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[56]

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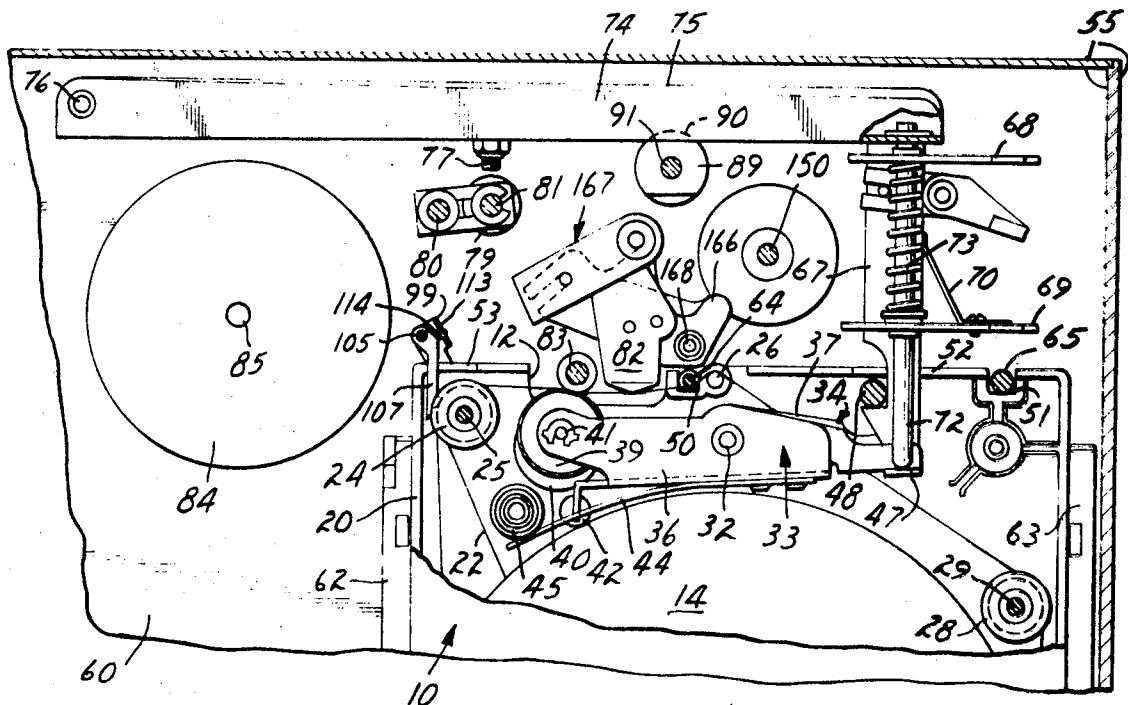
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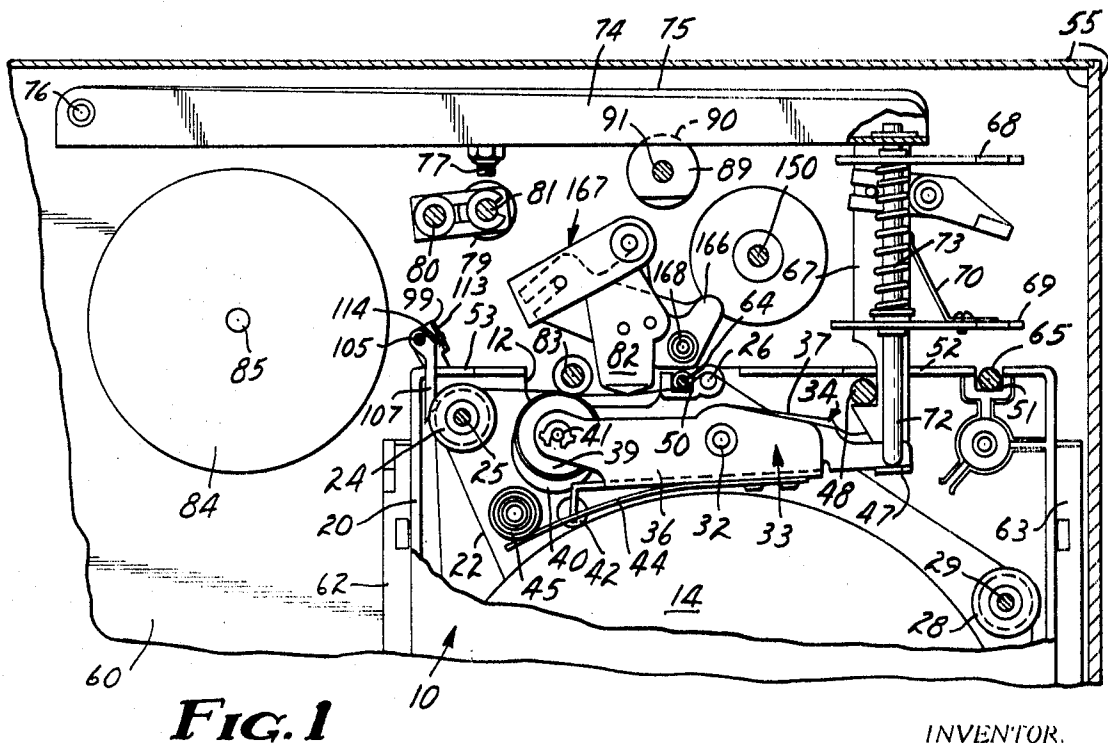
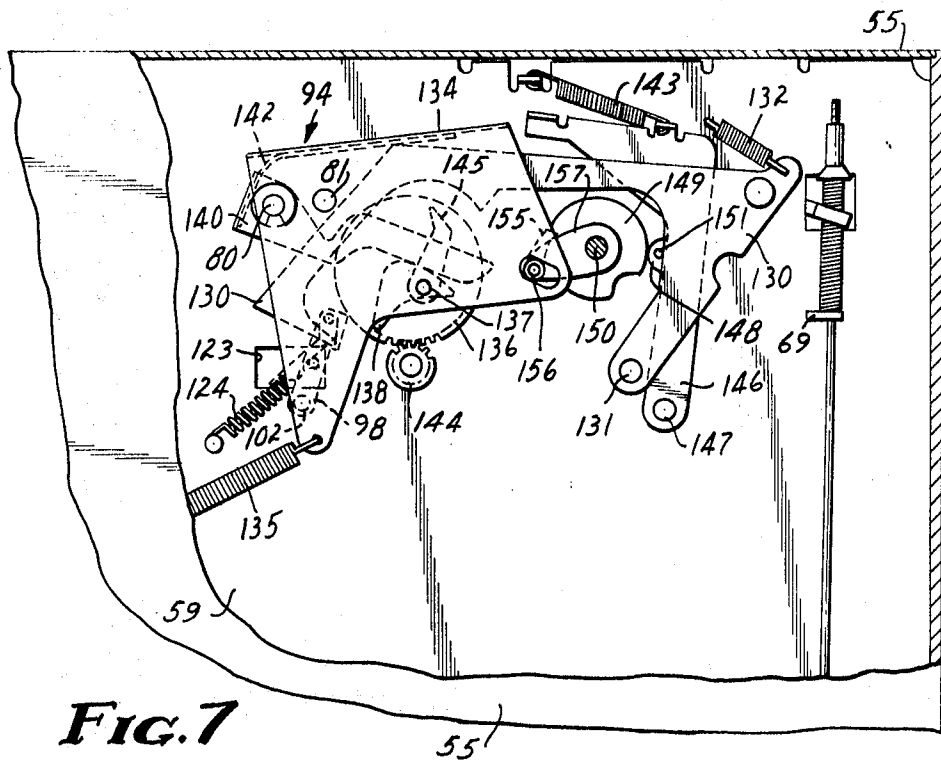
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[54] WEB END SENSING AND REVERSING APPARATUS 24 Claims, 9 Drawing Figs.

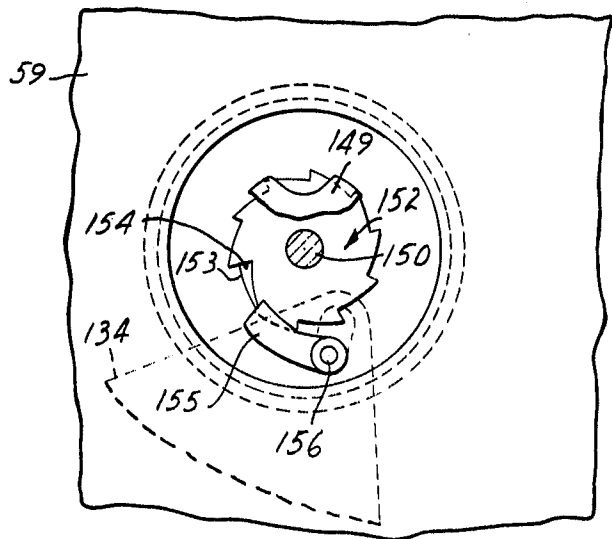
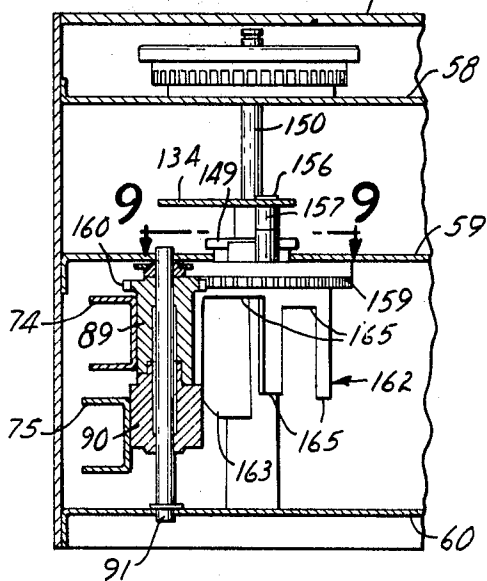
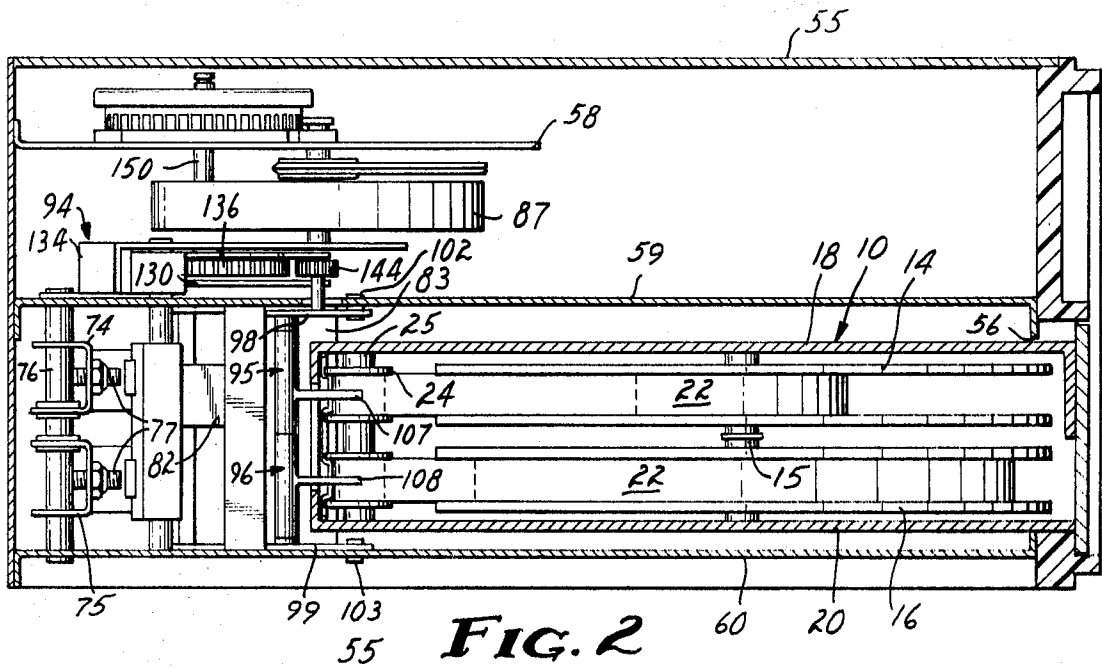
[52] U.S. Cl..... 274/4,
179/100.2, 226/9, 226/50
[51] Int. Cl..... G11b 5/10
[50] Field of Search..... 179/100.2
CA; 220/9, 43, 49, 50; 274/4 A

ABSTRACT: Apparatus for sensing the position of a web for performing a control function, such as reversing the direction of movement of a web, wherein the web is formed with a longitudinal slot and the apparatus has a first arm rotatably supported on one side of the web which extends transverse to the web and which rotatably supports a second arm to engage the web slot on the opposed side of the web, the second arm extending radially from its axis to contact the web and activate a web-reversing mechanism upon engagement of the web slot and rotation with the first arm by the moving web.





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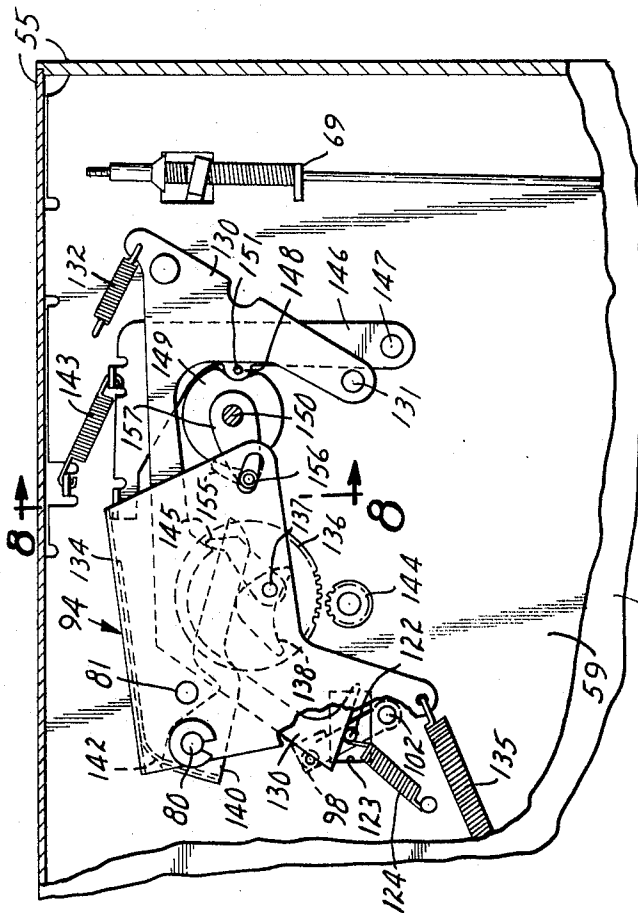


FIG. 6

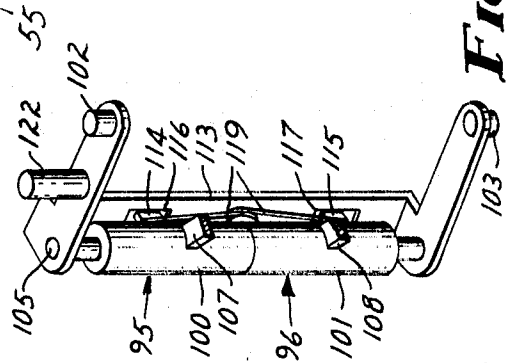


FIG. 5

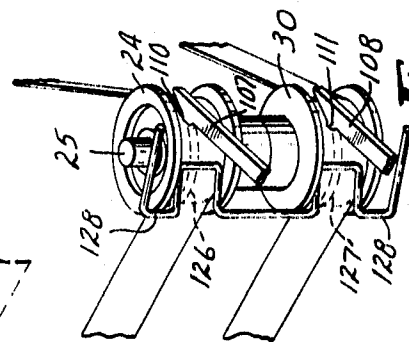


FIG. 4

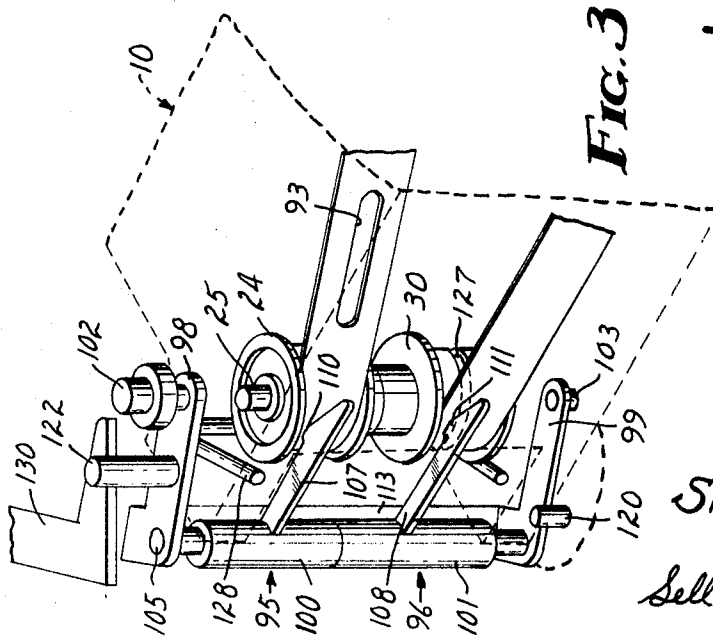


FIG. 3

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WEB END SENSING AND REVERSING APPARATUS

This invention relates to an improved apparatus for sensing the position of a web and for reversing the direction of movement of a web past a transducer in a recording and/or reproducing machine.

In the prior art, detecting of the end of a web and performing a control function such as reversing of the direction of movement of the web past a transducer has been accomplished in a variety of ways. Photocells detecting a transparent window at the end of a length of magnetic tape have been used to activate switches to reverse the tape drive. Such devices have been disadvantageous since the window may lose its transparency and the end of the web is then not detected. Other devices detect a change in the dimensions of the tape at its end and activate switches or move reversing linkages in response to the end detection. The detected alteration in dimensions of the web has generally been accomplished by addition of a clip at the end of the tape to increase its thickness or a reduction or increase in the width of the tape or in a leader attached to the end of the tape. However, these devices have been disadvantageous in that the clip may become dislodged or dislocated and the width of the tape may vary due to wear or distortion and thereby the reversing mechanism may be activated before it is desirable to do so or it may not be activated at all.

An advantage of the present invention is the provision of an apparatus which detects a slot in a moving web by positive engagement thereof and which is driven by the moving web to activate a web-reversing mechanism. A further advantage is the provision of a linkage which detects and engages a slot in a driven web and which is thereupon rotated by movement of the web through a sufficient distance to activate a web-reversing mechanism.

The present invention has the advantages desired of apparatus for reversing the direction of movement of a web relative to a transducer which is positioned along a web guide path. The apparatus, according to the present invention, comprises a web guide path, a web formed with a longitudinal slot at the position to be sensed and positioned along the guide path, a first member rotatably supported on one side of the web and extending transverse to the web, a second member rotatably supported on the first member on the opposed side of the web from the first member support, the second member extending from its axis to contact the web in alignment with the web slot, formed to engage the web slot and biased into contact with the web, and means for reversing the direction of movement of the web upon engagement of the web slot by the second member and rotation of the first and second member by the moving web.

The novel features and advantages of the present invention will become apparent after reading the following description which refers to the accompanying drawing wherein:

FIG. 1 is a fragmentary sectional view of a tape recorder/reproducer adapted to be used with a cartridge and utilizing an end-of-web sensing and reversing mechanism made in accordance with the present invention;

FIG. 2 is a transverse cross-sectional view of the recorder/reproducer and the end-of-web sensing mechanism of FIG. 1;

FIG. 3 is a perspective view of the end-of-web sensing mechanism of the recorder/reproducer of FIG. 1;

FIG. 4 is a perspective view of a part of the end of tape-sensing mechanism of FIG. 3;

FIG. 5 is a perspective view of the part of the mechanism of FIG. 3 deleted in FIG. 4;

FIG. 6 is a plan view of a part of the web-reversing mechanism of the recorder/reproducer of FIG. 1;

FIG. 7 is a plan view similar to that of FIG. 6 illustrating an alternate position of the parts;

FIG. 8 is a transverse cross-sectional view taken along line 8-8 of FIG. 6; and

FIG. 9 is a plan view partially in section taken along line 9-9 of FIG. 8.

Referring now to the drawings there is illustrated a web-reversing mechanism made in accordance with the present invention in combination with a magnetic tape recording and/or reproducing machine wherein the magnetic tape is contained within a tape cartridge.

The tape cartridge 10 comprises a boxlike container having a cutaway portion 12 in one edge wall and within which a pair of reels 14 and 16 are axially aligned and independently rotatably mounted on a shaft 15 supported between opposed sidewalls of the container. Means are provided for guiding the tape from one reel across the cutaway portion 12 and back across the cutaway portion to the other reel and a tape guide and reel brake assembly is provided.

The container is made from molded polymeric material and comprises an upper shell 18 and a lower shell 20 adapted to be secured together by suitable fasteners. The upper and lower shells 18 and 20 are formed with similar rectangular side and edge wall openings forming the rectangular recessed opening or cutaway portion 12 in one edge of the cartridge 10 to expose the tape in the tape path to be hereinafter described. A length of tape 22 is wound on each of the reels 14 and 16 in the same direction, i.e. the tape, as viewed in FIG. 1, is wound clockwise around the inner hub of each reel toward the periphery. Means are provided to define a tape guide path from one reel along one edge of the container 10 across the cutaway portion 12 and back across the cutaway portion to the other reel. The tape path extends from the upper reel 14 around a first guide pulley 24 rotatably mounted on a support pin 25 positioned on one side of the cutaway portion 12, across the cutaway portion 12 of the cartridge 10, around a stationary guide pin 26 positioned on the opposite side of the cutaway portion 12 from the first pulley 24, around a second guide pulley 28 rotatably mounted on a support pin 29, and to a third guide pulley (not shown). Guide pulley support pins 25 and 29 and guide pin 26 are positioned with their axes parallel to the axis of the reels 14 and 16 while the third guide pulley is journaled about an axis normal to the axis of the reels. The tape 22 in traversing the third guide pulley, is turned 180° and returns from the lower side of the third pulley, around a fourth guide pulley (not shown) rotatably mounted on pin 29 below second guide pulley 28, around the guide pin 26 spaced below the first pass across that pin; around a fifth guide pulley 30 rotatably mounted on support pin 25 below first guide pulley 24, and onto the lower reel 16.

The cartridge 10 is also provided with a tape guide and reel brake assembly which supports the pressure rollers which cooperate with a capstan 83 to advance the tape 22. The tape guide and reel brake assembly is supported by a pin 32 mounted between the upper and lower shells 18 and 20 and positioned midway of the width of the cartridge 10 between the tape guide pin 26 and the peripheries of reels 14 and 16 with its axis parallel to the axis of the reels. The tape guide and reel brake assembly comprises similar upper and lower reel brake and pressure roller subassemblies 33 and 34 which have channel-shaped bodies 36 and 37 rotatably mounted on support pin 32 generally midway of their lengths with their channel opening facing the edge of the cartridge 10 having the cutaway portion 12. The height of the subassembly bodies 36 and 37 are generally equal to the thickness of reels 14 and 16 and serve to guide the tape between pin 26 and the second and fourth guide pulleys. The subassembly bodies 36 and 37 each have one end extending across the cutaway portion 12, respectively supporting upper and lower pressure rollers 39 and 40 rotatably mounted on support pins 41 which extend between the flanges of the channel-shaped bodies 36 and 37. The closed wall of the channels adjacent the pressure rollers 39 and 40 are turned toward the reels 14 and 16 and support cylindrical friction brakes 42 which extend across the thickness of the reels 14 and 16. The positions of the pressure roller support pins 41 and friction brakes 42 on the subassembly bodies 36 and 37 are adjusted such that when the fric-

tion brakes 42 contact the peripheries of the reels 14 and 16 the pressure rollers 39 and 40 are within the cartridge 10 adjacent the cutaway portion 12. Leaf springs 44 are secured to the vertical walls of the subassembly bodies 36 and 37 and extend beyond the pressure rollers 39 and 40. They are loaded by a pin 45 extending between the upper and lower shells 18 and 20 to bias the friction brakes 42 into engagement with the peripheries of the reels 14 and 16 and the pressure rollers 39 and 40 away from the capstan 83.

At the end of the subassembly bodies 36 and 37 which extend away from the cutaway portion 12 of the cartridge 10 a major portion of the upper flanges and closed walls of the channels are removed forming the tape guide path, except for vertical tabs 47 on the remote ends thereof. The cartridge 10 is formed with an oblong opening (not shown) aligned with the vertical tabs 47 through which a pair of brake release and pressure roller activating rods 72 may extend to engage the tabs 47 as will be hereinafter described.

A cartridge-locking post 48 is supported by the upper and lower cartridge shells 18 and 20 to the side of the oblong brake release rod opening nearer the cutaway portion 12. Openings connecting pairs of opposed small rectangular recesses 50 and 51 are formed in the cartridge 10 in the same edge as cutaway portion 12, one pair to each side of the locking post 48 and generally equidistant therefrom. The recesses 50, nearer the cutaway portion 12, are between tape guide pin 26 and the cutaway portion 12. A narrow cartridge-locking arm slot 52 is formed in the center of the edge wall and extends from the opening by the rectangular recess 51 to a point adjacent the cartridge-locking post 48. An opening 53 is also formed in the corner of the cartridge 10 adjacent first and fifth tape guide pulleys 24 and 30 for access to the pulleys by a pair of end of tape-sensing arms 107 and 108. The function of the locking post 48, the rectangular recesses 50 and 51, the cartridge-locking arm slot 52, and the tape-sensing arms 107 and 108 will all be hereinafter described.

The recording apparatus cabinet 55 has a rectangular opening 56 between middle and lower support decks 59 and 60 having generally the same dimensions as the container edge wall in which the cutaway portion 12 is formed. Within the cabinet two vertical walls 62 and 63, one on either side of opening 56, guide the cartridge as it is pushed through opening 56 along a lower support deck 60 until the cartridge is positioned as shown in FIG. 1.

Two cartridge-positioning pins 64 and 65 are supported between the middle and lower support decks 59 and 60 and positioned to fit within the small rectangular recesses 50 and 51 in the cartridge edge wall. The positioning pin 64 that fits within recess 50 is formed with smaller diameter portions in the two areas in which the tape path crosses it to further guide the tape 22. A cartridge-locking arm 67 is movably supported generally midway of the height of a pair of brackets 68 and 69 extending between support decks 59 and 60 to pass through the narrow locking arm slot 52 in the container edge wall. This arm 67 has a curved end extending into the cartridge and is formed with a hook along one edge which engages cartridge-locking post 48. It is biased by a leaf spring 70 toward locking post 48 so that as the cartridge 10 is inserted into the apparatus the locking post 48 first contacts the curved end of the locking arm 67. Further movement of the cartridge then moves the locking arm 67 against the bias of leaf spring 70 until the locking post 48 passes the hook which is then forced into engagement with the post 48 by the leaf spring 70. A cartridge-locking lever (not shown) is supported at the front of the cabinet 55 and is connected by appropriate linkages to the locking arm 67 such that movement of the lever draws the hook in locking arm 67 securely against locking post 48. Such movement pulls the rectangular recesses 50 and 51 in the container edge wall snugly against cartridge-positioning pins 64 and 65 to positively position the tape guide path in the cartridge with respect to a transducer 82 and a drive shaft or capstan 83 in the apparatus.

A pair of brake release and pressure roller activating rods 72 are slidably supported by brackets 68 and 69, one above and one below cartridge-locking arm 67. These rods 72 are positioned to extend through the oblong opening in the container edge wall such that each rod contacts one of the vertical tabs 47 at the ends of the brake release and pressure roller subassemblies 33 and 34 when the cartridge 10 is locked in the apparatus. Each rod is biased by a spring 73 toward the cartridge 10 to rotate the brake subassemblies 33 and 34 about their support pin 32 and thereby to release the brakes 42 from the reels and press the pressure rollers 39 and 40 against the capstan 83. The ends of the brake release rods 72 which extend away from the cartridge 10 are restrained, each at one end of one of a pair of long channel-shaped arms 74 and 75. These arms 74 and 75 are rotatably mounted one above the other at their opposite ends on a shaft 76. With the cartridge locked in position and the apparatus in the "off" position, projections 77, one extending from each of the arms 74 and 75 generally midway of their lengths, rest against one end of a vertical brake release rod locator 79 which is rotatably mounted on a shaft 80 and which positions the arms 74 and 75 with the brake release rods 72 held against the force of compression springs 73 so that they contact the vertical tabs 47 without releasing the reel brakes 42.

With the cartridge 10 in position, locked in the apparatus, the tape 22 is in position for movement past a transducer or pickup and/or record means such as a magnetic head 82 by a uniform speed driving means such as capstan 83. The apparatus is provided with means (not shown) for driving the reels 14 and 16 in the same direction through slip clutches to maintain the proper tension in the tape as it is driven. It is placed in the "on" position by activation of a switch (not shown) on the front of the apparatus. Upon placing the apparatus in the "on" position the reel brakes 42 are released and one pressure roller presses the tape 22 against the capstan 83 (as illustrated in FIG. 1).

Activation of the "on" switch energizes a drive motor 84 having a vertical drive shaft 85 extending above the middle support deck 59. Through its drive shaft 85 and an idler wheel (not shown) the motor 84 drives a capstan flywheel 87 which is supported at its center between the upper and middle support decks 58 and 59 on the capstan 83 and which drives the capstan at a uniform speed. The capstan 83 is bearinged at its ends in the upper and lower support decks 58 and 60 and is positioned to be received in the cutaway portion 12 of the cartridge 10 on the side of the tape path opposite the pressure rollers 39 and 40. The capstan 83 provides for movement of the tape 22 along the tape path past the magnetic head 82 and is driven continuously in one direction when the apparatus is in the "on" mode. Activation of the "on" switch also energizes the magnetic head 82 and speaker circuitry for reproducing signals carried by the tape 22.

As the drive motor 84 is energized, the brake release rod locator 79, through appropriate gears and linkages from the motor drive shaft 85, is also rotated about its support shaft 80 to allow the brake release rods 72 to be moved by springs 73 against the vertical tabs 47 of the brake subassemblies 33 and 34. Movement of the release rods 72 rotates the channel-shaped arms 74 and 75 about their support shaft 76 until each arm rests against one of a pair of similar cams 89 and 90 secured to a camshaft 91. These cams 89 and 90 are 90° out of phase. One arm 74 and 75 is supported to permit its associated release rod 72 to rotate the associated brake subassembly 33 or 34 an extent sufficient to disengage the friction brake 42 from the periphery of a reel 14 or 16 and to move a pressure roller 39 or 40 to press the tape 22 against the capstan 83. At the same time the other arm 75 or 74 is supported to permit its associated release rod 72 to rotate the associated brake subassembly 34 or 33 an extent just sufficient to disengage the friction brake 42.

Reversing of the direction of travel of the tape is accomplished by cooperation of a longitudinal slot 93 in the tape 22 with an end-of-tape sensing assembly and a reversing assembly

94. In the illustrated embodiment two end-of-tape sensing assemblies 95 and 96 are provided, each sensing the end of the tape upon movement of the tape in one direction.

Each end-of-tape sensing assembly 95 or 96 comprises a first member 98 or 99 and a second member 100 or 101. Each first member 98 or 99 is supported at one end of a shaft 102 or 103 that is coaxial with the shaft of first and fifth guide pulleys 24 and 30. Each first member 98 or 99 is, then, rotatable about an axis which is perpendicular to either direction of movement of the tape along the guide path and parallel to the adjacent portions of the guide path. Each first member 98 or 99 extends from its support shaft 102 or 103 transverse to the guide path to a position on the opposed side of the guide path.

Each second member 100 or 101 is supported on its associated first member 98 or 99 on the opposed side of the tape guide path from the first member axis for rotation about an axis which is parallel to the first member axis. In the illustrated embodiment this is accomplished by supporting the second members 100 and 101 on a common shaft 105 that extends between the first members 98 and 99 parallel to the first member shafts 102 and 103 and the first and fifth pulley support shaft 25. Each second member 98 or 99 is formed with an arm 107 or 108 that extends perpendicularly from its axis in vertical alignment with the path of a tape slot 93 across its associated guide pulley 24 or 30. Each second member arm 107 or 108 has a length greater than the distance to the tape supporting surface of its associated guide pulley 24 or 30 so as to contact the tape 22 to one side of a plane defined by the first and second member axes in the area where the tape contacts the associated guide pulley 24 or 30. At its contact with the tape 22 each arm 107 or 108 is formed with an ear 110 or 111 having a thickness generally equal to the width of a tape slot 93 and a length less than that of a tape slot.

Each second member 101 or 102 is biased into contact with the tape 22. In the present embodiment this is accomplished by a strip 113 connecting the first members 98 and 99 adjacent the second members 101 and 102. Each second member 101 or 102 is formed with a tab 114 or 115 extending through an associated opening 116 or 117 in the connecting strip 113 that is larger than the tab 114 or 115. A torsion spring 119 supported centrally of the connecting strip 113 biases the second members into engagement with the tape 22. To position the end-of-tape sensing assemblies 95 and 96 with respect to the tape guide path a stop pin 120 is provided on the lower support deck 60 to contact the lower first member 99. A reverse actuating pin 122 extends from upper first member 98 through an opening 123 in the middle support deck 59. A tension spring 124 (FIGS. 6 and 7) extends between the actuating pin 122 and the middle support deck 59 to normally bias the end-of-tape sensing assemblies 95 and 96 against the stop pin 120.

Thus, as a predetermined length of tape passes around a guide pulley a tape slot 93 approaches a guide pulley 24 or 30. As it passes around the pulley an ear 110 or 111 of a second member is biased into the slot. To facilitate engagement of the tape slot 93 by a second member ear 110 or 111 the pulley 24 or 30 is formed with a slot 126 or 127 around its periphery into which the ear 110 or 111 may enter upon passing through a tape slot 93. Upon further movement of the tape 22 the end of the tape slot 93 moves against the ear causing the associated second member to rotate about its support shaft 105 against the bias of torsion spring 119 and both first members 98 and 99 to rotate about their shafts 102 and 103 against the bias of tension spring 124. This rotation is utilized to effect a control function such as activation of a reversing assembly 94. The reversing mechanism could be a switch activated by rotation of an end-of-tape sensing assembly 95 or 96 to reverse the direction of rotation of the tape drive motor. However, in the present embodiment a mechanical reversing assembly 94 is utilized.

A wireform link 128 extends between the upper and lower cartridge shells 18 and 20 adjacent the first and fifth guide pulleys 24 and 30. It is formed to pass across the width of the tape

22 between the flanges of both pulleys 24 and 30. It is positioned to pass across the tape in an area spaced from the contact of the second members 101 and 102 with the tape to lift a second member arm 107 or 108 out of engagement with a tape slot 93 after a sensing assembly 95 or 96 has rotated a sufficient distance to actuate the reversing assembly 94. This prevents momentum in the tape drive from pulling the tape slot 93 across a second member ear 110 or 111 to tear the tape. After the second member 101 or 102 has been lifted out of engagement with a tape slot 93 the assembly-biasing spring 124 rotates the assemblies 95 and 96 back to their normal rest position.

The reversing assembly 94 is activated upon rotation of an end-of-tape sensing assembly 94 or 96 by movement of the end of the reverse actuating pin 122 extending through the middle support deck opening 123 against a flat tripper link 130 supported above the middle deck 59. The tripper link 130 has the general shape of three sides of a parallelogram and is rotatably supported on a shaft 131 at its end removed from its contact with the actuating pin 122. It is biased by a spring 132 into contact with the actuating pin 122 and extends between the parallel upper and lower walls of an eccentric gear carrier 134 of said reversing assembly 94.

The eccentric gear carrier 134 is rotatably mounted on the same shaft 80 as the brake release rod locator 79 and it carries the release rod locator 79 by shaft 81 through the heretofore described movement from the "off" position to the "on" position illustrated in FIG. 6. An eccentrically mounted circular member or gear 136 is supported on a shaft 137 that extends between the parallel walls of the carrier 134 parallel to the shaft 80 and capstan 83. Secured to the gear shaft 137 above the eccentric gear 136 is a cam 138. The cam 138 cooperates with a cam follower 140 that is rotatably supported on the carrier shaft 80 and a leaf spring 142 under tension to normally bias the eccentric gear 136 toward engagement with a complementary gear 144 secured to the capstan 83. The leaf spring 142 extends between the sidewall of the gear carrier 134 and the cam follower 140 to normally urge the larger radius portion of the eccentric gear 136 away from the sidewall of the gear carrier 134 toward engagement with the capstan gear 144. A restraining arm 145 is secured to the eccentric gear shaft 137 below the gear 136. The restraining arm 145 cooperates, by engagement with a ledge protruding from the tripper link 130 (as illustrated in FIG. 6), with tripper link 130 to releasably hold the eccentric gear out of engagement with the capstan gear 144 against the bias of the cam follower 140.

An L-shaped arm 146 is rotatably supported on a shaft 147 adjacent the tripper link shaft 131 and extends between the tripper link 130 and the middle support deck 59. The unsupported end of this arm 146 is upturned and normally engages the sidewall of the eccentric gear carrier 134 to releasably hold the carrier substantially at its furthest oscillatory excursion from the capstan 83 against the clockwise rotational bias (as viewed in FIG. 6) of a tension spring 135. Arm 146 is formed with a rounded protrusion 146 which normally fits in an indentation in an indexing cam 149 under the bias of a spring 143. The cam 149 is carried by and secured to a rotatable cam shaft 150 bearing in the upper and lower support decks 58 and 60. A pin 151 extends vertically upward from the rounded protrusion of the L-shaped arm 146 to normally lie adjacent the inner edge of the tripper link 130 to hold the tripper link 130 out of engagement with the restraining arm 145 when the gear carrier 134 is released.

A pair of ratchet wheels 152 and 153 (FIG. 9) are supported below the indexing cam 149 on the rotatable shaft 150 in an opening in the middle support deck 59. The upper ratchet wheel 152 is secured to the indexing cam 149. It is formed with ten teeth, one of which 154 extends deeper into the periphery of the wheel than the others. The lower ratchet wheel 153 is supported for rotation about the rotatable cam shaft 150 and is formed with 10 teeth similar to the shallower teeth of the upper wheel 152. A pawl 155 is supported on a shaft 156. Shaft 156 extends between the flanges of the gear

carrier 134 for movement with the carrier and is supported on an arm 157 which arm 157 is rotatably supported above the indexing cam 149 on the rotatable camshaft 150. The pawl 155 is formed so that the portion thereof aligned with the upper ratchet wheel 152 extends radially inward toward the axis of the wheels further than the portion aligned with the lower ratchet wheel 153. This differential is made large enough so that the pawl 155 engages a tooth of the lower ratchet wheel 153 only when it also engages the deep tooth 154 in the upper ratchet wheel 152. Thus, when the pawl 155 moves the upper ratchet wheel 152 through a complete revolution the lower ratchet wheel 153 will only be moved through one-tenth of a revolution or 36°.

A large spur gear 159 is secured to the lower ratchet wheel 153 below middle support deck 59 for rotation about the rotatable camshaft 150. A smaller spur gear 160 is secured to the upper channel arm cam 89 for rotation about the channel arm camshaft 91. The diameters of these spur gears 159 and 160 are chosen so that the channel arm cams 89 and 90 rotate 90° when the lower ratchet wheel is rotated through 36° to move the pressure rollers 39 and 40 between their alternate positions, in or out of engagement with the capstan 83.

The pawl 155 forms a first driving member of two single direction clutches with each ratchet wheel 152 or 153 forming the second member of one of the clutches. The clutch formed with the upper ratchet wheel 152 provides for rotation of the rotatable camshaft 150 and the indexing cam 149 to which it is secured, while the clutch formed with the lower ratchet wheel 153 provides for rotation of the channel arm cams 89 and 90 carried by the camshaft 91. The clutches, therefore, provide for single direction rotation of their respective cam shafts 150 or 91 in response to oscillatory movement of the carrier 134.

Supported below large spur gear 159 on the rotatable cam shaft 150 is an axially stepped head positioner 162 and an axially inclined cam 163. The head positioner 162 is secured to the large spur gear 159. It is formed with 10 steps 165 equally spaced about its axis. These steps 165 are arranged on a cylinder to engage the upper surface of a lobe 166 (FIG. 1) extending from an assembly 167 supporting the magnetic head 82. The head assembly is supported on a shaft 168 and it is biased upward by a compression spring (not shown) to hold the lobe 166 against a step 165. The head positioner 162 thus provides 10 positions for the magnetic head 82. Five of those positions being aligned with five tracks on the upper pass of the tape and five positions with five tracks on the lower pass, the steps alternating between a position on the upper pass and a position on the lower pass. The axially inclined cam 163 is secured to the rotatable shaft 150 to rotate therewith. It is formed to engage the head assembly lobe 166 upon rotation of the shaft 150 from its normal position and to move the head assembly 167 downward against its biasing spring below the lowest extending of the head positioner steps 165 and then to release the lobe 166 as the shaft 150 completes one revolution.

In use an end-of-tape sensing assembly ear 110 or 111 engages a tape slot 93 causing rotation of the sensing assembly 95 or 96 as aforescribed to move the reverse actuating pin 122 against the tripper link 130. Movement of the tripper link 130 moves the ledge protruding from the tripper link of the path of the eccentric gear-restraining arm 145. This permits the cam follower 140 to force rotation of the eccentric gear 136 through the cam 138 bringing the eccentric gear 136 into mesh with the capstan gear 144 so that it is driven from the continuously rotating capstan 83. Because of the eccentricity of the gear 136 the gear carrier 134 during this initial movement is forced to rotate counterclockwise as viewed in FIG. 7 carrying the pawl 155 to rotate the upper ratchet wheel 152 one tooth or 36°. Rotation of the upper ratchet wheel 152 also rotates the rotatable shaft 150 and the indexing cam 149 and inclined head positioning cam 163 the same extent.

Rotation of the indexing cam 149 moves its indent out of alignment with the rounded protrusion of the L-shaped arm 146 so that the rounded protrusion is forced outward to ride

on the periphery of the disc 149 as illustrated in FIG. 7. This movement rotates the L-shaped arm 146 to remove its upturned end from the path of the sidewall of the eccentric gear carrier 134 and also to move the pin 151 extending from the rounded protrusion against the tripper link 130. Movement of the pin 151 against the tripper link holds the ledge of the tripper link 130 out of the path of the eccentric gear restraining arm 145.

Being unrestrained the eccentric gear 136 continues to mesh with and be driven by the capstan gear 144 and the eccentricity of the gear 136 together with the carrier-biasing spring 135 causes the carrier 134 to oscillate through an arc sufficient to move the pawl 155 against successive teeth on the upper ratchet wheel 152. This continued rotation moves the head assembly 167 downward through rotation of the inclined head positioning cam 163.

The upper ratchet wheel 152 is positioned so that the eighth tooth that the pawl 155 engages is the deep tooth 154. As the pawl 155 engages the deep tooth 154 it also engages a tooth on the lower ratchet wheel 153 and rotates the lower ratchet wheel, the larger spur gear 159 and the stepped head positioner 162 through 36°. The large spur gear 159 also rotates the small spur gear 160 through 90° thereby rotating the channel arm cams 89 and 90 through 90°. This rotation causes the channel-shaped arms 74 and 75 to exchange positions so that the channel arm 74 or 75 previously carrying the brake release rod 72, that only engaged its associated brake subassembly 33 or 34 sufficiently to release the brake 42 from the associated reel 14 or 16, is permitted to be rotated by its compression spring 73 to press its associated pressure roller 39 or 40 against the tape 22 at the capstan 83. The other arm 75 or 74 is moved outward to disengage its associated pressure roller 40 or 39 from the tape 22 without engaging its brake 42 against the associated reel 16 or 14. Since the tape is wound on the reels 14 and 16 in the same direction the changing of the pressure roller 39 or 40 engaging the tape 22 while the capstan 83 rotates continuously in one direction reverses the direction of movement of the tape along its guide path between the reels.

Rotation of the stepped head positioner 162 through 36 degrees positions a different step 165 in alignment with the head assembly lobe 166 corresponding to a track on the pass of the tape 22 which a pressure roller 39 or 40 engages. This provides positioning of the magnetic head 82 in line with a new track on the tape 22 and in the path of the pressure roller 39 or 40 that now cooperates with the capstan 83 to drive the tape.

After the pawl 155 has engaged the deep tooth 154 it engages two more teeth on the upper ratchet wheel 152 thereby completing one revolution of the rotatable shaft 150, the indexing cam 149, and the inclined head positioning cam 163. As aforescribed, completion of one revolution of the inclined cam 163 permits the head assembly 167 to be moved upward by its biasing spring so that the positioning lobe 166 engages the newly aligned head positioner step 165 and the magnetic head 82 is repositioned.

Completion of one revolution of the indexing cam 149 brings its indent back into alignment with the rounded protrusion of the L-shaped arm 146 which then moves back into the indent. This moves the upturned end of the L-shaped arm 146 into the path of the sidewall of the eccentric gear carrier 134 while the carrier 134 is returning from its furthest counterclockwise (as viewed in FIG. 6) excursion substantially at its furthest excursion from the capstan 83. The upturned end of the L-shaped arm 146, therefore, engages the sidewall of the carrier 134 preventing the carrier from completing its clockwise excursion. Movement of the L-shaped arm 146 also moves the pin 151 engaging the tripper link 130 permitting the tripper link 130 to return to its normal rest position with its protruding ledge in the path of the eccentric gear restraining arm 145. As the eccentric gear 136 continues its rotation the gear carrier 134 cannot move to compensate for the decrease in the radius of the gear 136 and the eccentric gear 136 disen-

gages from the capstan gear 144. The momentum of the eccentric gear 136 continues it in rotation until the restraining arm 145 contacts the ledge protruding from the tripper link 130 at which time it is prevented from again moving into mesh with the capstan gear 144. Thus, the indent in the indexing cam 149 provides preselected positions of the cam shafts 91 and 150 at which the L-shaped arm 146 is operative to hold the carrier 134 and the ledge of the tripper link 130 is operative to hold the eccentric gear 136 against their respective biasing springs 135 and 142.

The direction of travel of the tape 22 past the magnetic head 82 is thereby reversed and the magnetic head is repositioned. The machine is then in a position to reproduce signals on another track of the tape.

Having thus described the present invention, what I claim is:

1. In combination with a recording and/or reproducing machine wherein means are provided for moving a web which extends along a guide path past a transducer, the improvement which comprises:

means defining a web guide path,

a web extending along said guide path, said web being formed with at least one longitudinal slot spaced from an end thereof,

a first member supported adjacent one side of said web guide path for rotation about an axis which is perpendicular to the direction of movement of said web along and parallel to at least the adjacent portion of said web guide path, said member extending from said axis transverse to said guide path to a position on the opposed side of said path,

a second member supported on said first member for rotation about an axis parallel to said first member axis on the opposed side of said web guide path from said first member axis, said second member extending from its axis to contact said web to one side of a plane defined by said first and second member axes and in alignment with the path of said longitudinal web slot as said web moves along said guide path and being formed to engage said longitudinal slot,

means biasing said second member into contact with said web, and

means for performing a control function on said web moving means in response to rotation of said first and second members by said web upon engagement of said web slot by said second member.

2. The combination of claim 1 wherein said means defining a guide path includes a rotatable guide pulley around a portion of the periphery of which said web is guided, said guide pulley being supported coaxially with said first member.

3. The combination of claim 2 wherein said second member contacts said web in the area in which said web contacts the periphery of said guide pulley.

4. The combination of claim 3 wherein said guide pulley is formed with a peripheral slot aligned with the path of said web slot around said guide pulley to facilitate engagement of said web slot by said second member.

5. The combination of claim 1 including means for disengaging said second member from said web slot upon activation of said means for reversing the direction of movement of said web.

6. The combination of claim 1 wherein said means for performing a control function on said web moving means includes means for reversing the direction of movement of said web along said guide path.

7. The combination of claim 6 wherein said web is adapted to carry signals in at least two parallel longitudinal tracks, wherein said transducer is movable transversely of the width of said web path and normally aligned with one of said tracks, and including means for positioning said transducer in alignment with a different one of said tracks upon reversal of the direction of movement of said web.

8. The combination of claim 7 wherein said means for positioning said transducer includes a rotatable axially stepped

positioner formed with steps engageable with said transducer, each step corresponding to a different one of said tracks on said web, a rotatable axially inclined cam for disengaging said transducer from said positioner and returning it to said positioner during one revolution of said cam about its axis, means for rotating said cam through one revolution upon reversing of said web, and means for rotating said positioner while said transducer is held out of engagement by said cam to position a different one of said steps for engagement with said transducer.

9. The combination of claim 7 wherein said web in extending along said guide path presents a pair of parallel coplanar passes adjacent the path along which said transducer is movable, wherein said transducer is normally aligned with a track on one of said passes, and wherein said means for positioning said transducer positions said transducer in alignment with a different one of said tracks on the previously unaligned pass of said web.

10. The combination of claim 1 wherein said means for moving a web comprises:

a capstan positioned on one side of said web path, means for rotating said capstan continuously about its axis, and

a pair of pressure rollers mounted on the opposite side of said web path from said capstan for selective movement toward and away from the capstan,

wherein said web in extending along said guide path passes between said capstan and the first of said pressure rollers and returns between said capstan and the second of said pressure rollers, and wherein said means for performing a control function on said web-moving means comprises means for retracting one of said pressure rollers and for advancing the other of said pressure rollers to reverse the direction of movement of said web.

11. The combination of claim 10 wherein said web is adapted to carry signals in at least two parallel longitudinal tracks, wherein said transducer is supported adjacent said capstan for movement transverse of said web path and normally aligned with one of said tracks on one of said web passes across said capstan, and including means for positioning said transducer in alignment with a different one of said tracks on the previously unaligned pass of said web upon reversal of the direction of movement of said web.

12. The combination of claim 11 wherein said means for positioning said transducer includes a rotatably axially stepped positioner formed with steps engageable with said transducer, each step corresponding to a different one of said tracks on said web, a rotatable axially inclined cam for disengaging said transducer from said positioner and returning it to said positioner during one revolution of said cam about its axis, means for rotating said cam through one revolution upon reversing of said web, and means for rotating said positioner while said transducer is held out of engagement by said cam to position a different one of said steps for engagement with said transducer.

13. In combination, a drive shaft, a carrier mounted for oscillatory movement toward and away from said drive shaft on an axis parallel with that of said drive shaft, an eccentrically rotatable member mounted on said carrier for rotation on an axis parallel with that of said drive shaft, means biasing said carrier to urge said eccentric member toward engagement with said drive shaft, rotation of said drive shaft while said eccentric member is engaged therewith effecting rotation of said eccentric member and oscillatory movement of said carrier, means biasing said eccentric member to urge the portion thereof furthest from its axis into engagement with said drive shaft, a cam shaft and at least one cam supported thereon, a driving connection for effecting a single direction rotation of said cam carried by said cam shaft in response to oscillatory movement of said carrier, first releasable holding means associated with said eccentric member for holding the latter against the force of said biasing means with the portion thereof furthest from its axis generally retracted furthest from said drive shaft, second releasable holding means associated

with said carrier for holding the latter in a retracted position substantially at its furthest oscillatory excursion from said drive shaft when oscillated to said retracted position, carrier control means for engagement by said second holding means for rendering said second holding means operative to hold said carrier retracted when said cam shaft reaches a preselected position, and eccentric member control means for engaging said first holding means for rendering said first holding means operative to hold said eccentric member retracted when said cam shaft reaches a said preselected position.

14. The combination of claim 13 wherein said carrier control means includes an indexing cam carried by said cam shaft for engagement by said second holding means.

15. The combination of claim 14 wherein said eccentric member control means comprises an extension from said second holding means positioned to hold said first releasable holding means released as said second holding means is released.

16. The combination of claim 13 wherein said driving connection for effecting rotation of a cam carried by said camshaft in response to oscillatory movement of said carrier comprises a single direction clutch having an oscillatable first member connected to said carrier, a cooperating rotatable second member and means for driving a cam carried by said camshaft in response to rotation of said second member.

17. The combination of claim 16 wherein said carrier control means includes an indexing cam carried by said camshaft for engagement by said second holding means.

18. The combination of claim 17 wherein said indexing cam and said second member are secured to said camshaft to effect rotation of said indexing cam in response to rotation of said second member.

19. In a tape recorder having a rotating capstan and a pressure roller alternately movable into and out of engagement therewith for starting, maintaining, and stopping forward tape drive, the improvement comprising:

a carrier mounted for oscillatory movement toward and away from said capstan on an axis parallel with that of said capstan,

an eccentrically rotatable member mounted on said carrier for rotation on an axis parallel with that of said capstan, means biasing said carrier to urge said eccentric member toward engagement with said capstan, rotation of said capstan while said eccentric member is engaged therewith effecting rotation of said eccentric member and oscillatory movement of said carrier,

means biasing said eccentric member to urge the portion thereof furthest from its axis into engagement with said drive shaft,

a camshaft and at least one cam supported thereon, a driving connection for effecting a single direction rotation of said cam carried by said camshaft in response to oscillatory movement of said carrier,

first releasable holding means associated with said eccentric member for holding the latter against the force of said biasing means with the portion thereof furthest from its axis generally retracted furthest from said capstan, second releasable holding means associated with said carrier for holding the latter in a retracted position substantially at its furthest oscillatory excursion from said capstan when oscillated to said retracted position,

carrier control means for engagement by said second holding means for rendering said second holding means operative to hold said carrier retracted when said camshaft reaches a preselected position,

eccentric member control means for engaging said first holding means for rendering said first holding means operative to hold said circular member retracted rendering said first holding means operative to hold said circular member retracted when said camshaft reaches a said preselected position, and

means responsive to rotation of said camshaft from one said preselected position to the next adjacent preselected position for moving said pressure roller to its said alternate position.

20. The tape recorder of claim 19 wherein said carrier control means includes an indexing cam carried by said camshaft for engagement by said second holding means.

21. The tape recorder of claim 20 wherein said eccentric member control means comprises an extension from said second holding means positioned to hold said first releasable holding means released as said second holding means is released.

22. The tape recorder of claim 19 wherein said driving connection for effecting rotation of a cam carried by said camshaft in response to oscillatory movement of said carrier comprises a single direction clutch having an oscillatable first member connected to said carrier, a cooperating rotatable second member and means for driving a cam carried by said camshaft in response to rotation of said second member.

23. The tape recorder of claim 22 wherein said carrier control means includes an indexing cam carried by said camshaft for engagement by said second holding means.

24. The tape recorder of claim 23 wherein said indexing cam and said second member are secured to said camshaft to effect rotation of said indexing cam in response to rotation of said second member.

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