

PATENT SPECIFICATION (11)

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- (21) Application No. 4092/78 (22) Filed 18 Sept. 1975 (19)
(62) Divided out of No. 1 552 766
(23) Complete Specification filed 28 June 1976
(44) Complete Specification published 19 Sept. 1979
(51) INT. CL.³ G11B 21/26 21/04 21/18 21/22
(52) Index at acceptance
G5R B08 B251 B25Y B261 B262 B263 B361 B36Y B482
B545 B581 B58X B58Y B59X B59Y B611 B613
B61X B61Y B623 B638 B789
(72) Inventor MARVIN ALLAN LEEDOM



(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 invention, which is divided from Application No. 49109/75 (Serial No. 1,552,766) to which attention is hereby directed, generally relates to a disc record player, and more particularly, to an arrangement including a releasable coupling between a connector plate of a stylus arm unit and the remainder of the player.

In the U.S. Patent No. 3,917,903 (Taylor, et al), a magnetic coupling for detachably securing a stylus arm to a support member of a video disc player (of the type described in U.S. Patent No. 3,842,194) is described. In the magnetic coupling of the type described in Taylor, et al. patent, it is desirable to keep stray magnetic particles present in the vicinity of the coupling away from the mating surfaces of the support member and a connector plate secured to the stylus arm, to assure a rigid coupling therebetween.

The rigid coupling between the support member and the connector plate is particularly important where the support member is rendered subject to cyclical motion to correct velocity errors between the stylus and a record rotatably mounted in the player, to assure faithful transmission of cyclical motion. Reference may be made to U.S. Patent No. 3,711,641 for an illustration of an "armstretcher" apparatus for rendering cyclical motion to the support member.

The present invention is practised in a system which in general is for playing back signals prerecorded along a spiral on a record disc, which system includes a turn-

table for such record rotatably mounted with respect to a base of said playback system, and a carriage mounted for lateral motion relative to said base in correlation with progressive lateral motion of a playback stylus as it follows said spiral during playback. According to the invention, there is provided in such a system apparatus comprising: a stylus arm carrying said stylus at one end thereof; a first coupling element secured to the other end of said stylus arm; a cartridge having walls defining a protective enclosure for said stylus and said stylus arm; said cartridge being insertable in a compartment provided in said carriage; means mounted in said cartridge for flexibly suspending said first coupling element within said cartridge, wherein said suspending means establishes a location of said first coupling element permitting alignment thereof, when said cartridge is received in said compartment, with a cooperable second coupling element within the carriage; means mounted in said carriage for imparting translatory motion to said second coupling element during playback for opposing cyclical deviations in stylus/record relative velocity from a predetermined speed, wherein said translatory motion imparting means is movably mounted in said carriage; and means mounted in said carriage for providing relative displacement of said translatory motion imparting means relative to said cartridge to effect a releasable engagement between said first and second coupling elements during containment of said cartridge in said compartment permitting rigid transmission of said translatory motion from said second coupling element to said stylus.

In the accompanying drawings:

Figure 1 shows a video disc player incorporating 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

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arrangement used for suspending the stylus arm unit of Figure 2 in the cartridge of Figure 1;

5 Figure 4 shows a support member mounted in a carriage of the video disc player of Figure 1 for engagement with a connector plate of the stylus arm unit of Figures 2 and 3;

10 Figures 5a and 5b illustrate two embodiments of an apparatus for moving an armstretcher apparatus located in the carriage for effecting engagement of the support member of Figure 4 with the connector plate of Figures 2 and 3;

15 Figure 6 illustrates a locked groove escape apparatus for moving a groove-riding stylus out of a locked groove of a record; and

20 Figures 7-12 illustrate a sequence of operations involved in installing the cartridge in the carriage of the video disc player of Figure 1; still another embodiment of the apparatus for moving the armstretcher apparatus located in the carriage being illustrated in Figures 7-12.

25 In Figure 1, numeral 30 indicates a video disc player of the general type shown in the U.S. Patent No. 3,842,194 (Clemens). 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 motor board 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 (Stave) 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 replaceable 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.

65 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 condition 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 (Figure 6) 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 with reference to Figures 3 and 4. 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 7 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 12. 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.

The location of the free end 62 of the cantilever beam 63 with respect to the bottom surface of the cartridge 45, and the configuration of the leaf spring 61, are such that the stylus arm 51 is retained in a retracted position within the cartridge for protection (Figure 8). The retracted position provides a location for the stylus 55 withdrawn within the confines of the cartridge 45 remote from an opening in the bottom surface of the cartridge through which the stylus protrudes when the carriage 34 is in

the off-record rest position 38 (Figure 11) and the above-record play position (Figure 12).

When the cartridge 45 is outside the player (Figure 7), or when inside the player but not engaged with the armstretcher 46 (Figure 8), 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.

Figures 7—12 illustrate a sequence of operations involved in installation of the cartridge 45 in the carriage compartment 44. From Figure 7, 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 7) and an advanced position when the carriage lid is closed (Figures 10—12) 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.

An apparatus 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 shown in Figure 5a. A cam 67 is mounted in the carriage 34 for rotation about a pivot pin P in response to the motion of the carriage lid 65. The peripheral surfaces of the cam 67 engage the armstretcher 46 to cause relative displacement between the armstretcher and the carriage 34. A portion 68 in the armstretcher 46 is relieved to permit a small amount of overtravel by the cam 67. Further, relief 68 helps to spring load the armstretcher 46 against the cartridge 45, when the carriage lid 65 is closed, to assure accurate positioning of the cartridge in the carriage compartment. Additionally, the relief 68 tolerates a slight variation in the dimensions of the armstretcher 46, cartridge 45, and the carriage compartment 44.

The operation of another embodiment of the apparatus for moving the armstretcher 46 in the carriage compartment 44 to effect rigid engagement between the support member 64 and the connector plate 54 can be seen from Figure 5b. The operation of the moving apparatus of Figure 5b is similar to the moving apparatus of Figure 5a except that in the moving apparatus of Figure 5b the return spring 66 is not required. In the moving apparatus of Figure 5b, the carriage

lid 65 and the cam 67 are fixedly secured to a pivot pin which is rotatably mounted in the carriage 34. When the carriage lid 65 is opened, the cam 67 is rotated to retract the armstretcher 46 to the withdrawn position.

The operation of still another embodiment of the apparatus for moving the armstretcher 46 in the carriage compartment 44 to effect rigid engagement between the support member 64 and the connector plate 54 can be seen from Figures 8—12.

The cartridge 45 is placed in the carriage compartment 44 as shown in Figure 8, and the carriage lid 65 is closed. The cartridge 45 overlies the stylus arm lifter 47 during containment of the cartridge in the carriage compartment 44.

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 9. As the armstretcher moves forward, the support member 64 moves the connector plate 54 from the initial tilted position (e.g., 8° as shown in Figure 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 in Figure 9). 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 ensures 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, as shown in Figure 10. This lowers the leaf spring 61 to allow the stylus arm 51 to rest 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.

(5) 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 as shown in Figure 10.

10 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.

15 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 cartridge 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 as shown in Figure 1.

25 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 at the front end for receiving a portion provided in a structure associated with the resonator circuit board 75 during relative motion between the cartridge and the carriage 34.

30 When the hinged plate 46 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.

40 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 as shown in Figure 11 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.

55 The stylus arm lifting/lowering arrangement may be of the type disclosed in U.S. Patent No. 4,053,161 (U.K. Cognate Applications Nos. 37847/37849/75) (Serial No. 1,543,550).

60 When the stylus 55 is resting on the stylus brush 85 or the record 31, the compliant member is not bent or stressed. This feature prevents formation of a set in the compliant member during containment of the cartridge 45 in the carriage compartment 44. Thus, compliant member is in unstressed condition

65 while the cartridge is outside the carriage

compartment, and also while the cartridge is contained in the carriage compartment and the carriage is in the off-record rest position or in the above-record play position. The compliant member is stressed only in the interval between the off-record rest position and the above-record play position of the carriage (Figure 10) as the stylus arm is lifted to permit the stylus to clear the outside bead of the record. This interval is so short, that it has no noticeable effect on the "set" of the compliant member.

An aperture in the outer wall of the cartridge 45 permits passage of wiring between the stylus arm lifter 47 and the wiring channel 48. The cartridge 45 is provided with inner walls closely flanking the stylus arm unit 50 to limit access thereto. The keyed end shape and the solid cover of the cartridge 45 prevent backward or inverted insertion of the cartridge into the stylus housing compartment 44.

WHAT WE CLAIM IS:—

1. In a system for playing back signals prerecorded along a spiral on a record disc, which system includes a turntable for such record rotatably mounted with respect to a base of said playback system, and a carriage mounted for lateral motion relative to said base in correlation with progressive lateral motion of a playback stylus as it follows said spiral during playback; apparatus comprising:

a stylus arm carrying said stylus at one end thereof;

a first coupling element secured to the other end of said stylus arm;

a cartridge having walls defining a protective enclosure for said stylus and said stylus arm, said cartridge being insertable in a compartment provided in said carriage;

means mounted in said cartridge for flexibly suspending said first coupling element within said cartridge, wherein said suspending means establishes a location of said first coupling element permitting alignment thereof, when said cartridge is received in said compartment, with a cooperable second coupling element within the carriage;

means mounted in said carriage for imparting translatable motion to said second coupling element during playback for opposing cyclical deviations in stylus/record relative velocity from a predetermined speed, wherein said translatable motion imparting means is movably mounted in said carriage; and

means mounted in said carriage for providing relative displacement of said translatable motion imparting means relative to said cartridge to effect a releasable engagement between said first and second coupling elements during containment of said cartridge in said compartment permitting rigid



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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.

5 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 as shown in Figure 10. 10 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.

15 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 cartridge 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 as shown in Figure 1.

25 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 at the front end for receiving a portion provided in a structure associated with the resonator circuit board 75 during relative motion between the cartridge and the carriage 34.

30 When the hinged plate 46 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.

35 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 as shown in Figure 11 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.

40 The stylus arm lifting/lowering arrangement may be of the type disclosed in U.S. Patent No. 4,053,161 (U.K. Cognate Applications Nos. 37847/37849/75) (Serial No. 1,543,550).

45 When the stylus 55 is resting on the stylus brush 85 or the record 31, the compliant member is not bent or stressed. This feature prevents formation of a set in the compliant member during containment of the cartridge 45 in the carriage compartment 44. Thus, compliant member is in unstressed condition 50 while the cartridge is outside the carriage

compartment, and also while the cartridge is contained in the carriage compartment and the carriage is in the off-record rest position or in the above-record play position. The compliant member is stressed only 70 in the interval between the off-record rest position and the above-record play position of the carriage (Figure 10) as the stylus arm is lifted to permit the stylus to clear the outside bead of the record. This interval is 75 so short, that it has no noticeable effect on the "set" of the compliant member.

80 An aperture in the outer wall of the cartridge 45 permits passage of wiring between the stylus arm lifter 47 and the wiring channel 48. The cartridge 45 is provided with inner walls closely flanking the stylus arm unit 50 to limit access thereto. The keyed 85 shape and the solid cover of the cartridge 45 prevent backward or inverted insertion of the cartridge into the stylus housing compartment 44.

WHAT WE CLAIM IS:—

1. In a system for playing back signals 90 prerecorded along a spiral on a record disc, which system includes a turntable for such record rotatably mounted with respect to a base of said playback system, and a carriage 95 mounted for lateral motion relative to said base in correlation with progressive lateral motion of a playback stylus as it follows said spiral during playback; apparatus comprising:

a stylus arm carrying said stylus at one 100 end thereof;

a first coupling element secured to the other end of said stylus arm;

a cartridge having walls defining a protective enclosure for said stylus and said 105 stylus arm, said cartridge being insertable in a compartment provided in said carriage;

means mounted in said cartridge for flexibly suspending said first coupling element within said cartridge, wherein said suspending 110 means establishes a location of said first coupling element permitting alignment thereof, when said cartridge is received in said compartment, with a cooperable second coupling element within the carriage; 115

means mounted in said carriage for imparting translatable motion to said second coupling element during playback for opposing cyclical deviations in stylus/record 120 relative velocity from a predetermined speed, wherein said translatable motion imparting means is movably mounted in said carriage; and

means mounted in said carriage for providing relative displacement of said translatable motion imparting means relative to 125 said cartridge to effect a releasable engagement between said first and second coupling elements during containment of said cartridge in said compartment permitting rigid 130



transmission of said translatory motion from said second coupling element to said stylus.

2. Apparatus as defined in Claim 1 wherein said first and second coupling elements are magnetizable, said second magnetizable coupling element has walls defining a recess, and a permanent magnet is so mounted in said recess that it forms an annular cavity with said walls, the dimensions of said magnet establishing between it and said first coupling element during said engagement of the first and second coupling elements a gap greater than the separation between the magnet and said walls.

3. Apparatus as defined in Claim 1 or Claim 2 further including:

means mounted in said cartridge for releasably retracting said stylus arm within the confines of said cartridge remote from an opening in said cartridge through which said stylus may otherwise protrude; and

means for defeating said releasable retracting means for permitting protrusion of said stylus through said opening when said cartridge is received in said compartment and when said coupling elements are in engagement.

4. Apparatus as defined in Claim 3 wherein a compliant member secures said first coupling element to said stylus arm; wherein said suspending means establishes an angular orientation of said first coupling element with respect to said cartridge such that, when said stylus arm is held in said retracted position in said cartridge, said compliant member is unstressed.

5. Apparatus as defined in Claim 4 wherein the angular orientation of said first coupling element relative to said cartridge, when said first coupling element is in engagement with said second coupling element, and the angular orientation of said compliant member with respect to said first coupling element, permit said stylus to protrude through said opening when said releasable retracting means is defeated without stressing said compliant member.

6. Apparatus as defined in Claim 3,

Claim 4 or Claim 5 wherein said releasable retracting means comprises:

a spring for urging said stylus into playback relationship with said record during playback; wherein a first end of said spring is secured to said stylus; and

a cantilever member secured to the top wall of said cartridge; wherein a second end of said spring is secured adjacent to the free end of said cantilever member; wherein the location of said free end of said cantilever member and the configuration of said stylus spring are such that said stylus arm is held in said retracted position for a first position of said cantilever member, and such that said stylus is permitted to protrude through said opening for a second position of said cantilever member.

7. An apparatus as defined in Claim 6 wherein said defeating means comprises a lever secured to a lid of said carriage and wherein the location of said lever is such that it depresses said free end of said cantilever member to said second position.

8. Apparatus as defined in Claim 7 wherein an input terminal of a signal processing circuit is secured in said carriage; said stylus includes an electrode; said stylus spring is conductive; said securing of said first end of said stylus spring to said stylus effects an electrical connection between said stylus electrode and said first end of said stylus spring; the location of said input terminal in said carriage is such that said depression of said free end of said cantilever member during containment of said cartridge in said compartment effects an electrical connection between said second end of stylus spring and said input terminal to establish an electrical path between said stylus electrode and said signal processing circuit through said conductive spring.

T. I. M. SMITH,
Chartered Patent Agent,
50 Curzon Street,
London W1Y 8EU.
Agent for the Applicant.