

SPECIFICATION

CARTRIDGE CHANGER



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Field of the Invention

The present invention relates to a cartridge changer in which a plurality of cartridges each having a recording and reproduction medium are installed, any one of the plurality of installed cartridges being selected for recording or reproduction.

Background of the Invention

In such a cartridge changer, cartridge stock means is conventionally configured so as to remove a cartridge from each shelf in a stocker with a plurality of cartridges housed therein, through an outlet located in front of each shelf and to transfer the cartridge in a recording or reproduction direction through an outlet located behind the shelf.

Stock means of the conventional cartridge changer, however, requires means for opening and closing the outlets located in front of and behind each of the plurality of shelves, thereby requiring a large number of parts and high costs.

An object of the present invention is to provide an inexpensive cassette changer requiring a reduced number of parts by configuring the changer so that a stocker having a plurality of cartridges housed in parallel is moved in the cartridge juxtaposition direction and so that a selected

cartridge is moved into or out from one exclusive gate that is closed when the stocker is moved in the cartridge juxtaposition direction and that is open for housing or transfer.

Summary of the Invention

To attain this object, a cartridge changer according to the present invention comprises stock means having a stocker that can removably house a plurality of cartridges in parallel; transfer means for transferring the cartridge between recording and reproduction means for recording on and reproduction from the cartridge and an installation and removal position and the stocker; drive means for selecting and removing any one of the plurality of cartridges housed in the stocker or moving the stocker in the cartridge juxtaposition direction in order to house the cartridge at any position in the stocker; front hindrance means for preventing the cartridges in the stocker from protruding frontward from one of the openings formed in a mechanical base during the movement of the stocker and hindering another cartridge from being inserted from the front for recording on or reproduction from the cartridge; and rear hindrance means for hindering the cartridges in the stocker from protruding rearward from one of the openings formed in the mechanical base during the movement of the stocker and turning a loading switch on and off to insert the cartridge.

This configuration does not require means for opening and closing an outlet for each of the plurality of shelves in the stocker but can remove and house any selected one of the plurality of cartridges in the stocker by simply opening and closing the exclusive gates located in the front and rear, respectively.

The features and effects of the cartridge changer according to the present invention will be described in detail.

The present invention provides a cartridge changer in which a plurality of cartridges each having a recording and reproduction medium are installed, any one of the plurality of installed cartridges being selected for recording or reproduction, characterized in that there is provided an installation and removal position at which a cartridge for recording or reproduction is installed or removed, and in that the cartridge changer comprises: stock means having a stocker that can removably house the plurality of cartridges in parallel; transfer means for transferring the cartridge between recording and reproduction means for recording on and reproduction from the cartridge and the installation and removal position and the stocker; drive means for selecting and removing any one of the plurality of cartridges housed in the stocker or moving the stocker in the cartridge juxtaposition direction in order to house the cartridge at any position in the stocker; front hindrance means for preventing the cartridges in the stocker from protruding

frontward from one of the openings formed in a mechanical base during the movement of the stocker and hindering another cartridge from being inserted from the front during recording on and reproduction from the cartridge; rear hindrance means for hindering the cartridges in the stocker from protruding rearward from one of the openings formed in the mechanical base during the movement of the stocker and for turning a loading switch on and off during the insertion of the cartridge; and hook disengagement means for disengaging the cartridge from hook of the transfer means during the movement of the stocker in order to locate the hook outside the stocker. This configuration has the effects of moving the stocker with the plurality of cartridges housed therein in parallel, in the cartridge juxtaposition direction, moving a selected cartridge into or out from the one exclusive gate, and opening the gate before the stocker is moved in the cartridge juxtaposition direction while closing the selected cartridge prior to housing or transfer.

In addition, the cartridge changer according to the present invention is characterized by further comprising switching means for switching the drive force of one motor from the transfer means to the recording and reproduction means and to the movement of a cartridge holder in the cartridge juxtaposition direction; hook release means for disengaging the cartridge from the hook during the movement of the cartridge holder in the cartridge juxtaposition direction; rack folding means for preventing the rack of the

transfer means from protruding rearward; shutter open means for opening a shutter of the cartridge prior to recording or reproduction; and catching prevention means for preventing the shutter from being caught on a stocker wall when the cartridge is removed. This configuration has the effects of moving the stocker with the plurality of cartridges housed therein in parallel, in the cartridge juxtaposition direction, moving a selected cartridge into or out from the one exclusive gate, and closing the gate before the stocker is moved in the cartridge juxtaposition direction while opening it prior to housing or transfer, in order to reduce the overall length of the mechanism and to prevent the shutter from being caught in the stocker.

In addition, the present invention is characterized in that the cartridge stock means has the stocker having a square cross section so as to house and remove a plurality of cartridges, and in that the stocker has formed therein a plurality of shelves that extend in the cartridge juxtaposition direction and that are open in a transfer direction and is configured by moving in the cartridge juxtaposition direction to remove or house a selected cartridge only when it aligns with the one of the openings formed in the mechanical base, with the other cartridges blocked by a wall of the mechanical base and stocked in the stocker. This configuration has the effects of moving the stocker with the plurality of cartridges housed therein in parallel, in the juxtaposition direction and removing and

housing the only selected cartridge when it aligns with one of the openings.

In addition, the cartridge transfer means is characterized to have a drive rack that can be guided by the mechanical base to move in the transfer direction; a slide rack that can slide a specified amount along the drive rack; and a drive gear that meshes with both the drive and slide racks to transmit a force from the motor. A hook journaled to the top surface of the drive rack and urged by a spring to rotationally move a specified amount before engaging with the cartridge and a push-out lever journaled to the top surface of the drive rack and urged by a spring to rotationally move a specified amount are able to be inserted and passed through slits formed in side walls of the stocker and shaped like comb teeth. When the cartridge is transferred to the stocker position from a recording and reproduction position, a projecting portion of a click lever journaled to the mechanical base and urged by a spring to rotationally move a specified amount engages with a recess portion of the drive rack, while the teeth of the drive rack and the drive gear are disengaged from each other and the drive gear meshes only with the slide rack, thereby stopping the movement of the drive rack in the transfer direction by a specified amount. This configuration has the effect of stopping the movement of the drive rack in the transfer direction by a specified amount to obtain the accuracy for the cartridge stop position.

In addition, the drive means for driving in the cartridge juxtaposition direction, the stocker with the cartridges housed therein in parallel is characterized by holding the stocker in the transfer direction due to the fitting between a long projecting portion formed on the side wall of the stocker and the slit portion formed in the mechanical base. The drive means has a channel-shaped arm having both proximal ends journaled to the mechanical base, and shaft portions formed in the right and left of the stocker are slidably engaged with long holes formed at both arm-portion-side ends of the arm to engage a step cam provided on one side of the mechanical base so as to slide in the transfer direction, with a shaft portion provided in one side of the arm, so that when the stocker motor drives the step cam in the transfer direction, the arm drives the stocker in the cartridge juxtaposition direction while holding the stocker between the arm portions. This configuration has the effect of rotating the stocker motor to elevate and lower the stocker on a shelf-wise basis while holding the stocker in the longitudinal and lateral directions.

In addition, the front hindrance means for preventing the cartridges in the stocker from protruding forward from the one of the openings formed in the mechanical base during the movement of the stocker and hindering the insertion of another cartridge from the front during the recording or reproduction of the cartridge is characterized to have a front hindrance lever that is journaled to the frontward of the

mechanical base and urged by a spring so as to constantly occlude a front opening. A cam portion of the drive rack in the transfer means drives one end of the front hindrance lever to constantly close the front opening in the mechanical base except when the cartridge is housed or removed. This configuration has the effect of using the drive force of the drive rack to automatically open and close the front hindrance lever.

In addition, the rear hindrance means for hindering the cartridges in the stocker from protruding rearward from the one of the openings formed in the mechanical base during the movement of the stocker and for turning the loading switch on and off during the insertion of the cartridge is characterized to have a push-out lever journaled to the top surface of the drive rack in the transfer means, urged by a spring to rotationally move a specified amount, and adapted to turn the loading switch on and off using a projecting portion formed on its bottom surface. When the drive rack and the drive gear are disengaged from each other to stop the movement of the stocker at a desired position, a push portion of the push-out lever hinders the rear of the cartridge from protruding rearward from the stocker. This configuration has the effect of using the drive force of the drive rack to automatically operate the push-out lever.

In addition, the hook disengagement means for disengaging the cartridge from the hook of the transfer means during the movement of the stocker to locate the hook outside

the stocker is characterized by withdrawing the drive rack of the transfer means toward the recording and reproduction position by a specified amount from the position at which the stocker is elevated and lowered to replace the cartridge and then to return the drive rack to the stocker elevation and lowering position, so that the hook is opened to disengage the cartridge and is placed outside the stocker. This configuration has the effect of preventing the elevation and lowering of the stocker from being precluded by the disengagement between the hook and the cartridge.

In addition, the hook release means for disengaging the cartridge from the hook of the transfer means during the movement of the cartridge holder in the juxtaposition direction is characterized in that a projecting portion formed on an elevating and lowering rack pushes a cam portion of the hook to push back the hook in a direction in which it is disengaged from the cartridge in order to disengage the cartridge and the hook from each other so that the cartridge holder and the recording and reproduction means are subsequently lowered to start recording or reproduction. This configuration has the effect of preventing the recording and reproduction of the cartridge from being precluded by the disengagement between the hook and the cartridge.

In addition, the rack folding means for preventing the rack of the transfer means from protruding rearward is characterized in that the drive gear drives all of the slide rack, an auxiliary rack journaled to the slide rack, and the

drive rack and in that once this group of racks have been driven rearward to the recording and reproduction position, a projecting portion formed under the auxiliary rack is guided by a curved recess portion formed in the top surface of the mechanical base and is folded around a journaling portion. This configuration has the effect of preventing the auxiliary rack from protruding rearward from the mechanical base to reduce the overall length of the mechanism.

In addition, the catching prevention means for preventing the shutter of the cartridge from being caught on the stocker wall when the cartridge is removed and placed at the installation and removal position is characterized in that a projecting receiving portion for guiding the cartridge is formed on a shutter passage portion of the front opening formed in the mechanical base, and in that the amount of ejection in which the cartridge is ejected by the push-out lever of the transfer means is limited to the extent that the shutter of the cartridge does not abut on the projecting receiving portion. This configuration has the effect of allowing the recess receiving portion to accommodate the deflection of the cartridge to prevent an edge of the shutter from being caught on the inside of the stocker wall.

In addition, the cartridge transferred between the installation and removal position at which the cartridge is removed and replaced, a stock position, and the recording and reproduction position is characterized by having a recess portion in its side and in that the transfer means engages

the hook with this recess portion to transfer the cartridge from the installation and removal position to the recording and reproduction position, while abutting the push-out lever on the cartridge to transfer the cartridge from the recording and reproduction position toward the installation and removal position. This configuration has the effect of being able to transfer the cartridge without using any exclusive tray for transferring the cartridge.

In addition, a different form of catching prevention means for preventing the shutter of the cartridge from being caught on the stocker wall when the cartridge is removed and located at the installation and removal position is characterized by journaling a staged roller to the front opening of the mechanical base so that when the cartridge is pushed out, the staged roller supports the side and bottom of the shutter. This configuration has the effect of using the staged roller to support the side and bottom of the shutter in order to prevent the shutter from being caught on the stocker.

In addition, the hook of the hook disengagement means is characterized by being opened by an opening and closing lever, wherein the opening and closing lever has its neutral position maintained by a spring and is rotationally moved by the projecting portion of the slide rack, and wherein when rotationally moved against a spring, the opening and closing lever has different rotational movement directions between the movement of the slide rack toward the recording and

reproduction position and the movement of the slide rack toward the installation and removal position. This configuration has the effect of using the spring to rotationally move the opening and closing lever in both directions, thereby simplifying the structure and enabling reliable operations.

Brief Description of the Drawings

FIG. 1 is an outer perspective view showing the appearance of a cartridge changer having a recording and reproduction medium according to an embodiment of the present invention;

FIG. 2 is an outer perspective view showing the appearance of the cartridge changer according to the embodiment of the present invention;

FIG. 3 is an exploded perspective view of the cartridge changer according to the embodiment of the present invention;

FIG. 4 is a partly omitted front view of the cartridge changer according to the embodiment of the present invention;

FIG. 5 is a top view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge is opened;

FIG. 6 is a partly perspective left-side view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge is opened;

FIG. 7 is a front view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge and a front hindrance lever are opened;

FIG. 8 is a top view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge is closed and located at a recording and reproduction position:

FIG. 9 is a partly perspective left-side view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge is closed and located at the recording and reproduction position;

FIG. 10 is a front view of the cartridge changer according to the embodiment of the present invention showing a state in which the cartridge is closed and located at the recording and reproduction position and in which the front hindrance lever is closed;

FIG. 11 is a top view of the cartridge changer according to the embodiment of the present invention showing a cartridge stock position;

FIG. 12 is a partly perspective left-side view of the cartridge changer according to the embodiment of the present invention showing the cartridge stock position;

FIG. 13 is a perspective view showing the position relationship among a hook, a push-out lever, an opening and closing lever, a slide rack, and a switch according to the embodiment of the present invention;

FIG. 14 is a perspective view showing the position relationship between the opening and closing lever and the slide rack according to the embodiment of the present invention;

FIG. 15 is a perspective view showing the position relationship between the hook and an elevation and lowering rack according to the embodiment of the present invention;

FIG. 16 is a top view showing the position relationship among the cartridge, a shutter, and a stocker in the cartridge changer according to the embodiment of the present invention;

FIG. 17 is a top view showing a shutter catching state of the cartridge changer according to the embodiment of the present invention;

FIG. 18 is a top view of the position relationship with catching prevention means of the cartridge changer according to the embodiment of the present invention;

FIG. 19 is a partly omitted top view of a cartridge changer according to another embodiment of the present invention;

FIG. 20 is a front view of the cartridge changer according to another embodiment of the present invention;

FIG. 21 is a partly omitted left-side view of the cartridge changer according to another embodiment of the present invention; and

FIG. 22 is a perspective view of a staged roller portion of the cartridge changer according to another embodiment of the present invention.

Description of the Embodiments

A cartridge changer that is one embodiment of the present invention will be described below with reference to Figures 1 to 18.

The cartridge changer according to the present invention roughly comprises an installation and removal position A, stock means B, recording and reproduction means C, transfer means D, drive means E, front hindrance means F, rear hindrance means G, hook disengagement means H, switching means I, hook release means J, rack folding means K, shutter open means L, and catching prevention means M.

Each of the components will be described below. A direction in which the transfer means D transfers a cartridge is a horizontal direction for a normal installation, but is also referred to as a "longitudinal direction" below. A direction in which cartridges are juxtaposed in the stock means B is a perpendicular direction for the normal installation, but is referred to as a "vertical direction" or "elevation and lowering" below.

In FIG. 1, 1 is a front surface panel attached to a bottom plate 2 and having NO keys 3, an open close control 4, and a power button 5 on its front surface. Reference numeral 6 is a sheathing case for covering the cartridge changer according to the present invention, and 7 is an insulator provided on the bottom plate 2. Reference numeral 8 is a cartridge that is supplied from an opening 1a formed in the front surface panel 1 and that can be installed in or removed from the cartridge changer according to the present invention by pressing a cover 9 provided at the opening 1a so as to be opened and closed. The cartridge 8 has a transferring recess portion 8a and a shutter 8b.

FIGS. 2 and 3, 10 is a mechanical base mounted on the bottom plate 2, and the cartridge 8 moves in the direction of arrow a-b to enter or leave the mechanical base 10 from a front opening 10a formed in one portion of the mechanical base 10.

Next, a configuration of the transfer means D of the cartridge 8 will be explained with reference to FIGS. 2 to 13.

Reference numeral 11 is a drive gear journaled to the mechanical base 10 and configured by being rotated by a drive motor 12 to mesh with a gear portion 13a of a drive rack 13 provided so as to slide in the direction of arrow a-b relative to the mechanical base 10, in order to drive the drive rack 13 in the direction of arrow a-b.

Reference numeral 14 is a slide rack provided on the bottom surface of the drive rack 13 so as to slide a specified amount using long holes 14a and that is constantly urged by a tension spring 15 so as to slide in the direction of arrow (b) relative to the drive rack 13. That is, in the state shown in FIGS. 8 and 9, the drive gear 11 drives the drive rack 13 in the direction of arrow (a), and when the drive gear 11 encounters a teeth lacking portion 13b of the drive rack 13, the state shown in FIGS. 11 and 12 is entered. The drive gear 11 then meshes with a gear portion 14b of the slide rack 14 to drive the slide rack 14 in the direction of arrow (a).

In this case, a projecting portion 17a of a click lever 17 journaled to the mechanical base 10 and constantly urged

by a spring 16 to rotationally move a specified amount in the direction of arrow (c) pushes a recess portion 13c formed in a side wall of the drive rack 13 to stop the drive rack 13 at the position of the teeth lacking portion 13b. Furthermore, the slide rack 14 pushes a detection switch 29 for a stock position to stop the rotation of the drive motor 12.

While meshing with the drive gear 11, the slide rack 14 is further driven in the direction of arrow (a) against the tension spring 15, by a specified amount, that is, within the range of the long hole 14a. Then, the slide rack 14 overcomes the click force of the click lever 17 (the urging force of the spring 16) to drive the drive rack 13 in the direction of arrow (a) to enter the state shown in FIGS. 5 to 7.

A hook 19 is journaled to the top surface of the drive rack 13 and adapted to be rotationally moved by a spring 18 a specified amount in the direction of arrow (e) to engage its hook portion 19a with a recess portion 8a formed in a side wall of the cartridge 8 in order to transfer the cartridge 8 in the direction of arrow (b). When the cartridge 8 driven in the direction of arrow (a) reaches the installation and removal position A, a projecting portion 19d formed at the tip of the hook 19 is pressed and rotationally moved in the direction of arrow (f) by a vertical wall 10g of the mechanical base 10 to disengage the hook 19 from the cartridge 8.

Reference numeral 20 is a push-out lever journaled to the top surface of the drive rack 13 and urged to rotationally move a specified amount in the direction of arrow (f). The

push-out lever is adapted so that a push portion 20a is moved in the direction of arrow (a) together with the drive rack 13 to transfer the cartridge 8 in the direction of arrow (a).

Reference numeral 21 is a stocker in which a plurality of cartridges 8 can be removably housed in parallel, and comb-teeth-like slits 21c are formed in side walls of the stocker. The hook 19 and the push-out lever 20 are inserted and passed through the slit 21c to transfer the cartridge 8 from the installation and removal position A to a recording and reproduction position, where shutter open means L of a known configuration opens the shutter 8b for recording or reproduction.

Next, the stock means B for the cartridge 8 will be explained with reference to FIGS. 2 to 7.

The stocker 21 having a square cross section such that a plurality of cartridges 8 can be housed and removed is formed so that a plurality of shelves 21a are arranged in the vertical direction and so that the stocker is open in its longitudinal direction. The stocker 21 is adapted so as to be elevated and lowered with a plurality of cartridges 8 stocked using the group of shelves 21a, by driving shaft portions 21b formed on the respective side walls, in the direction of arrow g-h. During this elevation and lowering, the longitudinal position of the group of cartridges 8 is determined by being blocked by a front wall 10b and a rear wall 10c formed in the mechanical base 10.

A front opening 10a sized to allow one cartridge 8 to pass therethrough is formed in the front wall 10b of the mechanical base 10, and a rear opening 10d sized to allow one cartridge 8 to pass therethrough is also formed in the rear wall 10c of the mechanical base 10. That is, of the group of cartridges 8 in the stocker 21, only one cartridge 8 the height-wise position of which aligns with the front opening 10a or the rear opening 10d can be moved into and out from the stocker 21 in the longitudinal direction.

Reference numeral 21c is comb-teeth-like slits formed in side walls of the stocker 21. The hook 19 and the push-out lever 20 are inserted and passed through the slit 21c to remove or house only the one cartridge 8 from or in the stocker 21 in the longitudinal direction.

When the stocker 21 is elevated or lowered, projecting portions 21d formed on side walls of the stocker 21 are fitted in vertical slit portions 10f formed in side walls 10e of the mechanical base 10 and guided by the slit portions 10f so as not to incline the stocker 21 in the longitudinal direction.

Next, the drive means E for driving the stocker 21 in the vertical direction (the cartridge juxtaposition direction) to selectively remove any of the plurality of cartridges 8 housed in the stocker 21 or to house the cartridge 8 at any position in the stocker 21 is explained with reference to FIGS. 2 to 7.

The long projecting portions 21d formed on the side walls of the stocker 21 are fitted in the slit portions 10f formed

in the mechanical base 10 to hold the stocker 21 in the longitudinal direction. A channel-shaped arm 22 is provided to move the stocker 21 upward and downward, and has shaft portions 22a provided at the respective proximal-side ends and journaled to a bearing portion 10h of the mechanical base 10. The shaft portions 21b are slidably engaged with long holes 22b provided at the respective arm-portion-side ends in order to hold the stocker 21 in the lateral direction.

A step cam 23 that can slide in the direction of arrow a-b is provided on one side of the mechanical base 10 and has formed therein a step-like cam 23a with steps each used to move the shelves 21a of the stocker 21 vertically on a pitch-wise basis. The shaft portion 22c formed on the arm 22 is fitted in the step-like cam 23a.

A stocker motor 24 provided on the mechanical base 10 rotates an elevating and lowering drive gear 25 journaled to the mechanical base 10, and the drive gear 25 is meshed with a gear portion 23b of the step cam 23 to drive the step cam 23 in the direction of arrow a-b when the stoker motor 24 is rotated, thereby rotationally moving the arm 22 around the shaft portions 22a so as to elevate or lower in the direction of arrow g-h.

Reference numeral 36 is a sensor for detecting detected bodies 23c formed at a pitch corresponding to the steps formed in the step cam 23, and 37 is a reset switch for the sensor. The sensor and the reset switch are placed on a P base 38.

With the above configuration, the stocker motor 24 can be rotated to drive the stocker 21 so as to elevate or lower it on a shelf-21a-wise basis while holding the stocker in the longitudinal and lateral directions.

Next, a configuration of the front hindrance means F of the cartridge 8 will be described with reference to Figs 2 to 7.

When the stocker 21 is elevated or lowered, the front hindrance means F prevents the cartridge 8 from protruding forward (in the direction of arrow (a)) from one of the openings 10a formed in the mechanical base 10 in the front of the stocker 21 and thus precluding the stocker 21 from elevating or lowering. The front hindrance means also hinders another cartridge 8 from being incorrectly inserted during recording, reproduction, or transfer. For this purpose, a front hindrance lever 26 is provided that is journaled in front of the mechanical base 10.

When the cartridge 8 is located at the stocker position or the recording and reproduction position, a spring 27 constantly urges the front hindrance lever 26 to rotationally move it in the direction of arrow (j) so as to occlude the front opening 10a in the mechanical base 10. Then, a cam portion 13e formed on the top surface of the drive rack 13 pushes a projecting portion 26a formed at one end of the front hindrance lever 26 to drive the drive rack 13 in the direction of arrow (a) until it reaches a position at which the cartridge 8 can be installed or removed, as shown in FIG. 7. Then, the

front hindrance lever 26 is rotated in the direction of arrow (i) to open the front opening 10a in the mechanical base 10 to allow the cartridge 8 to leave the front opening 10a.

FIG. 10 shows a state in which the front hindrance lever 26 has closed the front opening 10a, and FIG. 7 shows a state in which the front opening 10a is open.

Next, a configuration of the rear hindrance means G for the cartridge 8 is described with reference to FIGS. 2 to 6.

When the stoker 21 is elevated or lowered, the rear hindrance means G prevents the cartridge 8 from protruding rearward (in the direction of arrow (b)) from the rear opening 10d formed in the mechanical base 10 in the rear of the stoker 21 and thus precluding the stoker 21 from elevating or lowering. The rear hindrance means G also turns a loading switch 28 on and off when the cartridge 8 is inserted. For this purpose, the push-out lever 20 is provided that is journaled to the top surface of the drive rack 13, that is urged by a spring to rotationally move a specified amount, and that is adapted to turn the loading switch 28 on and off using a projecting portion 20b formed on its bottom surface.

That is, the projecting portion 20b is formed on the bottom surface of the push-out lever 20 of the transfer means D for pushing the cartridge 8 out in the direction of arrow (a). In the state of the installation and removal position A in FIG. 5, when the cartridge 8 is replaced with a new one and this new cartridge is pushed into the direction of arrow (b), the push-out lever 20 is rotated in the direction of arrow

(e) to turn the loading switch (open switch) 28 off, thereby rotating the drive motor 12 to drive the drive rack 13 in the direction of arrow (b).

As regards this, when the drive rack 13 is driven in the direction of arrow (a) to push the cartridge 8 out in the installation and removal position A as shown in FIG. 5, the loading switch 28 is turned on to stop the rotation of the drive motor 12.

Reference numeral 29 is the detection switch for detecting the stock position of the drive rack 13. When the drive rack 13 is driven in the direction of arrow (a) to release the meshing of the drive gear 11 and is then stopped as shown in FIG. 13, the detection switch is pushed by the slide rack 14 to detect it to stop the rotation of the drive motor 12, thereby preventing the push portion 20a of the push-out lever 20 from pushing the cartridge 8 out from the stocker 21 in the direction of arrow (b), that is, hindering the cartridge 8 from moving rearward.

Next, a configuration of the hook disengagement means H for disengaging the cartridge 8 from the hook 19 of the transfer means D and locating the hook 19 outside the stocker 21 during the movement of the stocker 21 will be described with reference to FIGS. 3, 5, 6, and 10 to 14.

FIGS. 11 and 12 (10) show a position at which the stocker 21 is elevated and lowered in the direction of arrow g-h and at which the cartridge 8 in the stocker 21 is replaced with a new one. At this point, the front hindrance lever 26 of

the front hindrance means F prevents the cartridge 8 from moving from the stocker 21 in the direction of arrow (a), while the push-out lever 20 of the rear hindrance means G prevents the cartridge 8 from moving from the stocker 21 in the direction of arrow (b). Accordingly, to elevate or lower the stocker 21 with the cartridges 8 held therein, in the direction of arrow g-h, means is required to disengage the hook portion 19a of the hook 19 from the transferring recess portion 8a formed in the side wall of the cartridge 8.

That is, when the cartridge 8 is installed and any of the NO keys 3 is pressed to stock this cartridge 8 on the indicated shelf 21a, the hook 19 transfers the cartridge 8 in the direction of arrow (b) to drive the drive rack 13 in the direction of arrow (b), wherein the drive rack is currently in the state shown in FIGS. 5 and 6. The drive rack 13 is driven a specified amount until the cartridge 8 has exited from the stocker 21, and then the projecting portion 14d of the slide rack 14 pushes the switch 30 to stop the drive rack 13. Subsequently, the stocker motor 24 is rotated to elevate or lower the stocker 21 to a position at which the indicated shelf 21a of the stocker 21 aligns with the rear opening 10d in the mechanical base 10, and the stocker motor 24 is then stopped.

In FIGS. 3, 13, and 14, 31 is the opening and closing lever that is journaled to the mechanical base 10 so as to rotationally move a specified amount in the direction of arrow l-m and that is constantly urged by a spring 32 to rotationally

move to a neutral position. That is, a long hole 31e is formed in the opening and closing lever 31 so that a projecting portion 10k of the mechanical base 10 is fitted in the long hole 31e to allow the opening and closing lever 31 to be rotationally moved a specified amount in the direction of arrow l-m. The spring 32 is wound around a journaling boss portion and is channel-shaped, and its both ends are engagingly locked on the projecting portion 10k in such a way as to sandwich it. A spring catching section 31f is provided in the opening and closing lever 31 between the boss portion and the projecting portion 10k so that both ends of the spring 32 are caught on the spring catching portion 31f.

After the drive gear 11 has driven the drive rack 13 in the direction of arrow (a) to stock the cartridge 8 on the specified shelf 21a in the stocker 21 and when another cartridge 8 is to be transferred, the teeth lacking portion 13b releases the meshing between the drive rack 13 and the drive gear 11 to stop the driving of the drive rack 13. The projecting portion 17a of the click lever 17 then uses the force of the spring 16 to press the recess portion 13c of the drive rack 13 in the direction of arrow (c) in order to prevent the drive rack 13 from moving easily in the direction of arrow a-b.

Figure 13 shows a state in which the gear portion 14b of the slide rack 14 has meshed with the drive gear 11 to guide the long hole 14a in the slide rack 14 to a shaft portion 13d formed on the bottom surface of the drive rack 13, causing

the slide rack 14 to start sliding on the bottom surface of the drive rack 13 in the direction of arrow (a). In this state, when the slide rack 14 slides in the direction of arrow (a), the projecting portion 14c formed on the bottom surface pushes an inclining portion 31a formed on the top surface of the opening and closing lever 31 to rotationally move the opening and closing lever 31 in the direction of arrow (l) against the spring 32.

At this point, the projecting portion 31b formed on the opening and closing lever 31 pushes the projecting portion 19b formed in the rear of the hook 19 so as to extend downward, thereby rotationally moving the hook 19 in the direction of arrow (f) to disengage the hook portion 19a of the hook 19 from the transferring recess portion 8a formed in the side wall of the cartridge 8.

When the slide rack 14 further slides in the direction of arrow (a) and the projecting portion 14c reaches a flat portion 31c of the opening and closing lever 31, the projecting portion 14d formed on the bottom surface of the slide rack 14 pushes the detection switch 29 to stop the rotation of the drive motor 12, that is, the rotation of the drive gear 11. Thus, the stocker motor 24 can elevate or lower the stocker 21 in the direction of arrow g-h to align another specified cartridge 8 with the rear opening 10d in the mechanical base 10 in order to stop the stocker motor 24.

When the projecting portion 14c is then driven in the direction of arrow (b), the opening and closing lever 31 is

rotationally moved in the direction of arrow (m) by the spring 32 to return to the neutral position. The hook 19 engages with the cartridge 8 to transfer it in the direction of arrow (b) or uses the push-out lever 20 to transfer the cartridge 8 to the installation and removal position A in the direction of arrow (a).

Figure 14 shows the position relationship between the opening and closing lever 31 and the projecting portion 14c of the slide track 14. When the slide rack 14 located at the position shown by the imaginary line in Figure 14 is further driven by the drive gear 11 in the direction of arrow (a), the projecting portion 14c is removed from the flat portion 31c of the opening and closing lever 31. Once the side rack 14 has reached the position shown by a solid line, the spring 32 rotationally moves the opening and closing lever 31 in the direction of arrow (m) to return it to the neutral position.

Next, when the drive rack 13 and the slide rack 14 move in the direction of arrow (b) to allow the hook 19 to transfer the cartridge 8 in the direction of arrow (b), the projecting portion 14c passes the opening and closing lever 31 while pushing back the inside 31d of the inclining portion 31a of the opening and closing lever 31 to rotationally move the opening and closing lever 31 in the direction of arrow (m) against the spring 32. Thus, while remaining engaged with the cartridge 8, the hook 19 transfers the cartridge 8 in the direction of arrow (b).

After the projecting portion 14 has passed, the opening and closing lever 31 is rotationally moved in the direction of arrow (1) by the elastic force of the spring 32 to return to the neutral position. When driven again in the direction of arrow (a), the projecting portion 14c pushes the inclining portion 31a to rotationally move the opening and closing lever 31 in the direction of arrow (1) to disengage the cartridge 8 from the hook 19.

In addition, when the disc 8 in the stocker 21 is to be changed and when the projecting portion 14c has passed the inside 31d of the inclining portion 31a in the direction of arrow (b) to allow the projecting portion 14b to push the switch 30 as shown in Figures 13 and 14, the cartridge 8 transfer direction is changed from the direction of arrow (b) to the direction of arrow (a) to cause the cartridge 8 to be pushed back into the stocker 21 and then stopped. Then, the stocker motor 24 can be used to elevate or lower the stocker 21 to transfer another selected cartridge 8.

Next, the hook release means J for disengaging the hook 19 from the cartridge 8 when the cartridge holder 40 is elevated or lowered for recording on or reproduction from the cartridge 8 will be described with reference to Figures 2, 3, 6, and 15.

When the hook 19 has transferred the cartridge 8 to the recording and reproduction position by moving the drive rack 13 in the direction of arrow (b) to allow the cartridge 8 to pass through the slit 40a formed in the side wall of cartridge

holder 40, the teeth lacking portion 13b releases the meshing between the drive gear 11 and the drive rack 13, thereby driving an elevation and lowering rack 33 configured to start meshing with the horizontal drive gear 11 in the direction of arrow (a) in a known manner using the changeover lever 41.

This means is configured by using a known method so that when a cam portion 33a formed in the rack 33 engages with a shaft portion 40b formed on the cartridge holder 40 to drive the rack 33 in the direction of arrow (a), the cartridge holder 40 is lowered to start recording or reproduction, whereas when the rack 33 is driven in the direction of arrow (b), the recording or reproduction is cleared.

When the cartridge holder 40 is lowered with the cartridge 8 for recording or reproduction, the hook 19 and the cartridge 8 must be disengaged from each other to avoid adverse effects on recording and reproduction. A relevant configuration is shown in Figure 15.

In Figure 15, when the rack 33 is driven in the direction of arrow (a), a projecting portion 33b formed on the top surface of the rack 33 pushes a cam portion 19c formed on the bottom surface of the hook 19 to rotationally move the hook 19 in the direction of arrow (f), thereby disengaging the cartridge 8 from the hook 19.

In Figure 3, 34 and 35 are recording and reproduction switches, and pushing one of the switches stops the rack 33. When the drive motor 12 drives the rack 33 in the direction of arrow (b) to elevate the cartridge holder 40 to release

the meshing between the rack 33 and the drive gear 11, the changeover 41 meshes the rack 13 with the drive gear 11 in a known manner to drive the drive rack 13 in the direction of arrow (a), and the push-out lever 20 transfers the cartridge 8 toward the installation and removal position A.

Next, the rack folding means K for preventing the slide rack 14 of the transfer means D from protruding rearward will be explained with reference to Figures 2, 3, 8, and 9.

In order to prevent the slide rack 14 of the transfer means D from protruding rearward, an auxiliary rack 39 for extension is journaled to the rear of the slide rack 14 and the drive gear 11 drives all of the drive rack 13, the slide rack 14, and the auxiliary rack 39.

Once the drive rack 13, the slide rack 14, and the auxiliary rack 39 have been driven to the rear recording and reproduction position, a projecting portion 39a formed under the auxiliary rack 39 is guided by a curved recess portion 10i formed on the top surface of the rear of the mechanical base 10 so as to be folded around its journaling portion, thereby preventing the auxiliary rack 39 from protruding rearward from the mechanical base 10.

Next, the catching prevention means M for preventing the shutter 8b of the cartridge 8 from being caught on the wall of the stocker 21 when the cartridge 8 is pushed to the installation and removal position A will be described with reference to Figures 2, 3, 11, 12, and 16 to 18.

In Figure 11, when the push-out lever 20 pushes out the cartridge 8 in the direction of arrow (a) and when a projecting portion 8d formed in the front of the cartridge 8 is located inside the stocker 21 as shown in Figure 16, an edge 8c of the shutter 8b is not caught on a right wall 21e of the stocker 21. When, however, the projecting portion 8d is moved out from the stocker 21 in the direction of arrow (a) as shown in FIG. 17, the edge 8c is caught on the inside of the right wall 21e of the stocker 21.

In order to prevent this to further push the cartridge 8 out in the direction of arrow (a), a projecting receiving portion 10j for guiding the cartridge is formed at the tip of the mechanical base 10 and on a shutter passage portion of a front opening 10a formed in the mechanical base 10 to limit the amount of ejection in which the cartridge 8 is ejected by the push-out lever 20 to the extent that the shutter 8b of the cartridge 8 does not abut on the projecting receiving portion 10j.

This configuration enables the projecting receiving portion 10j to accommodate the deflection of the cartridge 8 in the direction of arrow (n) to prevent the edge 8c of the shutter 8b from being caught on the inside of the right wall 21e of the stoker 21.

Operations of the cartridge changer configured as described above that is one embodiment of the present invention will be described.

Open and Close Operations

In Figure 1, when the cartridge 8 moved out to the cartridge installation and removal position A is removed and a new cartridge 8 is then inserted and pushed in through the opening 1a in the front surface panel 1, a projecting portion 20b of the push-out lever 20 turns the loading switch 28 off to rotate the drive motor 12. This operation allows the drive gear 11 to drive the drive rack 13 in the direction of arrow (b) to engage the hook 19 with the cartridge 8 in order to transfer the cartridge 8 to the recording and reproduction position. Then, the cartridge holder 40 is lowered to cause the rack 33 to push the recording and reproduction switches 34, 35, thereby starting recording or reproduction.

When an open and close control 4 is then pushed, the drive motor 12 is rotated to drive the drive rack 13 in the direction of arrow (a), thereby allowing the push-out lever 20 to push out the cartridge 8 to the installation and removal position A as shown in Figures 1, 5, and 6. Then, a vertical wall 10g of the mechanical base 10 pushes and rotationally moves the projecting portion 19d at the tip of the hook 19 in the direction of arrow (f) to disengage the hook 19 and the cartridge 8 from each other. In addition, the projecting portion 20b of the push-out lever 20 pushes and turns on the loading switch 28 to stop the rotation of the drive motor 12.

Disc Stock Operation

Next, in Figure 1, when the cartridge 8 is installed in the opening 1a in the front surface panel 1 and any of the NO keys 3 is specified, the hook 19 transfers the cartridge

8 in the direction of arrow (b) and the projecting portion 14d of the slide rack 14 pushes the switch 30 to stop the transfer. The stocker motor 24 is then rotated to elevate or lower the stocker 21 until the elevation or lowering is stopped at a height at which the specified shelf 21a aligns with the rear opening 10d in the mechanical base 10.

Subsequently, the push-out lever 20 pushes back the cartridge 8 in the direction of arrow (a) (see Figure 13) to cause the projecting portion 14c of the slide rack 14 to rotationally move the opening and closing lever 31 in the direction of arrow (l), thereby allowing the hook 19 to be rotated in the direction of arrow (f) so as to be disengaged from the cartridge 8. Then, the projecting portion 14d of the slide rack 14 pushes the detection switch 29 to stop the rotation of the drive motor 12 in order to stock the cartridge 8 on the specified shelf 21a.

Disc Change Operation

In this case, the click lever 17 prevents the drive rack 13 from moving easily in a longitudinal direction, and the teeth lacking portion 13b has released the meshing between the drive rack 13 and the drive gear 11. Furthermore, the cartridge 8 is held inside the stocker 21 in such a way as to be sandwiched between the front hindrance lever 26 and the push-out lever 20, and has been disengaged from the hook 19.

Then, when any of the NO keys 3 is pushed to specify the cartridge 8 to be recorded or reproduced, the stocker motor 24 is rotated to elevate or lower the stocker 21 until the

rotation of the stoker motor 24 is stopped at a height at which the specified shelf 21a aligns with the rear opening 10d in the mechanical base 10.

Subsequently, when the drive motor 12 rotates to drive the slide rack 14 in the direction of arrow (b), the hook 19 rotationally moves in the direction of arrow (e) and engages with the cartridge 8. When the slide rack 14 is further driven in the direction of arrow (b), an end of the long hole 14a in the slide rack 14 pushes the shaft portion 13d of the drive rack 13 to drive the drive rack 13 in the direction of arrow (b). Thus, the hook 19 transfers the cartridge 8 to the inside of the cartridge holder 40 that is the recording and reproduction position, and the cartridge holder 40 is lowered to cause the rack 33 to push the hook 19 to disengage the cartridge 8 from the hook 19, thereby starting recording or reproduction. In this case, the shutter open means L of a known configuration opens the shutter 8b.

When any of the NO keys 3 is pushed to specify another cartridge 8 during the recording and reproduction, the cartridge holder 40 is elevated to cause the push-out lever 20 to drive the cartridge 8, for which recording or reproduction is being carried out, in the direction of arrow (a), thereby returning the cartridge 8 to the stoker 21, where it is stopped. Subsequently, the stoker 21 is elevated or lowered until the elevation or lowering of the stoker 21 is stopped at a height at which the specified cartridge 8 aligns with the rear opening 10d in the mechanical base 10.

Subsequently, the hook 19 transfers the specified cartridge 8 in the direction of arrow (b) for recording or reproduction. A similar process can be executed to change and remove the specified cartridge 8.

Next, another embodiment of the present invention will be described with reference to Figures 19 to 22.

Instead of the projecting receiving portion 10j formed at the tip of the mechanical base 10, a staged roller 45 is journaled at the tip of the mechanical base 10 to constitute the catching prevention means M.

According to this embodiment, when the cartridge 8 is removed, a side 45a of the staged roller 45 receives a side of the shutter 8b, while a staged portion 45b of the staged roller 45 receives the bottom surface of the shutter 8b. Thus, the rotation of the staged roller 45 can prevent the edge 8c of the shutter 8b from being caught on the inside of the right wall 12e of the stocker 21.

-36-

CLAIMS

1. A cartridge changer in which a plurality of
cartridges each having a recording and reproduction
5 medium can be installed, any one of the plurality of
installed cartridges being selectable for recording or
reproduction, the cartridge changer comprising:

recording and/or reproducing means for recording on
or reproducing from a cartridge;

10 a mechanical base having a front opening through
which a cartridge may be inserted or removed and a rear
opening through which a cartridge may be transferred to
or from said recording/reproducing means;

stock means having a stocker that can removably
15 house the plurality of cartridges, the cartridges being
parallel to one another;

transfer means for transferring the cartridge
between said front opening and said stocker, said
transfer means having a hook for engaging a cartridge
20 during transfer thereof;

drive means for selecting, removing or installing
any one of the plurality of cartridges housed in said
stocker or for moving the stocker in the direction
perpendicular to the cartridges in order to select,
25 remove or install a cartridge at any position in the
stocker;

front hindrance means for preventing the cartridges
in said stocker from protruding frontward from said front
opening in said mechanical base during movement of the
30 stocker and hindering another cartridge from being
inserted through said front opening during recording on
or reproduction from the cartridge;

a loading switch for controlling said transfer means
to stop at a position at which a cartridge may be
35 inserted or a position to which the stocker has been
moved in the direction perpendicular to the cartridge;

-37-

rear hindrance means for hindering the cartridges in
said stocker from protruding rearward through said rear
opening in said mechanical base during movement of said
stocker and for turning said loading switch on and off
5 during the insertion of the cartridge; and

hook disengagement means for disengaging the
cartridge from said hook of the transfer means during the
movement of said stocker in order to locate the hook
outside the stocker.

10

2. A cartridge changer according to claim 1 further
comprising:

switching means for switching the drive force of one
motor from said transfer means to said recording and
15 reproduction means and to the movement of a cartridge
holder in the cartridge juxtaposition direction;

hook release means for disengaging the cartridge
from said hook during the movement of the cartridge
holder in the direction perpendicular to said cartridge;

20 rack folding means for preventing the rack of said
transfer means from protruding rearward;

shutter open means for opening a shutter of said
cartridge prior to recording or reproduction; and

-38-

catching prevention means for preventing the shutter from being caught on a stocker wall when said cartridge is removed.

5 3. A cartridge changer according to claim 2, wherein in the rack folding means for preventing the rack of the transfer means from protruding rearward, the drive gear drives all of the slide rack, an auxiliary rack
10 journaled to the slide rack, and the drive rack, and wherein once this group of racks have been driven rearward to the recording and reproduction position, a projecting portion formed under said auxiliary rack is guided by
15 a curved recess portion formed in the top surface of the mechanical base and is folded around a journaling portion.

20 4. A cartridge changer according to claim 2 or 3, wherein in the catching prevention means for preventing the shutter of the cartridge from being caught on the stocker wall when the cartridge is removed and placed at the installation and removal position, a projecting
25 receiving portion for guiding the cartridge is formed on a shutter passage portion of the front opening formed in the mechanical base, and wherein the amount of ejection in which the cartridge is ejected by the push-out lever of the transfer means is limited to the extent that the
30 shutter of the cartridge does not abut on said projecting receiving portion.

5. A cartridge changer according to claim 2, 3 or 4, wherein said catching prevention means for preventing the
35 shutter of the cartridge from being caught on the stocker

-39-

wall when the cartridge is removed and located at the
installation and removal position journals a staged
roller to the front opening of the mechanical base so
that when said cartridge is pushed out, the staged roller
5 supports the side and bottom of the shutter.

6. A cartridge changer according to any one of the
preceding claims, wherein
the cartridge stock means has the stocker having a
10 square cross section so as to house therein and remove
therefrom a plurality of cartridges, and wherein the stocker
a plurality of shelves formed therein in the cartridge
juxtaposition direction to be open in a transfer direction
15 and is configured to move in the cartridge juxtaposition
direction to remove or house a selected cartridge only when
it aligns with the one of the openings formed in
the mechanical base, with the other cartridges blocked
20 by a wall of the mechanical base and stocked in
the stocker.

7. A cartridge changer according to any one of the
25 preceding claims, wherein
the cartridge transfer means has a drive rack that
can be guided by the mechanical base to move in the
transfer direction; a slide rack that can slide a
30 specified amount along the drive rack; and a drive gear
that meshes with both the drive and slide racks to transmit
a force from the motor, wherein a hook journaled
to the top surface of said drive rack and urged by a spring
to rotationally move a specified amount before engaging with
35 the cartridge and a push-out lever journaled to the top

-40-

surface of the drive rack and urged by a spring to rotationally move a specified amount are able to be inserted and passed through slits formed in a comb-teeth-like shape in side walls of said stocker, and wherein when the cartridge is transferred to the stocker position from a recording and reproduction position, a projecting portion of a click lever journaled to the mechanical base and urged by a spring to rotationally move a specified amount engages with a recess portion of the drive rack, while the teeth of the drive rack and the drive gear are disengaged from each other and the drive gear meshes only with the slide rack, thereby stopping the movement of the drive rack in the transfer direction by a specified amount.

8. A cartridge changer according to any one of the preceding claims, wherein the drive means, which is adapted for driving in the cartridge juxtaposition direction the stocker for housing therein the cartridges in parallel, holds the stocker in the transfer direction due to the fitting between a long projecting portion formed on the side wall of said stocker and the slit portion formed in the mechanical base, wherein the drive means has a channel-shaped arm having both proximal ends journaled to the mechanical base, and wherein shaft portions formed in the right and left of said stocker are slidably engaged with long holes formed at both arm-portion-side ends of the arm to engage

-41-

a step cam provided on one side of the mechanical base so as to slide in the transfer direction, with a shaft portion provided in one side of said arm, so that when the stocker motor drives said step cam in the transfer direction, the arm drives said stocker in the cartridge juxtaposition direction while holding the stocker between the arm portions.

9. The cartridge changer according to any one of the preceding claims, wherein the front hindrance means, which is adapted for preventing the cartridges in the stocker from protruding forward from the one of the openings formed in the mechanical base during the movement of the stocker and for hindering the insertion of another cartridge from the front during the recording or reproduction of the cartridge, has a front hindrance lever that is journaled to the front surface of the mechanical base and urged by a spring so as to constantly occlude a front opening, and wherein a cam portion of the drive rack in the transfer means drives one end of the front hindrance lever to constantly close the front opening in the mechanical base except when the cartridge is housed or removed.

10. The cartridge changer according to any one of the preceding claims, wherein the rear hindrance means, which adapted for hindering the cartridges in the stocker from protruding rearward from the one of the openings formed in the mechanical base

during the movement of the stocker and for turning the loading switch on and off during the insertion of the cartridge, has a push-out lever that is journaled to the top surface of the drive rack in the transfer means and urged by a spring to rotationally move a specified amount and that is adapted to turn the loading switch on and off using a projecting portion formed on the bottom surface of the lever, and wherein when said drive rack and said drive gear are disengaged from each other to stop the movement of said stocker at a desired position, a push portion of said push-out lever hinders the rear of the cartridge from protruding rearward from the stocker.

11. The cartridge changer according to any one of the preceding claims, wherein the hook disengagement means for disengaging the cartridge from the hook of the transfer means during the movement of the stocker to locate the hook outside the stocker withdraws the drive rack of the transfer means toward the recording and reproduction position by a specified amount from the position at which said stocker is elevated and lowered to replace the cartridge and then to return the drive rack to the stocker elevation and lowering position, so that said hook is opened to disengage the cartridge to be removed outside the stocker.

-43-

12. The cartridge changer according to claim 11, wherein the
hook of the hook disengagement means is opened by
an opening and closing lever, and the opening and closing
5 lever has its neutral position maintained by a spring,
and is rotationally moved by a projecting portion of
the slide rack, and wherein when rotationally moved against
a spring, the opening and closing lever has different
10 rotational movement directions between the movement of the
slide rack toward the recording and reproduction
position and the movement of the slide rack toward the
installation and removal position.

15

13. The cartridge changer according to any one of the
preceding claims, wherein
in the hook release means for disengaging the cartridge
from the hook of the transfer means during the movement
20 of the cartridge holder in the juxtaposition direction,
a projecting portion formed on an elevating and lowering
rack pushes a cam portion of the hook to push back
the hook in a direction in which it is disengaged from
25 the cartridge in order to disengage the cartridge and the hook
from each other so that the cartridge holder and the
recording and reproduction means are subsequently lowered
to start recording or reproduction.

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-44-

14. A cartridge changer according to any one of the preceding claims, wherein

5 the cartridge transferred between the installation and removal position at which the cartridge is removed and replaced, a stock position, and the recording and reproduction position has a transferring recess portion formed in the side thereof, and wherein the transfer means
10 engages the hook with said transferring recess portion to transfer the cartridge from the installation and removal position to the recording and reproduction position, while abutting the push-out lever on said cartridge to
15 transfer the cartridge from the recording and reproduction position toward the installation and removal position.

15. A cartridge changer constructed and arranged to operate substantially as hereinbefore described with
20 reference to the accompanying drawings.