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(54) STYLUS ARM LIFTING/LOWERING APPARATUS FOR A VIDEO DISC 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 relates to a video disc player, and, more particularly, relates to an apparatus suitable for use therein for lifting and lowering a stylus arm carrying a stylus.

In certain video disc systems, video information is recorded by means of geometric variations in the bottom of a smooth spiral groove on the surface of a record. The record surface includes a coating of conductive material which is preferably covered with a thin deposit of dielectric material. A stylus, supported at one end of a stylus arm, engages the record groove and includes an electrode which is spaced (e.g. by such dielectric deposits) from, and thereby establishes capacitance with the conductive coating of the record. The other end of the stylus arm is secured to a support by a compliant member. When the record is rotated, the electrode/record capacitance varies in response to the geometric variations in the bottom of the record groove passing beneath the stylus. The capacitance variations are converted to electrical signal variations by a suitable signal processing circuitry coupled to the stylus electrode. The output signal of the signal processing circuitry may be coupled to a conventional television receiver for reproduction. A system of the aforementioned type is described in general in U.S. Patent Nos. 3,842 194 and 3,783,196, U.K. Patent Nos. 1,392,201—1,392,206.

Video disc systems of the aforementioned type generally utilize 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 the stylus arm assembly across the entire recorded surface of the record. Also, in video disc systems utilizing the above-mentioned variable capacitor concept, it is desirable for accurate reproduction of the prerecorded signals that the stylus electrode maintain a substantially constant attitude in the record groove. Therefore, a lateral feed drive mechanism is provided for traversing the stylus housing 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 thespiral groove at the point of stylus/groove engagement during playback. Reference may be made to the U.S. Patent No. 3,870,835, U.K. Patent No. 1,466,925, for an illustration of a lateral feed drive mechanism.

In order to compensate for cylindrical variations in the stylus/record relative speed the locations of the stylus in the record groove is varied by rendering the stylus arm support member subject to translatory motion along the longitudinal axis of the stylus arm in a manner that opposes the cyclical variations. Reference may be made to the U.S. Patent No. 3,711,641, U.K. Patent No. 1,383,336, for an illustration of a translatory motion imparting means.

In video disc systems of the aforementioned type, the groove engaging requirement and the translatory motion requirement for the stylus result in a stylus arm unit which is extremely fragile and light-weight, with illustrative dimensions, as follows: tubular stylus arm outer diameter—0.024 inches, stylus arm inner diameter—0.020 inches (i.e., 0.002 inch thickness), stylus width—2 microns, stylus depth—5 microns.

In video disc systems of the abovesaid type, it is advantageous to effect a smooth landing of the stylus on the record for playback for example, for protecting the signal elements recorded in the groove bottom, the walls of the record groove, and the stylus.

For lowering of the stylus arm to establish stylus/record contact, one may utilize a conventional magnetic relay in conjunction with a movable iron core. To obtain a controlled acceleration of the movable iron core in such an arrangement, a device such as a dashpot is required which increases the mass of the moving system. Such an arrangement is undesirable because of added cost, power consumption, etc.

Further, in a system of the abovesaid type, the compliant member secured to the stylus arm has a tendency to form a "set" when it is held in a stressed condition for a period of time. The formation of the "set" is undesirable because it interferes with the ability of the stylus to track the record groove during playback.

Accordingly, it is desirable that the average position about which the compliant member moves during playback involves a substantially unstressed condition for the compliant member. For this purpose, the axes of the stylus arm and the compliant member are desirably disposed in substantial alignment when the stylus arm is in a lowered position for playback.

The present invention is set forth in Claim 1 and can be embodied, as will be described, in an apparatus which, in addition to obtaining a smooth landing of the stylus on the record for playback, disposes the stylus arm in a lowered position when the stylus housing is in an off-record rest position to permit stylus arm/compliant member alignment under sustained rest conditions. Means for achieving this forms the subject of divisional application 8294/5/78 (Serial No. 1,540,257). Thus the compliant member may be maintained in an unstressed condition when the stylus housing is in the off-record rest position, as well as when the stylus arm is lowered for playback. With this accomplished, maintenance of the compliant member in a stressed condition may be confined to transition periods, as, for example, when the stylus arm is raised to clear the rim of the record, as the stylus housing moves from the off-record rest position to the above-record play position, and vice versa.

Referring to the accompanying drawings:

Figure 1 is a plan view of a video disc player incorporating an apparatus according to the present invention for lifting and lowering a stylus arm carrying a stylus;

Figure 2(a) illustrates a stylus arm unit included in the video disc player of Figure 1;

Figure 2(b) illustrates a clamping spring for retractably clamping the stylus arm unit of Figure 2(a) in a cartridge;

Figure 3 is a side view of the player of Figure 1; a portion of the stylus housing of the player being removed to expose the stylus arm lifting/lowering apparatus of Figure 1; the cartridge enclosing the stylus arm unit of Figure 2 being shown outside the stylus housing;

Figure 4 is a perspective view of the stylus arm lifting/lowering apparatus of Figures 1 and 3;

Figure 5 is a cross sectional view of the stylus arm lifting/lowering apparatus of Figures 1, 3 and 4;

Figure 6 illustrates an alternative form for an electromagnet included in the stylus arm lifting/lowering apparatus of Figures 1, 3 and 4;

Figure 7 is a selectively operated circuit for providing a controlled excitation of the electromagnet included in the stylus arm lifting/lowering apparatus of Figures 1, 3 and 4; and

Figures 8—11 illustrate, a seriatim, operation of the stylus arm lifting/lowering apparatus of Figures 1, 3 and 4.

Figure 12 is a side view of the video record player illustrating a further embodiment of a stylus arm rest control apparatus;

Figures 13—16 illustrate, respectively a perspective view, a side view, a top view, and a front view of the stylus arm rest control apparatus of Figure 12.

In Figure 1, numeral 30 indicates a video disc system of the general type shown in the U.S. Patent No. 3,842,194. A record 31 is disposed for playback on a turntable 32 rotatably mounted on a motorboard 13. A stylus housing 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 stylus housing 34 from an off-record rest position 38 to an above-record play position 39. Reference may be made to the U.S. Patent 3,870,835 for illustration of an apparatus for laterally driving the stylus housing 34 in correlation with the groove-riding stylus 55 during playback. When the stylus housing 34 is in the off-record rest position 38, a hinged plate 40 conceals the stylus housing.

There are five basic chambers in the stylus housing 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 (respond-

ing to the detected version of modulated oscillations derived from the tuned circuit). Chamber 44 contains a replaceable stylus arm cartridge 45, a retractable armstretcher 46, and a stylus arm lifting/lowering apparatus 47. The armstretcher may be of the type shown in U.S. Patent No. 3,711,641. 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 molded 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 90° 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 a "stonewall" 57 (Figure 3) to relieve the stylus 55 from a locked groove. Reference may be made to the U.S. Patent No. 3,961,131, U.K. Application No. 8405/75, Serial No. 1,528,762, for an example of a locked groove escape arrangement.

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

As shown in Figure 2(a), an elastic diaphragm 58 is glued to the connector plate 54 of the stylus arm unit 50. The diaphragm 58 comprises a pair of elastic straps 59 and 59^1 joining end ribs 60 and 60^1. The elastic straps 58 and 59 have central projections 61 and 61^1 of appropriate wedge shapes providing slanted rear surfaces to which the connector plate 54 is glued. The slanted rear surfaces establish an 8° angle between the connector plate 54 and the forward surfaces of the elastic straps 59 and 59^1 for reasons given subsequently.

A pair of hooks 62 and 62^1 are molded into the rear end of the cartridge 45. In order to secured the diaphragm 58 to the cartridge 45 the end ribs 60 and 60^1 are stretched apart and drawn over the hooks 62 and 62^1. The hooks 62 and 62^1 have slots for seating the end ribs 60 and 60^1 and slots for seating the elastic strap 59 and 59^1. When the diaphragm 58 is properly secured to the cartridge 45, the aforesaid slots establish an angular orientation of the front surfaces of the elastic straps with respect to the cartridge 45 (i.e., perpendicular to the bottom surface of the cartridge body).

A U-shaped spring 63 releasably clamps the stylus carrying end of the stylus arm 51 in a retracted position in the cartridge 45, as shown in Figure 2(b) corresponding to a cross section on the line A—A in Figure 8 during storage and handling of the cartridge (i.e., outside the player compartment). The retracted position provides a location for the stylus 55 withdrawn within the confines of the cartridge 45 remote from an opening 64 in the cartridge through which the stylus protrudes when the stylus housing 34 is in the off-record rest position 38 (Figure 10) and the above-record play position 39 (Figure 11).

An angular orientation of the front surfaces of the elastic straps 59 and 59^1 relative to the cartridge 45 (e.g., perpendicular to the bottom surface of the cartridge), the angular orientation of the connector plate 54 relative to the front surfaces of the elastic straps (e.g., 8°) and the angular orientation of the compliant member 53 relative to the connector plate (e.g., 94°) is such that, when the stylus arm 51 is held in a retracted position in the cartridge, the compliant member is axially aligned with the stylus arm (and therefore relaxed because not bent) although the stylus arm is well up into the cartridge for protection. Axial alignment of the compliant member 53 with the stylus arm 51 during retention in the retracted position is advantageous because it prevents formation of a "set" in the compliant member during storage and handling of the cartridge 45.

Figure 3 illustrates the side view of the video disc player 30. A portion of the stylus housing 34 is broken away to show the stylus arm lifting/lowering apparatus mounted in the stylus housing compartment 44. The cartridge 45 is shown outside the stylus housing compartment 44.

The stylus arm lifting/lowering apparatus 47 of the present invention will now be described. Figure 4 illustrates the perspective view and Figure 5 illustrates a cross section of the stylus arm lifting/lowering apparatus 47. The apparatus includes a support structure 65 which is mounted within the stylus housing compartment 44 as shown in Figure 3. An electromagnet 66 is secured to the structure 65. The electromagnet 66 comprises a coil 67 wound about a magnetizable core 68. The magnetizable core 68 includes a pair of pole pieces 69 and 69^1 which define an air gap 70. The ends of the coil 67 are connected to a pair of terminals 71 and 71^1 (Figure 5).

One end of a leaf spring 72 is secured to the structure 65. The free end of the leaf spring 72 carries a stylus arm rest 73. The leaf spring 72 permits motion of the stylus arm rest 73 between an elevated position (Figure 9) and a depressed position (Figures 10—11). The stylus arm 73 in the elevated

position supports the stylus arm 51 in a raised position (Figure 9). The raised position of the stylus arm 51 precludes stylus/record contact when the stylus housing 34 is in the above-record play position 39.

The stylus arm rest 73 in the depressed position permits the stylus arm 51 to accupy a lowered position (Figures 10—11). The lowered position of the stylus arm establishes stylus/record contact when the stylus housing 34 is in the above-record play position 39.

Further the angle between the compliant member 53 and the connector plate 54, during containment of the cartridge 45 in the stylus housing compartment 44, is such that when the stylus arm 51 is in the lowered position, the compliant member is aligned with the stylus arm (and hence the compliant member is relieved).

A permanent magnet 74 is secured to the stylus arm rest 73 such that when the stylus arm rest is in the elevated position the permanent magnet is in close proximity to the air gap 70.

A circuit 75, shown in Figure 7, supplies a ramp voltage across the terminals 71 and 71^1 of the coil 67. The ramp voltage across the terminals 71 and 71^1 causes a controlled current of a given polarity to flow through the coil 67. The controlled current in the coil 67 establishes electromagnetic flux gradient in the air gap 70.

The orientation of the permanent magnet 74 relative to the gap 70 is such that the permanent magnet is repelled away from the gap in the presence of the controlled current of the given polarity in the coil 67. The electromagnetic repulsion of the permanent magnet 74 out of the air gap causes the stylus arm rest 73 to assume the depressed position (Figures 10 and 11).

When a switch 76 is closed, a capacitor 77 is charged through a resistor 78 to the DC supply voltage in the circuit 75 of Figure 7. The time constant of the RC circuit determines the rate of increase of voltage across the coil 67. The rate of increase of voltage across the coil 67 in turn, determines the rate at which the stylus arm rest 73 cbarrying the stylus arm 51 is lowered. By proper selection of the time constant of the RC circuit, a gentle set down of the stylus 55 on the record 31 for the playback can be assured.

In the circuit 75 of Figure 7, a transistor 79 is used as an impedance matching device to match the high impedance of the RC network to the low impedance of the coil 67 in the electromagnet.

To assure that the permanent magnet 74 is repelled downward from the electromagnet 66 upon the energization of the given polarity, the center of the air gap 70 is elevated with respect to the location of the permanent magnet 74, when the stylus arm rest is in the elevated position, as in the air gap arrangement shown in Figure 5, or the alternative air gap arrangement shown in Figure 6.

As shown in Figures 4—5, a plunger 80 is reciprocably mounted in the support structure 65. A base 81 of the plunger 80 rests on the leaf spring 72, for reasons stated subsequently.

Figures 8—11 illustrate the sequence of operations. As shown in Figure 8, a linkage 82 moves the armstretcher 46 toward the cartridge 45 in response to the motion of a lid 83 of the stylus housing 34. The armstretcher 46 causes a cyclical movement of a support member 84 to serve the above noted velocity correction purposes.

When the stylus housing lid 83 is closed, as shown in Figure 9, (1) the support member 84 rigidly engages the connector plate 54 for transmitting the cyclical motion to the stylus 55; and (2) a defeat lever 85, secured to stylus housing lid 83, depresses the clamping spring 63 to allow the stylus arm 51 to rest on the stylus arm rest 73.

When the hinged plate 40 is closed, as shown in Figure 10 a cam member 86, secured to the hinged plate, depresses the plunger 80 to cause the stylus arm rest 73 to assume the depressed position. When the stylus housing 34 is in the off-record rest position 38, the depression of the plunger 80 disposes the stylus arm 51 in the lowered position with the free end of the stylus arm being supported by the stylus 55 resting on a stylus brush 87.

When the stylus housing 34 moves from the off-record rest position 38 (Figure 10) to the above-record play position 39 (Figure 11), moving plunger 80 away from the vicinity of cam member 86, the leaf spring 72 lifts the stylus arm rest 73 to the elevated position, allowing the stylus 55 to clear the outer bead of the record 31, as the depression of the plunger 80 is no longer maintained by the cam member 86.

When the stylus housing 34 reaches a desired above-record play position 39, closing of switch 76 in the circuit 75 of Figure 7 energizes the electromagnet 66 to repel the permanent magnet 74 in a manner that causes the stylus arm rest 73 to assume the depressed position as shown in Figure 11. When the stylus housing 34 is in the above-record play position, the repulsion of the permanent magnet 74 disposes the stylus arm 51 in the lowered position establishing stylus/record contact for playback.

Upon playback completion, an opening of switch 76 effects a rapid decrease in the energization of the electromagnet 66, and a consequent lifting of arm rest 73 by spring 72. As stylus housing 34 returns to its rest position 38, however, engagement of cam

member 86 by plunger 80 causes plunger 80 to depress arm rest 72, returning arm 51 to its lowered position.

In Figure 12, the stylus arm unit 50 again comprises a stylus arm 51 formed with an aluminum tube with a plastic stylus holder 52 insert molded at one end of the stylus arm and a compliant member 53 insert molded at the other end of the stylus arm. The conductive connector plate 54, secured to compliant member 53, is flexibly suspended in the cartridge 90 by elastic means 58.

The cartridge 90 further includes a leaf spring 91, in the form of a ribbon, for urging the stylus 55 in the record groove during playback. One end of the leaf spring 91 is secured to the stylus 55. The other end of the leaf spring 91 is secured to the free end of a cantilever beam 92. Slots in the top wall of the cartridge 90 allow a strip-like portion of the top wall to function as the cantilever beam 92.

The location of the free end of the cantilever beam 92 with respect to the bottom surface of the cartridge 90, and the configuration of the leaf spring 91 is such that the stylus arm is held in a retracted position in the cartridge for protection. The retracted position provides a location for the stylus 55 withdrawn within the confines of the cartridge 90 remote from an opening in the bottom surface of the cartridge through which the stylus protrudes when the stylus housing 34 overlies the record 31 for playback.

When a lid 38 of the stylus housing 34 is closed during containment of the cartridge 90 in the stylus housing compartment 44, a defeat lever 83[1] secured to the stylus housing lid depresses the free end of the cantilever beam 92 to lower the stylus arm 51 on a stylus arm rest 95 of a stylus arm lifting/lowering apparatus 96. The cartridge 90 has a compartment which overlies the stylus arm lifting/lowering apparatus during containment of the cartridge in the stylus housing compartment 44.

Figures 13—16 illustrate a perspective view, a side view, a plan view, and a front view of the stylus arm lifting/lowering apparatus 96. The principle of magnetic repulsion of like poles is utilized to effect depression of the stylus arm rest 95 when the stylus housing 34 overlies the record to cause a gradual lowering of the stylus on the record 31 for playback.

The illustrated mechanism includes a structure 97 for an electromagnet formed by a coil 98, wound about an iron core 99 having a forward projecting pole piece 100. A pivot pin 101 extends through registered openings in spaced projections 102, 103 of the forward end of the structure 97 with sufficient clearance to permit rotation of the pivot pin in the openings. Secured to the pivot pin 101, between the projections 102, 103 in a plastic member 104 in which is embedded a permanent magnet 105. An extension 106 of the pivot pin 101 protrudes from one side of the structure 97. The stylus arm rest 95 is secured to the extension 106.

The pivot point for the plastic member 104 is so located that (in the absence of energization of the electromagnet) the weight of the magnet 105 causes the plastic member 104 to assume a downward extending position (i.e., rest position) in which the plastic member 104 abuts the forward end of the structure 97 with the permanent magnet 105 lying in close proximity to the pole piece 100. Under these conditions, the stylus arm rest 95 occupies the elevated position.

When, however, the coil 98 is energized with current of a polarity causing the pole piece 100 to assume the same poling as the proximate face of the permanent magnet 105 the force of repulsion between like poles causes the plastic member 104 to pivot away from the downward extending position of abutment with the forward end of the structure 97, with the amount of rotation of the plastic member being dependent upon the magnitude of the current in the coil 108. An illustrative repelled position for the plastic member 104 and the resultant depressed position for the stylus arm rest 95 is shown in Figure 12. The depressed position of the stylus arm rest 95 is desirably lower than that required to achieve stylus/record contact, whereby the stylus arm 51 is freed from contact with the stylus arm rest.

The described stylus arm lifting/lowering system has a number of advantages:

(1) The rate of lowering the stylus arm to the record is controlled electrically and can easily be varied.

(2) The mechanism is such that the stylus arm can be placed in the "play" attitude when the video disc player is "off". This allows the stylus arm to rest in a normal unstressed position so that rubber molded parts on the stylus arm do not take a permanent set during long idle periods.

(3) The device uses an efficient magnetic circuit so that only small current and power are required for operation.

(4) This device is small and compact for convenient fitting in the player's stylus housing.

WHAT WE CLAIM IS:—

1. In a system for playing back prerecorded signals from a spirally grooved record disposed on a turntable rotatably mounted with respect to a base of said playback system, said system including a stylus

member 86 by plunger 80 causes plunger 80 to depress arm rest 72, returning arm 51 to its lowered position.

In Figure 12, the stylus arm unit 50 again comprises a stylus arm 51 formed with an aluminum tube with a plastic stylus holder 52 insert molded at one end of the stylus arm and a compliant member 53 insert molded at the other end of the stylus arm. The conductive connector plate 54, secured to compliant member 53, is flexibly suspended in the cartridge 90 by elastic means 58.

The cartridge 90 further includes a leaf spring 91, in the form of a ribbon, for urging the stylus 55 in the record-groove during playback. One end of the leaf spring 91 is secured to the stylus 55. The other end of the leaf spring 91 is secured to the free end of a cantilever beam 92. Slots in the top wall of the cartridge 90 allow a strip-like portion of the top wall to function as the cantilever beam 92.

The location of the free end of the cantilever beam 92 with respect to the bottom surface of the cartridge 90, and the configuration of the leaf spring 91 is such that the stylus arm is held in a retracted position in the cartridge for protection. The retracted position provides a location for the stylus 55 withdrawn within the confines of the cartridge 90 remote from an opening in the bottom surface of the cartridge through which the stylus protrudes when the stylus housing 34 overlies the record 31 for playback.

When a lid 38 of the stylus housing 34 is closed during containment of the cartridge 90 in the stylus housing compartment 44, a defeat lever 83^1 secured to the stylus housing lid depresses the free end of the cantilever beam 92 to lower the stylus arm 51 on a stylus arm rest 95 of a stylus arm lifting/lowering apparatus 96. The cartridge 90 has a compartment which overlies the stylus arm lifting/lowering apparatus during containment of the cartridge in the stylus housing compartment 44.

Figures 13—16 illustrate a perspective view, a side view, a plan view, and a front view of the stylus arm lifting/lowering apparatus 96. The principle of magnetic repulsion of like poles is utilized to effect depression of the stylus arm rest 95 when the stylus housing 34 overlies the record to cause a gradual lowering of the stylus on the record 31 for playback.

The illustrated mechanism includes a structure 97 for an electromagnet formed by a coil 98, wound about an iron core 99 having a forward projecting pole piece 100. A pivot pin 101 extends through registered openings in spaced projections 102, 103 of the forward end of the structure 97 with sufficient clearance to permit rotation of the pivot pin in the openings. Secured to the pivot pin 101, between the projections 102, 103 in a plastic member 104 in which is embedded a permanent magnet 105. An extension 106 of the pivot pin 101 protrudes from one side of the structure 97. The stylus arm rest 95 is secured to the extension 106.

The pivot point for the plastic member 104 is so located that (in the absence of energization of the electromagnet) the weight of the magnet 105 causes the plastic member 104 to assume a downward extending position (i.e., rest position) in which the plastic member 104 abuts the forward end of the structure 97 with the permanent magnet 105 lying in close proximity to the pole piece 100. Under these conditions, the stylus arm rest 95 occupies the elevated position.

When, however, the coil 98 is energized with current of a polarity causing the pole piece 100 to assume the same poling as the proximate face of the permanent magnet 105 the force of repulsion between like poles causes the plastic member 104 to pivot away from the downward extending position of abutment with the forward end of the structure 97, with the amount of rotation of the plastic member being dependent upon the magnitude of the current in the coil 108. An illustrative repelled position for the plastic member 104 and the resultant depressed position for the stylus arm rest 95 is shown in Figure 12. The depressed position of the stylus arm rest 95 is desirably lower than that required to achieve stylus/record contact, whereby the stylus arm 51 is freed from contact with the stylus arm rest.

The described stylus arm lifting/lowering system has a number of advantages:

(1) The rate of lowering the stylus arm to the record is controlled electrically and can easily be varied.

(2) The mechanism is such that the stylus arm can be placed in the "play" attitude when the video disc player is "off". This allows the stylus arm to rest in a normal unstressed position so that rubber molded parts on the stylus arm do not take a permanent set during long idle periods.

(3) The device uses an efficient magnetic circuit so that only small current and power are required for operation.

(4) This device is small and compact for convenient fitting in the player's stylus housing.

WHAT WE CLAIM IS:—

1. In a system for playing back pre-recorded signals from a spirally grooved record disposed on a turntable rotatably mounted with respect to a base of said playback system, said system including a stylus

arm carrying a groove-riding stylus at one end thereof, and being pivotally secured, at the end thereof remote from said one end to a support member:

apparatus comprising:

a movable element secured to said support member for movement between a first location and a second location, said movable element including a permanent magnet;

a stylus arm rest secured to said movable element and engageable with said stylus arm in a region thereof away from said pivoted end of said stylus arm, the arrangement being such that said stylus arm rest occupies an elevated position when said movable element is in said first location, and a depressed position when said movable element is in said second location, said stylus arm rest in said elevated position supporting said stylus arm in a manner precluding stylus/record contact and in said depressed position permitting the stylus arm to establish such contact when the stylus overlies a record for playback;

a stationary element secured to said support member and including means for generating magnetic flux, the location of said stationary element being such that said permanent magnet is located in proximity to said magnetic flux generating means when said stylus arm rest is in said elevated position; and

selectively operated means for providing energization of said magnetic flux generating means in a direction to generate such flux with a given polarity the orientation of said permanent magnet relative to said magnetic flux generating means being such that said permanent magnet is repelled away from said magnetic flux generating means during said energization of the latter, and the repulsion of said permanent magnet causing motion of said stylus arm rest from said elevated position to said depressed position.

2. Apparatus as defined in Claim 1 wherein said support member comprises a stylus arm carriage mounted for lateral motion with respect to said record in correlation with lateral motion of said groove riding stylus during playback.

3. An apparatus as defined in Claim 2 wherein said selectively operated means causes said energization of said magnetic flux generating means when said stylus arm carriage overlies said record to lower said stylus arm to establish stylus/record contact for playback.

4. An apparatus as defined in Claim 2 wherein:

said magnetic flux generating means comprises a coil wound about a magnetizable core having a pole piece;

said selectively operated means is effective to cause a unidirectional controlled current to flow through said coil to provide said energization;

said location of said stationary element is such that a pole of said permanent magnet is situated in close proximity to said pole piece when said movable element is in said first location; and the polarity of said pole of said permanent magnet is the same as the polarity of said pole piece in the presence of said unidirectional controlled current in said coil to effect said repulsion of said permanent magnet.

5. An apparatus as defined in Claim 4 wherein: said movable element is fixedly secured to a pivot pin having an axis which is disposed substantially perpendicular to, and offset from, the axis of said permanent magnet; said stationary element includes means for permitting adjustable rotation of said pivot pin such that said pole of said permanent magnet is located in close proximity with said pole piece of said magnetizable core in the absence of said unidirectional controlled current in said coil; said stylus arm rest is secured to said pivot pin such that the axis of said stylus arm rest is substantially parallel to, and offset from, said axis of said pivot pin; and the positioning of said stylus arm rest on said pivot pin serves to locate said stylus arm rest in said elevated position while said coil remains deenergized, and to locate said stylus arm rest in said depressed position while said coil remains energized.

6. Record playback appears having a stylus arm positioning arrangement substantially as hereinbefore described with reference to Figures 3—6 or Figures 12—16 of the accompanying drawings.

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