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(54) MAGNETIC TAPE RECORDING AND/OR REPRODUCING APPARATUS

(71) We, SONY CORPORATION, a corporation organised and existing under the laws of Japan, of 7—35 Kitashinagawa-6, Shinagawa-ku, Tokyo, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to magnetic tape recording and/or reproducing apparatus.

In a prior art video tape recorder (VTR) in which magnetic recording and/or reproducing are performed by winding a magnetic tape around the guide drum in α-it is generally necessary to wind the magnetic tape around the guide drum in a α-shape or Ω-shape at a predetermined angle to the guide drum. In the prior art VTR, winding and unwinding of the magnetic tape are very complicated and it is very difficult to wind the magnetic tape on the guide drum at a predetermined angle each time.

According to the present invention there is provided a magnetic tape recording and/or reproducing apparatus comprising a cylindrical tape guide drum having at least one rotary magnetic head, at least one tape guide means for engaging a magnetic tape, the magnetic tape extending between spaced take-up and supply reels which are mounted on the apparatus when the apparatus is to be used, and means for moving said tape guide means in an arcuate path about at least a portion of the periphery of the tape guide drum whereby the magnetic tape is moved into engagement with the tape guide drum for scanning by said rotary head or heads.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view illustrating a rotary magnetic head of one embodiment of a magnetic tape recording and/or reproducing apparatus according to the present invention;

Figure 2 is a plan view of the rotary head of Figure 1 at the beginning of a tape winding operation;

Figure 3 is an elevation of the rotary head of Figure 1 at the beginning of a tape winding operation;

Figure 4 is a plan view of the rotary head of Figure 1 at the end of a tape winding operation;

Figure 5 is an elevation of the rotary head of Figure 1 at the end of a tape winding operation;

Figure 6 is a perspective view of part of the magnetic tape recording and/or reproducing apparatus;

Figure 7 is a longitudinal sectional view of a tape cassette used in the magnetic tape recording and/or reproducing apparatus;

Figure 8 is a longitudinal sectional view of the reel table of the magnetic tape recording and/or reproducing apparatus;

Figure 9 is an enlarged plan view of the magnetic tape recording and/or reproducing apparatus of the present invention;

Figure 10 is a perspective view of another part of the magnetic tape recording and/or reproducing apparatus;

Figure 11 is a perspective view illustrating a part of a lock releasing lever of the magnetic tape recording and/or reproducing apparatus;

Figures 12A to 12F, inclusive, are plan views illustrating geometrical relations between the lock releasing lever of Figure 11 and its locking pin;

Figure 13 is a part of the circuit diagram of the magnetic tape recording and/or reproducing apparatus illustrating the relations between switches and a motor;

Figure 14 is a side view illustrating the casing of the magnetic tape recording and/or reproducing apparatus wherein a part of the

casing is broken away for the purpose of illustration;

Figure 15 is a plan view of part of another embodiment of the present invention, showing means for preventing double winding of the magnetic tape at the beginning of a tape winding operation; and

Figure 16 is a plan view illustrating the means of Figure 15 at the end of a tape winding operation.

A rotary magnetic head will first be described with reference to Figures 1 to 5. In Figure 1, a bearing member 3 having at its upper end portion a lower guide drum member 2 is mounted on or fixed to a base plate 1, bearings 5 and 6 are respectively provided in upper and lower end portions of a cylindrical bore of the bearing member 3, and a coil spring 4 is disposed between the bearings 5 and 6. A rotary shaft 7 is supported by the bearings 5 and 6. At the lower end of the shaft 7 a pulley 8 is fixed to the shaft 7, the pulley 8 being driven by a motor (not shown) through a belt. To the upper end portion of the shaft 7 is secured an upper guide drum member 9 having nearly the same diameter as the lower guide drum member 2.

At the lower surface of the upper drum member 9 a rotary magnetic head 10 and a balancing weight (balancer) 11 are mounted diametrically opposite each other. That is, the balancing weight 11 is disposed at the symmetrical position relative to the magnetic head 10 with respect to the centre of the lower surface of the upper drum member 9 for the purpose of compensating for the displacement of the centre of the gravity of the upper drum member 9 caused by the magnetic head 10. The upper drum member 9 and the lower drum member 2 constitute a guide drum 12. On the outer circumferential surface of the guide drum 12, a magnetic tape 13 is wound in use in an α (alpha) shape or an Ω (omega) shape and magnetic recording and/or reproducing is achieved by the rotation of the magnetic head 10 which is caused by the rotation of the upper guide drum member 9.

A bearing means 14 is mounted on the outer circumferential surface of the bearing member 3 in its middle region. On the outer circumferential surface of the bearing means 14 a ring-shaped guide holding member 15 is rotatably mounted. An engaging roller 18 is provided which is supported by a movable supporting lever 17 and can when required engage in a notch or recess 16 formed in the periphery of the guide holding member 15, the supporting lever 17 being movable against the resilience of a spring 103 which will be described later on.

A tape-supply-side guide member or guide pin 19, a first sub-guide member or guide roller 20, a second sub-guide member or guide roller 21 and a take-up-side guide member or guide pin 22 are respectively mounted on the upper surface 15a of the guide holding member 15 at angular spacings of about 90 degrees. Near the outside of the guide pin 19, a third sub-guide member or guide roller 23 is provided. Since it is unnecessary to alter the pitch of the magnetic tape 13 by the first and second rollers 20 and 21, the first and second rollers 20 and 21 are made cylindrical and their rotational axes are perpendicular to the surface 15a. The third roller 23 and the guide pin 19 are the tape guide members to alter the pitch of the tape travelling direction. To achieve this the third roller 23 is made cone-shaped with its rotational axis perpendicular to the surface 15a and the guide pin 19 is also made cone-shaped in the opposite sense with respect to the third roller 23 and with its rotational axis also perpendicular to the surface 15a. Since the guide roller 23 and the guide pin 19 change the pitch of the tape travelling direction upwards by a predetermined angle, the guide pin 19 may be upside-down cone-shaped and the guide roller 23 may be cylindrical. However, the guide roller 23 and the guide pin 19 may be cylindrical with their rotational axes tilted for the same object.

The guide pin 22 comprises a lower cylindrical portion 22a and an upper tapered guide portion or cone-shaped portion 22b, and alters the travelling direction of the tape 13 through the predetermined angle by the cone-shaped portion 22b and then guides the tape 13 horizontally at a different height from the initial horizontal direction. A tape supply guide roller 24 and a tape take-up guide roller 25 are rotatably mounted on the base plate 1.

When a tape cassette 41 is mounted on the apparatus, the tape 13 supplied from a supply reel 43 in the tape cassette 41 via the guide roller 24, is inserted into a gap a formed between the guide drum 12 and the guide pin 19 and a gap b formed between the guide drum 12 and the guide pin 22 as illustrated in Figures 2 and 3, and then, the tape 13 is fed to a take-up reel 44 also in the tape cassette 41 via the guide roller 25. By pushing a play button 30 (Figure 9), that is, a recording button or reproducing button, the roller 18 is removed from the notch 16 and then the guide holding member 15 is rotated by about one revolution in the anti-clockwise direction as shown by an arrow A in Figure 2, and thereafter the roller 18 again engages into the notch 16, as will be described in detail layer. This causes the tape 13 to be wound around the guide drum 12 in α (alpha) shape as shown in Figures 4 and 5, and further the position of the lower edge of the tape 13 at the guide pins 19 and 22 is regulated by flanges 26 and 27 of the guide pin 19 and the cone-shaped portion 22b respectively. As a result of this, the angle

of the tape 13 wound around the guide drum 12 is always kept constant. Further, when the tape 13 is initially inserted into the gaps *a* and *b*, and the tape 13 is strained by rotation of either one of the reels 43 or 44, the lower edge of the tape 13 is supported by the flanges 26 and 27. Accordingly, if the guide holding member 15 is rotated the tape 13 is smoothly wound around the guide drum 12.

Recording or reproducing is achieved by causing the tape 13 to travel as shown in Figures 4 and 5 by means of a capstan 31 and a pinch-roller 32 (Figure 9), and also by transmitting the rotation of a motor M (Figure 13) to the rotary magnetic head 10 through the pulley 8, the rotary shaft 7 and the upper guide drum member 9. To wind the tape 13 around the guide drum 12 about 360 degrees, it is enough to arrange the guide pins 19 and 22 in such a manner that the common inner tangential line of the guide pins 19 and 22 is substantially a tangent to the periphery of the guide drum 12.

Unwinding of the tape 13 from the guide drum 12 is achieved by removing the roller 18 from the notch 16, rotating the guide holding member 15 by about one revolution in the clockwise direction as shown by an arrow B in Figure 4, and then re-engaging the roller 18 in the notch 16. This action is carried out by opening a cover 34 of a case 33 (Figure 14) or pushing a rewind button 35 (Figure 9) as described in detail later. It will be apparent that unwinding of the tape 13 is very easily done.

The reel table and the tape cassette mounted on it will be described with reference to Figures 6, 7 and 8. As shown in Figure 7, the tape cassette 41 comprises a case 42, a take-up reel 43 and a supply reel 44 mounted one above the other in the case 42, the video tape 13 with its ends fixed to the reels 43 and 44, and the guide rollers 24 and 25 (Figures 2 and 4). The lower supply reel 44 comprises a cylindrical internal gear portion 48 and an annular tape holding plate portion 49 which extends outwardly from a position slightly higher than the lower end of the gear portion 48, and a lower projecting portion 48a of the gear portion 48, the lower projecting portion 48a being inserted into a lower opening 50 of the case 42 so as to be freely rotatable. The take-up reel 43 mounted above the supply reel 44 comprises a cap-shaped internal gear portion 51 and an annular tape holding plate portion 52 which extends outwardly from the lower end of the gear portion 51. A ring-shaped projection 54 formed on the upper inside surface of the case 42 is inserted into a ring-shaped groove 53 formed on the outer surface of the gear portion 51.

As shown in Figure 8, a rotary shaft 57 is rotatably journaled to a base plate 56 of a reel table 55 through a bearing 58, and a flange 59 of the rotary shaft 57 is continuously and resiliently pressed upward by a spring 60. A wheel 61 is fixed to the rotary shaft 57 and a take-up reel wheel 62 which is also journaled rotatably on the shaft 57 rests on the wheel 61 with frictional material such as a felt pad therebetween, the wheel 62 being rotatably mounted on the shaft 57. A supply reel wheel 63, a reel holding plate 64 and a supply gear 65 are rotatably supported by the rotary shaft 57 in that order, the wheel 63, plate 64 and gear 65 being secured together. A key 66 fixed to the shaft 57 is inserted in a ring-shaped groove 67 of the wheel 63 to prevent movement of the wheel 63, the plate 64 and the gear 65 in the axial direction. A take-up gear 68, which is smaller than the gear 65 in diameter, is fixed to the shaft 57 at the upper end thereof. There is a small gap between the gear 68 and the top of the gear 65, and the gear 68 meshes with the internal gear portion 51, while the gear 65 is made to be geared into the internal gear portion 48. Since the gears 65 and 68 have inclined portions 65a and 68a at the upper circumferential portions thereof, the gears 65 and 68 can easily be engaged with the gear portions 48 and 51.

Referring also to Figure 7, a distance *c* between the upper surface of the plate 64 and the upper surface of the gear 68 is selected to be slightly larger than a distance *d* between the lower surface of the gear portion 48 of the supply reel 44 and the internal surface of the central part of the gear portion 51 of the take-up reel 43. Therefore, when the case 42 is mounted on the reel table 55, the lower end of the supply reel 44 rests on the reel holding plate 64, and the contact between the reels 43 and 44 is released, so that the reels 43 and 44 are separated and are able to rotate independently.

In use, therefore, the case 42 is fixed to the reel table 55 with the gear 68 meshed with the internal gear portion 51, the gear 65 meshed with the internal gear portion 48, and a part of the magnetic tape 13 wound around the guide drum 12 in the manner set forth above. In this case, since the magnetic tape 13 is supplied from the supply reel 44 and is taken up by the take-up reel 43 disposed above the supply reel 44, there is a height difference between the tape 13 on the supply reel 44 and that on the take-up reel 43, and it is convenient to wind the tape 13 around the guide drum 12 at an angle.

During operation, the tape 13 is transferred at a predetermined speed by the capstan 31 and the pinch roller 32, as will be described in detail later. At the same time the rotation of the wheel 62 is transmitted through the frictional material to the wheel 61, and the rotation of the wheel 61 is transmitted to the gear 68 through the rotary shaft 57. Con-

sequently, the take-up reel 43 meshed with the gear 68 rotates to wind the magnetic tape 13 around the reel 43. The difference between the travelling speed of the magnetic tape 13 and the rotational speed of the pulley 62 is absorbed by the frictional material.

When a fast forward button 36 is pushed, the pinch roller 32 is moved away from the capstan 31 and the rotation of the wheel 61 is directly transmitted to the take-up reel 43, so that the tape 13 is transferred at a predetermined fast forward speed, as will be described later in detail.

When a rewind button 35 is pushed, the wheel 62 is not rotated and only the wheel 63 rotates. In this case, the rotation of the wheel 63 is transmitted to the gear 65 through the plate 64, so that the supply reel 44 rotates at a high speed almost equal to that of the rotation of the wheel 63 to wind the magnetic tape 13 around the supply reel 44, as will be described later in detail.

Since the diameters of the internal gear portions 48 and 51 are designed to be relatively large in the present example the driving force is smoothly transmitted from the gears 65 and 68 to the gear portions 48 and 51 and the reels 43 and 44 rotate without unsteadyness. The internal gear portions 48 and 51 preferably have a diameter larger than 1/6 and more preferably have a diameter larger than 1/4 of the diameter of the hub portions or the tape holding plate portions 49 and 52, in other words, the maximum diameter of the wound tape 13.

The overall driving means will now be described with reference to Figures 6 and 9 to 12. In Figure 9 a reciprocating lever 37 interlocked with a play button 30 is coupled to a V-shaped lever 39 by means of a pin 38; contacts, with an inclined edge 40, a pin 70 secured to a pinch roller supporting plate 69; and bears against a V-shaped lever 72 by means of a projection 71 formed on the lever 37. The pinch roller supporting plate 69 is rotatable about a shaft 127. The V-shaped lever 39 is rotatable about a shaft 73, and is actuated by projections 76 and 77 formed on reciprocating levers 74 and 75 interlocked respectively with the fast forward button 36 and the rewind button 35. The pin 38 is secured to one end of the lever 39 and at the other end of the lever 39 a working arm 78 is rotatably supported by a shaft 140. As shown in Figure 11, the movement of the working arm 78 is limited to one direction by a stop 79 formed on the lever 39 and the arm 78 is biassed into contact with the stop 79 by a wire spring 80 stretched between the lever 39 and the arm 78 around the shaft 140.

Referring again to Figure 9, the lever 17 with the roller 18 and an idler lever 81 are rotatably supported by a shaft 82. A pin 83 secured on the lever 17 is inserted into a transverse slit 84 formed in the idler lever 81. At one end of the lever 81 an idler 86 for driving thme guide holding member 15 is supported by a shaft 85 and the lever 81 is biassed by a coil spring 87 so as always to be subjected to a clockwise rotational force.

An L-shaped lever 88 is coupled to the reciprocating lever 75 by a shaft 89 at one end, and a pin 92 secured on an idler lever 91 is inserted into a longitudinal slit 90 of the L-shaped lever 88. The levers 88 and 91 are rotatable around supporting shafts 93 and 94 respectively. The idler lever 91 acts as a stop for a pin 96 secured on an idler lever 95 at one end thereof, the lever 95 being rotatably supported by a shaft 100. A reel driving idler 98 is rotatably supported by a shaft 97 secured on the idler lever 95 at the other end thereof. The idler lever 95 is always biassed to rotate to the anticlockwise direction in Figure 9 by a spring 99 one end of which is fixed to the end of the idler lever 95.

The rotational force to rotate the lever 17 in the anticlockwise direction in Figure 9 is given thereto by the spring 103. A stop pin 104 is fixed to the lever 91. The pin 104 contacts with a curved edge 105 of the lever 81 when the lever 91 turns in the clockwise direction in Figure 9 to limit rotation of the lever 81 in the clockwise direction.

One end of a lever 107 is rotatably supported by a shaft 106 secured on the lever 17 and a pin 110 of a brake lever 109 is inserted on a longitudinal slot 108 formed in the lever 107 at the other end thereof. The brake lever 109 is supported rotatably by a shaft 111 and biassed to be rotated in the anticlockwise direction in Figure 9 by a spring 133.

A brake lever 112 for braking both the wheels 61 and 63 simultaneously is supported rotatably by a shaft 113 and is biassed to be rotated in the anticlockwise direction in Figure 9 by a spring 114. This lever 112 is moved in the clockwise direction in Figure 9 against the resilient force of the spring 114 when being pressed by the ends of the lever 37 or 74 by a pin 115 secured on the lever 75 to release the braking action. In other words, braking action is only exerted in the "stop" condition.

The V-shaped lever 72 rotatably supports an idler 118 by a shaft 117 at one end, and is rotatably supported by a shaft 116 and subjected to rotational forces in the clockwise direction in Figure 9, by rotation (120) and translation (122) of lever 72 by a spring 119. The lever 72 can also be pressed by a pin 120 secured on the lever 74, or the projecting portion 71, and rotated in the anticlockwise direction to press the idler 118 against an idler 121. When the lever 74 moves forward and its projecting portion 122 pushes and rotates a tongue member 123,

the idler 118 is moved down to make contact with the wheel 61 or with the wheel 62. The former case represents the state of fast forward winding of the tape 13 and the latter case represents the state of recording and/or reproducing.

The lever 75 has formed thereon a projection 124 which contacts the brake lever 109. A spring 125 is provided to bias the lever 39 in the clockwise direction in Figure 9, and a spring 126 is provided to bias the plate 69 in the clockwise direction in Figure 9.

On the outer surface of the guide holding member 15 is provided a stop projection 128 which engages with a stop projection 130 formed on a stop lever 129 supported rotatably by a shaft 131. The stop lever 129 is associated with a switch S_3 (Figure 13) to open or close the switch S_3. As shown in Figure 14, a switch S_1 is provided near the cover 34, the switch S_1 being opened when the cover 34 is opened and closed when the cover 34 is closed. As shown in Figures 2 and 4, a switch S_2 is provided near the guide roller 24, the switch S_2 being closed when the tape 13 is stretch between the guide rollers 20 and 24 to be wound around the guide holding plate 15 and opened when there is no tape 13. A switch S_4 (Figure 9) provided near the lever 17 is actuated by the lever 17, that is, the switch S_4 is closed in the state as shown in Figure 9 but opened when the lever 17 is moved in the clockwise direction to the forward moving state. A switch S_5 (Figure 9) is actuated by the play button 30, the fast forward button 36 and the rewiind button 35 respectively, the switch S_5 being opened in the state shown in Figure 9 but closed when the button 30, 36 or 35 is pushed.

One example of an electric circuit diagram including switches S_1 to S_5, a motor M and an electric power source 137 is shown in Figure 13. In this example the switch S_3 and the switch S_4 are connected in parallel, the switch S_5 is connected in series to the parallel circuit of the switches S_3 and S_4. The switches S_1 and S_2 are connected in series with each other, and the series circuit of the switches S_1 and S_2 is connected to the series circuit composed of the switch S_5 and the parallel circuit of the switches S_3 and S_4 in parallel. One terminal of the motor M is connected to one terminal of the power source 137 and the circuit of the switches S_1 to S_5 is connected between the other terminals of the motor M and power source 137.

As described above, by pushing the play button 30 after setting a tape cassette 41 on the reel table means 55, the lever 37 is moved downward in Figure 9 to rotate the lever 39 in the anticlockwise direction, so that the working arm 78 acts to release the roller 18 from the notch 16 as shown in Figures 12A to 12C. The switch S_5 is closed by pushing the play button 30 and the closed switch S_5, and the switch S_3 which is closed already as shown in Figure 9 closes the circuit including the motor M and the power source 137 to start rotation of the motor M. As a result of this, the capstan 31, a shaft 132 and the pulley 8 are rotated. Since the capstan 31 always contacts with the idler 86, the idler 86 is rotated thereby. When the roller 18 moves, the lever 17 also moves in the clockwise direction in Figure 9, so that the pin 83 moves to the other end of the longitudinal slot 84 to release the lever 81. As a result of this, the lever 81 is turned in the clockwise direction in Figure 9 by the action of the spring 87, and the idler 86 is contacted with the outer surface of the guide holding member 15, to start the rotation of the guide holding member 15 in the anticlockwise direction in Figure 9. When the guide holding member 15 has rotated one revolution, the stop projection 128 is engaged with the stop projection 130, and at the same time the roller 18 returns to engage with the notch 16 under the action of the spring 103, so that the guide holding member 15 is stopped. As mentioned above, upon one rotation of the guide holding member 15, the magnetic tape 13 is wound around it in α (alpha) shape as shown in Figures 4 and 5. In this state, the switch S_2 is closed by the tape 13 which is stretched between the guide rollers 20 and 24. The lever 81 returns in accordance with the return motion of the roller 18 and the idler 86 is separated from the guide holding member 15. When the curved surface of the projection 130 of the lever 129 contacts with the curved surface of the projection 128, the lever 129 is displaced similarly as shown in Figure 16, so that the previously closed switch S_3 is opened momentarily and by the return of the lever 17 the switch S_4 is closed.

The lever 112 is pushed by the end of the lever 37 to release the braking action exerted on the wheels 61 and 62. Movement of the lever 37 also rotates the plate 69 in the anticlockwise direction in Figure 9 by contact of the pin 70 with the inclined edge 40. As a result of this, the pinch roller 32 carried by the plate 69 is moved towards the capstan 31 and the tape 13 is driven. At the same time, the projection 71 of the lever 37 presses the lever 72 to rotate it in the anticlockwise direction in Figure 9, which causes the idler 118 to contact with the idler 121 and the wheel 62. As a result of this, the rotational movement of the shaft 132 is transmitted to the wheel 62 through the idlers 121 and 118, the rotational movement of the wheel 62 is further transmitted to the take-up reel 43 as described above, and finally the reel 43 takes up the magnetic tape 13 thereon. Since the rotation of the motor M

is transmitted to the pulley 8, the magnetic head 10 rotates as described above, and makes contact with the tape 13 which is travelling around the guide drum 12. Thus, magnetic recording or reproducing is achieved.

When the stop button is pushed in the above-mentioned playing state, that is, in the recording or reproducing state, the lever 37 returns to its original position and the lever 39 also returns due to the action of the spring 125. In this case, the working arm 78 can be rotated in the anticlockwise direction in Figure 12, so that the roller 18 does not prevent the returning motion of the lever 39, as shown in Figures 12D to 12F. Similarly other members such as the pinch roller 32 and the idler roller 118 return to their original positions respectively. In this time, the switch S_5 is opened, but the cover 34 of the case 33 is closed and the tape 13 is still wound around the guide drum 12, so that the switches S_1 and S_2 are still maintained in their closed condition and the motor M is still kept in drive condition. The pinch roller 32 moves away from the capstan 31 and the braking lever 112 contact with the wheel 61, therefore motion of the tape 13 is stopped.

In this stopped state, by pushing the rewind button 35, the lever 75 is moved downward in Figure 9, so that the lever 88 is moved by means of the shaft 89 around the supporting point, that is, the shaft 93, in the anticlockwise direction in Figure 9. By this rotating movement of the lever 88, the lever 91 is actuated through the pin 92 and is moved around the shaft 94 in the clockwise direction in Figure 9. Due to this rotational movement, a pin 141 mounted on the lever 91 pushes the holding lever 17 and moves the lever 17 in the clockwise direction in Figure 9, and in turn the roller 18 is removed from the notch 16 by the rotational movement of the lever 17. Due to the above-mentioned rotational movement of the lever 91, the pin 96 is released from the stopping action of the lever 91, so that the lever 95 is rotated around the shaft 100 in the anticlockwise direction in Figure 9, due to the action of the spring 99. In accordance with this rotational movement of the lever 95, the idler 98 is contacted with a rubber coated portion 134 of the outer face of the guide holding member 15 and also with the wheel 63. Since the roller 18 is removed from the notch 16, and the take-up reel 43 is being braked by the above-mentioned motion of the lever 75, and further the supply reel 44 is being rotated in the direction to rewind the tape 13 by the transmission of rotational movement of the motor M, the rotational force is applied to the guide holding member 15 by the tension of the tape 13 to rotate the guide holding member 15 in the direction shown in Figure 4 by the arrow B. When the guide holding member 15 has rotated by one revolution, the guide holding member 15 returns to its original state shown in Figures 2 and 3. In this case, the rotation of the guide holding member 15 is assisted by the rotation of the shaft 132 transmitted through the idler 98, so that the guide holding member 15 completes one revolution. During this returning movement, since the lever 107 is moved in the upward direction in Figure 9 by the movement of the lever 16, the lever 109 is released from the stopping action of the longitudinal slot 108 and the projection 124. Therefore, the lever 109 turns around the supporting point, that is, shaft 111, in the anticlockwise direction in Figure 9, to give the braking action to the wheel 61. Since the pin 104 moves to contact the lever 105, although the lever 17 moves to the "forward" position, the lever 81 is prevented from being moved to the "forward" position and the idler 86 is not moved as in the state of "play". When the guide holding member 15 has rotated one revolution in the clockwise direction in Figure 9 and the roller 18 is again engaged in the notch 16 by the similar action as in the "playing" state, the lever 109 returns. In this case, since the lever 112 is moved by the forward movement of the lever 75 to prevent the braking action, the wheel 64 is rotated by the idler 98 and the tape 13 is wound back to the supply reel 44. Since the switches S_3, S_4 and S_5 are closed and accordingly the circuit of the motor M is closed, the motor M is driven.

Referring to Figure 14, return motion of the guide holding member 15 is also carried out by opening the cover 34 of the casing 33. For this purpose, a movable member 135 and the switch S_1, which switch S_1 is closed when the cover 34 is opened and opened when the cover 34 is closed, are respectively provided on the cover 34. The movable member 135 and the moving portion of the switch S_1 may be common. The closed cover 34 is not opened when the rewind button 35 is pushed, because the movable member 135 is held in a longitudinal slot 136 formed in the lever 75 at its free end as shown in Figure 9 and is not moved by the movement of the lever 75 in the downward direction in Figure 9, which is caused by the pushing of the rewind button 35.

In the above-mentioned "stop" state, when the closed cover 34 is opened the switch S_1 is closed and the movable member 135 is moved to drive the lever 75 in the downward direction in Figure 9. The operation is identical to that of the above-mentioned case of pushing the rewind button 35, except that the switch S_5 is opened and the switch S_1 is closed. Therefore, when the guide holding member 15 is returned, the motor circuit which was closed by the switches S_1 and S_2 is opened due to the opening of the switch

S_2 to stop the motor M. In this case, the winding of the tape 13 around the guide drum 12 is released but the rewinding of the tape 13 is not carried out.

Since in the above-mentioned "stop" state, the tape 13 is already wound around the guide drum 12 in α (alpha) shape, the tape 13 would be wound twice if, when the play button 30 is pushed, the guide holding member 15 were rotated in the direction of the arrow A in Figure 2. Such rotation of the guide holding member 15 must be prevented. In this case, although the idler 86 contacts with the guide holding member 15 through the movement of the lever 81, due to the movement of the lever 17 which is caused by the pushing of the play button 30, similarly to the above-mentioned case but contrary to the above-mentioned "play" state, the switch S_3 is opened and moreover the switch S_4 is also opened by the movement of the lever 17 when the idler 86 contacts with the guide holding member 15. Accordingly, the motor M is not driven even if the switch S_5 is closed. The lever 17 return immediately and the switch S_4 is closed to drive the motor M, but the idler 86 is separated from the guide holding member 15 when the lever 17 turns, so that the guide holding member 15 is not rotated.

In Figures 15 and 16 a modification of the embodiment for mechanically preventing the double winding of the tape 13 is shown. In this case the switches S_3 and S_4 are eliminated and one terminal of the switch S_5 is connected to the motor M and the other terminal thereof is connected directly to the power source 137. Figure 15 shows the state where the tape 13 is not wound about the guide drum 12, that is, corresponding to the state shown in Figures 2 and 3. In this example, since the flat face of the projection 130 of the stop lever 129 and the flat face of the projection 128 are in contact with each other, a working arm 138 provided on the stop lever 129 does not make contact with the shaft 85 of the idler 86, and the idler 86 makes contact with the guide holding member 15 to rotate this member 15 one revolution. In this case the motor M is driven when the switch S_5 is closed.

On the other hand, Figure 16 shows the state where the tape 13 is wound around the drum 12 in α (alpha) shape, that is, corresponding to the state shown in Figures 4 and 5. In this case, since the lever 129 is displaced by the contact of the curved face of the projection 130 of the stop lever 129 with the curved face of the projection 128, the working arm 138 contacts the shaft 85 to act as a stop for the shaft 85. Accordingly, the contact of the idler 86 with the guide holding member 15 is prevented. Therefore, although the switch S_5 is closed to drive the motor M, the guide holding member 15 is not rotated.

In the "stop" state, if the fast forward button 36 is pushed the lever 74 is moved in the downward direction in Figure 9, the idler 118 contacts with the wheel 62 and the switch S_5 is closed, so that the motor M is driven to achieve the fast winding operation.

Although as described, the guide holding member 15 rotates independently of the guide drum 12, the guide holding member 15 may be designed to rotate with the lower guide drum portion 2.

Various other modifications can of course be made without departing from the invention as defined by the appended claims.

WHAT WE CLAIM IS:—

1. A magnetic tape recording and/or reproducing apparatus comprising a cylindrical tape guide drum having at least one rotary magnetic head, at least one tape guide means for engaging a magnetic tape, the magnetic tape extending between spaced take-up and supply reels which are mounted on the apparatus when the apparatus is to be used, and means for moving said tape guide means in an arcuate path about at least a portion of the periphery of the tape guide drum whereby the magnetic tape is moved into engagement with the tape guide drum for scanning by said rotary head or heads.

2. Apparatus according to claim 1 comprising additional tape guide means mounted around the periphery of the tape guide drum, said means moving all of said tape guide means simultaneously in arcuate paths about at least a portion of the periphery of the tape guide drum whereby the magnetic tape is moved into engagement with the tape guide drum for scanning by said rotary head or heads.

3. Apparatus according to claim 2 wherein all of said tape guide means are mounted on a support member movable in an arcuate path about at least a portion of the periphery of the tape guide drum.

4. Apparatus according to claim 3 wherein said tape guide means sequentially engage the magnetic tape during said movement in said arcuate path.

5. A magnetic tape recording and/or reproducing apparatus including means automatically to engage a magnetic tape with a rotary magnetic head, the apparatus comprising a magnetic tape wound on spaced take-up and supply reels, a cylindrical tape guide drum having at least one rotary head, a member mounted for rotation relative to the tape guide drum, a plurality of tape engaging means mounted on said member and spaced from the tape guide drum, at least one of said tape engaging means being disposed to engage said magnetic tape when said apparatus is in an inactive condition, and means

S_2 to stop the motor M. In this case, the winding of the tape 13 around the guide drum 12 is released but the rewinding of the tape 13 is not carried out.

Since in the above-mentioned "stop" state, the tape 13 is already wound around the guide drum 12 in α (alpha) shape, the tape 13 would be wound twice if, when the play button 30 is pushed, the guide holding member 15 were rotated in the direction of the arrow A in Figure 2. Such rotation of the guide holding member 15 must be prevented. In this case, although the idler 86 contacts with the guide holding member 15 through the movement of the lever 81, due to the movement of the lever 17 which is caused by the pushing of the play button 30, similarly to the above-mentioned case but contrary to the above-mentioned "play" state, the switch S_3 is opened and moreover the switch S_4 is also opened by the movement of the lever 17 when the idler 86 contacts with the guide holding member 15. Accordingly, the motor M is not driven even if the switch S_5 is closed. The lever 17 return immediately and the switch S_4 is closed to drive the motor M, but the idler 86 is separated from the guide holding member 15 when the lever 17 turns, so that the guide holding member 15 is not rotated.

In Figures 15 and 16 a modification of the embodiment for mechanically preventing the double winding of the tape 13 is shown. In this case the switches S_3 and S_4 are eliminated and one terminal of the switch S_5 is connected to the motor M and the other terminal thereof is connected directly to the power source 137. Figure 15 shows the state where the tape 13 is not wound about the guide drum 12, that is, corresponding to the state shown in Figures 2 and 3. In this example, since the flat face of the projection 130 of the stop lever 129 and the flat face of the projection 128 are in contact with each other, a working arm 138 provided on the stop lever 129 does not make contact with the shaft 85 of the idler 86, and the idler 86 makes contact with the guide holding member 15 to rotate this member 15 one revolution. In this case the motor M is driven when the switch S_5 is closed.

On the other hand, Figure 16 shows the state where the tape 13 is wound around the drum 12 in α (alpha) shape, that is, corresponding to the state shown in Figures 4 and 5. In this case, since the lever 129 is displaced by the contact of the curved face of the projection 130 of the stop lever 129 with the curved face of the projection 128, the working arm 138 contacts the shaft 85 to act as a stop for the shaft 85. Accordingly, the contact of the idler 86 with the guide holding member 15 is prevented. Therefore, although the switch S_5 is closed to drive the motor M, the guide holding member 15 is not rotated.

In the "stop" state, if the fast forward button 36 is pushed the lever 74 is moved in the downward direction in Figure 9, the idler 118 contacts with the wheel 62 and the switch S_5 is closed, so that the motor M is driven to achieve the fast winding operation.

Although as described, the guide holding member 15 rotates independently of the guide drum 12, the guide holding member 15 may be designed to rotate with the lower guide drum portion 2.

Various other modifications can of course be made without departing from the invention as defined by the appended claims.

WHAT WE CLAIM IS:—

1. A magnetic tape recording and/or reproducing apparatus comprising a cylindrical tape guide drum having at least one rotary magnetic head, at least one tape guide means for engaging a magnetic tape, the magnetic tape extending between spaced take-up and supply reels which are mounted on the apparatus when the apparatus is to be used, and means for moving said tape guide means in an arcuate path about at least a portion of the periphery of the tape guide drum whereby the magnetic tape is moved into engagement with the tape guide drum for scanning by said rotary head or heads.

2. Apparatus according to claim 1 comprising additional tape guide means mounted around the periphery of the tape guide drum, said means moving all of said tape guide means simultaneously in arcuate paths about at least a portion of the periphery of the tape guide drum whereby the magnetic tape is moved into engagement with the tape guide drum for scanning by said rotary head or heads.

3. Apparatus according to claim 2 wherein all of said tape guide means are mounted on a support member movable in an arcuate path about at least a portion of the periphery of the tape guide drum.

4. Apparatus according to claim 3 wherein said tape guide means sequentially engage the magnetic tape during said movement in said arcuate path.

5. A magnetic tape recording and/or reproducing apparatus including means automatically to engage a magnetic tape with a rotary magnetic head, the apparatus comprising a magnetic tape wound on spaced take-up and supply reels, a cylindrical tape guide drum having at least one rotary head, a member mounted for rotation relative to the tape guide drum, a plurality of tape engaging means mounted on said member and spaced from the tape guide drum, at least one of said tape engaging means being disposed to engage said magnetic tape when said apparatus is in an inactive condition, and means

for rotating said member, to move said tape engaging means in arcuate paths about at least a portion of the periphery of the tape guide drum, during which movement and tape engaging means engage said magnetic tape to guide the same into engagement with the tape guide drum for scanning by said rotary head or heads.

6. A magnetic tape recording and/or reproducing apparatus comprising a tape guide drum defining a generally cylindrical surface, magnetic head means rotatable about the axis of said surface in a plane between the ends of the latter, spaced engaging means for a magnetic tape arranged so that a run of the magnetic tape therebetween is substantially tangential to said cylindrical surface and is inclined with respect to said plane of rotation of the magnetic head means, drive means for rotating the magnetic head means and for longitudinally advancing the magnetic tape between supply and take-up reels therefor, and a device operable selectively to wrap the magnetic tape between said engaging means about said tape guide drum and to unwrap the magnetic tape from said tape guide drum, said device comprising at least one tape engaging member spaced radially from said tape guide drum, a rotatable support member carrying said tape engaging member for movement about said tape guide drum in an arcuate path into which only a portion of said run projects, means operable selectively to effect a predetermined rotational movement of said support member in one direction during which said tape engaging member engages said portion of the tape about said tape guide drum to a predetermined angular extent, and means operable selectively to effect said predetermined rotational movement of the support member in the opposite direction to unwrap the magnetic tape from said tape guide drum.

7. Apparatus according to claim 6 wherein control means are provided which are actuable to cause operation of said drive means for rotating the magnetic head means and of said drive means for advancing the magnetic tape in the direction from said supply reel to said take-up reel during recording and reproducing operations of the apparatus, and further to cause operation of said means to effect rotational movement of said support member in said one direction during an initial period of recording and reproducing operations.

8. Apparatus according to claim 7 wherein means are provided to prevent operation of said means to effect rotational movement of the support member in said one direction in the event that the magnetic tape is already wrapped about said tape guide drum.

9. Apparatus according to claim 7 wherein control means are provided which are actuable to cause operation of said drive means for advancing the magnetic tape in the direction from said take-up reel to said supply reel during rewinding operation of the apparatus, and further to cause operation of said means to effect rotational movement of said support member in said opposite direction for unwrapping the magnetic tape from said tape guide drum during an initial period of said rewinding operation.

10. Apparatus according to claim 7 wherein a casing is provided with a cover movable between open and closed positions, and control means are provided responding to the opening of said cover while the magnetic tape is wrapped about said tape guide drum to cause operation of said means to effect rotational movement of said support member in said opposite direction for unwrapping the magnetic tape from said tape guide drum.

11. Apparatus according to any one of claims 6 to 10 wherein said support member carries at least one additional tape engaging member spaced radially from said tape guide drum and also spaced said one tape engaging member, said additional engaging member including first and second parts respectively engageable with said portion of the tape run and with another portion of the tape run upon movement of said additional engaging member in an arcuate path in response to rotation of said support member in said one direction, and said second part of the additional engaging member and the first-mentioned engaging member having flanges engageable with said magnetic tape at a longitudinal edge of the latter precisely to determine the angle with respect to said plane at which the magnetic tape is wrapped on said tape guide drum.

12. Apparatus according to any one of claims 6 to 11 wherein said take-up and supply reels are contained in a cassette supportable by a mounting and driving assembly of said apparatus, said assembly including slip clutch means having a driving member and a driven member to be coupled with said take-up reel and being frictionally engaged to said driving member, and a drive which is to be coupled with said supply reel, and said drive means for advancing the tape includes a capstan and a pinch roller engageable therewith and operable to advance the tape in the direction from said supply reel to said take-up reel and rotary means selectively engageable with said driving and driven members of the slip clutch means and with said drive wheel so as to wind the magnetic tape on said take-up reel and on said supply reel, respectively.

13. Apparatus according to claim 12 wherein control means are provided which are actuable for a play operation of the apparatus to cause operation of said drive means for rotating the magnetic head means, operation of said capstan and pinch roller to ad-

rance the magnetic tape to said take-up reel, and engagement of said rotary means with said driving member so as to rotate said take-up reel in its tape-winding direction through said slip-clutch means, and further to cause operation of said means to effect rotational movement of said support member in said one direction for wrapping the magnetic tape about said tape guide drum during an initial period of said play operation.

14. Apparatus according to claim 13 wherein control means are provided which are actuable for fast forward operation of the apparatus to cause engagement of said rotary means directly with said driven member, whereby to effect relatively rapid rotation of said take-up reel in its tape-winding direction.

15. Apparatus according to claim 13 wherein means are provided to prevent operation of said means to effect rotational movement of said support member in said one direction in response to actuation of said control means in the event that the magnetic tape is already wrapped about the tape guide drum.

16. Apparatus according to claim 15 wherein said means to effect rotational movement of the support member in said one direction includes an electric motor, and an electric circuit for operating said motor including a first switch which is closed upon actuation of said control means and which is in series with parallel-connected second and third switches, said second switch being opened in response to the rotation of said support member in said one direction for wrapping of the magnetic tape about said tape guide drum, and said third switch being opened during said initial period of said play operation.

17. Apparatus according to claim 16 wherein a casing is provided with a cover movable between open and closed positions, said motor is also operable to cause operation of said means to effect rotational movement of said support member in said opposite direction for unwrapping the magnetic tape from said tape guide drum, and an alternate circuit for operating said motor includes a fourth switch which is closed only in response to the magnetic tape being wrapped about said tape guide drum, and a fifth switch in series with said fourth switch and being closed only in response to the movement of said cover to said open position.

18. Apparatus according to claim 12 or any one of claims 13 to 17 as directly or indirectly dependent on claim 12 wherein control means are provided which are actuable for a rewind operation of the apparatus to cause engagement of said rotary means with said drive wheel, whereby to urge rotation of said supply reel in its tape winding direction, and further to brake rotation of said take-up reel in its tape unwinding direction during an initial period of said rewind operation so that the resulting pull on the magnetic tape wrapped about said tape guide drum will cause said rotation of said support member in said opposite direction from said tape guide drum.

19. Apparatus according to any one of claims 6 to 18 wherein latching means are normally engaged to hold said support member in a predetermined position against rotation, and said latching means is released upon operation of said means to rotate the support means in said one direction and said opposite direction.

20. A magnetic tape recording and/or reproducing apparatus substantially as hereinbefore described with reference to the accompanying drawings.

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