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(54) A DRIVE MECHANISM FOR MAGNETIC RECORDING/REPRODUCING APPARATUS

(71) I, ITSUKI BAN, a Japanese Subject, of 829 Higashioizumi-machi, Nerima-ku, Tokyo, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to particularly described in and by the following statement:—

This invention relates to magnetic tape recording and/or reproducing apparatus and more particularly to a driving mechanism for the reel shafts thereof.

According to this invention a reel shaft drive mechanism for magnetic recording/reproducing apparatus comprises a lever rotatably supported by a shaft; a first pulley and an idler coupled for rotation in synchronism with each other both being pivoted on the lever away from the shaft; a second pulley and a third pulley pivoted respectively at positions on the lever substantially symmetrical with respect to a line passing through the centres of the first pulley and the shaft, the centre distances between the second pulley and the shaft and between the third pulley and the shaft both being greater than the centre distance between the first pulley and the shaft; a fourth pulley driven by a motor; a drive belt wound round the first, second, third and fourth pulleys; the idler being urged selectively against the periphery of either one of the reel shaft drive wheels as the lever rotates in either the clockwise or counterclockwise direction, the arrangement being such that the direction of rotation of the lever is determined by the difference of tension in the drive belt which in turn depends upon the direction of rotation of the motor.

Preferably, a slip mechanism is provided on any one of the idler, fourth pulley and one of the reel shaft drive wheel.

An embodiment of the invention will now

be described by way of example with reference to the accompanying drawings, of which:—

Figure 1A is a perspective view of a casing for magnetic tape recording/reproducing apparatus;

Figure 1B is perspective view of magnetic tape recording/reproducing apparatus including the casing of Figure 1A;

Figure 2 is a plan view showing the internal construction of the apparatus of Figure 1B;

Figure 3 is a plan view showing a mechanism for reel shaft driving wheels;

Figure 4 is a vertical section of the apparatus of Figure 1B;

Figure 5 is a plan view of a mode changeover mechanism;

Figure 6 is a side view of another example of push-button mechanism.

Referring to Figure 1A, a casing 91 made by press-forming aluminium plate is an inverted channel and has in its upper wall a group of small holes 91a for the passage of sound from a loud-speaker. A body 92 is inserted into the casing 91 as shown in Figure 1B, flanges 91d and 91e along both sides of the bottom of the casing serving to guide the body. Figure 1B shows the body fully extended in the direction of arrow A, the body being prevented from further movement by a stop member (not shown). In this position, a cassette 96 on the reel shafts 81 and 81a can be replaced or turned over. After replacement or turning of the cassette, the body 92 is pushed back into the casing 91. Volume and tone controls 97 and 98 and jack sockets 99 and 95 for a microphone and an earphone are provided in the front wall of the body 92. In the wall of the cassette 96 there are holes 82 and 83 for receiving a capstan and guide holes 84 and 85 for receiving pins mounted on a

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deck to locate the cassette 96. The capstan fits into either hole 82 or hole 83 depending upon which side of the cassette is to be used. A microphone P is built in the body 92, a changeover switch for recording/reproduction being not shown. Push-buttons 41, 42, 43 and 44 provided on the body are designated respectively "stop", "reproduction" (or "recording"), "rewind" and "fast-feed", as will be described with reference to Figure 2. Batteries can be fitted in the body 92 from beneath.

The interior of the body 92 will now be described with reference to Figure 2, in which the cassette 96 is shown by dotted line, the casing 91 is omitted and which shows an empty space 98 for batteries, accessible by opening a cover (not shown) at the rear of the body 92. A metal deck 88 fixed to the body 92 by bolts at 88a, 88b and 88c etc. carries a bearing in which a capstan 24 is rotatably supported. A fly-wheel 24b is fixed to the under side of the capstan. Reel-shafts 81 and 81a and reel shaft driving wheel 20 and 20a are rotatably supported on the deck by shafts 45 and 45a.

An electric motor M fixed to the deck 88, drives a pulley 35 connected to fly-wheel 24b by a drive belt 21. A magnetic head 22 is fixed to a support 26 which is rotatably supported by a shaft 26a mounted on the deck 88. On the free end of the lever 25, which is pivoted at its central portion on the support 26, there is a pinch roller 23. The support 26 is elastically biased clockwise as shown by arrow B by a spring (not shown) and the lever 25 is elastically biased counterclockwise as shown by arrow C by a spring (not shown) so that the pinch roller 23 presses against the capstan 24 to pinch a magnetic tape placed therebetween. An erase head 27 is fixed to the support 26 which is rotatably supported at its end by the shaft 26a and when the support 26 is rotated counterclockwise, the pinch roller 23 separates from the capstan 24, and the magnetic head 22 and the erase head 27 separate from the cassette 96. At this time, the free end 25a of the lever 25 abuts a stop pin 28 mounted on the deck 88, and the lever 25 is rotated clockwise against the force of the spring biasing the lever in the direction of arrow C. Consequently, a relatively small rotation of the support 26 causes wide separation of the pinch roller 23 and the capstan 24. When the support 26 is in the position shown in the figure, the apparatus is in the reproduction mode, and when the support 26 rotates counterclockwise, it is in a non-reproduction mode. The fly-wheel 24b protrudes into a cut-out 88-1 in the deck 88. The deck 88 is bent at 88-2 with its right-hand portion being stepped (see also Figure

4). The cassette 96 (shown dotted) can be set in the body by fitting hubs in the cassette over the reel-shafts 81 and 81a, and is located by guide pins 84a and 85a which pass through the guide holes 84 and 85 as shown in Figure 1B.

Referring now to Figure 3, a drive mechanism for the reel shaft driving wheels 20 and 20a includes a pulley 24d fixed to the capstan 24, which is rotatably supported by a shaft 24a mounted on the deck 88 (see also Figure 4). A generally Y-shaped lever 32 is rotatably supported at its centre by a shaft 32-1 mounted on the deck 88, and pulleys 37, 38 and 39 are supported respectively by shafts 37-1, 38-1 and 39-1 mounted on respective ends of the arms of the Y-shaped lever 32. A drive belt 31 passes over a pulley 36 supported by a shaft mounted on the deck 88 and is wound round the pulleys 24d, 37, 38 and 39, the tensions in portions 31a and 31b of the belt 31 being substantially equal when the capstan 24 is stationary. A wheel 40 is frictionally coupled to the pulley 39 by a conventional slip mechanism. When the capstan 24 rotates counterclockwise, the tension in the portion 31b becomes larger than that in the portion 31a due to the friction between the pulleys 37, 38 and 39 and their respective shafts and to the torque on the wheel 40. Consequently, the lever 32 rotates counterclockwise so that the wheel 40 presses against a rubber ring around the periphery of the reel shaft drive wheel 20. Accordingly, the reel shaft drive wheel 20 is rotated counterclockwise, and the magnetic tape is taken up by the hub through the reel-shaft 81, thereby enabling reproduction or fast feeding. During reproduction, slip occurs between the wheel 40 and the pulley 39, and the motor M rotates in the forward direction at a constant speed. When a governor for the motor M is inoperative, the motor rotates at high speed (fast feed mode). The centre distances between the shafts 32-1 and 37-1 and between 32-1 and 38-1 are made larger than that between the shafts 32-1 and 39-1, so that the force with which the wheel 40 presses against the reel shaft drive wheel 20 is high. The reaction of the driving force on the reel-stand 20 applies a counterclockwise torque to the lever 32 and the larger load on the wheel 40 applies pressure against the reel shaft drive wheel 20.

When the motor M is reversed, the tension in the portion 31a of the belt 31 becomes larger than that in the portion 31b, so that the lever 32 and wheel 40 rotate clockwise. Consequently, the wheel 40 swings rapidly away from the reel shaft drive wheel 20 to press at an angle against the reel shaft drive wheel 20a. Accordingly,

the reel-shaft drive wheel 20a is driven clockwise to take up the magnetic tape through the reel-shaft 81a. At this time, the governor for the motor M is inoperative, i.e. the rewind mode is existing.

As will be understood from the above, the forward/reverse rotations of the motor M selectively drive the reel drive wheel 20 and 20a and the shafts 81 and 81a.

Referring now to Figures 4 and 5, the operation mode changeover mechanism includes a frame 51 (Figure 5) which is fixed to the body 92 and on which actuating bars 55, 56, 57 and 58, for effecting changeover of respective modes, are slidably supported for movement transversely through the frame (in right- and left-ward directions on the figure). These bars are biased by springs (not shown) in the direction of the arrow. A bar 53 supported by the frame 51 is also slidable through the frame longitudinally (in up- and down-wards directions in the figure) and is biased by a spring 53a in the upward direction in the figure. In the state shown in the figure, the actuating bar 57 has been moved rightward and is held there by a step-shaped portion or pawl which engages behind a lock pin mounted on the bar 53. When an actuating bar 55, for example, is now moved rightward, this bar 55 is held by another lock pin on the bar 53, but in the process the bar 53 moves downwardly to release the actuating bar 57 which then moves leftward. Any one of the actuating bars 55, 56, 57 and 58, may, upon movement to the right, be locked in position by the bar 53. The above described mechanism is known as an interlock mechanism.

Pins 55c, 56c and 58c mounted respectively on the right ends of the actuating bars 55, 56 and 58 abut a slide bar 61 which is supported for movement from right to left in the direction of a slot in the bar through which guide pins 61a and 61b mounted on the deck 88 protrude. A pin 61c on the right end of the slide bar 61 abuts the support 26 which upon the rightward movement of one of the actuating bars 55, 56 and 58, is displaced counterclockwise, to establish the non-reproduction mode. The mechanism including the pinch roller 23 on the lever 25 is omitted from the figure. The left hand end of each of the actuating bars 55, 56, 57 and 58 is bent into a C-shape (Figures 4, 5 and 6) and has holes 55a, 56a, 57a and 58a respectively. In Figure 4, the interlock mechanism 49 (comprising the frame 51 and the bar 53—see Figure 5), is shown dotted. The actuating bar 58 is also shown dotted. A rod 44b associated with the push-button 44 passes through the hole 58a and rods associated with push-buttons 41, 42 and 43 pass respectively through the holes 55a, 57a and 56a, shown in Figure 5.

The push-buttons 41, 42, 43 and 44 are located respectively in depressions 41a, 42a, 43a and 44a, as shown in Figure 2, in such a manner that the push-buttons can slide from right to left in the depressions. A member 52 is slidable relative to the body 92 from right to left along slots 52c and 52d provided therein. As seen in Figure 4, an eccentric idler 47 is supported on the right hand end of the member 52 by a shaft 47-1 and the left end of the member 52 is formed into an L-shape 52b, which is engageable with any one of the push-button rods. A lever 63 is rotatably supported by a shaft 63a mounted on the body 92, and is biased clockwise by a spring (not shown) and the member 52 is biased leftward by a spring (not shown). Leftward movement of the member 52 is restrained by a bent portion or a projection 63b formed at the left end of the lever 63, which abuts against the left end of the member 52 to lock the member and thereby hold the idler 47 away from a drive wheel 24c fixed to the lower end of the capstan 24.

In Figure 4, when the push-button 44 is depressed, the push-button rod 44b associated therewith and passing through a through-hole 44d in the member 52, pushes the lever 63 which is displaced counterclockwise to release the member 52 from the bent portion 63b. As a result the member 52 moves leftward, and a rubber ring around the periphery of the idler 47 contacts the wheel 24c and begins to rotate. This moves the member 52 together with the actuating bar 58 rightwards through the push-button rod 44b which engages with the member 52. The force required for this movement is relatively large, and the larger force creates, by its reaction, an equivalent pressure between the idler 47 and the wheel 24c, thus establishing a positive drive between the wheel 24c and the idler 47. After about one half revolution of the idler 47, the actuating bar 58 is locked by the interlock mechanism, and the previously locked actuating bar 57 (in Figure 5) automatically moves to the left. With further rotation of the idler 47, the member 52 begins to move back leftward, and the push-button rod 44b is lifted by spring 44c and separates from the hole 44d. After another half revolution of the idler 47, the member 52 returns leftward to its original position and abuts with its left end the bent portion 63b of the lever 63. This mechanism is so designed that the member 52 abuts the portion 63b after slightly less than one full revolution of the idler 47, and accordingly the idler 47, upon its further slight rotation, separates from the wheel 24c whereupon rotation ceases automatically.

As will be understood from the above description, the actuating bar 58 is moved

rightward by the capstan power means and locked, and the other actuating bar returns leftward.

Other mechanisms associated with the other push-buttons 41, 42 and 43 are similar to the above and operate in a similar manner. That is, upon the depression of any of the push-buttons, the associated actuating bar is moved rightward by the corresponding push-button rod, and locked.

Figure 5 illustrates the reproduction (or recording) mode, where the capstan 24 and the pinch roller 23 (Figure 4) pinch the magnetic tape therebetween, and the magnetic heads 22 and 27 are in contact with the magnetic tape. The capstan 24 rotates counterclockwise, and so that the magnetic tape is taken up by the hub through the reel-shaft 81 as described in connection with Figure 3. Upon the depression of the push-button 44 (as described above), the actuating bar 58 moves to the right and is locked, and the actuating bar 57 returns leftward. The abutting pin 58c then pushes the bar 61 to the right, and the support 26 is rotated counterclockwise by the abutting pin 61c, to separate the pinch roller 23, the magnetic head 22 and the erase head 27 from the cassette. A projection 58b on the actuating bar 58 depresses an electric switch 64 which makes the governor for the motor M inoperative, and consequently the motor M rotates at high speed, thereby establishing the fast-feed mode.

Upon the depression of the push-button 43 (Figure 2) the actuating bar 56 moves rightward and is locked and the actuating bar 58 returns to the left. The bar 61 is held in the right-hand position by the abutting pin 56c, and the support 26 is held in the angular position reached during counterclockwise rotation, that is, the position corresponding to the non-reproduction mode. A projection 56d on the actuating bar 56 makes an electric switch 62a while the switch 64 is kept operative by the projection 56b. The switch 62a reverses the motor M, thus establishing the rewind mode in which the magnetic tape is taken up at high speed by the hub through the reel-shaft 81a as described in connection with Figure 3.

Upon depression of the push-button 42 (Figure 2), the actuating bar 57 is moved to the right by the associated push-button rod and locked, and the actuating bar 56 is returned. The switches 62a and 64 become inoperative so that the motor M rotates in the forward direction at normal speed. At the same time, the bar 61 returns leftward, and the support 26 rotates clockwise to establish the reproduction mode. A hole 42d in the member 52 as shown in Figure 5,

permits the lower end of the rod associated with the push-button 42 to pass through the member and push the lever 63 to release locking of the member 52.

Upon depression of the push-button 41 (Figure 2) the associated rod releases the member 52 which then makes one reciprocating movement by virtue of the idler rotation, and the actuating bar 55 moves rightward and is locked. At the same time the actuating bar 57 moves leftward. An electric switch 62 is opened by a projection 55b on the actuating bar 55. The support 26 is rotated counterclockwise through the abutting pin 55c and the bar 61 moves to a position corresponding to the non-reproduction mode. At this time, an electric switch 65 is opened by the support 26, switches 65 and 62 being source line switches connected in parallel to each other, thus forming AND circuit. Accordingly, by closing any one of these switches, electric power is supplied to the apparatus from the source, and the power supply is shut off only when both the switches open. In the above mentioned state, both the switches 65 and 62 are open and there is no power supply, thus establishing the stop mode. The idler 47, having completed one half revolution, is rotated further by the fly-wheel 24b until the member 52 abuts the bent portion 63b of the lever 63, when the idler 47 is separated from the wheel 24c and rotation ceases.

As will be understood from the above description, by depressing one of the push-buttons 41, 42, 43 and 44, any desired mode (stop, reproduction, rewind and fast-feed) can be established. The push-buttons can be depressed with the small force necessary to overcome the biasing force of the spring 44c for example. The spring biasing the member 52 to the left may be a light spring and accordingly, the member 52 can be released by the application of only a small force, because when the member 52 has moved to the left and the idler 47 has come into contact with the wheel 24c, the idler is subjected to substantially no load and can rotate lightly. It is when the member 52 begins to move to the right during rotation of the idler 47, that the load on the idler begins to increase. Mode changeover is performed by utilizing the capstan power means which rotates at a stable at a low speed for a predetermined period of time, and accordingly the operation is positive and generates little noise. The apparatus can be of simple construction economical in manufacture, small in size and flat in shape. Further, as seen in Figure 2, the push-buttons are held in the depressed position to provide an indication of the existing mode.

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Figure 6 shows another example of the push-button. The construction is similar in general to that of Figure 4 except that a compressed spring 44e is provided for upwardly biasing the rod 44b associated with push-button 44 and an electromagnetic device is associated with the push-button rod. A soft steel plate 44g is fixed to the underside of the push-button 44. There is also an exciting coil 70a in a yoke (of soft steel) 70 which is fixed to the body, and through the centre aperture of the yoke passes the push-button rod (of soft steel) 44b. Upon depression of the push-button 44, the lever 63 the member 52 and the actuating bar 58 are operated in a manner similar to that in the embodiment of Figure 4, thus establishing the fast-feed mode. Alternatively, by supplying current for a short period of time through terminals 70d and suitable switch, the plate 44g is attracted toward the yoke and the push-button 44 and the rod 44b are lowered, thus initiating changeover to the fast-feed mode by the previously described action of the lower end 44f of the rod 44b. The lowering of the push-button rod 44b requires a small force sufficient to overcome the biasing force of the light spring 44e so that the current required is small and the electromagnetic device may be small and light. Similar electromagnetic devices are associated with the other push-buttons 41, 42 and 43 (Figure 2).

Our copending Application 3144/76 (Serial No. 1,534,306) from which the present case is divided relates to the magnetic tape recording and/or reproducing apparatus described herein.

WHAT I CLAIM IS:—

1. A drive mechanism for the reel shafts

of a magnetic tape recording/reproducing apparatus, comprising a lever rotatably supported by a shaft; a first pulley and an idler coupled for rotation in synchronism with each other both being pivoted on the lever away from the shaft; a second pulley and a third pulley pivoted respectively at positions on the lever substantially symmetrical with respect to a line passing through the centres of the first pulley and the shaft, the centre distances between the second pulley and the shaft and between the third pulley and the shaft both being greater than the centre distance between the first pulley and the shaft; a fourth pulley driven by a motor; a drive belt wound round the first, second, third and fourth pulleys; the idler being urged selectively against the periphery of either one of the reel shaft drive wheels as the lever rotates in either the clockwise or counterclockwise direction, the arrangement being such that the direction of rotation of the lever is determined by the difference of tension in the drive belt which in turn depends upon the direction of rotation of the motor.

2. A mechanism according to claim 1, including a slip mechanism on any one of the idler, fourth pulley and one of the reel shaft drive wheels.

3. A reel shaft drive mechanism for magnetic recording/reproducing apparatus constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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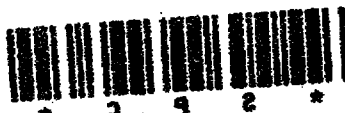


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