

"Drive mechanism for a recording tape which can alternately be taken up by and unwound from reels."

The invention relates to a drive mechanism for a recording tape, specifically a magnetic tape, which can alternately be taken up by and unwound from reels, mechanism comprises two driven capstans for the transport of the recording tape, associated pressure rollers, arranged on pivotal levers, being engageable with one of said capstans depending on the direction of movement of the recording tape, which pivotal levers are alternately pivotable by a driven control plate having two fixed end positions, and two winding mandrels for the reels, which are alternately engageable with the drive motor via a pivotal transmission, whose pivotal position depends on the direction of rotation of the drive motor.

Such a drive mechanism is known from US-PS 3,684,209. In said mechanism the control plate is constituted by a two-armed lever which is pivotable about an axis. One lever arm is provided with diverging extensions which urge either the one or the other pivotal lever with the corresponding pressure roller away from the capstan. The control plate can be pivoted by means of a gear cam which is eccentrically journaled on a gear wheel and which engages a fork of the control plate. The winding mandrels are switched over by means of the control plate via a rod transmission. The capstans are driven separately.

This construction requires relatively much space in a cassette recorder. In cassette recorders, specifically those to be built into motor-cars, only a limited space is available. Bulky constructions, in particular constructions demanding a large surface area, are therefore not suitable.

From the DE-OS 24 40 824 it is known to drive the winding spindles selectively via a pivotal member which carries the transmission wheels. The pivotal member pivots about the motor shaft and depending on the direction of rotation of the motor causes the transmission wheel to be applied, driven by friction, to the spindle of one winding mandrel or the spindle of the other winding mandrel.

It is the object of the invention to provide a drive

mechanism in which all functions can be switched automatically to operation in the reverse direction by merely changing the direction of rotation of the drive motor. 11

According to the invention a drive mechanism of the type defined in the opening paragraph solves this problem, in that during normal operation the pivotal transmission drives the winding gear associated with the driven winding mandrel, that the linearly movable control plate comprises switching portions which cooperate with a first switching gear of the driven winding mandrel, and that during reversal of the direction of rotation and the consequent pivotal movement of the pivotal transmission, during which the winding gear driven so far is stopped and the stationary winding gear is set into rotation, the control plate is shifted in such a way by the switching gear which is now rotated that via a lever mechanism it positions the pressure roller associated with the rotating switching gear against the associated capstan, the other pressure roller being lifted off simultaneously.

Owing to this construction of the drive mechanism a reversal of the direction of rotation of the drive motor triggers a kind of chain reaction, such that one function reversal causes a further function reversal until all drive elements have been switched to operation in the reverse direction.

By the use of a linearly movable control plate having switching portions room is available in the apparatus for accomodating the gear wheels necessary for the tape transport, such as transmission gears and flywheels. By changing over the pivotal transmission, which is effected automatically in response to a change of the direction of rotation, the control plate is also shifted and this control plate in turn then changes over the pressure rollers. Thus, all change-over movements are initiated merely, without any additional steps, by a change of the direction of rotation of the drive motor.

A further embodiment of the invention is characterized in that the pivotal transmission comprises a swing arm and at least one swing-arm gear arranged thereon, which gear is associated with a commutator, which in the absence of control signals produced in the stationary condition causes a reversal of the direction of rotation of the drive motor. By arranging the commutator on a swing-arm gear this gear is not only used for driving the winding mandrels, but also for detecting the operational condition of the recorder.

A further embodiment of the invention is characterized in that two swing-arm gears are arranged one on top of the other on the free end of the swing arm, that one of the swing-arm gears is continuously driven by the drive motor, and that the said swing-arm gear
5 drives the other swing-arm gear provided with the commutator via a slipping clutch. Thus, the gear wheels on the swing arm, via the slipping clutch arranged between them, limit the torque exerted on the winding mandrels. In this way only one torque-limiting slipping clutch for the two winding mandrels is required.

10 A further embodiment of the invention is characterized in that depending on the position of the swing arm the swing-arm gear provided with the commutator drives the winding gear of the winding mandrel which is engageable in the pivotal position and the other, continuously driven swing-arm gear drives a second switching gear
15 arranged on the same winding mandrel as the driven winding gear and the first switching gear. Thus, via the swing-arm gears, depending on the pivotal position of the pivotal transmission, the drive mechanism drives the winding gear associated with the relevant winding mandrel via the slipping clutch and drives the associated switching gear directly,
20 which except for the switching intervals rotates freely in the driven condition.

A further embodiment of the invention is characterized in that during fast forward or fast reverse winding with the head support withdrawn the swing-arm gears of the pivotal transmission are bypassed
25 by means of a bypass gear. This bypass gear ensures that during fast forward or reverse winding the slipping clutch is rendered inoperative. The full driving torque is then applied to the winding mandrel being driven.

In accordance with a further embodiment of the invention the
30 driving portions of the control plate comprise gear-rack segments, which co-operate with the first switching gears constructed as switching pinions. Such gear-rack segments provide precise engagement.

In accordance with a further embodiment of the invention the first and second switching gears are journalled on the winding spindles
35 of the winding mandrels so as to be freely rotatable. Thus, no further spindles and no further space are required for the switching gears.

A further embodiment of the invention is characterized in that in the gear-rack segments have such a length and are arranged in

such a way relative to the switching pinion that the gear-rack segment which during change-over of the pivotal transmission meshes with the first switching gear or pinion which has been set into rotation shifts the control plate via the associated gear-rack segments from one end position to the opposite end position, in which the segment is disengaged, whilst the other gear-rack segment, which was previously disengaged, now meshes with the switching pinion, which now rotates freely. Owing to the limited length of the gear-rack segments and their arrangement the segments disengage themselves.

Furthermore, it is advantageous if the control plate is latched in its two end positions by means of an over-centre spring. This latching in the end positions ensures a correct engagement during normal operation.

A further embodiment of the invention is characterized in that the pivotal levers carrying the pressure rollers are constituted by angular levers and are arranged on a head support carrying the magnetic head so as to be pivotable near their angular portions, that the angular levers carry the pressure rollers on one lever-arm end, that a tension spring acts on the other lever-arm end, and that the head support with the magnetic head and the pressure rollers can be moved away from the tape against the force of the springs.

Finally, in accordance with a further embodiment of the invention, the control plate, which is arranged on a chassis edge, transmits switching movements initiated by the pivotal transmission to a double-armed lever arranged on an adjacent chassis edge, which lever in turn transmits said movements via a slide arranged on a further adjoining chassis edge to the pivotal levers which can be pivoted by the slide. Switching over is then effected via components surrounding the central part of the tape deck.

An embodiment of the invention will now be described in more detail with reference to the accompanying drawing. In the drawing:

Figure 1 is a schematic plan view of the drive mechanism in accordance with the invention together with associated electrical circuitry,

Figure 2 illustrates the parts of the drive mechanism of Figure 1 which co-operate with each other.

The drive mechanism is in particular intended for reverse operation of cassette recorders. Such reverse operation has the

advantage that without removal the cassette can be played continuously in the forward or reverse mode.

There are two capstans 1 and 3, which are provided with flywheels 5 and 7. The winding mandrels 9 (Figure 2) are arranged on
5 drive spindles 11 and 13.

The mechanism is driven by a reversible drive motor 15. A belt 19, which runs over a pulley 17 of the drive motor, drives the flywheels 5 and 7. An additional tensioning roller 21 provides the necessary belt tension. A further belt 23 is passed over the pulley
10 17 and drives a drive gear 25. A drive pinion 29 is mounted on the spindle 27 of the drive wheel 25.

A pivotal transmission 31 co-operates with the drive pinion 29 of the drive wheel 25. This pivotal transmission 31 comprises a swing arm 33, which is arranged eccentrically relative to the drive
15 gear spindle 27 near the drive wheel 25 so as to be pivotable relative to the chassis, not shown, of the apparatus. A transmission gear 37 and a commutator gear 39 are arranged to be rotatable on the free end 35 of the swing arm 33 parallel to each other and one above the other. The two gears 37 and 39 are connected to each other via a slipping
20 clutch 41. The transmission gear 37 is constantly in mesh with the drive pinion 29 of the drive wheel 25. On its upper side the commutator gear 39 is provided with a commutator ring 43, which ring co-operates with a commutator device 47 provided with spring contacts 45.

The winding gears 49 are rigidly connected to the winding
25 spindles 11 and 13, as is shown in Figure 2. Parallel to the winding gears 49 switching gears 50 are arranged on the winding spindles 11 and 13. These switching gears 50 are freely rotatable on the winding spindles 11 and 13. Switching pinions 51, which co-operate with gear-rack segments 52, are rigidly coupled to the switching gears 50. The
30 switching gears 50 and pinions 51 are not involved in the tape transport by the winding mandrels 9 and are arranged to be freely rotatable on the winding spindles 11 and 13 in order to simplify the construction. The distance between the winding gears 49 and the switching gears 50 corresponds to the distance between the gears 39 and 37 of the swing arm 33. Therefore, the upper gears 39 and 49 as well as the lower gears 37 and
35 50 are situated in the same horizontal planes.

Switching over from forward to reverse operation is effected by means of the drive motor 15. The forward direction is indicated by

the smooth arrows 53, all the smooth arrows near the motor 15 bearing the reference numeral 53. The reverse direction is indicated by means of the feathered arrows 54.

In addition to the electrical reversal of the directions
5 mechanical reversals are necessary, because the drive should be changed from the capstan 1 and the winding spindle 11 to the capstan 3 and the winding spindle 13 or vica versa. Mechanical change-over is achieved by means of a control plate 57 which is axially movable along a chassis edge 56, a double-armed lever 59, which is movable by said
10 control plate and is arranged on an adjacent shorter chassis edge 58, and a head slide 61, which is movable by the lever 59 along the next longer chassis edge 60. Thus, the control plate 57 determines the movements of the head slide 61 via the lever 59. The control plate 57, the lever 59 and the head slide 61 are connected by pivots 115 and 119.
15 The head support 55 is supported on the apparatus by means of pressure springs 63, which urge the head support with the magnetic head against the tape, not shown. For fast forward and fast reverse operation it is advisable to lift the magnetic head 65 off the tape. This is effected by means of control plates 67, which are connected to the fast-forward
20 button 69 and the fast-reverse button 71. Each control plate is formed with a slot 73, which is engaged by a pin 75 of the head support 55. When one of the buttons 69 and 71 is depressed, the pin 75 moves along an oblique face 77 and pulls the head-support 55 away from the tape against the action of the springs 63.

25 Angular levers 79 are arranged on the head support 55 near the angular portion 81 to be pivotable about axes 83. On one end 85 the angular levers carry a pressure roller 87. The other end 89 is attached to a tension spring 93, which connects it to the head slide 61. Moreover, the head slide 61 has stops 95, which can butt against the
30 attachment pins 87 of the tension springs 93.

The head support 55 is provided with a fork guide 99. This fork guide 99 guides a pin 101. This pin 101 belongs to a double-armed lever 103, which is freely rotatable about the capstan 1. On the end of the lever 103 which is remote from the end with the pin 101 a bypass
35 gear 105 is arranged. This gear 105 can couple the gears 37 and 39 to each other and thereby render the slipping clutch 41 inoperative.

The control plate 57 is axially movable in the direction of a double-headed arrow 107, the slots 109 being guided along stationary

pins 111. The slots 109 limit the travel of the control plate 57. Said gear rack segments 52 are arranged on the control plate and are adapted to engage the switching pinion 51. The double-armed lever 59, which is pivotable about a pivot 113, has a pivotal connection 115 with the control plate 57. The double-armed lever 59 therefore follows the movements of the control plate 57. On the end which is remote from the pivot 115 the double-armed lever 59 is provided with a fork guide 117, which guides a pin 119 which belongs to the head slide 61. Thus, the movements of the control plate 57 are transmitted directly to the head slide 61.

Automatic reverse operation will now be described in more detail hereinafter, the buttons for fast forward 69, fast reverse 71 and manually influenced reverse operation 121 not being considered, for the time being.

It is assumed that the pulley 17 rotates in the direction of the smooth arrow 53. The swing arm 33 has then pivoted in the direction of the smooth arrow A and the commutator gear 39 meshes with the winding gear 49 of the winding spindle 11. The drive mandrel 9 of the winding spindle 11 is thus driven and takes up the tape supplied to it. The winding gear 49 of the winding spindle 13 rotates freely, thereby allowing the tape to be unwound from this spindle. The control plate 57 has shifted in the direction of the smooth arrow A and an over-centre spring 123 maintains the control plate 47 in this end position. One of the tension springs 93 presses the pressure roller 87 associated with the capstan 1 against this capstan 1. The capstan 1 and the flywheel 5 revolve in the direction of the smooth arrow A. The capstan 1 and the associated pressure roller 87 feed the tape past the magnetic head 65 with the desired speed. At the end of the tape the winding spindle 13 is stopped by the tape end.

When the winding spindle 13 stops, the winding gear 49 of the winding spindle 11 is also stopped via the tape. The commutator gear 39 then also stops. The commutator ring 43 is now also stationary and the commutator device 47 produces a command signal to indicate that the commutator ring 43 and the commutator gear 39 are stationary. Via a control line 125 a corresponding signal is supplied to the reversing circuit 127. This reversing circuit processes the signal in such a way that the direction of rotation of the motor 15 is reversed. The motor 15 is now started in the direction of the feathered arrow 54. The drive

gear 25 is then also rotated in the direction of the feathered arrow. The drive pinion 29 now moves the swing arm 33 in the direction of the feathered arrow via the transmission gear 37 and causes said swing arm to change over. The gears 37 and 39 then mesh with the switching gear 50 and the winding gear 49 of the winding spindle 13 and are thus rotated. The switching pinion 51 of the winding spindle 13 engages with the gear rack segment 52 and moves the control plate 57 in the direction of the feathered arrow over the centre of the spring 123. The shifting process is terminated when the plate 57 has reached its other end position, in which it is latched by means of the over-centre spring 123. In this end position the gear-rack segment 129 engages the switching pinion 51 of the winding spindle 11. The gear-rack segment 52 is now disengaged from the switching pinion 51 on the winding spindle 13.

Via the two-armed lever 59 the head slide 61, coupled to the control plate 57, is slid in the opposite direction. This means that the nose 95' of the head slide 61 has urged the angular lever 79 away from the capstan 1 and the tension spring 93 near the capstan 3 has swung the corresponding angular lever 79 with the pressure roller 87 against the capstan 3. In this way automatic reversal is completed and the tape is now played in the opposite direction, the two capstans and in particular the capstan 3 which is now operative, rotating in the direction of the feathered arrow 3.

In addition to automatic reverse operation, manual operation is possible. One possibility to achieve this is to press a reversing button 121. Upon depression of this reversing button a wiper switch 131 is actuated, which via a line 133 supplies a reversing signal to the reversing circuit 127. Thus, reversal of the play mode may also be initiated manually. The switching operation proceeds as described in the foregoing.

Generally, it is also required to proceed to another passage on the tape by fast forward or reverse winding. For this purpose the buttons 69 and 71 are provided. When the fast-forward button 69 is depressed, it moves a rod 137 in the direction of a arrow 139 via a control plate 135 and thereby releases an interlock between its end 141 and a nose 143 of the control plate 57. Furthermore, the fast-forward button 69 moves the head support and thus the magnetic head away from the tape against the direction of compression of the spring 63 via the oblique face 77. Further, a switch 145 is closed, which

ensures that the drive motor 15 receives the full supply voltage. When the fast-forward button 69 is released the play mode is continued in the same direction.

When the fast-reverse button 71 is depressed, in the same way as for the fast-forward button, the latching rod 137 is first moved in the direction of the arrow 139. Via the oblique face 77 the head support is moved away from the tape and a wiper contact 147 provides the reversal of the direction of the drive mechanism in that a nose 149 of the push-button rod 150 acts on the said contact 147. Thus, when the fast-reverse button 71 is depressed the direction of tape transport is also reversed. Since the switch 145 is closed again, the tape speed increases. When the button 71 is released the contact 147, which is actuated again, reverses the direction of the drive motor and thus of the entire drive mechanism. The tape speed is then reduced to the normal playing speed.

When the tape speed is increased it not unlikely that the slip of the slipping clutch 41 becomes excessive, so that the tape transport is no longer effected with the desired speed. In order to overcome this problem the lever 103 has been provided. Each time that the oblique face 77 moves the head support 55 away from the tape against the action of the spring 63, the lever 103 is pivoted so far that the bypass wheel 105 engages the two gears 37 and 39. In this way the slipping clutch 41 is bypassed. This means that the winding gears 49 are driven by the drive gear 29 without slipping. When the button 69 or 71 is released and the corresponding push-button rods return, the head support 55 is again moved against the tape via the pressure springs 63 and the bypass gear 105 is disengaged from the gears 37 and 39.

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