

PATENT SPECIFICATION

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- (21) Application No. 20224/77 (22) Filed 18 Sept. 1975 (19)
(62) Divided out of No. 1 552 767
(23) Complete Specification filed 3 June 1976
(44) Complete Specification published 19 Sept. 1979
(51) INT. CL.² G11B 21/06 21/12 21/16
(52) Index at acceptance

G5R B08 B251 B25Y B261 B262 B263 B361 B36Y B443
B581 B58X B58Y B591 B59X B59Y B611 B613
B61X B61Y B623 B638 B789



(54) SIGNAL PICKUP SYSTEM FOR A DISC RECORD PLAYER

(71) We, RCA CORPORATION, a corporation organized under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, City and State of New York, 10020, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention, which is divided from application no. 22369/76 (Serial No 1552767) ("the parent application"), relates to record players especially suitable for playing grooved video discs.

In a video disc system of the type described in the U.S. Patent No. 3,842,194, a stylus arm, carrying a stylus at one end and a connector plate secured to its other end via a compliant member, may advantageously be treated as a replaceable unit of a size convenient to handle, whereby when the stylus wear calls for a replacement, the user may readily remove and replace the stylus arm unit without requirements for mechanical skill and dexterity.

In U.K. Applications 43525/75 and 43526/75 (Serial Nos. 1522845 and 1523326) replacement cartridges for enclosing the stylus arm unit are disclosed. In these cartridges, the stylus arm occupies one of the following positions: (a) a retracted storage position outside the player, (b) a retracted off-record rest position while installed in the player, and (c) a protruding above-record play position also while installed in the player.

In accordance with a basic concept of the present invention, there is provided a player for playing back signals prerecorded along a spiral on a disc record disposed on the surface of a turntable rotatably mounted with respect to a base of said player, said player including: a pick-up stylus; a carriage mounted for lateral motion relative to said base; means for causing lateral motion of said carriage normally in correlation with, but independent of, normal progressive

lateral motion of said stylus as it follows said spiral in engagement with said record during playback; a flexible coupler securing one end of a stylus arm to a cooperating member in said carriage; an abutment mounted within said carriage; and a compliant stylus holder carrying said pick-up stylus and rigidly secured to the other end of said stylus arm; wherein said compliant stylus holder has a projecting portion which is disposed in a direction substantially perpendicular to said turntable surface; and wherein, when said stylus arm is in position for record engagement by the stylus, the location of said projecting portion with respect to said carriage is such that said projecting portion will engage said abutment if during playback the lateral position of the stylus remains substantially unchanged while the lateral motion of the carriage continues, whereby to urge said stylus in the direction of its normal lateral motion. In this way a locked groove condition of the stylus can be relieved as will be further explained herein-after.

In the accompanying drawings:

FIGURE 1 is a partial top view of a video disc player incorporating a pick-up cartridge and embodying the present invention;

FIGURE 2 is a perspective view of a stylus arm unit housed in the cartridge of FIGURE 1;

FIGURE 3 is a perspective view of an arrangement used for suspending, in accordance with the invention claimed in the parent application, the stylus arm unit of FIGURE 2 in the cartridge of FIGURE 1;

FIGURE 4 illustrates a locked groove escape apparatus for moving a groove-riding stylus out of a locked groove condition of a record in accordance with the present invention;

FIGURE 5 shows a sectional view of the carriage of the video disc player of FIGURE 1 showing it in an open condition with a pick-up cartridge poised for insertion therein;

FIGURE 6 shows a sectional view of the carriage in a closed condition with the cart-

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ridge installed therein and the stylus in playing position; and

FIGURE 7 is an exploded perspective view of an arrangement of some of the parts in the carriage relatively to the cartridge.

Only so much of these Figures will be described as is necessary for a proper understanding of the present invention. For a fuller description including illustrations showing the relative locations of cooperating parts at times during the sequence of operations for inserting the cartridge and bringing the player to the playing condition shown in FIGURE 6, reference is directed to the parent application.

In FIGURE 1, numeral 30 indicates a video disc player of the general type shown in the U.S. Patent No. 3,842,194. A record 31 is rotatably mounted for playback on a turntable 32 secured to a motorboard 33. A carriage 34 is mounted for lateral motion relative to the motorboard 33 in correlation with lateral motion of a stylus 55 (FIGURE 2) riding in a spiral-groove 35 disposed on the surface of the record 31 during playback. Slots 36 and 37 are provided in the motorboard 33 to permit lateral motion of the carriage 34 from an off-record rest position 38 to an above-record play position 39. Reference may be made to the U.S. Patent No. 3,870,835 for illustration of an apparatus for laterally driving the carriage 34 in correlation with the groove-riding stylus 55 during playback. When the carriage 34 is in the off-record rest position 38, a hinged plate 40 overlies the carriage.

There are five basic chambers in the carriage 34. Chambers 41, 42 and 43 are for enclosing respective circuit boards for respective elements of the signal processing circuitry of the playback system: (a) resonator (forming a tuned circuit with the stylus electrode/record capacitance), (b) oscillator (supplying UHF oscillations to the tuned circuit), and (c) preamplifier (responding to the detected version of modulated oscillations derived from the tuned circuit). Chamber 44 contains a replacement pickup cartridge 45, a retractable armstretcher 46, and a stylus arm lifter 47. The armstretcher may be of the type shown in U.S. Patent No. 3,711,641 (Palmer). Chamber 48 forms a wiring channel to hold the lead wires to the various circuit boards.

The cartridge 45 houses an insert molded stylus arm unit 50 shown in FIGURE 2. The insert molded stylus arm unit 50 consists of a stylus arm 51 formed of an aluminum tube e.g., 0.024 inch outer diameter and 0.002 inch thickness) with a plastic stylus holder 52 glued at one end of the stylus arm and a compliant member 53 molded at the other end of the stylus arm to connect the stylus arm with a metal connector plate 54. The compliant member 53 is in unstressed con-

dition when it is aligned with the stylus arm 51. The angle between the stylus arm 51 and the connector plate 54 is 94° for reasons given subsequently. The plastic stylus holder 52 contains a slot to hold the stylus 55 when it is glued in place. A small projection 56 is molded at the top of the plastic stylus holder 52 to engage with an abutment 49 (FIGURES 4-7) to relieve the stylus 55 from a locked groove of the record 31.

The arrangement for suspending the stylus arm unit 50 in the cartridge 45 will now be explained.

As shown in FIGURE 3, a pair of elastic straps 57 and 58 are glued to the connector plate 54 of the stylus arm unit 50. The elastic straps 57 and 58 are secured to a pair of slanted bearing surfaces 59 and 60 provided at the rear end of the cartridge 45. The slanted rear bearing surfaces 59 and 60 establish an 8° angle between the connector plate 54 and a direction perpendicular to the bottom surface of the cartridge 45. FIGURE 5 shows the slanted bearing surface 60.

The cartridge 45 further includes a leaf spring 61, in the form of a conductive ribbon, for urging the stylus 55 into the record groove 35 during playback as shown in FIGURE 6. One end of the leaf spring 61 is secured to the stylus 55 in electrical contact with an electrode included in the stylus. The other end of the leaf spring 61 is secured to the free end 62 of a cantilever beam 63. Slots 63¹ in the top wall of the cartridge 45, as shown in FIGURE 1, allow a strip-like portion of the top wall to function as the cantilever beam. While in this particular embodiment the cantilever beam 63 is integral with the cartridge 45, it could be separately secured to the top wall of the cartridge.

When the cartridge 45 is outside the player (FIGURE 5), or when inside the player but not engaged with the armstretcher 46, the stylus arm 51 is held in a retracted position in the cartridge for protection. In either of these positions, the compliant member 53 is not bent or stressed, and therefore, the formation of a permanent "set" in the compliant member, which could cause mistracking of the stylus 55 during playback is prevented.

From FIGURE 5, it can be seen that armstretcher 46 has a support member 64 for engagement with the connector plate 54 of the cartridge 45 during containment thereof in the carriage compartment 44. The armstretcher 46 is slidably mounted in the carriage compartment 44 for movement between a withdrawn position when a lid 65 of the carriage is open (FIGURE 5) and an advanced position when the carriage lid is closed (FIGURE 6) in response to the motion of the carriage lid. A coil spring 66

connected between the armstretcher 46 and the carriage 34 returns the armstretcher to the withdrawn position when the carriage lid 65 is opened.

One form of mechanism for traversing the armstretcher 46 in the carriage compartment 44 to effect rigid engagement between the support member 64 and the connector plate 54 is indicated in dotted lines; others are shown in the parent application.

When the cartridge 45 has been placed in the carriage compartment 44 (in which location it overlies the stylus arm lifter 47) and the carriage lid 65 is closed, the support member 64 enters the interior of the cartridge 45 through an opening 69 at the rear end of the cartridge for engagement with the connector plate 54 as shown in FIGURE 6. As the armstretcher moves forward, the support member 64 moves the connector plate 54 from the initial tilted position (e.g., 8°) to a position matching the engaging surface of the support member (e.g., perpendicular to the bottom surface of the cartridge 45 as shown). The elastic straps 57 and 58 permit the connector plate 54 to assume the new orientation. The connector plate 54 is made from magnetizable material. The support member 64 is also magnetizable. The support member 64 has walls defining a recess 70 as shown in FIGURE 4. A permanent magnet 71 is centrally mounted in the recess 70. The flux of the permanent magnet 71 secures the connector plate 54 to the support member 64 for rigidly transmitting cyclical motion of the support member to the connector plate during the support member/connector plate engagement. The separation between the permanent magnet 71 and the connector plate 54 is made greater than the separation between the permanent magnet and the walls of the support member 64 so that the strongest magnetic field is in the annular cavity. The magnetic field in the annular cavity attracts any stray magnetic particles present in the vicinity away from the mating surfaces of the connector plate 54 and the support member 64. Such an arrangement assures rigid connection between the support member 64 and the connector plate 54.

As the carriage lid 65 is closed further, a defeat lever 72 depresses the free end 62 of the cantilever beam 63. This lowers the leaf spring 61 to allow the stylus arm 51 to rest (not shown) on a control rod 73 of the stylus arm lifter 47.

The end of the leaf spring 61 affixed to the cantilever beam 63 is urged against a contact rivet 74 provided on a resonator circuit board 75 to establish an electrical path between the stylus electrode and the signal processing circuit via the leaf spring.

When the carriage lid 65 is closed, a spring 76, secured to the carriage lid,

presses the armstretcher 46 down into the carriage compartment 44 to establish proper seating of the armstretcher.

From FIGURE 1 it can be seen that a spring 77, secured to the carriage compartment 44, presses the armstretcher 46 against the side wall of the carriage compartment to assure lateral alignment of the armstretcher.

The engagement of the defeat lever 72 with the cartridge 45 assures proper seating of the cartridge in the carriage compartment 44. In order to assure lateral alignment of the rear end of the carriage 45 with the armstretcher 46, the armstretcher has a projection 78 which enters a recess 79 provided in the rear end of the cartridge during relative motion between the armstretcher and the cartridge.

Further, in order to assure lateral alignment of the front end of the cartridge 45 with the contact rivet 74, the cartridge has a cavity 80 at the front end for receiving a portion 81 provided in a structure 88 associated with the resonator circuit board 78 during relative motion between the cartridge and the stylus housing 34 as shown in FIGURE 7.

When the hinged plate 40 is closed, a projection 82 depresses a plunger 83 connected to the rod 73 of the stylus arm lifter 47. An aperture 84 is provided at the top of the cartridge 45 to permit passage of the plunger 83 as shown in FIGURE 1.

When the carriage 34 is in the off-record rest position 38 under the plate 40, the plunger 83 depresses the stylus arm lifter rod 73 and the stylus rests on a stylus brush 85. Further, when the carriage 34 moves from the off-record rest position 38 to the above-record play position 39, the stylus arm lifter rod 73 lifts the stylus arm 51 as depression of the plunger 83 is no longer obtained by the projection 82. Again, when the carriage 34 reaches the above-record play position 39, the stylus arm lifter 47 is activated to permit the stylus 55 to rest on the record 31 as shown in FIGURE 6.

The stylus arm lifting/lowering arrangement may be of the type disclosed in U.S. Patent No. 4053161 (cognate UK Applications 37847/37849/75). (Serial No. 1543550)

When the stylus 55 is resting on the stylus brush 85 or the record 31, the compliant member 53 is not bent or stressed. This feature prevents a formation of a set in the compliant member during containment of the cartridge 45 in the carriage compartment 44, as is explained in the parent application.

The arrangement for relieving the stylus 55 from a locked groove in the record 31 during playback will now be explained with reference to FIGURES 2 and 4. The stylus holder 52 is molded from compliant plastic

material with the deflector 56 molded at the top. The deflector 56 is disposed in a direction substantially perpendicular to the surface of the turntable 32 when the stylus arm is lowered for playback as shown in FIGURE 6. When the stylus 55 encounters a locked groove in the record 31 during playback, its radial position remains substantially unchanged while the carriage 34 traverses radially inward toward the axis of rotation of the record thereby reducing the spatial separation between the abutment 49 and the deflector 56. When the abutment 49 engages the deflector 56, it pushes the deflector radially inward whereby the stylus 55 is relieved from a locked groove of the record.

Where the record 31 is rotating at 450 rpm, where the record has 5,555 groove convolutions per inch, and where the separation between the deflector 56 and the abutment 49 is of the order of 0.010 inches, approximately 7 seconds would elapse between the time when the stylus 55 encounters a locked groove in the record and the time when the abutment engages the deflector to relieve the stylus from the locked groove. During the 7 second interval, the stylus 55 would be repetitively scanning the same groove (i.e., locked groove) in the record 31 which could be annoying to the viewer. It is desirable, for effecting immediate relief of the stylus 55 from the locked groove, to consistently locate the deflector 56 very close to the abutment 49 when the cartridge 45 is installed in the carriage compartment 44 and the stylus arm 51 is lowered for playback. To assure very precise and consistent positioning of the deflector 56 with respect to the abutment 49 during playback, the abutment 49 is made integral with the structure 88 having the portion 81 which is received in the cavity 80 at the front end of the cartridge 45 as shown in FIGURE 7. Accurate positioning of the abutment 49 with respect to the structure 88, of the cartridge 45 with respect to the structure 88, and of the deflector 56 with respect to the cartridge assures an accurate and consistent relationship between the deflector and the abutment during playback to give excellent operating results in that locked grooves are relieved quickly.

WHAT WE CLAIM IS:—

1. A player for playing back pre-recorded signals from a spirally grooved record disposed on the surface of a turntable rotatably mounted with respect to a base of said player, said player including: a carriage mounted for lateral motion relative to said base; means for causing lateral motion of said carriage normally in correlation with, but independent of, normal progressive lateral motion of a groove-riding stylus during playback; a flexible coupler securing one

end of a stylus arm to a cooperating member located in said carriage; an abutment mounted within said carriage; and a compliant stylus holder carrying said groove riding stylus and rigidly secured to the other end of said stylus arm; wherein said compliant stylus holder has a projecting portion which is disposed in a direction substantially perpendicular to said turntable surface; and wherein when said stylus arm is lowered to permit said stylus to protrude through an opening in said carriage for record engagement the location of said projecting portion with respect to said carriage is such that said projecting portion will engage said abutment when said stylus encounters a locked groove in said record during playback, whereby to effect radially inward movement of said stylus thereby relieving it from said locked groove.

2. A player for playing back signals pre-recorded along a spiral on a disc record disposed on the surface of a turntable rotatably mounted with respect to a base of said player, said player including: a pick-up stylus; a carriage mounted for lateral motion relative to said base; means for causing lateral motion of said carriage normally in correlation with, but independent of normal progressive lateral motion of said stylus as it follows said spiral in engagement with said record during playback; a flexible coupler securing one end of a stylus arm to a cooperating member in said carriage; an abutment mounted within said carriage; and a compliant stylus holder carrying said pick-up stylus and rigidly secured to the other end of said stylus arm; wherein said compliant stylus holder has a projecting portion which is disposed in a direction substantially perpendicular to said turntable surface; and wherein, when said stylus arm is in position for record engagement by the stylus, the location of said projecting portion with respect to said carriage is such that said projecting portion will engage said abutment if during playback the lateral position of the stylus remains substantially unchanged while the lateral motion of the carriage continues, whereby to urge said stylus in the direction of its normal lateral motion.

3. A player according to claim 1 or 2 wherein said flexible coupler is mounted within a protective cartridge for said stylus; wherein said carriage has a compartment for releasably receiving said cartridge such that said securing of said stylus arm to said cooperating member is achieved during reception of said cartridge in said compartment; and wherein said abutment has a portion for engagement with said cartridge so as to accurately locate said cartridge within said compartment upon said cartridge reception.



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material with the deflector 56 molded at the top. The deflector 56 is disposed in a direction substantially perpendicular to the surface of the turntable 32 when the stylus arm is lowered for playback as shown in FIGURE 6. When the stylus 55 encounters a locked groove in the record 31 during playback, its radial position remains substantially unchanged while the carriage 34 traverses radially inward toward the axis of rotation of the record thereby reducing the spatial separation between the abutment 49 and the deflector 56. When the abutment 49 engages the deflector 56, it pushes the deflector radially inward whereby the stylus 55 is relieved from a locked groove of the record.

Where the record 31 is rotating at 450 rpm, where the record has 5,555 groove convolutions per inch, and where the separation between the deflector 56 and the abutment 49 is of the order of 0.010 inches, approximately 7 seconds would elapse between the time when the stylus 55 encounters a locked groove in the record and the time when the abutment engages the deflector to relieve the stylus from the locked groove. During the 7 second interval, the stylus 55 would be repetitively scanning the same groove (i.e., locked groove) in the record 31 which could be annoying to the viewer. It is desirable, for effecting immediate relief of the stylus 55 from the locked groove, to consistently locate the deflector 56 very close to the abutment 49 when the cartridge 45 is installed in the carriage compartment 44 and the stylus arm 51 is lowered for playback. To assure very precise and consistent positioning of the deflector 56 with respect to the abutment 49 during playback, the abutment 49 is made integral with the structure 88 having the portion 81 which is received in the cavity 80 at the front end of the cartridge 45 as shown in FIGURE 7. Accurate positioning of the abutment 49 with respect to the structure 88, of the cartridge 45 with respect to the structure 88, and of the deflector 56 with respect to the cartridge assures an accurate and consistent relationship between the deflector and the abutment during playback to give excellent operating results in that locked grooves are relieved quickly.

WHAT WE CLAIM IS:—

1. A player for playing back pre-recorded signals from a spirally grooved record disposed on the surface of a turntable rotatably mounted with respect to a base of said player, said player including: a carriage mounted for lateral motion relative to said base; means for causing lateral motion of said carriage normally in correlation with, but independent of, normal progressive lateral motion of a groove-riding stylus during playback; a flexible coupler securing one

end of a stylus arm to a cooperating member located in said carriage; an abutment mounted within said carriage; and a compliant stylus holder carrying said groove riding stylus and rigidly secured to the other end of said stylus arm; wherein said compliant stylus holder has a projecting portion which is disposed in a direction substantially perpendicular to said turntable surface; and wherein when said stylus arm is lowered to permit said stylus to protrude through an opening in said carriage for record engagement the location of said projecting portion with respect to said carriage is such that said projecting portion will engage said abutment when said stylus encounters a locked groove in said record during playback, whereby to effect radially inward movement of said stylus thereby relieving it from said locked groove.

2. A player for playing back signals pre-recorded along a spiral on a disc record disposed on the surface of a turntable rotatably mounted with respect to a base of said player, said player including: a pick-up stylus; a carriage mounted for lateral motion relative to said base; means for causing lateral motion of said carriage normally in correlation with, but independent of normal progressive lateral motion of said stylus as it follows said spiral in engagement with said record during playback; a flexible coupler securing one end of a stylus arm to a cooperating member in said carriage; an abutment mounted within said carriage; and a compliant stylus holder carrying said pick-up stylus and rigidly secured to the other end of said stylus arm; wherein said compliant stylus holder has a projecting portion which is disposed in a direction substantially perpendicular to said turntable surface; and wherein, when said stylus arm is in position for record engagement by the stylus, the location of said projecting portion with respect to said carriage is such that said projecting portion will engage said abutment if during playback the lateral position of the stylus remains substantially unchanged while the lateral motion of the carriage continues, whereby to urge said stylus in the direction of its normal lateral motion.

3. A player according to claim 1 or 2 wherein said flexible coupler is mounted within a protective cartridge for said stylus; wherein said carriage has a compartment for releasably receiving said cartridge such that said securing of said stylus arm to said cooperating member is achieved during reception of said cartridge in said compartment; and wherein said abutment has a portion for engagement with said cartridge so as to accurately locate said cartridge within said compartment upon said cartridge reception.



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- 5 4. A record player having an arrangement for relieving a locked groove condition substantially as hereinbefore described with reference to FIGURE 4 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.