United States Patent

Ogura et al.

[15] **3,667,624**

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[54] CASSETTE-TAPE SUPPLYING APPARATUS

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[73] Assignee: **Hitachi, Ltd.**, Tokyo, Japan

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[30] **Foreign Application Priority Data**

Jan. 30, 1970 Japan.....45/7711

[52] **U.S. Cl.** .....**214/8.5 A**, 214/7, 214/8.5 F, 242/181, 274/4 F

[51] **Int. Cl.**.....**B65g 60/00**

[58] **Field of Search** .....214/8.5 F, 8.5 A, 7, 6 D, 6 BA; 351/123, 125; 274/4 F; 242/180, 181

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Assistant Examiner—George F. Abraham
Attorney—Craig, Antonelli, Stewart & Hill

[57] **ABSTRACT**

A cassette-tape supplying apparatus permitting a continuous recording or reproduction of a number of cassette tapes, which is constructed such that a number of cassettes are set upright on an input hopper and that they are fed under the upright state in the order of the first, second and third holders to be outputted from said third holder, and in which said second holder is adapted, upon swivelling, to mount said cassettes onto at least one deck.

3 Claims, 13 Drawing Figures

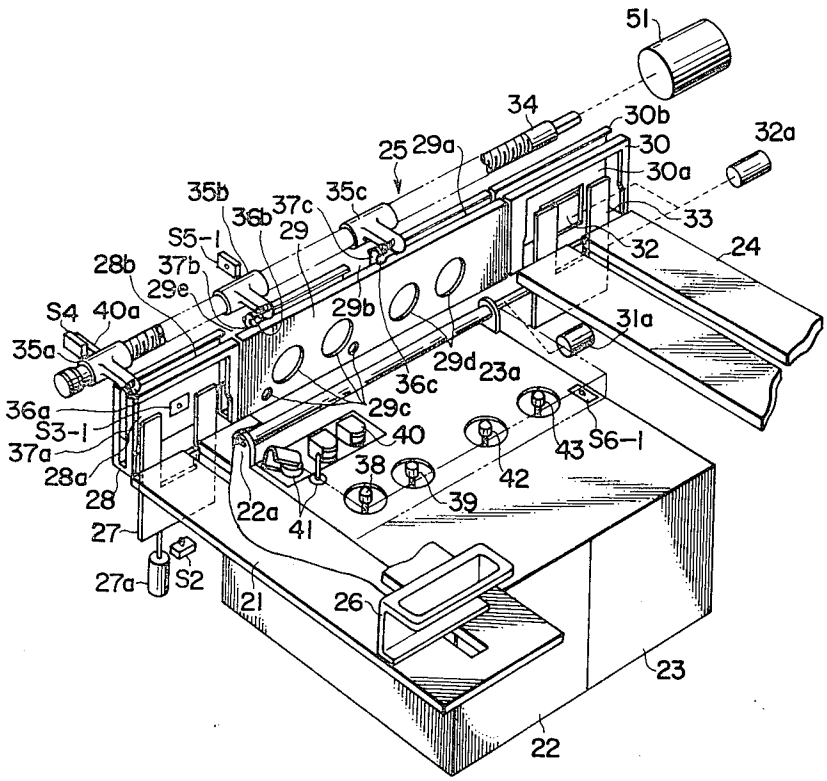

FIG. 1

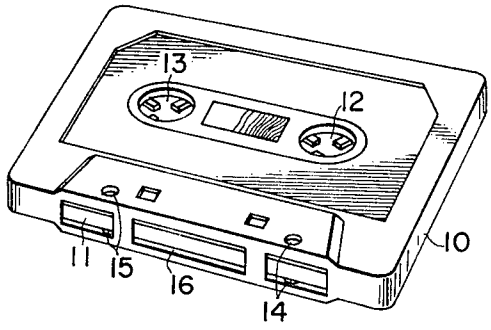

FIG. 2A

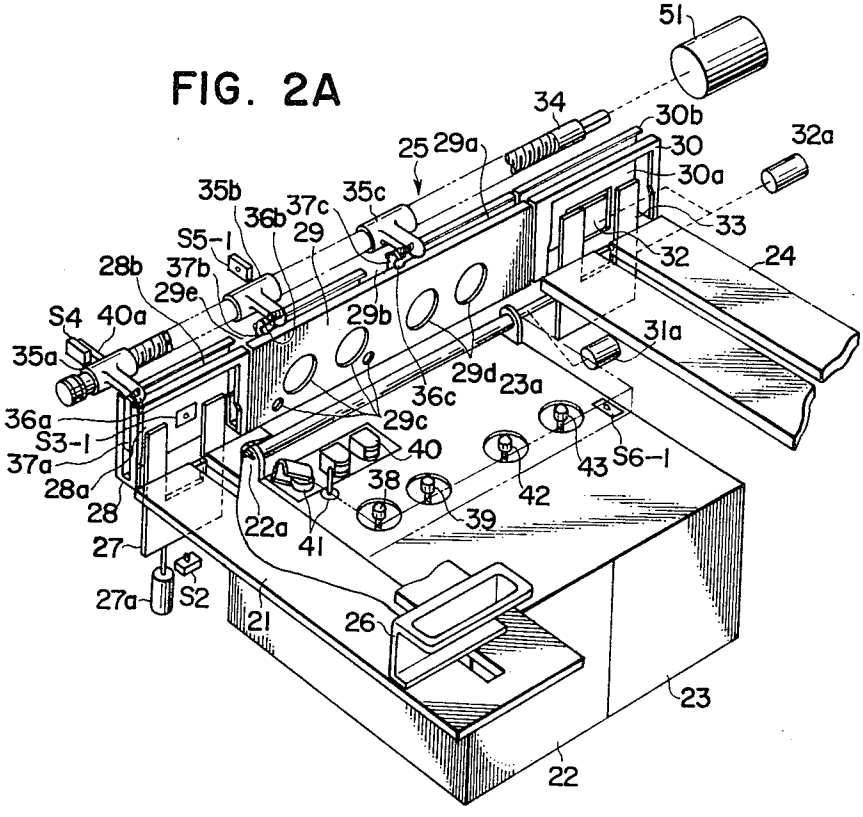

FIG. 2B

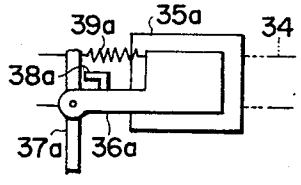

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FIG. 3A

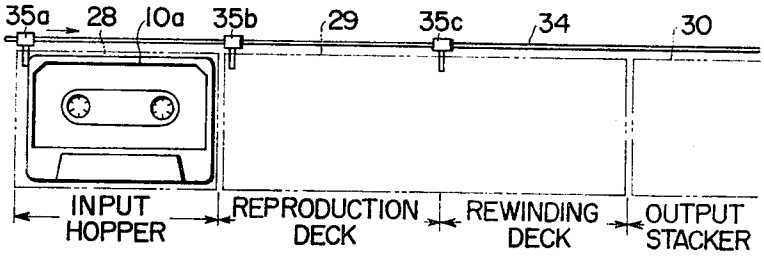

FIG. 3B

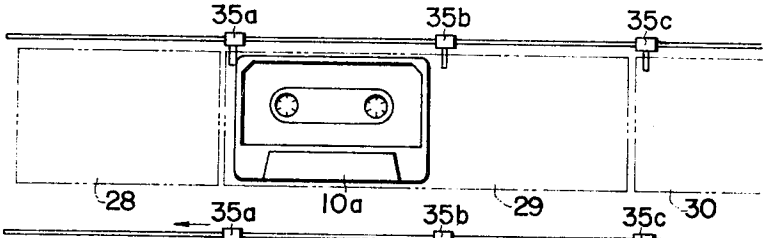

FIG. 3C

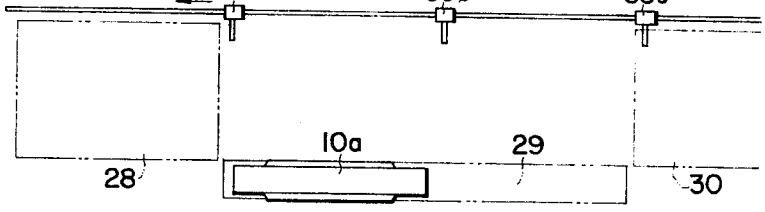

FIG. 3D

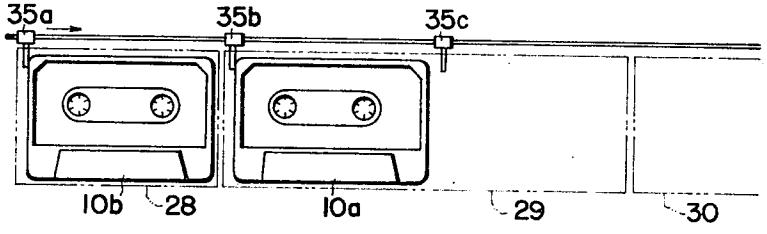

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FIG. 3E

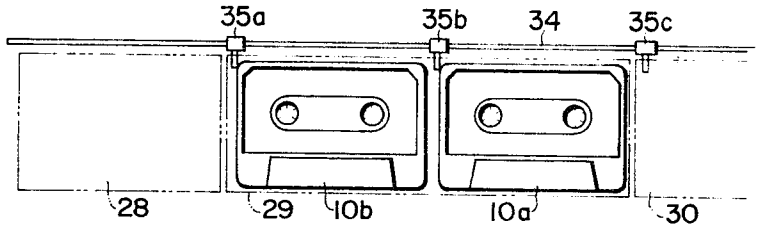

FIG. 3F

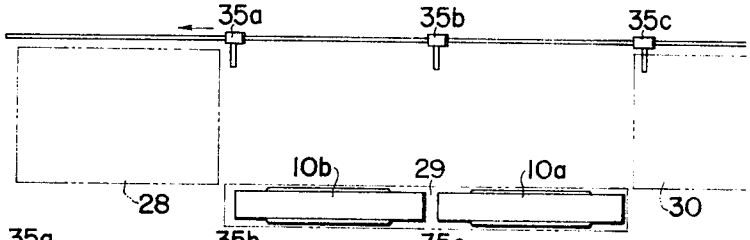

FIG. 3G

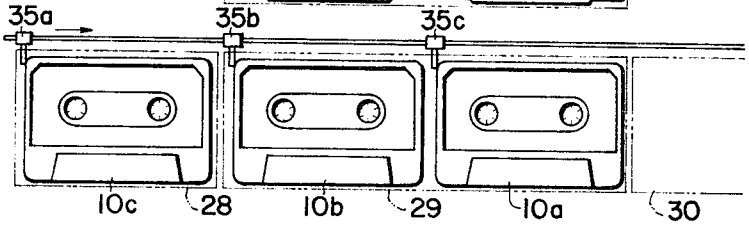

FIG. 3H

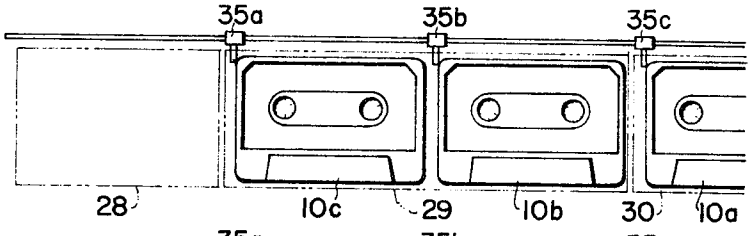

FIG. 3I

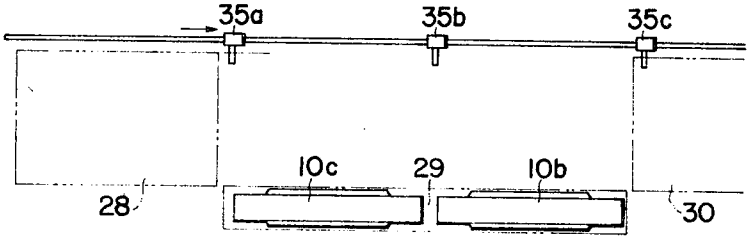

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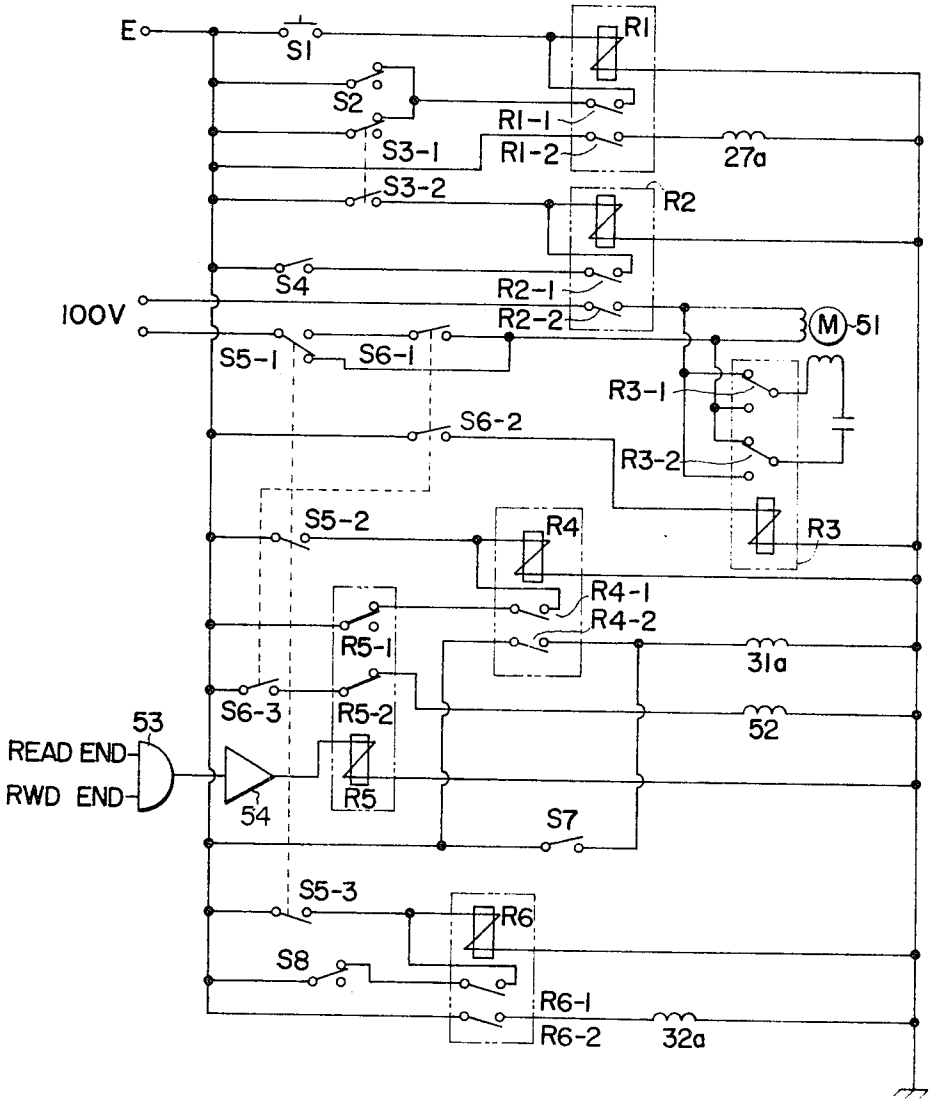
FIG. 4



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CASSETTE-TAPE SUPPLYING APPARATUS

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

This invention relates to a cassette-tape supplying apparatus. More particularly, it relates to a cassette-tape supplying apparatus permitting a continuous recording or reproduction of a number of cassette tapes.

2. DESCRIPTION OF THE PRIOR ART

It is generally carried out by hands to charge a recording or reproducing apparatus with a cassette tape, and to remove it therefrom. It is accordingly impossible to automatically conduct a continuous recording (including sound recording, etc.) or reproduction (including musical performance, etc.) of a number of cassette tapes.

Some apparatus for a continuous recording or reproduction of a number of cassette tapes are presently being tried, but they cannot be said to be fully satisfactory because of, e.g. their mechanical complication.

SUMMARY OF THE INVENTION

An object of this invention is to provide a cassette-tape supplying apparatus permitting a continuous recording or reproduction.

This invention comprises an input hopper on which a number of cassettes are set upright, an output stacker, a first holder for receiving cassettes from said input hopper, a second swivellable holder adjacent to said first holder and adapted, upon swivelling, to set said cassettes onto at least one deck, a third holder adjacent to said second holder and for outputting said cassettes to said output stacker, and a cassette supplying mechanism for sequentially feeding said cassettes from said first holder to said third holder under such state that said cassettes are set upright.

According to this invention, since the cassettes are sequentially supplied from the input hopper to the holder section, a continuous recording or reproduction is permitted. In addition, since the cassettes are fed under the upright state, the mechanism is made very simple.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing a common cassette.

FIG. 2A is a perspective view showing an embodiment of this invention.

FIG. 2B is a view showing, in detail, a part of FIG. 2A.

FIGS. 3A to 3I are views illustrating the supplying states of cassettes for explaining this invention, respectively.

FIG. 4 is a circuit diagram for explaining this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, an example of a cassette **10** is shown. The cassette **10** has a magnetic tape **11** and reels (not shown) contained therein, and is provided with hub-inserting holes **12** and **13** into which are inserted hubs for rotating the reels. Holes **14** and **15** are for insertion of a capstan shaft. An opening **16** is formed such that a magnetic head is pressed thereto to provide the contact between it and the magnetic tape **11**.

CONSTRUCTION

FIG. 2 shows an embodiment of this invention. It is a magnetic-recording reproducing apparatus with two decks, which comprises an input hopper **21**, a reproduction deck **22**, a rewinding deck **23** and an output stacker **24**. Also included is a cassette-tape supplying mechanism **25** by which this invention is characterized. The cassette **10** is caused to stand on the input hopper **21** with the side of the opening **16** downwards. A number of cassettes are thus set upright between a cassette weight **26** and a shutter **27**. The cassette weight **26** is kept pulled or pushed towards the shutter **27** by means of, e.g., a spring, so as to urge the cassettes towards the shutter. The shutter **27** has a shutter magnet **27***a* connected thereto. It is normally closed as shown in the figure, while it is opened upon

energization of the magnet **27***a*. Accordingly, the cassettes are normally hindered by the shutter **27**, and are not given to the cassette-tape feeding mechanism **25**. The cassette-tape supplying mechanism **25** consists mainly of a cassette holder section and a feeding section. The cassette holder section is divided into three parts, i.e. the first holder **28**, the second holder **29** and the third holder **30**. The first holder **28** is substantially equal in width to the input hopper **21**, and has on the side of the input hopper **21** an opening **28***a* being slightly larger than the cassette. In addition, an opening **28***b* is provided in the upside so as to separate the front and back walls. A switch **S3–1** is arranged, which is actuated when the cassette is pushed into the first holder **28**. In adjacency to the first holder **28**, the second holder **29** is disposed at the positions of the reproduction deck **22** and the rewinding deck **23**. Similarly to the first holder **28**, an opening **29***a* is formed in the upside of the second holder **29**. A further opening **29***b* leading to the opening **29***a* is provided in that portion of the back of the second holder **29** which corresponds to the junction between the reproduction deck **22** and the rewinding deck **23**. The junction between the first holder **28** and the second one **29** is, at the front, in such condition that they are nearly in contact with each other. In contrast, at the back, an opening **29***e* is formed in the first or second holder so as to provide some space. Passed through the respective lugs **22***a* and **23***a* of the reproduction deck **22** and the rewinding deck **23** is a shaft **31**, to which the second holder **29** is fixed. The shaft **31** is turned by a rotary solenoid **31***a*. Accordingly, the second holder **29** is swivelled upon turning of the shaft **31**, so as to be covered on the reproduction deck **22** and the rewinding one **23**. A switch **S6–1** is provided on the deck **23**, and is actuated when the second holder **29** is covered on the decks. The third holder **30** is disposed in adjacency to the second holder **29** and at the position of the output stacker **24**. The third holder **30** has an opening **30***a* similar to the opening **28***a* of the first holder **28** on the side of the output stacker **24**, and a further opening **30***b* on the upper side. At the back of the third holder **30**, an opening is formed in which an ejector **32** is contained. The ejector pushes out cassettes having been supplied to the third holder **30**, to the output stacker **24**. A shutter **33** is disposed between the third holder **30** and the output stacker **24**, and normally closes the passage between them. The ejector **32** and the shutter **33** are connected with a rotary solenoid **32***a* to be actuated thereby.

The cassette supplying section is provided in proximity to the first to third holders and in parallel thereto, and comprises a threaded screw **34** and three carriers **35***a* to **35***c*. The spacings between the adjacent ones of the carriers **35***a* to **35***c* are equal, and are slightly wider than each cassette. The carriers are moved leftwards or rightwards upon rotation of the screw **34** by a reversible motor **51**. However, the relation in the relative positions among the three carriers is fixed. Under the initial state, the carrier **35***a* is located at the left end of the first holder **28**, while the carrier **35***b* is positioned at the left end of the second holder **29**, i.e. substantially at the boundary between the hopper **21** and the reproduction deck **22**. The carrier **35***c* is positioned substantially at the center of the second holder **29**, i.e. substantially at the boundary between the reproduction deck **22** and the rewinding deck **23**. The carriers **35***a* to **35***c* have parts **36***a* to **36***c* extending above the holders, respectively, and hold pawls **37***a* to **37***c* by means of the parts **36***a* to **36***c*, respectively. The pawls **37***a* to **37***c* extend into the holders through the openings **28***b* and **29***b* in the upsides of the holders.

FIG. 2B illustrates in detail the carrier section. The pawl **37***a* is urged clockwise by a spring **39***a*, and is held in contact with a protrusion **38***a* of the holding part **36***a* to have its clockwise swivel prohibited. As a result, the pawl **37***a* is adapted to swivel anticlockwise by an external force. The carrier **35***a* is further provided with an arm **40***a* (refer to FIG. 2A), a switch **S4** being kept "off" under the state in FIG. 2A. When the carrier **35***a* is moved rightwards to release the contact between the arm **40***a* and the switch **S4**, the switch **S4** will

be thrown open. At the position of the carrier **35***b*, a switch S5–1 is arranged. When the carrier **35***a* is moved to the position of the switch S5–1, the arm **40***a* will be brought into contact with the switch S5–1 to effect the change-over operation thereof.

OPERATION

A number of cassettes are set upright on the input hopper **21**, and are pushed towards the first holder **28** by the cassette weight **26**. However, the shutter **27** is closed, so that they are not fed into the first holder **28**. When the shutter magnet **27***a* is energized thereby to draw the shutter downwards to open it, one of the cassettes is supplied into the first holder **28**. Since the interior width of the holder is approximately equal to the thickness of the cassette, only one cassette is accommodated. When the accommodation of the cassette into the first holder **28** is sensed by the switch S3–1, the shutter **27** will be closed to intercept the passage between the input hopper **21** and the first holder **28**. When the screw **34** is rotated by the motor **51**, the three carriers **35***a* to **35***c* will be simultaneously moved rightwards. The cassette **10***a* in the first holder **28** is pushed rightwards under the upright state by the pawl **37***a* of the carrier **35***a* (FIG. 3A). As shown in FIG. 3B, the cassette **10***a* is fed to the position of the reproduction deck **22**. This results from the changeover of the switch S5–1 by the arm **40***a* of the carrier **35***a*. When the cassette **10***a* is supplied to the desired position, the second holder **29** will be covered, as shown in FIG. 3C, on the decks owing to the turning of the shaft **31**. Since the holder is provided with the opening **29***e* at the position of the pawl **37***a*, the swivel of the holder is not impeded by the pawl. On the reproduction deck **22**, there are disposed hubs **38** and **39** for driving the reels of the cassette, a magnetic head **40**, a capstan **41**, etc. On the other hand, the second holder **29** is formed with openings **29***c* at positions corresponding to the hub-inserting holes **12**, **13** and capstan-inserting holes **14**, **15** of the cassette. Therefore, when the second holder **29** is brought down onto the decks, the hubs **38**, **39** etc. will be inserted through the openings **29***c* into the insertion holes **12**, **13** etc. of the cassette. In the next step, the cassette or the magnetic head is moved as may be required, to provide the contact between the magnetic head **40** and the magnetic tape **11** in order to conduct a recording reproducing operation. In the meanwhile, the screw **34** is rotated to return the carriers **35***a* to **35** *c* to the positions as shown in FIG. 3A. In addition, the shutter **33** on the side of the output stacker **24** is then opened, so that the ejector **32** advances to effect the action of ejecting a cassette in the third holder **30** onto the stacker **24**. In the present stage, however, no cassette is supplied in the third holder **30**. Hence, no cassette is actually pushed out onto the stacker **24**. Upon completion of the recording reproduction of the cassette **10***a*, the second holder **29** is restored to the original state.

In order to bring the next cassette to the recording reproduction, the shutter **27** is opened to feed the next cassette **10***b* into the first holder **28** (FIG. 3D). As illustrated in FIG. 3E, the cassette **10***a* is supplied to the position of the rewinding deck **23** by the carrier **35***b*, while the cassette **10**b is fed to the position of the reproduction deck **22** by the carrier **35***a*. When the two cassettes **10***a* and **10***b* are supplied into the second holder **29**, it will be swivelled to set the cassette **10***a* on the rewinding deck **23** and the cassette **10***b* on the reproduction deck **22** (FIG. 3F). On the rewinding deck **23** there are disposed hubs **42** and **43**, which are inserted into the insertion holes **12** and **13** of the cassette through openings **29***d* formed in the second holder **29**. It is accordingly taken into consideration that the cassette **10***a* has its tape rewound under the state of FIG. 3F so as to be used without any rewinding process when it is subsequently set. The cassette **10***b* is set on the reproduction deck **22**, and has the recording reproduced in parallel with the rewinding process of the cassette **10***a* at the rewinding deck **23**. Upon completion of the respective rewinding and reproducing processes of the cassettes **10***a* and **10***b*, the second holder **29** is restored to the original state.

When the reproduction of the next cassette **10***c* is to be conducted, the cassette **10***c* will be fed into the first holder **28** as shown in FIG. 3G, and the three cassettes **10***a* to **10***c* will be simultaneously supplied rightwards in the upright state. The cassette **10***a* delivered to the third holder **30** is fed onto the output stacker **24** by the ejector **32** after the shutter **33** is opened. Then, the shutter **33** is closed. Upon swivel of the second holder **29**, the cassettes **10***b* and **10***c* are respectively set on the rewinding deck **23** and the reproduction one **22** to effect the rewinding and reproducing processes in parallel. In the meantime, the carriers **35***a* to **35***c* are returned leftwards to the original positions (FIG. 3I). Repetition of the steps illustrated in FIGS. 3G to 3I will sequentially and continuously perform the recording, reproduction and the tape rewinding.

The cassette supplying mechanism shown in FIGS. 2A and 3 is not to be restricted to the embodiment, but may be put into practice with, for example, a rack and pinion or a link mechanism without departing from the spirit of this invention.

Furthermore, while the above embodiment has been described as having reproduction and rewinding decks, this is based on the idea that the tape in the cassette as having been taken up from one reel to the other on the reproduction deck is rewound so as to be immediately usable for subsequent reproduction. Disposition of only the reproduction deck is allowed. It is also possible to provide the rewinding deck prior to the reproduction deck. Yet furthermore, the reproduction deck may be replaced with a deck for recording.

FIG. 4 illustrates a circuit arrangement applicable to the cassette-tape supplying apparatus in FIG. 2A.

When a start switch S1 is turned "on", a relay R1 will be actuated to close contacts R1–1 and R1–2. Upon closure of the contact R1–1, the relay R1 is held through the switches S2, S3–1 and the contact R1–1. In addition, the shutter magnet **27***a* is energized through the contact R1–2 to open the shutter **27**. When the shutter **27** is fully opened, the switch S2 will be turned "off". Further, the first cassette is fed into the first holder **28** upon the full opening of the shutter **27**. The cassette fed into the first holder **28** renders "off" the switch S3–1 of the first holder. Simultaneously, a switch S3–2 is actuated to become "on". When the switch S3–1 becomes "off", the holding circuit of the relay R1 will be interrupted, resulting in opening the contact R1–2 to de-energize the shutter magnet **27***a* thereby to close the shutter **27** under the bias of the spring.

Since the switch S3–2 is actuated simultaneously with the switch S3–1 and is kept "on", a relay R2 operates to bring contacts R2–1 and R2–2 to the closed condition. As a result, the motor **51** is connected to an AC power source of 100 V so as to revolve in the forward direction. Thus, the carriages or carriers **35***a* to **35***c* start feeding a cassette. Immediately the carriage **35***a* has left its home position, the carriage return switch S4 is turned "off". When the cassette is sent out from the first holder **28** to the second holder **29**, the switch S3–2 will be released. However, the switch S4 is turned "on", so that the relay R2 is held and that the cassette continues to be fed. When the carriage **35***a* comes to the position of the switch S5–1 (the position at which the cassette is to stop), the switch S5–1 will be changed-over by the arm **40***a* of the carriage **35***a*. The motor **51** is accordingly stopped.

Interlocked with the switch S5–1, a switch S5–2 is turned "on" to operate a relay R4. Hence, a contact R4–2 is closed to turn the rotary solenoid **31***a*, so that the second holder **29** is mounted onto the decks along with the cassette. The relay R4 is held through a contact R5–1 of a relay R5 and its own contact R4–1. When the second holder **29** is correctly mounted on the decks, the cassette-setting switch S6–1 (S6–2, S6–3) will be turned "on." The switch S6–2 actuates a relay R3, with the result that the motor **51** is rotated in the reverse direction. The carriages are returned by the reverse rotation of the motor **51**. As soon as the carriages begin to return, the switch S5–1 is reverted (the position shown in FIG. 4). But the carriages continue to return with a by-pass circuit. When the carriages return to their home positions, the switch S4 will become "off" to break the holding of the relay R2. Therefore, the contact R2–2 is opened to stop the motor **51**.

On the other hand, when the cassette is mounted on the deck, a tape head assembly magnet **52** will be energized through a contact **R5–2** of a relay **R5** since the switch **S6–3** is kept "on." Therefore, the tape head **40**, the guide, the pinch roller **41**, etc. are inserted into the cassette to start the respective operations, such as the recording reproduction, on the decks. When signals indicating the completion of the respective operations on the decks, i.e. those of the completion of reading (READ END) and the completion of rewinding (RWD END) are imparted to an AND gate **53**, the AND gate produces an output, which is amplified by an amplifier **54** and is fed to the relay **R5** to actuate the latter to bring the contact **R5–2** to the open condition. As a result, the tape head assembly is returned by the bias of a spring.

Upon returning of the tape head assembly, a switch **S7** (a tape-head-assembly returning switch) becomes "off" to cut off the holding current through the rotary solenoid **31***a* of the second holder. Thus, the second holder **29** is restored to the original position by force of a spring (not shown).

As mentioned above, when the carriage **35***a* is stopped at the position of the switch **S5–1**, the switch **S5–3** will be turned "on." A relay **R6** is therefore energized to actuate the shutter/ejector rotary solenoid **32***a* through a contact **R6–2**. The shutter **33** and the ejector **32** are mechanically interlocked. In the first step, the shutter **33** is opened and the ejector **32** pushes out the cassette in the third holder **30** onto the stacker **24**. In the next step, the shutter **33** is closed and the ejector **32** returns. Upon completion of this series of actions, a limit switch **S8** for the shutter/ejector rotary solenoid is turned "off" to cut off the holding current of the relay **R6** thus to finish all the operations. Since the three carriages are kept returned to their home positions, the cassettes begin to be supplied again.

As described above, in accordance with this invention, a number of cassettes may be sequentially fed in such state that they are always standing. In addition, the cassettes may be set onto a deck for the purpose of recording, reproduction or rewinding by swivelling the second holder. The recording, reproduction or rewinding may be automatically and continuously performed with a simple mechanism.

We claim

1. A cassette-tape supplying apparatus comprising an input hopper on which a number of cassettes are set upright, an output stacker, a first holder for receiving cassettes from said input hopper, a second swivellable holder adjacent to said first holder and adapted, upon swivelling, to set said cassettes onto at least one deck, a third holder adjacent to said second holder and for outputting said cassettes to said output stacker, and a cassette supplying means for sequentially feeding said cassettes from said first holder to said third holder under such a state that said cassettes are set upright.

2. A cassette-tape supplying apparatus according to claim **1**, wherein said cassette supplying means comprises a reversible motor, a screw connected to said motor and arranged substantially in parallel with said first, second and third holders, a plurality of carriages arranged at spacings each being slightly larger than the width of said each cassette, said carriages having their moving direction determined by the rotary direction of said screw and extending in said holders to push said cassettes, and means to determine the forward rotation, reverse rotation and stopping of said motor.

3. A cassette-tape supplying apparatus according to claim **2**, wherein said carriages comprise a first carriage for feeding said cassette in said first holder to said second holder, and a second carriage for feeding said cassette in said second holder to said third holder, the relation in position between said first and second carriages being always fixed.

* * * * *