

MECHANISM FOR CHANGING THE TAPE TRANSPORT DIRECTION  
IN AN AUTO-REVERSE TYPE TAPE RECORDER

Field of the Invention

The present invention relates to a mechanism for changing the tape transport direction in an auto-reverse type tape recorder and/or player.

Background of the Invention

One of the conventional mechanisms for changing the tape transport direction for use in an auto-reverse type tape recorder is disclosed in a Japanese Patent Application Laid Open No Sho 60-113-349. According to this conventional mechanism, when a slide plate 1 is in the left-hand position as shown in FIG. 3, a right change-over gear 4 is meshed with a small-diameter gear 5<sub>1</sub> of a right transmission gear 5 by means of the clockwise rotation of a right rotatable plate 2 due to the tension force of a tension spring 3, while a left change-over gear 7 is separated from a small-diameter gear 8<sub>1</sub> of a left transmission gear 8 by means of the clockwise rotation of a left rotatable plate 6 due to the compressive force of the tension spring 3. Moreover, since a pinch roller change-over plate 9 is inclined to the left

by means of a cam pin 10, a right pinch roller 12 on a right end of a rod-shaped spring 11 is passed to, and pinches with, a right capstan 13, and at the same time, a left pinch roller 14 on a left end of the rod-shaped spring 11 is separated from a left capstan 15. Accordingly, the turning force of the motor (not shown) is transmitted to a right reel support 17 through the right transmission gear 5, the small-diameter gear 5<sub>1</sub>, the right change-over gear 4 and a right reel gear 16, and therefore a tape (not shown) is transported to the right through the right pinch roller 12 and right capstan 13 and then wound on a right reel (not shown).

On the other hand, when the slide plate 1 is in the right-hand position as shown in FIG 4, the right change-over gear 4 is separated from the small-diameter gear 5<sub>1</sub> of the right transmission gear 5 by means of the counterclockwise rotation of the right rotatable plate 2 due to the compressive force of the tension spring 3, while the left change-over gear 7 is meshed with the small-diameter gear 8<sub>1</sub> of the left transmission gear 8 by means of the counterclockwise rotation of the right rotatable plate 6 due to the tension force of the tension spring 3. Further, since the pinch roller change-over plate 9 is inclined to the right by means of the cam pin 10, the right pinch roller 12 on the right end of the rod-shaped spring 11 is separated from the right capstan 13, and at the same time, the left pinch roller

12 on the left end of the rod-shaped spring 11 is pressed to, and pinches with, a left capstan 15. Thus, the turning force of the motor is transmitted to a left reel support 19 through the small-diameter gear 8<sub>1</sub> of the left transmission gear 8 engaged with a large-diameter gear 5<sub>2</sub> of the right transmission gear 5, the left change-over gear 7 and the left reel gear 18, and therefore, the tape (not shown) is transported to the left through the left pinch roller 14 and left capstan 15 and then wound on a left reel (not shown).

However, in this conventional mechanism for changing the tape transport direction, there have been the disadvantages that there is a large number of component parts and the construction thereof is complicated.

#### Summary of the Invention

It is a principal object of the present invention to provide an improved mechanism for changing the tape transport direction of an auto-reverse type tape recorder enabling the above discussed disadvantages of prior art mechanisms to be avoided.

In accordance with the invention there is provided a mechanism for changing the tape transport direction in an auto-reverse tape recorder and/or player, comprising : forward and reverse

transmission gears disposed respectively in the vicinity of forward and reverse reel gears, said transmission gears being meshed with each other and driven by a motor; a change-over gear supporting member supported movably on a head-mounting plate on which a magnetic head is mounted; a change-over gear supported rotatably on said change-over gear supporting member to mesh alternatively with both the forward reel gear and forward transmission gear or the reverse reel gear and reverse transmission gear when said change-over gear supporting member is in forward or reverse positions respectively; and a change-over plate for bringing forward and reverse pinch rollers alternatively to pinch with corresponding capstans, and having means for engaging said change-over gear supporting member to move it between forward or reverse positions on the head-mounting plate.

In a preferred embodiment, said change-over gear supporting member is made of synthetic resin and has a flexible arm on each of two opposite sides thereof so as to absorb the excess movement of said change-over plate, and said engaging portion of said change-over plate is composed of an opening having two operative side edges positioned immediately adjacent to respective corresponding flexible arms of said change-over gear supporting member for urging said change-over gear supporting member to said forward or reverse positions when the change-over plate is moved

in forward or reverse directions.

Thus, when said change-over plate is moved in said left or right direction to allow said change-over gear supporting member to be moved in the corresponding direction, the change-over gear is separated from the reel gear and transmission gear at one side, and at the same time, meshed with both the other reel gear and transmission gear at the other side.

#### Brief Description of Drawings

The present invention will become more readily apparent from the following description of a preferred embodiment thereof shown, by way of example only, in the accompanying drawings, wherein :

FIG 1 is a top plan view of an auto-reverse type tape recorder and/or player which is provided with a mechanism for changing the tape transport direction embodying the present invention;

FIG 2 is a perspective view, partially broken away, of the mechanism shown in FIG 1;

FIG 3 is a top plan view illustrating the prior art mechanism for changing the tape transport direction in which

a head-mounting plate is positioned in the left-hand position; and

FIG 4 is a top plan view of the same mechanism as shown in FIG 3 except that the head mounting plate is positioned in the right-hand position.

#### Detailed Description of the Invention

A preferred embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, and especially to FIG 1 and 2.

FIG 1 is a top plan view of an auto-reverse type tape recorder which is provided with a mechanism for changing the tape transport direction and FIG 2 is a perspective view, partially broken away, of the mechanism shown in FIG 1. In these drawings, a chassis is generally designated as 20. Disposed rotatably in the centre area of the chassis 20 are a pair of reel supports or spindles 21 and 22.

A reel gear for normal speed rotation 23 and reel gear for high-speed rotation 25 are fixed to the lower end of the reel support 21, while a reel gear for normal speed rotation 24 and reel gear for high-speed rotation 26 are fixed to the lower end of the reel

support 22. It should be noted that, in the drawings for clarity, the gears are illustrated in a simple circle form corresponding to the pitch circle thereof.

The turning force of a motor 27 is to be selectively transmitted to the reel support 21 through a power transmission mechanism 28, a change-over gear 29 and the reel gear for normal-speed rotation 23, or to the reel support 22 through the power transmission mechanism 28, the change-over gear 29 and the reel gear for normal speed rotation 24.

The motor 27 is fixed on one side (upper surface) of the chassis 20. The power transmission mechanism 28 which is disposed on the other (under) side of the chassis 20 is composed of a first gear 28<sub>1</sub> fixed on a shaft of the motor 27, a second gear 28<sub>2</sub> engaging with the first gear 28<sub>1</sub>, a third gear 28<sub>3</sub> rotating coaxially together with the second gear 28<sub>2</sub>, a fourth gear 28<sub>4</sub> engaging with the third gear 28<sub>3</sub>, a forward or right transmission gear 30 engaging with the fourth gear 28<sub>4</sub>, and a reverse or left transmission gear 31 engaging with the right transmission gear 30. The right transmission gear 30 consists of large and small-diameter gears 30<sub>1</sub> and 30<sub>2</sub> rotating coaxially with each other, and the left transmission gear 31 also consists of large and small-diameter gears 31<sub>1</sub> and 31<sub>2</sub> rotating coaxially with each other. The large-diameter gear 31<sub>1</sub> of the left transmission gear

31 is meshed with the large-diameter gear 30<sub>1</sub> of the right transmission gear 30 which is, in turn, meshed with the fourth gear 28<sub>4</sub>. The change-over gear 29 is supported rotatably on the under surface of the front end of a head-mounting plate (slide plate) 32 which is mounted for movement in the direction of arrows A and B. A shaft 29<sub>1</sub> of the change-over gear 29 which passes movably through, and projects upwardly from, an elongated opening 33 formed on the front end of the head-mounting plate 32 in the direction perpendicular to the direction of movement thereof is supported rotatably by a change-over gear supporting member 34.

The change-over gear supporting member 34 is made of synthetic resin and has two flexible arms 34<sub>1</sub> and 34<sub>2</sub> which project one from each of two opposite sides thereof, and which engage sides of an opening 36 formed in the vicinity of the centre portion of a change-over plate 35. The change-over plate 35 is mounted on the upper surface of the chassis 20 so as to slide in the right or left-hand direction (the direction of arrows C and D perpendicular to the direction of movement of the head-mounting plate 32). The change-over plate 35 has slides 35<sub>1</sub> and 35<sub>2</sub> which are slidable in slide engaging openings 20<sub>1</sub> and 20<sub>2</sub> which are formed in the chassis 20. When the head-mounting plate 32 is in a position in the direction of arrow A, and the change-over plate 35 is moved to a reverse position in the left-hand direction (the

direction of arrow C), the change-over gear 29 is meshed with both the reel gear for normal speed rotation 23 of the left reel support 21 and the small-diameter gear 31<sub>2</sub> of the left transmission gear 31, thereby resulting in the normal speed rotation of the left reel support 21. At this time, the flexible arm 34<sub>1</sub> on one side of the change-over gear supporting member 34 is urged by one operating side edge 36<sub>1</sub> of the opening 36 of the change-over plate 35 so that the change-over gear 29 is biased in the direction engaging with the reel gear for normal speed rotation 23.

When the head-mounting plate 32 is in a position in the direction of arrow A, and the change-over plate 35 is moved to a forward position in the right-hand direction (the direction of arrow D), the change-over gear 29 is engaged with both the reel gear for normal speed rotation 24 of the right reel support 22 and the small-diameter gear 30<sub>2</sub> of the right transmission gear 30. Also, the change-over plate 35 is moved, a left pinch roller (not shown) is separated from a left capstan (not shown), and at the same time, a right pinch roller (not shown) is urged to pinch with a right capstan (not shown) so that the right reel support 22 is rotated at a normal speed, thereby allowing the tape transport direction to be reversed. At this time, the flexible arm 34<sub>2</sub> on the other side of the change-over gear supporting member 34 is urged by the other operative side edge 36<sub>2</sub> of the

opening 36 of the change-over plate 35 so that the change-over gear 29 is biased in the direction engaging with the reel gear 24 of the right reel support 22.

The head-mounting plate 32 mounts a magnetic head 37 thereon. The magnetic head 37 is separated from, or brought to the tape of the tape cassette according to the position of the head-mounting plate 32 which is urged in the direction of arrows A by means of a flexible spring (not shown). The head-mounting plate 32 is to be moved in connection with the movement of first and second high-speed operating members 38 and 39. The first and second high-speed operating member 38 and 39 are disposed one over the other on the upper surface of the chassis 20 to reciprocate in the same direction as the direction of movement of the change-over plate 35, i.e. in the direction of arrows E and F. The high-speed operating members 38 and 39 are biased in the direction of arrow E by means of return springs 40 and 41, and can be reciprocated separately. The return springs 40 and 41 at one end thereof are attached to a spring support 42 on the chassis 20, and at the other sides thereof are attached to respective corresponding spring supports 43 and 44 on the first and second high speed operating members 38 and 39. Perforated in the high-speed operating members 38 and 39 are cam openings 45 and 46. The cam openings 45 and 46 have respectively arched cam surfaces 45<sub>1</sub> and 46<sub>1</sub> which contact a cam follower 47<sub>1</sub> of a

rotatable lever 47 supported rotatably on the upper surface of the chassis 20. Thus, when at least one of the high-speed operating members 38 and 39 is moved in the direction of arrow F, the cam follower 47<sub>1</sub> of the rotatable lever 47 follows the cam surface 45<sub>1</sub> and/or 46<sub>1</sub> so that the head-mounting plate 32, which contacts a lower contact piece 47<sub>2</sub> of the rotatable lever 47 is retracted in the direction of arrow B against the elastic force of the spring.

The high-speed operating members 38 and 39 each have respectively first and second tappets 38<sub>1</sub> and 38<sub>2</sub>, and 39<sub>1</sub> and 39<sub>2</sub>. The first tappets 38<sub>1</sub> and 39<sub>1</sub> make contact with a first portion 48<sub>1</sub> on one end of a rotatable member 48, whereas the tappets 39<sub>1</sub> and 39<sub>2</sub> make contact with a second portion 48<sub>2</sub> on the other end of the rotatable member 48. The rotatable member 48 is disposed above the chassis 20 so that a shaft 49 projecting from the under surface of the centre portion of the rotatable member 48 projects in to an elongated hole 20<sub>3</sub> to allow movement in the direction of movement of the head-mounting plate 32.

Accordingly, the rotatable member 48 is constrained to move in the same direction as the direction of movement of the head-mounting plate 32, ie the direction of arrows G and H as shown in FIG 1, within the limits of the elongated hole 20<sub>3</sub>. The rotatable member 48 on the approximate middle thereof is

connected to the change-over plate 35 through a rotatable arm 50. The rotatable arm 50 on the approximate middle thereof is supported rotatably on one side of the chassis 20. The rotatable arm 50 has an opening 51 engaged rotatably with the shaft 49 of the rotatable member 48, and an end part 52 fitted rotatably in an opening 53 in the change-over plate 35. Accordingly, when the change-over plate 35 moves in the right-hand direction (the direction of arrow D), the rotatable member 48 is moved in the direction of arrow G through the rotatable arm 50 and is then positioned in the first position. Also, when the change-over plate 35 is moved in the left-hand direction (the direction of arrow C), the rotatable member 48 is moved in the direction of arrow H through the rotatable arm 50 and is then positioned in the second position.

A pair of capstans and pinch rollers (not shown) are disposed symmetrically on the chassis 20 so that when the head-mounting plate 32 is advanced in the direction of arrows A, one of the pinch rollers pinches with a corresponding capstan. When the head-mounting plate 32 is retracted in the direction of arrow B, the two pinch rollers are separated from respective corresponding capstans.

Now the operation of the mechanism for changing the tape transport direction will be described.

First, the normal speed operation of the mechanism will be explained.

In Figure 1, the change-over plate 35 is in the forward position in the direction of arrow D. Also, both the first and second high-speed operating members 38 and 39 are in a position in the direction of arrow E, and consequently the head-mounting plate 32 is in a position in the direction of arrow A so that the magnetic head 37 contacts a tape of a tape cassette (not shown) which is loaded on the reel supports 21 and 22 and also the pinch roller (not shown) pinches the tape with the capstan (not shown). Since the change-over plate 35 is in a position in the direction of arrow D, as mentioned above, the change-over gear 29 is meshed with both the reel gear for normal speed rotation 24 of the right reel support 22 and the small-diameter gear 30<sub>1</sub> of the right transmission gear 30. Thus, in the state of Figure 1, the right reel support 22 is rotated at a normal speed, and therefore the recording, or playing operation, in which the tape is transported at a normal speed from the left reel support 21 toward the right reel support 22, is performed.

When the change-over plate 35 is moved in the direction of arrow C from the position shown in Figure 1, the change-over gear supporting member 34 moves in the direction of arrow C along the

elongated opening 33 together with the change-over gear 29. At this time, the change-over gear 29 is separated from both the reel gear for normal speed rotation 24 of the right reel support 22 and the small-diameter gear 30<sub>2</sub> of the right transmission gear 30, and then meshed with both the reel gear for normal speed rotation 23 of the left reel support 21 and the small-diameter gear 31<sub>2</sub> of the left transmission gear 31. Accordingly, the left reel support 21 is rotated at a normal speed to allow the tape transport direction to be reversed, and thereby the recording or playing operation, in which the tape is transported at a normal speed from the right reel support 22 toward the left reel support 21, is performed.

Next, the high-speed operation of the mechanism will be explained.

When the change-over plate 35 is moved in the direction of arrow D to allow the tape to be transported at a normal speed from the left reel support 21 towards the right reel support 22, the rotatable member 48 is moved in the direction of arrow G to the first position.

In such a state, when only the first high speed operating member 38 is moved in the direction of arrow F, the head-mounting plate 32 is moved in the direction of arrow B to allow the change-over

gear 29 to be separated from both the reel gear for normal speed rotation 24 of the right reel support 22 and the small-diameter gear 30<sub>2</sub> of the right transmission gear 30. Further, by moving the first high-speed operating member 38 in the direction of arrow F, the first tappet 38<sub>1</sub> presses the first portion 48<sub>1</sub> of the rotatable member 48 so that the rotatable member 48 will be rotated counterclockwise from the position shown in Figure 1. Together with the rotating of the rotatable member 48, a high-speed change-over member (not shown) is rotated in one direction, and a gear for fast forward motion (not shown) supported on the high-speed change-over member is meshed with both the gear for high-speed rotation 25 of the left reel support 21 and the large-diameter gear 31<sub>1</sub> of the left transmission gear 31. Also, the magnetic head 37 and pinch roller are retracted by moving the first high-speed operating member 38, which rotates the rotatable lever 47, so that the left reel support 21 is rotated at a high-speed to allow the tape to be transported at a high-speed from the right reel support 22 toward the left reel support 21.

Moreover, in a state that the rotatable member 48 was positioned in the first position, when only the second high-speed operating member 39 is moved in the direction of arrow F, the second tappet 39<sub>2</sub> of the second high-speed operating member 39 presses the second portion 48<sub>2</sub> of the rotatable member 48. In consequence, the rotatable member 48 is rotated clockwise from the position

shown in Figure 1. Together with this rotation of the rotatable member 48, the high-speed change-over member (not shown) is rotated in the other direction, and the gear for fast forward motion (not shown) is meshed with both the gear for high-speed rotation 26 of the right reel support 22 and the large-diameter gear 30<sub>1</sub> of the right transmission gear 30. Also, the magnetic head 37 and pinch roller are retracted by moving the second high-speed operating member 39, which rotates rotatable lever 47 so that the right reel support 22 is rotated at a high-speed to allow the tape to be transported at a high-speed from the left reel support 21 toward the right reel support 22.

On the other hand, when the change-over plate 35 is moved in the direction of arrow C from the position shown in Figure 1 to allow the tape to be transported at a normal speed from the right reel support 22, toward the left reel support 21, the rotatable member 48 is moved in the direction of arrow H and then positioned in the second position.

In such a state, when only the first high-speed operating member 38 is moved in the direction of arrow F, the second tappet 38<sub>2</sub> of the member 38 presses the second portion 48<sub>2</sub> of the rotatable member 48 to allow the rotatable member 48 to be rotated clockwise from the position shown in Figure 1. Therefore, the right reel support 22 is rotated at a high-speed, as described

above.

In a state that the rotatable member 48 was positioned in the second position, when only the second high-speed operating member 39 is moved in the direction of the arrow F, the first tappet 39<sub>1</sub> of the member 39 presses the first portion 48<sub>1</sub> of the rotatable member 48 to rotate the rotatable member 48 counterclockwise from the position shown in Figure 1, and thereby the left reel support 21 is rotated at a high-speed in the same way as above-mentioned.

When both the first and second high-speed operating member 38 and 39 are moved in the direction of arrow F while the tape is travelling at a normal speed from the left reel support 21 toward the right reel support 22 or vice versa, the change-over plate 35 is moved in the direction of arrow C or D to allow the tape transport direction to be reversed. Then, when the first and second high-speed operating member 38 and 39 is released to allow them to return in the direction of arrow E by the elastic force of the springs 40 and 41, the change-over plate 35 is locked and maintained in the new position thereof.

From the above description, it will be readily seen that the mechanism for changing the direction of tape transport is so constituted that only a change-over gear and associated change-over supporting member are disposed on the head-mounting plate,

thereby enabling the tape recorder to be simplified. Moreover, the mechanism for changing the direction of tape transport does not require the conventional tension spring, so enabling the number of component parts thereof to be decreased. Also, the mechanism allows the engaging rotation between the change-over gear and the transmission gear or the reel gear to be smoothly performed, while preventing the component parts from failure, since the change-over gear supporting member made of synthetic resin has the flexible arms projecting from the both sides thereof so as to absorb elastically excess movement of the change-over plate.

CLAIMS

1. A mechanism for changing the tape transport direction in an auto-reverse tape recorder and/or player, comprising: forward and reverse transmission gears disposed respectively in the vicinity of forward and reverse reel gears, said transmission gears being meshed with each other and driven by a motor; a change-over gear supporting member supported movably on a head-mounting plate on which a magnetic head is mounted; a change-over gear supported rotatably on said change-over gear supporting member to mesh alternatively with both the forward reel gear and forward transmission gear or the reverse reel gear and reverse transmission gear when said change-over gear supporting member is in forward or reverse positions respectively; and a change-over plate for bringing forward and reverse pinch rollers alternatively to pinch with corresponding capstans, and having means for engaging said change-over gear supporting member to move it between forward or reverse positions on the head-mounting plate.
2. A mechanism according to Claim 1, wherein said change-over gear supporting member is made of synthetic resin and has a flexible arm projecting from each of two opposite sides thereof so as to absorb elastically excess movement of said



change-over plate, and said means for engaging is composed of an opening having two operative side edges positioned immediately adjacent to respective corresponding flexible arms of said change-over gear supporting member for urging said change-over gear supporting member to said forward or reverse positions when the change-over plate is moved in forward or reverse directions.

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