

PATENT SPECIFICATION (11)

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(54) SPRING LOADED STYLUS RECORD PLAYBACK APPARATUS

(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 relates to apparatus for playing records, especially video discs.

A video disc system of the type described in U.K. Specifications Nos. 1,392,201—206 generally utilizes records having groove densities of the order of four to eight thousand groove convolutions per inch. A typical video record of this type may have a groove convolution spacing of the order of 3.5 microns. The fragile walls of relatively narrow record grooves cannot be dependably relied upon to pull a stylus arm unit, across the entire recorded surface of the record. Also, in video disc systems of the type described in abovesaid patent, it is desirable for accurate reproduction of the prerecorded signals that the stylus electrode maintain a substantially constant attitude in the record groove during playback. Therefore, a lateral feed drive mechanism is provided for traversing a carriage supporting the stylus arm unit in proper time relationship with the lateral motion of the stylus due to the spiral groove so as to continuously maintain the longitudinal axis of the stylus arm substantially tangential to the spiral groove at the point of stylus/groove engagement during playback. U.K. Specification No. 1,466,925 illustrates such a lateral feed drive mechanism.

The stylus needs a certain tracking force to assure proper tracking and seating of the stylus in the record groove during playback. Typically, all the tracking force comes from the weight of the stylus arm unit, and the

tracking is, essentially, mass controlled along the record groove and up-and-down on any defect in the record groove.

Different systems have been heretofore tried to provide spring loading. Many of these systems employ a coil spring stretched between the stylus arm and a supporting structure. These systems, however, have proved unsatisfactory because they tend to bend the stylus arm setting up undesired oscillations therein and causing mistracking of the stylus. The problem is particularly acute where the stylus arm unit is extremely fragile and lightweight and where the tracking speed is relatively high.

In the present invention, as set forth in the appended claims, a required tracking force is provided by a spring which is connected to and acts between the stylus itself and a housing or carriage in which the stylus arm is supported. It has been found that such an arrangement substantially reduces signal drop-outs during playback, because the spring causes the stylus to quickly return to the record when the stylus is launched in space by a defect in the record.

In addition to providing stylus tracking force, the stylus spring may serve to properly locate the free end of the stylus arm relative to the housing or carriage, and to establish, where appropriate, electrical connection between an electrode on the stylus and signal processing circuitry of the player.

In the accompanying drawings:

Figure 1 is a video disc player incorporating a spring loaded stylus apparatus embodying the present invention;

Figure 2 is a perspective view of a cart-ridge in which the spring loaded stylus apparatus of Figure 1 is housed;

Figure 3 is a perspective view of a stylus arm unit to which the spring loaded stylus of Figures 1 and 2 is secured;

Figure 4 is a side view of the stylus arm unit showing the spring loaded stylus apparatus;



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Figure 5 is a front view of the stylus arm unit of Figures 3 and 4; and

Figure 6 is a side view of a portion of another embodiment of the spring loaded stylus apparatus of the present invention.

In Figure 1, numeral 10 indicates a video disc player of the general type shown in U.K. Specification No. 1,392,202. A record 11 is rotatably mounted for playback on a turntable 12 secured to a motorboard 13 of the player. A carriage 14 is mounted for lateral motion relative to the motorboard 13 in correlation with lateral motion of a stylus 15 riding in a spiral groove disposed on the surface of the disc record 11 during playback.

A stylus arm unit 16 is housed in a cartridge 17. The cartridge 17 is received in a compartment 18 provided in the carriage 14. Figure 2 shows a perspective view of the cartridge 17.

As can be seen from Figure 3, the stylus arm unit 16 comprises a stylus arm 19 formed with an aluminum tube (e.g., 0.024 inch outer diameter and 0.002 inch thickness) with a plastics stylus holder 20 glued at one end of the stylus arm and a compliant member 21 molded at the other end of the stylus arm. The compliant member 21 exhibits greater compliance than the stylus holder 20 to slow, i.e., low frequency, motion of the stylus arm 19 (e.g., due to record warpage, eccentricity, etc.). The stylus holder 20 exhibits a higher compliance than the member 21 to high frequency motion of the stylus arm 19 (e.g., due to "orange peel" type record surface).

The compliant member 21 is in substantially unstressed condition when it is aligned with the stylus arm 19 (See Application No. 22370/76 (Serial No. 1,552,768)). A connector plate 22 is glued to the compliant member 21 in a manner that establishes 94° angle therebetween. The plastics stylus holder 20 contains a slot 23 in which the stylus 15 is glued in place. A small projection 24 is molded at the top of the plastics stylus holder 20 to engage with an abutment to relieve the stylus 15 from a locked groove. U.S. Patent No. 4,049,280 (U.K. Application No. 20224/74) (Serial No. 1,552,769) of M. A. Leedom, entitled, "PICKUP CARTRIDGE", illustrates such a locked groove relief arrangement.

The stylus arm unit 16 is suspended in the cartridge 17 by an elastic diaphragm 25 as shown in Figures 1 and 2. A U-shaped spring 26 releasably clamps the stylus arm 19 in a retracted position in the cartridge 17 during storage and handling of the cartridge (i.e., while the cartridge is outside the compartment 18). The retracted position provides a location for the stylus 15 withdrawn within the confines of the cartridge 17 remote from an opening in the bottom

wall of the cartridge through which the stylus may protrude (e.g., during playback).

A support member 27 of an armstretcher apparatus 28 engages the connector plate 22 during containment of the cartridge 17 in the compartment 18. The armstretcher 28 is slidably mounted in the compartment 18 for movement between a withdrawn position when a lid 29 of the cartridge 14 is open to an advanced position when the carriage lid is closed in response to the motion of the carriage lid. The support member 27 enters the interior of the cartridge 17 through an opening 30 in the cartridge to engage the connector plate 22 when the armstretcher 28 is advanced. The U.S. Patent No. 3,711,641 illustrates such an armstretcher apparatus.

A spring defeat lever 31, secured to the carriage lid 29 enters the interior of the cartridge 17 through an opening 32 in the cartridge to defeat the clamping spring 26 during containment of the cartridge in the compartment 18 upon closure of the carriage lid.

The cartridge 17 further includes a leaf spring 33, in the form of a ribbon, for urging the stylus 15 in the record groove to establish stylus tracking pressure during playback as shown in Figure 1. The first end of the leaf spring 33 is secured to the stylus 15 as shown in Figures 1, 3, and 4. The second end of the leaf spring 33 is secured to a flat 34 on a portion of a ball 35 as shown in Figures 1, 4, and 5. The ball 35 is friction loaded into a socket 36 provided in the cartridge 17 so that the flat portion protrudes from the socket. The cartridge 17 has an access opening 37 in communication with the socket 36 for inserting a tool into a hex-shaped hole 38 provided in the ball 35 for the purpose of adjustment of the stylus. Such adjustment may, for example, serve to center the stylus arm 19 in the cartridge 17 or to vary the stylus/record tracking pressure. After such adjustment at the factory, the ball 35 may be firmly glued in place.

The stylus adjusting apparatus is of the type described and claimed in copending Application No. 49107/75 (Serial No. 1,552,764).

The second end of the leaf spring 33 is located so that the stylus arm 19 is normally aligned with the compliant member 21. As previously indicated, the compliant member 21. As previously indicated, the compliant member 21 is in substantially unstressed condition when it is aligned with the stylus arm 19. Alignment of the compliant member 21 with the stylus arm 19 is advantageous because it prevents formation of a "set" in the compliant member which may interfere with the ability of the stylus 15 to track the record groove.

Figure 6 is a side view of a portion of another embodiment of the spring loaded stylus apparatus in which the leaf spring

33 is bowed in a direction opposite that shown in the embodiment of Figures 1—5.

Where the stylus 15 incorporates an electrode for detecting signal variations in the spiral groove in the record 11 during playback, the leaf spring may be made of conductive material to provide an electrical connection between the stylus electrode and the signal processing circuitry 40 (Figure 1) of the video disc player 10. In that case, the first end of the leaf spring 33 is secured to the stylus 15 in a manner that establishes electrical connection between the leaf spring and the stylus electrode. The signal processing circuitry 40 has an input terminal 41 which contacts the second end of the leaf spring 33 during containment of the cartridge 17 in the compartment 18 to establish the abovementioned electrical connection.

The cartridge may be of the type described in the U.S. Patent No. 4,049,280.

WHAT WE CLAIM IS:—

1. Apparatus for playing back signals precoded along a spiral on a record rotatably mounted on a turntable of the apparatus, comprising:

a pick-up stylus secured to one end of a stylus arm;

a carriage mounted for lateral motion relative to a base of said apparatus in correlation with progressive lateral motion of said stylus as it follows said spiral during playback;

means supporting the other end of said stylus arm within said carriage; and

a spring for urging said stylus into engagement with said record during playback to provide a desired tracking force, said spring having a first end secured to said stylus and a second end secured within said carriage for movement therewith.

2. An apparatus as defined in Claim 1 wherein said spring comprises a leaf spring disposed in a bowed configuration.

3. Apparatus as defined in Claim 1 or 2, comprising:

a compliant member securing said other end of said stylus arm within said carriage; and

means for causing said lateral motion of said carriage during playback in such correlation with said lateral motion of said stylus that said stylus arm is maintained substantially tangential to said record spiral at the

point of the stylus/record engagement, said second end of said spring being secured within said carriage above said stylus so that said stylus arm is normally aligned with said compliant member.

4. Apparatus as defined in any preceding Claim, wherein the stylus comprises a pick-up electrode, a pick-up signal processing circuit of the apparatus has an input terminal located within said carriage, and said spring is made of electrically conductive material and has its said second end connected to said input terminal, the securing of said first end of the spring to said stylus effecting an electrical connection between said first end and said electrode to establish an electrical path between the stylus electrode and said signal processing circuit via said spring.

5. A pick-up cartridge for playing disc records comprising:

a housing having a bottom adapted to be supported adjacent such record;

a stylus arm assembly including: a substantially straight and elongated stylus arm; a compliant member supporting one end of said stylus arm within said housing and closely adjacent to said housing bottom; and a stylus holder securing a record-engaging playback stylus to the other end of said stylus arm, said compliant member exhibiting greater compliance than said stylus holder to slow motion of said stylus arm but said stylus holder exhibiting greater compliance than said compliant member to rapid motion of said stylus arm, and the mass of said stylus arm assembly being insufficient to alone provide a desired tracking force of the stylus against the record as a function of gravity to track said record; and

a spring connected to said stylus and to said housing and effective therebetween to provide the desired tracking force.

6. A cartridge as defined in Claim 5 wherein said stylus includes a pick-up electrode; said spring is electrically conductive and the connection between said spring and said stylus serves to establish an electrical path from said stylus electrode via said conductive spring.

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Where the stylus 15 incorporates an electrode for detecting signal variations in the spiral groove in the record 11 during playback, the leaf spring may be made of conductive material to provide an electrical connection between the stylus electrode and the signal processing circuitry 40 (Figure 1) of the video disc player 10. In that case, the first end of the leaf spring 33 is secured to the stylus 15 in a manner that establishes electrical connection between the leaf spring and the stylus electrode. The signal processing circuitry 40 has an input terminal 41 which contacts the second end of the leaf spring 33 during containment of the cartridge 17 in the compartment 18 to establish the abovementioned electrical connection.

The cartridge may be of the type described in the U.S. Patent No. 4,049,280.

WHAT WE CLAIM IS:—

1. Apparatus for playing back signals precoded along a spiral on a record rotatably mounted on a turntable of the apparatus, comprising:

a pick-up stylus secured to one end of a stylus arm;

a carriage mounted for lateral motion relative to a base of said apparatus in correlation with progressive lateral motion of said stylus as it follows said spiral during playback;

means supporting the other end of said stylus arm within said carriage; and

a spring for urging said stylus into engagement with said record during playback to provide a desired tracking force, said spring having a first end secured to said stylus and a second end secured within said carriage for movement therewith.

2. An apparatus as defined in Claim 1 wherein said spring comprises a leaf spring disposed in a bowed configuration.

3. Apparatus as defined in Claim 1 or 2, comprising:

a compliant member securing said other end of said stylus arm within said carriage; and

means for causing said lateral motion of said carriage during playback in such correlation with said lateral motion of said stylus that said stylus arm is maintained substantially tangential to said record spiral at the

point of the stylus/record engagement, said second end of said spring being secured within said carriage above said stylus so that said stylus arm is normally aligned with said compliant member.

4. Apparatus as defined in any preceding Claim, wherein the stylus comprises a pick-up electrode, a pick-up signal processing circuit of the apparatus has an input terminal located within said carriage, and said spring is made of electrically conductive material and has its said second end connected to said input terminal, the securing of said first end of the spring to said stylus effecting an electrical connection between said first end and said electrode to establish an electrical path between the stylus electrode and said signal processing circuit via said spring.

5. A pick-up cartridge for playing disc records comprising:

a housing having a bottom adapted to be supported adjacent such record;

a stylus arm assembly including: a substantially straight and elongated stylus arm; a compliant member supporting one end of said stylus arm within said housing and closely adjacent to said housing bottom; and a stylus holder securing a record-engaging playback stylus to the other end of said stylus arm, said compliant member exhibiting greater compliance than said stylus holder to slow motion of said stylus arm but said stylus holder exhibiting greater compliance than said compliant member to rapid motion of said stylus arm, and the mass of said stylus arm assembly being insufficient to alone provide a desired tracking force of the stylus against the record as a function of gravity to track said record; and

a spring connected to said stylus and to said housing and effective therebetween to provide the desired tracking force.

6. A cartridge as defined in Claim 5 wherein said stylus includes a pick-up electrode; said spring is electrically conductive and the connection between said spring and said stylus serves to establish an electrical path from said stylus electrode via said conductive spring.

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