

Video and audio recorders preferably store the information on magnetic tape which is accommodated in a cassette on two adjacent spools. Thereby, the cassette is inserted such that the spools frictionally engage in corresponding arbors of the driving mechanism of the play-back apparatus.

In conventional video recorders having a rotating head drum, it is necessary to pull the magnetic tape out of the cassette by a threading mechanism and to feed it around the periphery of the head drum with the aid of guide means. This threading process is effected by a threading motor which places the magnetic tape in its playing position by means of a threading carriage driven by a cam plate for example.

The spindles are driven by a further motor, which may also be constructed as a capstan motor, whereby this drive takes place via a pivoted wheel for example, which is coupled on each occasion to the pulling spindle while the feed spindle maintains the required tape tension by means of a friction brake. Because a uniform tape tension is necessary over the whole length of the tape, the instantaneous tape tension is sensed by a tape tension sensor and, in dependence on the position of the sensor, is converted into a matching braking effect for the feed spindle.

It is known to drive the spindle by a capstan motor, whose shaft is inserted into the cassette, via a belt driven pivoted wheel whereby each spindle is provided with a frictional coupling. The drive is effected at the driving side of the frictional coupling. A uniform tape tension is attained by these couplings in association with a sling brake which engages with the coupling part of the feed spindle under the control of the tape tension sensor. For a changed speed of the spindle, during frame search for example, it is usual to drive the pivoted wheel by one or more intermediate wheels which are placed in contact with the aid of a link-motion for example.

Furthermore, recorders are known in which the capstan shaft is arranged outside the cassette whereby the rubber pressure roller, also known as a GA roller, is inserted into the cassette. For the play mode, the GA roller is guided onto the magnetic tape by threading elements so that the magnetic tape can be driven from outside the cassette by the capstan shaft. Since, in an arrangement of this type, the direction of rotation of the capstan shaft does not coincide with the direction of rotation of a pivoted wheel driven by an intermediate wheel, a reversal of the direction of rotation has to take place by means, for example, of a

further intermediate wheel.

The object of the invention is to present a recorder having a capstan motor arranged outside the cassette for the winding- and tape drive in which 1) a reversal of the direction of rotation for driving the pivoted wheel is achieved in a simple manner, 2) the construction of a required frictional coupling is simplified and 3) an adaption of the speed of rotation of the spindle for the different operating modes is made possible in a simple manner.

This object is achieved in accordance with the invention by the features specified in claim 1. Advantageous developments of the invention are specified in the appendant claims.

Basically, a planetary gear, which is driven via a rubber belt by the capstan motor arranged outside the cassette, is connected-up in front of the pivoted wheel that is driving the spindle. A frictional coupling, whose effect can be adjusted by the threading motor controlling the operating modes via levers and control plates, is integrated into the housing of the driving means. The coupling comprises a felt constructed in the shape of a ring and is effective between a stationary control ring that can be adjusted in height and a likewise adjustable-in-height planetary wheel carrier which is rotatable about the common coupling axis and in which the shafts of the planetary wheels are mounted. The lower side of the planetary ring carrier is pressed against the coupling plate by means of a centrally arranged compression spring. The planetary wheels themselves are constructed as toothed gears and are freely rotatable about their axes. They are in engagement on the driving side with a sun wheel driven by the pulley and, on the driven side, with a bell wheel which drives the pivoted wheel. In dependence on the transfer torque which is transmitted from the bell wheel to the pivoted wheel, the planetary wheel carrier carries out a self rotation. If, as the reversal of this process, the planetary wheel carrier is held or braked by the adjustable coupling, then a defined transfer torque can be passed-on from the pivoted wheel to the spindle. It is possible in this way to construct the spindle without its own frictional coupling.

Different transfer torques are required for a constant tape tension during the individual operating modes. In the "Play" mode i.e. during the recording and reproduction modes, a relatively small transfer torque has to be used for a predetermined driving speed for the take-up spindle. The speed is achieved by the step-down ratio defined in the drive means for a static planetary

wheel carrier i.e. the planetary wheel carrier is held in place due to the frictional coupling in this operating mode, the frictional coupling is not yet active. Only with increasing transfer torque does the frictional coupling begin to come into play since the planetary wheel carrier carries out a self-rotation at a low self-speed in the direction of rotation of the driving pulley. The driving torque is limited by the effect of the frictional coupling whereby a desired take-up tape tension is obtained.

For the mode "backward search", a greater transfer torque is required because of the greater tape path between the driving capstan shaft and the spindle driven by the pivoted wheel. In order to achieve this, the stationary control part carrying the frictional coupling is guided closer to the planetary wheel carrier by the threading motor so that the contact force on the coupling felt is increased and thus the torque is made larger.

For the rewind mode i.e. for fast forward or else rewinding of the magnetic tape, the planetary gear is by-passed under the control of the threading motor. This likewise happens by altering the position of the planetary gear in that the stationary control part, with the assistance of the spring force of the centralised compression spring, lowers the planetary wheel carrier so far that burls mounted on the planetary wheel carrier can engage in recesses of the pulley. The shafts of the planetary carrier are thereby connected to the pulley so that the rotating pulley can directly drive the bell wheel via the planetary wheels.

This process can be carried out for a magnetic tape which has been threaded out but which is not being driven. For this, the GA roller merely has to be lifted off the capstan shaft.

The process described for the rewind mode may likewise be carried out if a reversal of the direction of rotation is required for a change of operating mode. In this way, it is possible to guide the pivoted wheel in a short time from one to the other spindle with the help of the capstan motor without the tape tension of the threaded-out magnetic tape experiencing any alteration.

However, this manner of reversing the direction of rotation has the disadvantage that a still frame reproduction with single step advance in the forward and backward direction is not possible since, upon lifting the GA roller from the magnetic tape, a plurality of individual frames may be jumped over. In order nevertheless to achieve a reversal of the direction of

rotation with a laid-on GA roller as well as an unaltered position of the tape and tape tension, the control of the reversal is not carried out by the capstan motor but rather by the threading motor. With a static transmission, this occurs by rotation of the planetary ring carrier through a specific angle in that the externally accessible, height-adjustable coupling ring, which for its part is stationary and which is in engagement with the shafts of the planetary wheels via the coating of the coupling, is displaced by the threading motor via a gear train. During the course of this procedure, the coupling ring alters its predefined height position in order to achieve the tape tension at the required height during running of the capstan motor after the reversal has occurred.

The invention will be explained hereinafter in more detail by means of an embodiment with the help of the Figures:

Figure 1 shows, in a schematic illustration, the winding and tape drive means for a magnetic tape cassette 2 which is mounted in a chassis 1 for the transport mechanism. The magnetic tape 12 is fed out from the cassette 2 by the threading motor 11 via threading elements 8, 9 and 9a by means of not-illustrated guiding means and wrapped around a head drum 16. The capstan motor 5 is arranged outside the cassette 2. On the one hand, its shaft 7 drives the magnetic tape 12 in association with an adjoining GA roller 10 but, moreover, it serves for the driving of the planetary gearing 14 via the rubber belt 13. The pivoted wheel 4, which drives the supply spindle 6a of the magnetic tape spool 3a for the tape running direction indicated by the arrow in the illustration, is in engagement with the driven part 15, the bell wheel of the planetary gear 14. Since, in the illustration, the magnetic tape 12 is driven by the GA roller 10, the operating mode "backward frame search" is thus indicated. If, in the arrangement sketched, the GA roller 10 is lifted off the capstan shaft by the threading motor 11, there results the operating mode "backward rewind". However, for this operating mode, the capstan motor has to exhibit another direction of rotation since, in this operating mode, the planetary gearing is by-passed as described in Figure 2.

Figure 2 shows, in a sectional view, the planetary gear 14 which is provided with a frictional coupling. The planetary gear represents a component which is attached to the chassis 1 via a mounting stand 17. The central shaft 18 having a sleeve 19 serves as the rotation shaft for the driving part 20 which is provided with a headsheave and a sun wheel, as well as, for the driven part 21 which drives the pivoted wheel 4 and which is

also referred to as a bell wheel. The pivoted wheel 4 is likewise mounted centrally of the gear axis by means of the pivoted wheel lever 22, and it is freely movable in the pivot plane.

The transmission of the torque takes place by means of planetary wheels 23 that have ring gears on their periphery which are in engagement with the sun wheel 20 and the bell wheel 21. The planetary wheels 23 are rotatably mounted on the shafts 24 whereby the shafts 24 are likewise rotatably held in a lower and an upper planetary wheel carrier 25, 26. The planetary wheel carriers 25, 26 are arranged to be rotationally symmetrical with respect to the drive shaft 18 and can carry out a self rotation about this shaft.

The planetary wheel carrier 26 is fixed in its position in the axial direction while the lower planetary wheel carrier 25 is displaceable as regards its position in the axial direction by a lever 27 that is displaceable by the threading motor by means of a ramp 28 which is effective on a stationary control ring 29 that is adjustable in height. A felt ring 30, which serves as the coupling coating for the frictional coupling, is arranged between the stationary control ring 29 that is adjustable in height, which represents one part of the coupling, and the lower planetary wheel carrier 25 as a further part of the coupling. The pressure contact for the coupling is effected by a centrally arranged compression spring 31 which is effective between the lower planetary wheel carrier 25 and a metal ring 32, wherein, the metal ring 32 is supported on a shoulder of the planetary wheel shaft 24.

Since the planetary gear represents a step-down ratio between the driving means and the driven means, which ratio is set such that, in combination with the intermediate wheel 4, a predetermined number of revolutions of the spindle is achieved for the normal "play mode", but, on the other hand, a higher rotational speed is sought for the tape winding mode, a means is provided for cancelling the effect of the planetary gear. To this end, the lower planetary wheel carrier 25 can be lowered by the lever 27 having the stationary control ring 29 that is adjustable in height and is safeguarded from self rotation by the blocking lug 33 to such an extent that burls 34 mounted on the planetary wheel carrier 25 engage in recesses 35 of the pulley 20. The shafts 24 of the planetary wheels 23 can thereby be driven at the pulley speed and the upstanding planetary wheels 23 transmit this speed to the bell wheel 21.

This "short-circuiting" of the planetary gear can also

be carried out whenever a reversal of the winding drive means has to occur due to a change of operating mode. Namely, due to this measure, it is possible to swivel the pivoted wheel 4 from the one to the other spindle without altering the tape tension when the magnetic tape is threaded out and the GA roller 10 is lifted off the tape 12.

For expensive apparatus having single frame stepping in the forward and backward directions, this type of reversal of the direction of rotation is not however appropriate since the frame that was last set cannot be restored with certainty due to the lifting of the GA roller 10 and due to the pivoting process. Consequently, the reversal of the direction of rotation with an engaged GA roller 10 is controlled by the threading motor 11 via the cam plate 36 in this type of apparatus.

Fig. 3 depicts the reversal of the direction of rotation by means of a cam plate driven by the threading motor. In the Figure, the magnetic tape 12 is drawn out of the cassette 2 by threading elements 8, 9 and 9a and is wrapped around the head drum 16. The GA roller 10 presses the magnetic tape 12 against the capstan shaft 7. The tape tension is set by the tape tension sensing lever 40. The play back mode is represented by the position of the pivoted wheel 4.

For a reversal of the direction of rotation with a static capstan shaft 7 and maintained tension of the tape tension in the arrangement described, a drive voltage is supplied to the threading motor 11 via, for example, a microprocessor control means upon the provision of the reversal command, by virtue of which the cam plate 36 is shifted in the direction of the arrow by the shaft 37 via the intermediate wheel 38 and the drive wheel 39. The cam plate 36 is in engagement with the planetary gear 15 via the toothed segment 41 in such a way that the control ring 29 illustrated in Fig. 2, which of itself is stationary although adjustable in height, is rotated through a certain angle.

Fig. 4 depicts, in a sectional view, the adjustment of the control ring 29 on the planetary gear. The illustration of the planetary gear is basically identical with that of Fig. 2. The part of the cam plate 36, which is in engagement via the toothed segment 41 with an adjustment ring 42 that is rotatably mounted in the chassis 1, can be perceived below the metal chassis 1. An adjustment part 43 is connected to the adjustment ring 42, which part has a recess in the form of a longitudinal groove in which the blocking lug 33 of the height-adjustable control ring 29 engages. The rotational movement of the cam plate 36 is transmitted

via the adjustment ring 42 having the adjustment part 43 to the blocking lug 33 of the control ring 29. Consequently, the planetary wheels 26 are also rotated by the coupling layer 30, which wheels thus control the bell wheel 21 and the pivoted wheel 4 attached to the pivoted wheel lever 22 in the desired manner of operation.

The coupling effect due to the height adjustment of the control ring 29 is set by the lever 27 which is likewise displaceable by the threading motor 11 via not-illustrated driving parts.



Claims

1. Recorder including a winding and tape drive means for a magnetic tape cassette (2) which comprises two adjacent spools (3, 3a) which carry the magnetic tape and into which there engages a respective spindle (6, 6a) that is driven by a capstan motor (5) via a pivoted wheel (4), wherein the shaft (7) of the capstan motor (5) is arranged outside the cassette (1) and threading elements (8, 9, 9a) as well as a rubber pressure roller (10) for driving the magnetic tape engage in the cassette, which control elements that are driven by means of a threading motor (11) can be projected for the guidance of the magnetic tape (12) out of the cassette, characterised in that, a planetary gear (14), which comprises a frictional coupling and which is in engagement with the pivoted wheel (4), is driven by the capstan motor (5) via a resilient driving element (13).
2. Recorder in accordance with Claim 1, characterised in that, for certain operating modes, the planetary gear (14) can be mechanically by-passed by a control means which is enabled by the threading motor (11).
3. Recorder in accordance with Claim 1, characterised in that, the frictional coupling arranged in the housing of the planetary gear can have its effect adjusted by a control means enabled by the threading motor (11) by means of a lever (27).
4. Recorder in accordance with Claim 3, characterised in that, the effect of the frictional coupling can be adjusted by a stationary coupling ring (29) that can be adjusted in height.
5. Recorder in accordance with Claim 2 or 3, characterised in that, the frictional coupling acts uniformly on the driving rotation of the planetary wheels (23).
6. Recorder in accordance with any of the Claims 1 to 5, characterised in that, the spindles (6, 6a) are constructed of a single piece of synthetic material.
7. Recorder in accordance with Claim 1, characterised in that, the planetary gear (14) comprises a plurality of planetary wheels (23), preferably 3 planetary wheels, which comprise a ring gear and which are distributed uniformly at a radius, and that the planetary wheels (23) are in engagement with the driving coupling part (sun wheel and headsheave 20) and the driven coupling part (bell wheel 21) via the toothing.



8. Recorder in accordance with Claim 1, characterised in that, the planetary gear (14) comprises a predefined reduction ration between the driving part and the driven part.

9. Recorder in accordance with Claim 4, characterised in that, for the purpose of reversing the direction of rotation, the pivoted wheel (4) can be displaced by a cam plate (36) when adjusting the clearance of the magnetic tape (12) with the rubber pressure roller (10) in contact, a stationary capstan motor (5) and active coupling effect.

10. Recorder in accordance with Claim 9, characterised in that, the reversal of the direction of rotation of the pivoted wheel (4) is effected via the cam plate (36) by rotation of the coupling ring (29) by means of the threading motor (11).