

"TAPE RECORDER"

This invention relates to a tape recorder of the cassette type.

A conventional tape recorder of the cassette type having a plurality of operation buttons to be manually pushed in normally includes an operation button for reproduction or recording as well as an operation button for stopping. In this manner, operation buttons are provided for individual functions of a tape recorder. Due to provision of such operation buttons, the conventional tape recorder has a drawback that it is complicated in structure, comparatively large in overall size, and low in operability.

It is an object of the invention to provide a tape recorder which is reduced in overall size and improved in operability with a reduced number of operation buttons and is particularly effective where it is applied as a portable or car-carried device only for reproduction or for recording.

According to the invention, there is provided a tape recorder comprising a head plate mounted for movement from a home position beyond an actuated position and having a magnetic head mounted thereon, means for urging said head plate toward the home position, an arresting member operable upon first movement of said head plate beyond the actuated position for subsequently arresting said head plate at its actuated position and operable upon second movement of said head plate beyond the actuated position for releasing said head plate from its arrested condition to allow said head plate to return to its home position, a switch having a motor energizing position and a motor deenergizing position, a switch operating member responsive to the actuated position of said head plate for holding said switch to the motor energizing position and responsive to the home position of said head plate for holding said switch to the motor deenergizing position, a motor which is energized when said switch is in the motor energizing position, a rotary member connected to be rotated by said motor, tape end detecting means for detecting arrival of an end of a tape, and a releasing member which is moved from an inoperative position to an operative position in response to a tape end detection signal from said tape

end detecting means, whereby, when said releasing member is in the operative position, said releasing member is engaged and moved by said rotary member to move said arresting member out of arresting engagement with said head plate to allow said head plate to return from its actuated position to its home position.

In the tape recorder, when the head plate is pushed in to or beyond the actuated position for the first time, it is arrested at the actuated position by the arresting member of the double action type. Upon such movement of the head plate, the magnetic head is moved into contact with a magnetic tape within a tape cassette loaded in position in the tape recorder while a pinch roller is contacted under pressure with a capstan shaft of the tape recorder with the magnetic tape held therebetween. Also, the switch operating member is moved to change over the switch from the motor deenergizing position to the motor energizing position. Consequently, a motor is energized to start its rotation to begin feeding of the tape, thereby starting reproducing or recording operation of the tape recorder. When the magnetic tape comes to its end, the tape end detecting means detects this and operates the releasing member to move from the inoperative position to the operative position so that the releasing member is

sooner or later engaged and moved by the rotary member to move the arresting member out of its arresting engagement with the head plate. As a result, the head plate is returned to its home position, and consequently the switch operating member is moved to cause the switch to change over from the motor energizing position to the motor deenergizing position, thereby rendering the motor inoperative. On the other hand, if the head plate is pushed in for the second time before arrival of an end of the tape, it is released from the arresting engagement thereof by the arresting member and is thus allowed to return to its home position. Accordingly, reproducing or recording operation can be started and stopped freely by pushing in operation of the head plate, that is, by manual operation of a single operation button.

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

FIG. 1 is a schematic plan view showing part of a tape recorder of a preferred embodiment of the invention in a stopped condition;

FIG. 2 is a similar view but showing the tape

recorder of FIG. 1 in an operating condition;

FIG. 3 is an enlarged perspective view of an arresting member incorporated in the tape recorder of FIG. 1; and

FIG. 4 is a plan view of the arresting member of FIG. 3.

Referring first to FIG. 1, there is shown only essential part of a cassette tape recorder of an embodiment of the invention when the tape recorder is in a stopped condition. Since the cassette tape recorder shown has a basic construction similar to that well known in the art, only those portions thereof which relate to the present invention are shown in the drawings.

The cassette tape recorder shown includes a reel receiver 1 for driving a winding side tape reel within a tape cassette A loaded in position in the tape recorder when the tape recorder operates for reproduction or recording. The tape recorder further includes a reel base 2 from which a turning force is transmitted to the reel receiver 1 via a friction transmission mechanism not shown.

A head plate 3 is located obliquely forwardly of

the reel base 2. The head plate 3 is mounted for movement only in forward and backward directions, that is, in upward and downward directions in FIG. 1, under the guidance of a pair of elongated holes 4a, 4b perforated therein and a pair of fixed guide pins 5a, 5b fitted in the elongated holes 4a, 4b, respectively. The head plate 3 is normally urged in the forward direction, that is, in the downward direction in FIG. 1, by a spring 6. An operating piece 7 extends in the forward direction from a front edge of the head plate 3, and an operation button 8 is secured at an end of the operating piece 7. A projection 9 extends horizontally in a leftward direction from a left side of the head plate 3, and a pin 10 is erected uprightly at an end portion of a lower face of the projection 9. A magnetic head 11 is secured to an upper face of the head plate 3 in an opposing relationship to a head admitting opening of a tape cassette A loaded in position in the tape recorder. A pin 12 is erected uprightly on the upper face of the head plate 3, and a tape tension detecting lever 13 is supported for pivotal motion on the pin 12 and extends horizontally in leftward and rightward directions. The tape tension detecting lever 13 is normally urged to pivot in a clockwise direction by a spring 14 which extends between the tape tension detecting lever 13 and

the head plate 3. Such clockwise pivotal motion of the tape tension detecting lever 13 is limited by a pin 15 secured to the head plate 3. The tape tension detecting lever 13 has a slidably engaging element 16 secured to a left end thereof for slidably engaging with a magnetic tape, and has a bent pressing lug 17 formed at a right end thereof.

A switch operating plate 18 is located below the head plate 3 and extends transversely to the direction of movement of the head plate 3. The switch operating plate 18 is mounted for back and forth movement in directions perpendicular to the direction of movement of the head plate 3 under the guidance of a pair of elongated holes 19a, 19b perforated in the switch operating plate 18 and a pair of fixed guide pins 20a, 20b fitted in the elongated holes 19a, 19b, respectively. The switch operating plate 18 is normally urged in the leftward direction by a spring 21. The switch operating plate 18 has an inclined end face 22 formed at a left portion thereof for engaging with the pin 10 on the projection 9 of the head plate 3. A pin 23 is erected uprightly at a portion of a lower face of the switch operating plate 18 adjacent a left end of the inclined end face 22. Meanwhile, an insulator member 24 is mounted at a right end face of the switch operating

plate 18. A switch 25 is located rightwardly in an opposing relationship to the insulator member 24 such that when the switch operating plate 18 is moved in the rightward direction in FIG. 1, the switch 25 may be pressed and turned on by the insulator member 24.

An arresting member 26 is located below the switch operating plate 18 and mounted for pivotal motion around a fixed guide pin 20a and also for lateral rocking motion by a predetermined limited amount in a plane of the fixed guide pin 20a. The arresting member 26 cooperates with the pin 10 secured to the projection 9 of the head plate 3 to constitute an arresting mechanism of the double action type. The arresting member 26 is urged in the clockwise direction as indicated by a solid line arrow mark 28 in FIG. 3 and in the upward direction as indicated by another solid line arrow mark 29 in FIG. 3 in a plane of the fixed guide pin 20a by means of a spring 27. Referring to FIGS. 3 and 4, the arresting member 26 has formed adjacent a free end thereof a low flat slip face 30 on which a lower end of the pin 10 of the projection 9 of the head plate 3 slides, a pivotal motion limiting wall 31 which engages with the pin 10 to limit the clockwise pivotal motion of the arresting member 26 around the pin 20a, an inclined face 32a and a contiguous high flat face 32

which slidably engage with the lower end of the pin 10 when the pin 10 moves in a direction indicated by a full line arrow mark B in FIG. 3, a step 34 which is located adjacent the high flat face 32 at an intermediate height and defines an arresting wall 33 together with the high flat face 32, an intermediate step 36 which is located at an intermediate height between the high flat face 32 and the step 34 at a position nearer to the base end of the arresting member 26 than the high flat face 32 and the step 34 and defines an inclined face 35 together with the step 34, an intermediate wall 34a extending uprightly from the slip face 30 to the high flat face 32 and the step 34, and an interior wall 37 which defines the interior terminal end of the intermediate step 36 and also of the slip face 30.

Referring back to FIG. 1, a releasing plate 38 is supported at a base end portion thereof for pivotal motion around the fixed guide pin 20b on the upper face of the switch operating plate 18. The releasing plate 38 is bifurcated at the other free end thereof to define a pressure receiving piece 39 which extends toward a rear face of the pressing lug 17 of the tape tension detecting lever 13 and an engaging pawl 40 which extends toward the reel base 2. The releasing plate 38 is normally urged to pivot in a counterclockwise direction

around the fixed guide pin 20b, and such counterclockwise pivotal motion of the releasing plate 38 is limited by a pin 42 erected uprightly on the upper face of the switch operating plate 18. Another pin 43 is erected uprightly at a position on the upper face of the switch operating plate 18 opposite to the pin 42 with respect to the engaging pawl 40. The accurate location of the pin 42 will be hereinafter described.

In the meantime, a pin 44 is erected uprightly on an upper face of the reel base 2. The pin 44 is located such that it may move across a locus C of movement of a terminal end of the engaging pawl 40 of the releasing plate 38 when the reel base 2 rotates. A tape driving motor 46 is connected to the reel base 2 and a capstan shaft not shown so that a turning force thereof may be transmitted to the latter. The tape driving motor 46 is energized when the switch 25 is on. It is to be noted that a pinch roller is omitted in FIG. 1.

Now, operation of the tape recorder of the construction described above will be described.

At first, a tape cassette A is loaded in position in the tape recorder. In this condition, the operation button 8 will be manually pushed in to an actuated position to move the head plate 3 in the backward direction as seen in FIG. 2. As the head plate 3 is

moved backwardly in this manner, the pin 10 thereon presses against the inclined end face 22 of the switch operating plate 18 to move the switch operating plate 18 in the rightward direction against the urging force of the spring 21. Upon the rightward movement of the switch operating plate 18, the pin 42 thereon presses against the engaging pawl 40 of the releasing plate 38 to pivot the releasing plate 38 in the clockwise direction against the urging force of the spring 41 to move the terminal end of the engaging pawl 40 to a position above the reel base 2 as seen in FIG. 2. On the other hand, as the head plate 3 is moved backwardly as described above, the lower end of the pin 10 thereon rides first on the inclined face 32a and then on the high flat face 32 of the arresting member 26 while the pin 10 slidably moves on the pivotal motion limiting wall 31 of the arresting member 26. Accordingly, the arresting member 26 is rocked in a direction opposite to the direction of the solid line arrow mark 29 in FIG. 3 against the urging force of the spring 27. Then, as the head plate 3 is further moved backwardly, the lower end of the pin 10 moves away from the high flat face 32 and now rides on the intermediate step 36 as a result of resultant rocking motion of the arresting member 26 in the direction of the solid line arrow mark 29 in FIG. 3,

and then the pin 10 approaches the interior wall 37 of the arresting member 26 until the head plate 3 is stopped from further backward movement due to engagement of the fixed guide pin 5b with the forward end of the elongated hole 4b of the head plate 3. Then, when the operation button 8 is released from manual operation, the head plate 3 tries to return to its home position due to the urging force of the spring 6. In this instance, however, since the pin 10 is arrested by the arresting wall 33 of the arresting member 26 after forward movement thereof by a little distance over which the lower end of the pin 10 first slides on the intermediate step 36 and then on the step 34 as a result of resultant rocking motion of the arresting member 26 in the direction of the solid line arrow mark 29, the head plate 3 is stopped at such an arrested position. In other words, the head plate 3 is arrested at its actuated position. The distance of such forward movement of the pin 10 corresponds to a distance of a gap D which remains between the fixed guide pin 5b and the forward end of the elongated hole 4b of the head plate 3 when the head plate 3 is arrested in its actuated position as shown in FIG. 2. In the position wherein the head plate 3 is arrested at the actuated position, the magnetic head 11 is in contact

with a magnetic tape not shown and the slidably engaging element 16 of the tape tension detecting lever 13 is also in contact with the magnetic tape but at a different position. In addition, a pinch roller not shown is contacted under pressure with a capstan shaft not shown with the magnetic tape interposed therebetween. In this position, the switch operating plate 18 is at its rightwardly moved position while the releasing plate 38 is at an angular position pivoted by a corresponding amount in the clockwise direction from its home position. Here, the pin 42 is located on the switch operating plate 18 such that when the head plate 3 is arrested at its actuated position, the terminal end of the arresting pawl 40 of the releasing plate 38 may be positioned adjacent a locus of movement of the pin 44 on the reel base 2 but may not enter a range of the locus of movement of the pin 44, and a slight gap may remain between the pressure receiving piece 39 of the releasing plate 38 and the pressing lug 17 of the tape tension detecting lever 13. On the other hand, as the switch operating plate 18 is moved in the rightward direction, the insulator member 24 thereon is contacted with and presses a contact element against the other contact element of the switch 25, thereby to bring the switch 25 from a motor deenergizing position to a motor

energizing position, that is, to turn the switch 25 on. Consequently, the motor 46 is energized to start its rotation to begin a reproducing or recording operation of the tape recorder.

When it is intended to interrupt the reproducing or recording operation, the operation button 8 will be manually pushed in again. As the operation button 8 is pushed in in this manner, the head plate 3 may be moved backwardly also by the distance of the gap D. As the head plate 3 is moved backwardly in this manner, the pin 10 thereon is moved away from the arresting wall 33 and is then engaged with and presses against the inclined face 35 of the arresting member 26. Consequently, the arresting plate 26 is pivoted in a direction opposite to the solid line arrow mark 28, that is, in the counterclockwise direction, until the lower end of the pin 10 comes to a position above and is dropped onto the slip face 30 of the arresting plate 26 due to resultant rocking motion of the arresting plate 26 in the direction of the solid line arrow mark 29. Then, if the operation button 8 is released from manual operation, the head plate 3 is returned to its home position as shown in FIG. 1 by the urging force of the spring 6 while the pin 10 thereon slides on the intermediate wall 34a of the arresting member 26. As the head plate 3 is

returned in this manner, the switch operating plate 18 is moved in the leftward direction in FIG. 2 by the urging force of the spring 21 to cause the switch 25 to turn off, that is, to cause the switch 25 to change over from the motor energizing position to the motor deenergizing position, thereby attaining a stopped condition of the tape recorder.

On the other hand, if an end of a tape is reached during the reproducing or recording operation of the tape recorder, a stopped condition is attained automatically by a sequence of operations described below. In particular, when a tape comes to its end, it is acted upon by a high tensile force. The high tensile force will act as a force to push the slidably contacting element 16 in the forward direction, that is, in the downward direction in FIG. 2. Consequently, the tape tension detecting lever 13 is compulsorily pivoted in the counterclockwise direction as indicated by a solid line arrow mark E in FIG. 2 against the urging force of the spring 14. Upon such counterclockwise pivotal motion of the tape tension detecting lever 13, the pressing lug 17 thereon presses against the pressure receiving piece 39 of the releasing plate 38 to pivot the releasing plate 38 in the clockwise direction around the pin 20b to an operative position in which the

terminal end of the engaging pawl 40 of the releasing plate 38 is positioned within the range of the locus of movement of the pin 44 on the reel base 2. Since the reel base 2 is rotating in the counterclockwise direction in FIG. 2 then, the pin 44 will sooner or later be engaged with an end portion of the engaging pawl 40 to pivot the releasing plate 38 in the clockwise direction in FIG. 2. When the releasing plate 38 is pivoted by a predetermined amount in the clockwise direction, the releasing plate 38 is engaged with and presses against the pin 43 on the switch operating plate 18. Consequently, the switch operating plate 18 is further moved in the rightward direction. Upon such rightward movement of the switch operating plate 18, the pin 23 thereon is abutted with the left side of the arresting member 26 and pivots the arresting member 26 in the counterclockwise direction in FIG. 2 around the pin 20a. Upon such counterclockwise pivotal motion of the arresting member 26, the lower end of the pin 10 on the head plate 3 moves from the step 34 to the slip face 30 and consequently the pin 10 is disengaged from the arresting wall 33 of the arresting member 26, thereby releasing the arrested condition of the head plate 3. Consequently, the head plate 3 is returned to its home position as shown in FIG. 1 by the urging force of the

spring 6, and this allows the switch operating plate 18 to be moved in the leftward direction back to its home position, thereby attaining a stopped condition of the tape recorder.

Since the tape recorder of the embodiment described above includes in combination the arresting mechanism of the double action type and the tape end detecting mechanism, a reproducing or recording operation of the tape recorder can be started and stopped freely by operation of the single operation button 8, and it can be automatically stopped when a tape comes to its end during such reproducing or recording operation. Accordingly, the number of operation buttons can be reduced by one comparing with a conventional tape recorder. As a result, the tape recorder is simplified in construction and improved in operability and is very effective particularly where it is applied to a device of the portable type or the car-carried type.

It will be appreciated that the present invention is not limited to the specific embodiment described hereinabove. In particular, while in the embodiment the pin 44 for pivoting the releasing plate 38 when a tape comes to its end is erected uprightly on the reel base 2, it is alternatively possible to locate a pin for

pivoting a releasing plate on any other rotary member such as a capstan fly-wheel which is driven to rotate by a motor. Further, while in the embodiment the releasing plate 38 is first pivoted from its inoperative home position as shown in FIG. 1 to a stand-by or inoperative intermediate position as shown in FIG. 2 by the pin 42 on the switch operating plate 18 upon first movement of the head plate 3 beyond its actuated position and is then further pivoted, upon second movement of the head plate 3 from or beyond its actuated position, from the stand-by position to an operative position in which the end of the releasing member 38 is within the range of the locus of movement of the pin 44, alternatively an additional fixed pin may be provided to normally hold the releasing plate 38 to the stand-by position such that the releasing member 38 may be moved from the stand-by position to the operative position by the pin 42 on the switch operating plate 18.

As apparent from the foregoing description, according to the present invention, a tape recorder can be provided which is simplified in construction, reduced in overall size and remarkably improved in operability.



CLAIMS:

1. A tape recorder comprising a head plate mounted for movement from a home position beyond an actuated position and having a magnetic head mounted thereon, means for urging said head plate toward the home position, an arresting member operable upon first movement of said head plate beyond the actuated position for subsequently arresting said head plate at its actuated position and operable upon second movement of said head plate beyond the actuated position for releasing said head plate from its arrested condition to allow said head plate to return to its home position, a switch having a motor energizing position and a motor deenergizing position, a switch operating member responsive to the actuated position of said head plate for holding said switch to the motor energizing position and responsive to the home position of said head plate for holding said switch to the motor deenergizing position, a motor which is energized when said switch is in the motor energizing position, a rotary member connected to be rotated by said motor, tape end detecting means for detecting arrival of an end of a tape, and a releasing member which is moved from an inoperative position to an operative position in response to a tape end detection signal from said tape



end detecting means, whereby, when said releasing member is in the operative position, said releasing member is engaged and moved by said rotary member to move said arresting member out of arresting engagement with said head plate to allow said head plate to return from its actuated position to its home position.

2. A tape recorder as set forth in claim 1, wherein said rotary member is a reel base for receiving a tape reel thereon.

3. A tape recorder as set forth in claim 1, wherein said rotary member is a fly-wheel for a capstan of said tape recorder.

4. A tape recorder as set forth in claim 1, wherein said tape end detecting means includes a tape tension detecting member which is moved by a tensile force of a tape when the tape comes to its end.

5. A tape recorder as set forth in claim 1, wherein said head plate has a button mounting portion for mounting either a reproducing button or a recording button thereon.

6. A tape recorder as set forth in claim 1, wherein said releasing member further has a second inoperative position which is farther from said rotary member than the first-mentioned inoperative position, said releasing member being moved from the second



inoperative position to the first inoperative position when said head plate is moved from the home position to the actuated position.

7. A tape recorder as set forth in claim 1, wherein said rotary member has a projection which defines a predetermined locus of movement when said rotary member rotates, and said releasing member is a lever mounted for pivotal motion around a fixed axis, whereby, when said lever is pivoted from the inoperative position to the operative position, a free end portion of said lever enters a range of the locus of movement of said rotary member so that rotation of said rotary member will cause said projection thereon to engage with said free end portion of said lever to pivot said lever thereby to release the arresting engagement of said arresting member with said head plate.

8. A tape recorder substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

---