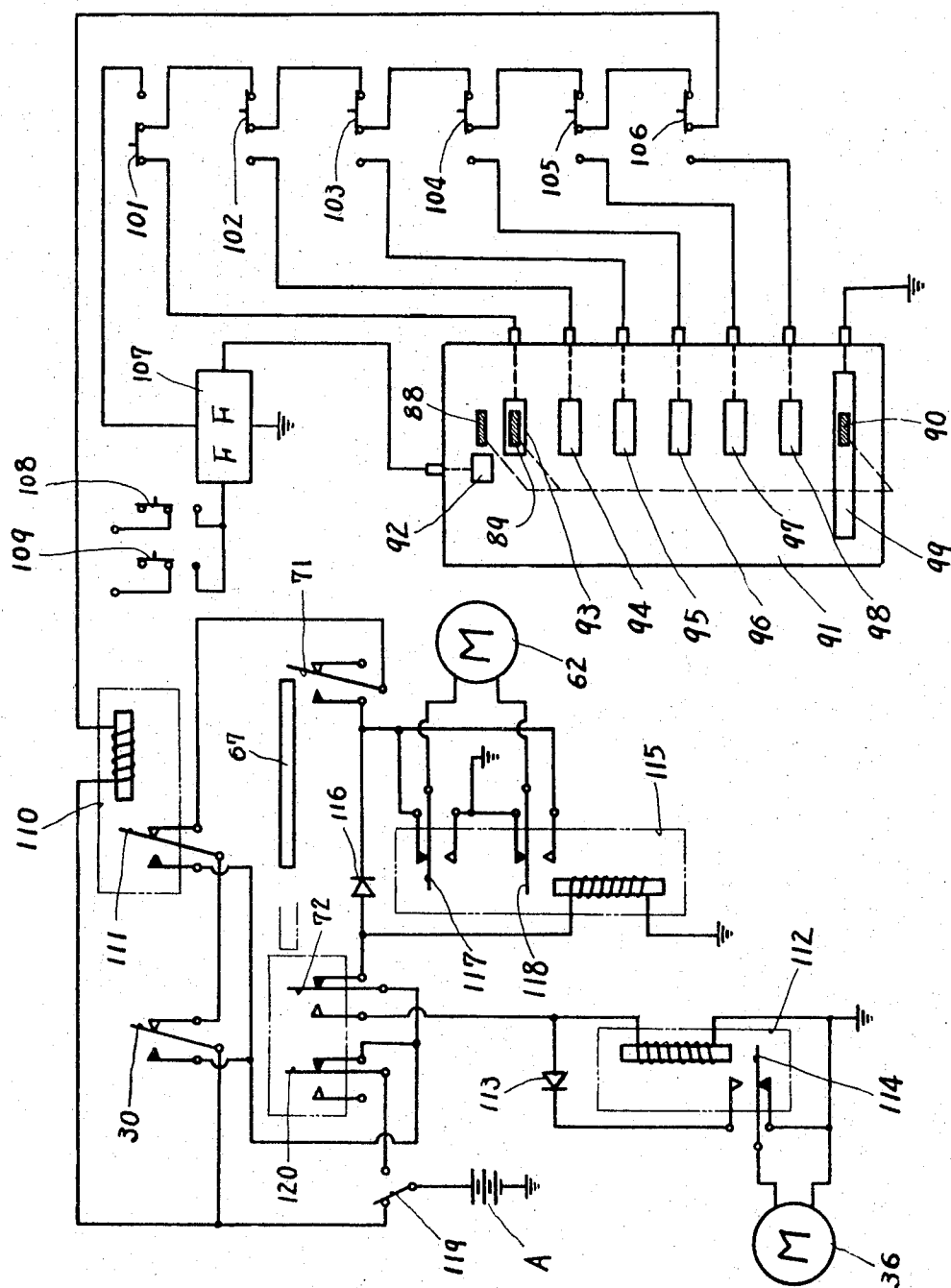


Fig. 10



TAPE RECORDER FOR ENDLESS TAPE CARTRIDGES

This invention relates to an improvement of a tape recorder for endless tape cartridges, and more particularly to means for automatically selecting a desired tape cartridge from a plurality of stored cartridges in storing means and feeding the selected cartridge to reproducing means or playing means.

An object of the present invention is to provide a novel tape recorder that affords automatic selection of a desired cartridge from a plurality of stored cartridges in storing means and reproducing the sound of the selected cartridge at playing means of the tape recorder.

Another object of the present invention is to provide means for automatically feeding a plurality of tape cartridges in predetermined sequence.

Still another object of the present invention is to provide means for effectively carrying the selected cartridge from the stored position to the playing means and for returning the cartridge in the playing means to original position of the storing means.

Further object of the present invention is to provide unique means for correlatively controlling the storing means, the carrying means and the playing means, so that by only pushing one of the desired selecting button, selection of the cartridge, conveyance and feed of the selected cartridge, reproduction and return of the cartridge can be automatically performed.

In carrying out the invention in one aspect thereof, a selective tape recorder for endless cartridges is provided in which the apparatus comprises storing means for receiving a plurality of endless tape cartridges, playing means for reproducing the tape, carrying means for carrying the cartridge from the storing means to the playing means and from the playing means to the storing means, and control means for correlatively controlling the storing means, the playing means and the carrying means, said storing means being provided with a plurality of cases attached to rotatable endless chain means so as to move with the claim means, each of said cartridge being stored in the appropriate case so as to move along transverse direction against advancing direction of the case to feed and withdraw the cartridge to and from playing means.

Other objects and advantages of the subject invention will become apparent from reading the following detailed description and by reference to the accompanying drawings wherein;

FIG. 1 is a perspective view of the tape recorder according to the present invention;

FIG. 2 is a plan view, partially broken away, of the tape recorder;

FIG. 3 is a sectional view of the tape recorder taken along the line 3—3 in FIG. 2;

FIG. 4 is a sectional view of the tape recorder taken along the line 4—4 in FIG. 2;

FIG. 5 is a sectional view of the recorder taken along the line 5—5 in FIG. 2;

FIG. 6 is a view of a picker means in the tape cartridge;

FIG. 7 is a perspective view of a case for the cartridge and a plate having contact points of the tape recorder;

FIG. 8 is an enlarged plan view of a drive mechanism of the storing means of the tape recorder;

FIG. 9 is a sectional view taken along the line 9—9 in FIG. 8; and

FIG. 10 is diagrammatic control circuit of the controlling means of the tape cartridge according to the present invention.

Referring particularly to FIGS. 1, 2 and 3 of the drawings, a combination of tape recording-playing device 11 is constructed and operable to handle magnetic type tape contained in a cartridge 12 commonly known as endless reel tape. The device 11 comprises storing means 13 for storing a plurality of cartridges 12, conventional reproducing means or playing means 14 for reproducing the sound of the magnetic tape, conveying means 15 for conveying the cartridge from and to the storing means to and from the playing means, and controlling means 16 for controlling the means 12, 13 and 14 electrically and correlatively, said storing means being provided with a mouth 17 for feeding and taking the cartridge to and from the storing means 13.

As illustrated in FIGS 2 and 3, the storing means 13 includes a pair of endless chains 25 and 26 which are supported by sprockets 21, 22, 23 and 24 in parallel with each other, said sprockets being mounted on an horizontal drive shaft 19 and an idle shaft 20 supported by side walls of a frame 18. Illustrated at numerals 27 are cases for receiving the cartridge, and each case is carried by the chains 25, 26 at back surface thereof through a pair of projections 28 and 29. One projection 28 is provided with a cam follower 31 for actuating a limit switch 30 (see FIG. 5) to set a predeterminate position of the case to the playing means 14. The motion of the cam follower 31 is delivered to a first cam 32 secured on a shaft 33 and then to the limit switch 30 through a second cam 34 secured to the shaft 33 and having return spring 35 as particularly shown in FIG. 5.

The drive shaft 19 can be rotated selectively by means of a motor 36 and manual handle 37 as shown in FIG. 8. The energy of the motor 36 is delivered an idle sprocket 41 rotatably mounted on the drive shaft 19 through a reduction gear 56, a sprocket 39 secured on a shaft 38 and an endless chain 40 extending around the sprockets 39 and 41, and then to the drive shaft 19 through a ratchet 42.

The ratchet 42 comprises a disc 43 cooperating with the idle sprocket 41, a gear wheel 44 secured to the drive shaft 19 and a pair of pawls pivoted on the disc 43. The manual handle 37 can be removably connected to one end 46 of the drive shaft by means of engaging member 47. The manual handle is used when the cartridges are set in the storing means of the device, and when the drive shaft 19 is rotated by the manual handle 37 the rotation is not delivered to the motor 36 by means of the ratchet 42.

Each case 27 is equipped with a pair of vertical walls 50 (FIG. 2 and 3) at leading end and tail end thereof whereby the cartridge received in the case may be moved in transverse direction to the advancing direction of the case. To prevent falling of the cartridge from the case during its translation, covers 51, 54 and 55 are arranged around the chains 25 and 26. At least, said cover 51 is made of elastic material, and a lower end of the cover 51 is secured to a boss 52 and upper end of the cover being loosely supported by a holder 53, so that compression of the cover 51 against the cartridge in the case may be automatically adjusted.

As shown in FIGS. 2, 3 and 4, the carrying means 15 is positioned above the chains 25, 26 opposed to the playing means 14 and being actuated by a spiral shaft 58 which is energized by a motor 62 through a sprocket

59, chain 60, sprocket 61 and a shaft 63. The spiral shaft 58 is provided with a moving member 65 in engagement with a spiral groove 64 of the spiral shaft 58, said moving member 65 being prevented to rotate by a pair of guides 66 (FIG. 3), whereby the moving member may be moved in both directions along the shaft 58 by clockwise and counterclockwise rotation of the shaft 58. The moving member 65 has at lower portion thereof a U-shaped carrying member 67 having forward and rear engaging projections 68 and 69. When the cartridge 12 in the case 27 is delivered from the case to the playing means, the rear projection 69 is adapted to engage with the rear edge of the cartridge 12 to move the latter with the carrying member 67, and when the cartridge 12 is transported from the playing means to the case the forward projection 68 is adapted to engage with the forward edge of the cartridge 12 for carrying the cartridge with the carrying member. A space between the projections 68 and 69 of the carrying member is so arranged to allow passing of the case 27 with cartridge during movement of the case 27. The carrying member 65 is further provided with a protrusion 70 at upper portion thereof to actuate a limit switch 71 which is positioned in the playing means 14, the limit switch 71 being adapted to stop the motor 62. On the opposite side to the limit switch 71 a limit switch 72 is secured to the frame 18, the latter switch 72 being actuated by the rear edge of the cartridge.

The mouth means 17 consists of an opening 76 having a cover 75, and a funnel-shaped guide 77 as shown in FIG. 3.

To pick up the cartridge in the case 12, there is a picker 78 (FIG. 6) which is arranged in the frame 18 under the cover 75. The picker 78 includes a vertical sliding bar 79 having a button 80 at upper end thereof, said bar being normally biased its upward position by means of spring 81. A lower end of the bar 79 is contacted with upper surface of a free end of an arm 83 secured to a spindle 82, and the latter is provided with a second arm 84, a free end of which is adapted to raise the cartridge. When the bar 79 is manually pushed on, the spindle 82 is rotated clockwise direction with the second arm 84 through the first arm 83 as illustrated at dotted line in FIG. 6. The raised end of the second arm 84 strikes the partly exposed back surface of the cartridge in the case 27 through an opening 85 formed in the case 27 thereby rising the cartridge to facilitate producing manipulation of the cartridge from the case.

The control means 16 controls the storing means 13, the playing means 14 and carrying means 15. Such a playing means 14 may be formed of conventional manner, so that explanation of manner for controlling the playing means is omitted from the below illustration of the control means.

As shown in FIGS. 7 and 10, the control means 16 includes three electrically connected contact makers 88, 89 and 90 attached on the back surface of the each case 27, said contact makers being cooperated with stationary contact points 92 to 99 formed on a plate 91 positioned above the passing line of the case. Said contact makers 88 and 90 are adapted to contact with the contact points 92 and 99 and other contact maker 89 being cooperated with any one of contact points 93 to 98. A number of contact points 93 to 98 are equal to that of cases 27, and the position of contact maker 89 of the each case is different from that of other cases so that the contact maker 89 is contacted with appropriate

point of the contact points 93 to 98. A group of push switches 101 to 106 are connected to the points 93 to 98, respectively, that is, the switch 101 to the point 93, the switch 102 to the point 94, the switch 103 to the point 95, the switch 104 to the point 96, the switch 105 to the point 97 and the switch 106 to the point 98. A group of said push switches are of the type of alternative selective switch, and the latter being formed so as to change connections between a power source A and any one of the points and between the power source A and a flip flop circuit F,F.

The flip flop circuit is arranged in such a manner that when the pulse dispatched from senses formed on the cartridge tape to detect each end of individual play and all plays is entered through a switch 108 for one track or a switch 109 for four track, connection to ground is set into OFF condition, and when the contact point 92 on the plate 91 is grounded by contacting of the contact maker 88 through the contact point 99 the said OFF condition is reset into ON condition whereby the connection to ground is usually maintained ON condition when there is no input pulse from the senses. The push switches 101 to 106 are adapted to actuate a relay 110 having a switch 111. In ON condition of the relay 110 said switch 111 connects the output from the limit switch 30 to the limit switch 71, and in OFF condition to the limit switch 72. When the limit switch 30 is in ON condition by action of the second cam 34, output terminal of the switch 30 is connected with the switch 111 of the relay, and in OFF condition with the limit switch 72. When the limit switch 72 is changed into ON condition by the rear edge of the cartridge 12, a relay 112 is energized, and through a diode 113 and a switch 114, the motor 36 is actuated. In OFF condition of the switch 114 or the relay 112, both poles of the motor 36 are shorted to stop immediately the motor and to prevent conduction electromotive force generated from the motor to the relay 112 when the switch 114 is changed into OFF condition. Further, when the switch 72 is in OFF condition, output from the power source is connected with a relay 115 and switches 117 and 118 of the relay 115 via a diode 116. The relay 115 is adapted to rotate the motor 62 clockwise and counterclockwise direction. That is, in ON condition of the relay 115 the motor is rotated in positive direction or clockwise direction whereby the carrying member 67 moves from the playing means 14 to the case 27, and in OFF condition, rotation of the motor 67 and motion of the carrying member 27 are vice versa. When the limit switch 71 is changed into ON condition by the carrying means 67 the connection from the switch 111 of the relay 110 to the relay 115 is cut, and in OFF condition of the limit switch connection between the switch 111 and the switches 117, 118 of the relay 115 is maintained but the relay is not energized by virtue of the diode 116, so that the reverse rotation of the motor 62 is performed. Designated at 119 is a manual main switch which connects the power source with a limit switch 120 in its OFF condition. Said limit switch 120 is actuated by the carrying member 67 as well as the limit switch 72, and is usually connected with the limit switch 72. The limit switch 120 is adapted to return the playing cartridge to the appropriate case 27 when the main switch 119 is changed into Off condition during playing condition. In FIG. 10, the control circuit is shown reproducing condition of the cartridge 12 selected by the push switch 101. Now, in case of other

cartridge, for example, as cartridge corresponding to the push switch 102 is desired, the switch 102 is pushed in and changed into OFF condition. By reason of that the push switch 101 to 106 are formed of the type of alternative selective switch, the push switch 101 is automatically changed into ON condition by manipulation of the push switch 102 and the relay 110 being changed into OFF condition to switch the switch 111 of the relay 110, forming a circuit connection between the power source and the limit switch 72 whereby the switches 117 and 118 in the relay 115 are changed into other side by action of the relay 115 and output from the limit switch 72 being connected with the switch 117, 118 through the diode 116, so that the motor 62 may be rotated into positive direction. The motor drives the spiral shaft 58 in positive direction to move the carrying member 67 from the playing means 14 to the case thereby transporting the cartridge 12 in the playing means 14 to the case 27. When the transportation is finished the limit switch 72 is changed ON condition by action of the rear edge of the cartridge 12 in the carrying member, so that the relay 112 and the switch 114 are changed into ON condition. This connects output from the limit switch 72 with the motor 36 to rotate the latter whereby the case 27 having the cartridge 12 is moved with rotation of the chains 25 and 26. Upon the movement of the case 27, the limit switch 30 is relieved from contact with the second cam 34 whereby the switch 30 is changed into ON condition. Then, the case 27 corresponding to the switch 102 is moved to the plate 91, and the contact makers of the case 27 are come into contact with the appropriate contact point 94 and the contact point 99 of the plate 91, forming electrical connection between the contacts 94 and 99. This energizes the relay 110 to change the switch 111 for cutting off connection to the limit switch 72. However, the limit switch 72 is connected with the power source via the limit switch 30 thereby maintaining moving action of the case 27. When the case 27 is reached to predetermine position, the limit switch 30 is changed into ON condition by the case 27 to cut off the connection between the power source and the limit switch 72, thereby stopping the motor 36 with the case 27. Simultaneously, the power source is connected with the limit switch 71 through the switch 111 in the relay 110. As the limit switch 71 is in the state of no contact with the carrying member 67, the power source is connected with the switches 117 and 118 in the relay 115 via the limit switch 71. But the relay 115 maintains its OFF condition by virtue of the diode 116 thereby rotating the motor 62 to reverse direction. Thus, the carrying member 67 performs supply of cartridge 12 corresponding to the push switch 102 to the playing means 14.

When the carrying member 67 reaches to the playing means 14, the limit switch 71 is actuated by the carrying member 67 thereby stopping the motor 62. Therefore, the selected cartridge 12 is maintained in the playing means whereby the reproduction of the cartridge 12 may be performed.

Further, in the present invention, a plurality of tape cartridge can be reproduce automatically and in predetermined sequence. In this case, all the push switches 101 to 106 are changed into the flip flop circuit 107, and the switch 108 or the switch 109 is changed into ON condition to enter pulse from the senses in the cartridge tape into the flip flop circuit 107. By the above

manipulation the relay 110 is changed into OFF condition, so that, as well as above mentioned manner, cartridge 12 in the playing means 14 may be set into the case 27 and then moved away with the case 27. When the contact maker 88 of the next case having cartridge to be subsequently played comes into contact with the contact point 92 of the plate 91, the flip flop circuit 107 is reset to form a grounded condition whereby the relay 110 is changed into ON condition. Thus, movement of the case is stopped and the next cartridge is inserted into the playing means 14 by the carrying member 67 to reproduce the cartridge. The above cycle is automatically repeated thereby performing reproduction of a plurality of the cartridges in predetermined sequence.

The subject invention in its broader aspects is not limited only to the specific embodiment shown and described but departure may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and with sacrificing its chief advantages.

What I claim is:

1. A tape recorder for endless tape cartridges comprising a frame, storing means on the frame for storing a plurality of endless tape cartridges, playing means on the frame for reproducing the tape cartridges, carrying means on the frame for carrying the cartridge from the storing means to the playing means and from the playing means to the storing means, said storing means including endless conveyor means, power means for moving the conveyor means, a plurality of cases attached to the conveyor means for movement therewith, each of the cases adapted to carry an endless tape cartridge and having a bottom wall for supporting a cartridge and first and second electrically connected contacts secured to the bottom wall, a first contact and a plurality of second contacts mounted on the frame adjacent the path along which the cases are moved by the conveyor means, the first contact on each case being engageable with the first contact on the frame and the second contact on each case being engageable with one of the second contacts on the frame as the cases are moved past the contacts on the frame, switch means on the frame operatively connected to the second contacts on the frame and to the power means for the conveyor, and a switch selection means for each of the second contacts on the frame operatively connected to the second contact and to the switch means whereby activation of the switch selection means associated with one of the second contacts on the frame will cause movement of the conveyor means to stop after the second contact of a case which is engageable with said one contact on the frame engages said one contact on the frame to position said case adjacent the carrying means.

2. The structure of claim 1 in which the carrying means includes a shaft rotatably mounted on the frame and extending transversely to the direction of conveyor movement, the shaft being provided with a spiral groove, second power means for rotating the shaft, a moving member mounted on the shaft and engaging the groove for movement along the shaft as the shaft rotates, and a cartridge carrying member secured to the moving member for movement therewith, the cartridge carrying member being positioned above the cases and having a pair of downwardly extending projections spaced apart in the direction transverse to the direction of conveyor movement, the distance between the

downwardly extending projections being greater than the transverse dimension of the cartridges, one of the downwardly extending projections being engageable with a cartridge as the carrying member is moved in one direction by the moving member and the other downwardly extending projection being engageable with a cartridge as the carrying member is moved in the other direction by the moving member whereby a cartridge can be moved transversely relative to the direction of conveyor movement.

3. A tape recorder for endless tape cartridges comprising a frame, storing means on the frame for storing a plurality of endless tape cartridges, playing means on the frame for reproducing the tape cartridges, carrying means on the frame for carrying the cartridge from the storing means to the playing means and from the playing means to the storing means, said storing means including endless conveyor means, first power means for moving the endless conveyor means, a plurality of cases attached to the conveyor means for movement therewith, each of the cases adapted to carry an endless tape cartridge and having a bottom wall for supporting a cartridge and spaced-apart front and rear walls extending generally transversely to the direction in which the

conveyor moves, said carrying means including a shaft rotatably mounted on the frame and extending transversely to the direction of conveyor movement, the shaft being provided with a spiral groove, second power means for rotating the shaft, a moving member mounted on the shaft and engaging the groove for movement along the shaft as the shaft rotates, and a cartridge carrying member secured to the moving member for movement therewith, the cartridge carrying member being positioned above the cases and having a pair of downwardly extending projections spaced apart in the direction transverse to the direction of conveyor movement, the distance between the downwardly extending projections being greater than the transverse dimension of the cartridges, one of the downwardly extending projections being engageable with a cartridge as the carrying member is moved in one direction by the moving member and the other downwardly extending projection being engageable with a cartridge as the carrying member is moved in the other direction by the moving member whereby a cartridge can be moved transversely between the front and rear walls of the supporting case.

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