

AUTOMATIC REVERSING DEVICE FOR A TAPE RECORDER

BACKGROUND OF THE INVENTION

1) Field of the Invention

This invention relates to an automatic reversing device for a tape recorder which detects stopping of rotation of a reel base and alternately renders a pair of pinch rollers operative and inoperative.

2) Description of the Prior Art

Conventional tape recorders normally include a pair of reel bases, a pair of capstan shafts and a pair of pinch rollers all located in a symmetrical relationship with respect to a magnetic head, and a rotation transmitting member interposed in each of a pair of rotation transmitting routes along which rotation of the capstan shafts is transmitted to the respective reel bases. Some of such conventional tape recorders incorporate an automatic reversing device in order to allow continuous recording or reproduction at an end of a magnetic tape thereon. Such an automatic reversing device is normally constituted such that, in response to a detection signal from a detecting means which detects stopping of rotation of the reel bases, the rotation transmitting members are alternatively

moved into and out of the corresponding rotation transmitting routes and the pinch rollers are alternatively moved into and out of contact with the corresponding capstan shafts.

5 However, in such conventional automatic reversing devices as described above, a member for supporting a rotation transmitting member and a member for moving a pinch roller into and out of contact with a capstan shaft are formed in separate members, which additionally
10 requires provision of springs for urging the individual members. One of such automatic reversing devices is disclosed, for example, in Japanese Patent Laid-Open No. 60-76046, and in the device, means for detecting
15 stopping of rotation of a reel base is constituted from several different members cooperating with each other and with the reel base and a rotation transmitting member. Such a conventional arrangement raises a problem that the quantity of components of the device is
20 large and construction and operation of the device is complicated, which results in a high production cost of the entire device.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an automatic reversing device for a tape

recorder wherein the entire construction thereof is simplified significantly and reduction in quantity of components and in cost can be attained.

According to the present invention, there is
5 provided an automatic reversing device for a tape recorder wherein a pair of reel bases, a pair of capstan shafts and a pair of pinch rollers are located in a symmetrical relationship with respect to a magnetic head, and a rotation transmitting member is interposed
10 in each of a pair of rotation transmitting routes along which rotation of said capstan shafts is transmitted to the respective reel bases, comprising detecting means for detecting stopping of rotation of said reel bases, and a single change-over operating member having said
15 rotation transmitting members mounted for rotation thereon, said change-over operating member being mounted for shifting movement in opposite directions in parallel to a line interconnecting said capstan shafts between a first operative position in which one of said rotation
20 transmitting members thereon establishes the corresponding rotation transmitting route while the other rotation transmitting member disconnects the corresponding rotation transmitting route and one of said pinch rollers on the same side as the one rotation
25 transmitting member with respect to said magnetic head

is pressed against the corresponding capstan shaft while the other pinch roller is spaced away from the corresponding capstan shaft and a second operative position in which the one rotation transmitting member
5 thereon disconnects the corresponding rotation transmitting route while the other rotation transmitting member establishes the corresponding rotation transmitting route and the one pinch roller is spaced away from the corresponding capstan shaft while the
10 other pinch roller is pressed against the corresponding capstan shaft, said change-over operating member being alternatively moved from one to the other of said first and second operative positions or vice versa in response to a mechanical detection signal from said detecting
15 means.

In the automatic reversing device, shifting movement of a single member, namely the change-over operating member, in one of opposite directions will cause alternative movement of the rotation transmitting
20 members into and out of the corresponding rotation transmitting routes and alternative movement of the pinch rollers into and out of contact with the corresponding capstan shafts.

Thus, supporting means for the rotation
25 transmitting members and means for alternatively moving

the rotation transmitting members and the pinch rollers are provided by the single change-over operating plate. Accordingly, the quantity of components can be reduced significantly and the entire device can be simplified in construction, which contributes in reduction in cost of the entire device.

A specific embodiment of the present invention will now be described in detail by way of example with reference to the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a bottom plan view showing a tape recorder mechanism in which an automatic reversing device of the present invention is incorporated;

15 FIGS. 2 and 3 are enlarged bottom plan views of part of the automatic reversing device of FIG. 1 showing different stages in changing over operation from a first operative position of FIG. 1 to a second operative position; and

20 FIG. 4 is a view similar to FIG. 1 but showing the automatic reversing device in the second operative position.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring first to FIG. 1, a tape recorder in which an automatic reversing device according to the

present invention is incorporated is shown with a rear cover and a chassis omitted to facilitate observation of the automatic reversing device. The tape recorder shown includes a pair of right and left reel bases 1a, 1b for
5 receiving tape reels in a tape cassette thereon. In the position shown in FIG. 1, a tape not shown is supplied from a tape reel not shown received on the left-hand side reel base 1a and is wound onto another tape reel not shown mounted on the right-hand side reel base 1b.

10 The tape recorder further includes a magnetic head 2 mounted on a head plate not shown mounted for back and forth movement in a vertical direction in FIG. 1. The reel shafts 1a, 1b, a pair of capstan shafts 3a, 3b, a pair of pinch rollers 4a, 4b are
15 located substantially at symmetrical positions on opposite sides with respect to the magnetic head 2. The capstan shafts 3a, 3b are connected to be normally driven to rotate in opposite counterclockwise and clockwise directions, respectively, by a common motor
20 not shown and have a pair of small gears 5a, 5b and a pair of flywheels 6a, 6b mounted thereon, respectively.

A change-over operating plate 7 having a channel-shaped plan is located forwardly, that is, downwardly in FIG. 1, of a line interconnecting the capstan shafts 3a,
25 3b and mounted for longitudinal shifting movement in

leftward and rightward directions in FIG. 1 in parallel to the interconnecting line under the guidance of a pair of fixed pins 9a, 9b which are fitted in a pair of elongated holes 8a, 8b, respectively, formed in the change-over operating plate 7. A pair of arms 7a, 7b extend rearwardly from opposite right and left ends of the change-over operating plate 7 toward the reel bases 1a, 1b, and a pair of rotation transmitting members each including two integral larger and smaller gears 10a and 11a or 10b and 11b are supported for rotation at rear end portions of the arms 7a, 7b of the change-over operating plate 7 by means of a pair of shafts 12a, 12b integral therewith, respectively. A pair of eccentric cams 13a, 13b and a pair of crescent-shaped cams 14a, 14b are integrally formed on rear faces of the rotation transmitting members so that when the rotation transmitting members rotate, they are rotated around axes of the shafts 12a, 12b. The eccentric cams 13a, 13b are located and extend around the shafts 12a, 12b while the crescent-shaped cams 14a, 14b are located outside the eccentric cams 13a, 13b and have inner concave circumferential faces opposed to outer peripheries of the eccentric cams 13a, 13b, respectively.

The pinch rollers 4a, 4b are supported on a pair

of support members 16a, 16b mounted for pivotal motion around a pair of shafts 15a, 15b so that they may be engaged with or disengaged from the capstan shafts 3a, 3b, respectively. Each of the support members 16a, 16b
5 has an upwardly bent lug 17a or 17b formed thereon.

The change-over operating plate 7 further has a pair of openings 18a, 18b formed therein through which the bent lugs 17a, 17b of the support members 16a, 16b extend upwardly, respectively. The openings 18a, 18b
10 are each partially defined by an inclined camming edge 19a or 19b of the change-over operating plate 7, respectively, which is arranged such that, when the change-over operating plate 7 moves leftwardly, the left inclined edge 19b may be slidably engaged with the bent
15 lug 17b of the left support member 16b and pivot the left support member 16b clockwise around the shaft 15b to move the left pinch roller 4b away from the capstan shaft 3b as seen in FIG. 1, but on the contrary when the change-over operating plate 7 moves rightwardly, the
20 right inclined edge 19a may be slidably engaged with the bent lug 17a of the right support member 16a and pivot the right support member 16a counterclockwise around the shaft 15a to move the right pinch roller 4a away from the capstan shaft 3a. It is to be mentioned here that
25 the support members 16a, 16b are normally urged to pivot

in the clockwise and counterclockwise directions so as to contact the pinch rollers 4a, 4b thereon with the capstan shafts 3a, 3b, respectively, by individual springs not shown.

5 A toggle lever 23 is mounted for pivotal motion around a pivot 31 at a fixed location near the right end of the change-over operating plate 7 and is connected at an end thereof to a torsion toggle spring 20 in such a manner that the torsion toggle spring 20 may urge the
10 toggle lever 23 to pivot alternatively to a pair of fixed stopper pins 21, 22 from a neutral or center line interconnecting the pivot 31 of the toggle lever 23 and the other fixed end of the torsion toggle spring 20. The toggle lever 23 is connected at the other end
15 thereof to the change-over operating plate 7. The toggle lever 23 and the torsion toggle spring 20 constitute a pinch roller changing over mechanism together with the change-over operating plate 7. Thus, when the change-over operating member 7 is moved in the
20 rightward direction from the position shown in FIG. 1 against the urging force of the torsion toggle spring 20 until the toggle lever 23 is pivoted in a counterclockwise direction beyond the neutral line mentioned above, the urging force of the torsion toggle
25 spring 20 will now act to pivot the toggle lever 23 in

the counterclockwise direction to further move the change-over operating plate 7 in the rightward direction, thereby moving the right pinch roller 4a away from the capstan shaft 3a.

5 In the position shown in FIG. 1, the larger one 10a of the integral larger and smaller gears 10a, 11a which constitute the right one of the rotation transmitting members is in meshing engagement with the small gear 5a which is integral with the capstan shaft 10 3a and the other smaller gear 11a is in meshing engagement with a large gear 24a mounted in a concentrical relationship with the reel base 1a. Meanwhile, the larger one 10b of the integral larger and smaller gears 10b, 11b which constitute the left one of 15 the rotation transmitting members is out of engagement with the small gear 5b which is integral with the capstan shaft 3b and the other smaller gear 11a is also out of engagement with another large gear 24a which is mounted in a concentrical relationship with the reel 20 base 1b. The meshing engagement between the gears 10a and 5a, 11a and 24a or 10b and 5b, 11b and 24b is controlled by a position of the change-over operating plate 7 in the leftward and rightward directions such that when those gears located at one side positions with 25 respect to the magnetic head 2 are in meshing engagement

with each other, the other gears located at the other side positions are out of meshing engagement with each other.

A pair of cam followers 25a, 25b are mounted on
5 and in frictional fitting engagement with shafts not shown which are common with the reel bases 1a, 1b, respectively, so that rotation of the reel bases 1a, 1b may be transmitted to the cam followers 25a, 25b, or in other words, the cam followers 25a, 25b may be urged to
10 rotate by the reel bases 1a, 1b, respectively, through the frictional engagement of the cam followers 25a, 25b with the common shafts. The reel bases 1a, 1b are also connected to the large gears 24a, 24b, respectively, via known friction mechanisms not shown so as to allow the
15 reel bases 1a, 1b to be stopped compulsorily while the large gears 24a, 24b continue their rotation. Each of the cam followers 25a, 25b has a projection 26a or 26b formed thereon for slidably contacting with an outer peripheral face of the eccentric cam 13a or 13b and also
20 with an outer convex circumferential face of the crescent-shaped cam 14a or 14b, respectively. Each of the cam followers 25a, 25b further has formed thereon an abutting lug 27a or 27b which extends laterally in a direction away from the slidably contacting portion 26a
25 or 26b, and a resilient finger or extension 28a or 28b

for engaging with hub portions of the rotation transmitting members around the shaft 12a or 12b, respectively. A pair of stopper pins 29a, 29b are erected uprightly at fixed positions in an opposing relationship to the abutting lugs 27a, 27b of the cam followers 25a, 25b, respectively. A fixed retaining plate 30 extends in leftward and rightward directions so as to cover over the reel bases 1a, 1b and the cam followers 25a, 25b.

10 Now, operation of the automatic reversing mechanism will be described. In the position shown in FIG. 1, the right pinch roller 4a is in contact with the capstan shaft 3a with a magnetic tape interposed therebetween so that rotation of the capstan shaft 3a in
15 a direction indicated by an arrow mark is transmitted to the right reel base 1a via the gears 5a, 10a, 11a and 24a and the associated friction mechanism not shown to wind the tape onto a tape reel received on the reel base 1a. In this instance, the turning force of the reel
20 base 1a is transmitted through the frictional engagement of the reel base 1a with the common shaft as a force to urge the cam follower 25a to pivot in the counterclockwise direction as indicated by an arrow mark. Consequently, the slidably contacting projection
25 26a of the cam follower 25a is held in sliding contact

with the outer circumferential face of the eccentric cam 13a. So far as the slidably contacting projection 26a of the cam follower 25a is held in sliding contact with the outer peripheral face of the eccentric cam 13a so
5 that the cam follower 25a is pivoted back and forth around the shaft common with the reel base 25a by the eccentric cam 13a, the slidably contacting projection 26a will not be brought into sliding contact with the outer convex peripheral face of the crescent-shaped cam
10 14a. Accordingly, the rotation transmitting route from the capstan shaft 3a to the reel base 1a via the gears 5a, 10a, 11a and 24a and the friction mechanism will be maintained.

Now, it is assumed that reproduction or recording
15 is being performed while the tape is being wound onto the reel received on the right-hand side reel base 1a. In this condition, the change-over operating plate 7 is in its leftwardly shifted position. Accordingly, the gear 5b is held out of meshing engagement with the gear
20 10b, and the gear 11b is held out of meshing engagement with the gear 24b. Meanwhile, the cam follower 25b is being acted upon by a turning force in the counterclockwise direction from the reel base 1b through the frictional engagement thereof with the shaft common
25 with the reel base 1b. However, since the extension 28b

of the cam follower 25b is resiliently pressed against the hub portion of the rotation transmitting member around the shaft 12b, the slidably contacting projection 26b of the cam follower 25b is held in sliding contact with the outer peripheral face of the eccentric cam 41b. Consequently, the slidably contacting projection 26b of the cam follower 25b will not be brought into sliding contact with the outer convex peripheral face of the crescent-shaped cam 15b if the rotation transmitting member on the shaft 12b starts its rotation.

Accordingly, the left rotation transmitting member (gears 10b, 11b) is maintained in a position disconnected from the reel base 1b in which it is out of engagement with the large gear 24b and the gear 5b.

Then, if the tape has been wound up fully onto the right-hand side reel, it is stretched taut between the reels so that rotation of the reel base 1a is stopped while yielding a slip at the friction mechanism interposed between the large gear 24a and the reel base 1a because the large gear 24a continues its rotation. Consequently, the cam follower 25a is no more urged by the turning force of the reel base 1a in the counterclockwise direction so that, after the slidably contacting projection 26a thereof is subsequently moved to a maximum eccentric position by the outer peripheral

face of the eccentric cam 13a, that is, to a possible farthest position from the shaft 12a, it will thereafter remain at the position. As the gears 10a, 11a continue their rotation in this condition, the slidably
5 contacting projection 26a of the cam follower 25a will soon be brought into sliding contact with the outer convex peripheral face of the crescent-shaped cam 14a as seen in FIG. 2. Consequently, as the gears 10a, 11a further rotate, the cam follower 25a is pivoted in the
10 clockwise direction by the crescent-shaped cam 14a until the abutting portion 27a of the cam follower 25a is brought into abutment with the stopper pin 29a. While the cam follower 25a is prevented from further pivoting in the clockwise direction by the stopper pin 29a, since
15 the gears 10a, 11a still continue their rotation, rotation of the crescent-shaped cam 14a will now move the shaft 12a and hence the change-over operating plate 7 in the rightward direction in FIG. 1 due to sliding contact of the crescent-shaped cam 14a with the slidably
20 contacting projection 26a of the cam follower 25a. As the change-over operating plate 7 is moved in the rightward direction in this manner, the gear 11a is disengaged from the gear 5a and the gear 11a is disengaged from the gear 24a. FIG. 3 shows a condition
25 just before such disengagement occurs.

In an initial part of the rightward movement of the change-over operating plate 7 by a certain distance, the toggle lever 23 is pivoted in the counterclockwise direction by the change-over operating plate 7 while
5 accumulating the urging force in the torsion toggle spring 20. Then, when the toggle lever 23 is pivoted beyond the neutral line interconnecting the pivot 31 of the toggle lever 23 and the fixed end of the torsion toggle spring 20, the accumulated urging force of the
10 torsion toggle spring 20 is released and acts as a force to urge the toggle lever 23 to pivot further in the counterclockwise direction. Consequently, the change-over operating plate 7 is moved rapidly in the rightward direction. Thereupon, the left inclined edge 19b of the
15 change-over operating plate 7 releases the bent lug 17b of the left support member 16b therefrom and thus allows the support member 16b to be pivoted in the counterclockwise direction around the shaft 15b by the spring not shown while the right inclined edge 19a is
20 engaged with the bent lug 17a of the right support member 16a and pivots the support member 16a in the counterclockwise direction against the urging of the associated spring not shown. Consequently, the left pinch roller 4b is brought into contact with the capstan
25 shaft 3b while the right pinch roller 4a is brought out

of contact with the capstan shaft 3a. Meanwhile, the smaller gear 11b constituting the left rotation transmitting member is brought into meshing engagement with the large gear 24b while at the same time the
5 larger gear 10b is brought into meshing engagement with the small gear 5b coaxial with the capstan shaft 3b. This position of the device is shown in FIG. 4 and is substantially symmetrical to the position shown in FIG. 1. In the position shown in FIG. 4, the left reel
10 base 1b is rotated in a clockwise direction to wind a tape onto the left reel while performing a reproducing or recording operation. Thus, the automatic reversing operation of the device is completed.

In this manner, when rotation of one of the reel
15 bases 1a, 1b being driven via its associated rotation transmitting route to rotate so as to wind a tape onto a tape reel received on the one reel base is stopped upon arrival of an end of the tape, the change-over operating plate 7 is shifted alternatively in one of the opposite
20 directions so that the rotation transmitting route to the reel base 1a or 1b from the corresponding capstan shaft 3a or 3b is disconnected and the corresponding pinch roller 4a or 4b is brought out of contact with the same capstan shaft 3a or 3b so as to stop feeding of the
25 tape by the capstan shaft 3a or 3b while the other

rotation transmitting route to the other reel base 1b or
1a is established and the corresponding pinch roller 4b
or 4a is brought into contact with the corresponding
capstan shaft 3b or 3a with the tape interposed
5 therebetween so as to feed the tape in the opposite
direction.

It is to be noted that while in the embodiment
described above a tape stopping detecting mechanism is
constituted from a combination of the eccentric cams
10 13a, 13b, crescent-shaped cams 14a, 14b, cam followers
25a, 25b and stopper pins 29a, 29b, it is not limited to
the specific construction, and another combination may
also be available.

Having now fully described the invention, it will
15 be apparent to one of ordinary skill in the art that may
changes and modifications can be made thereto without
departing from the spirit and scope of the invention as
set forth herein.



CLAIMS:

1. An automatic reversing device for a tape recorder wherein a pair of reel bases, a pair of capstan shafts and a pair of pinch rollers are located in a symmetrical relationship with respect to a magnetic head, and a rotation transmitting member is interposed in each of a pair of rotation transmitting routes along which rotation of said capstan shafts is transmitted to the respective reel bases, comprising detecting means for detecting stopping of rotation of said reel bases, and a single change-over operating member having said rotation transmitting members mounted for rotation thereon, said change-over operating member having a first operative position in which one of said rotation transmitting members thereon establishes the corresponding rotation transmitting route while the other rotation transmitting member disconnects the corresponding rotation transmitting route and in which one of said pinch rollers on the same side as the one rotation transmitting member with respect to said magnetic head is pressed against the corresponding capstan shaft while the other pinch roller is spaced away from the corresponding capstan shaft, said change-over operating member further having a second operative



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position in which the one rotation transmitting member
thereon disconnects the corresponding rotation
transmitting route while the other rotation transmitting
member establishes the corresponding rotation
5 transmitting route and in which the one pinch roller is
spaced away from the corresponding capstan shaft while
the other pinch roller is pressed against the
corresponding capstan shaft, said change-over operating
member being moved in parallel to a line interconnecting
10 said capstan shafts alternatively from said first to
said second operative position or from said second to
said first operative position in response to a
mechanical detection signal from said detecting means.

2. An automatic reversing device for a tape
15 recorder according to claim 1, wherein said change-over
operating member is connected to a single spring member
such that the latter may urge the former to
alternatively move to one of said first and second
operative positions from an intermediate neutral
20 position provided by said spring member.

3. An automatic reversing device for a tape
recorder according to claim 1 or 2, wherein said
detecting means includes a pair of detecting members
each provided for detecting stopping of rotation of a
25 corresponding one of said reel bases, and a pair of



operating means each cooperating with a corresponding one of said detecting members for alternatively moving said change-over operating member from said first operative position to said second operative position or vice versa when stopping of rotation of one of said reel bases is detected by one of said detecting members.

4. An automatic reversing device for a tape recorder according to claim 3, wherein each of said detecting members is frictionally coupled to a corresponding one of said reel bases so that the former may be urged in a fixed direction by the latter while the latter is rotating, but when rotation of the latter is stopped, the urging force by the latter may disappear to allow the former to remain at its position, each of said operating means operating when the urging force by the corresponding reel base disappears.

5. An automatic reversing device for a tape recorder according to claim 4, wherein each of said detecting members is mounted in a coaxial relationship with the corresponding reel base.

6. An automatic reversing device for a tape recorder according to claim 4 or 5, wherein each of said operating means includes a first and a second cam mounted for integral rotation with a corresponding one of said rotation transmitting means, and a fixed stopper



element, and each of said detecting members has a cam
follower portion which is held, while the corresponding
reel base is rotating, in contact with the corresponding
first cam but is engaged, when rotation of the
5 corresponding reel base stops, with the corresponding
second cam so that, as the corresponding rotation
transmitting member further rotates, the second cam
first moves the detecting member until the detecting
member is stopped by the corresponding stopper element
10 and then moves the rotation transmitting member and
hence said change-over operating member from said first
operative position to said second operative position or
vice versa.

7. An automatic reversing device for a tape
15 recorder according to claim 6, wherein each of said
detecting members has a resilient extension formed
thereon for resiliently urging the detecting member to
engage said cam follower portion of the detecting member
with said first cam of the corresponding operating
20 means.

8. An automatic reversing device for a tape recorder
substantially as hereinbefore described with reference to, and
as shown in, the accompanying drawings.
