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Yuki et al.

[11] **3,901,516**

[45] **Aug. 26, 1975**

[54] **APPARATUS FOR PREVENTING OBLIQUE MOVEMENT OF A PICKUP FOR A RECORD PLAYER DURING ITS ASCENDING OR DESCENDING MOVEMENT**

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[21] Appl. No.: **464,196**

Related U.S. Application Data

[63] Continuation of Ser. No. 256,968, May 25, 1972, abandoned.

[30] **Foreign Application Priority Data**

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May 29, 1971 Japan ..... 46-44483[U]

[52] **U.S. Cl.** ..... **274/1 D**
[51] **Int. Cl.** **G11b 19/22**
[58] **Field of Search** ..... 274/23, 1 D

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Attorney, Agent, or Firm—Cushman, Darby & Cushman

[57] **ABSTRACT**

During the reproduction on a record player, a force is always acting on a pickup arm stylus in a direction from the peripheral portion of the rotating disc record toward the center thereof. In order to cancel this inwardly acting force, a constantly acting counterbalancing force is usually applied to the pickup arm having the stylus to balance the former force. However, said counterbalancing force is objectionable when the stylus is descending to or ascending from the disc record, since this force, having no force to be balanced, causes the stylus to move obliquely. Apparatus of the invention comprises means for frictionally or magnetically engaging with the pickup arm to prevent the stylus from its oblique movement.

11 Claims, 11 Drawing Figures

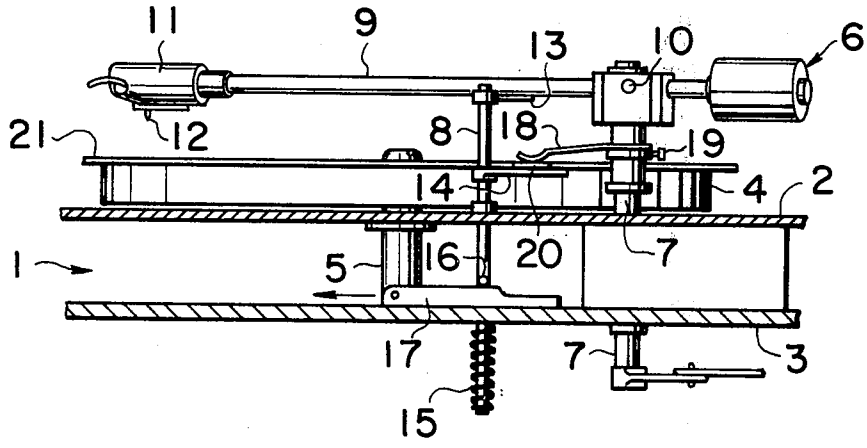


FIG. 1(a)
PRIOR ART

FIG. 1(b)
PRIOR ART

FIG. 2

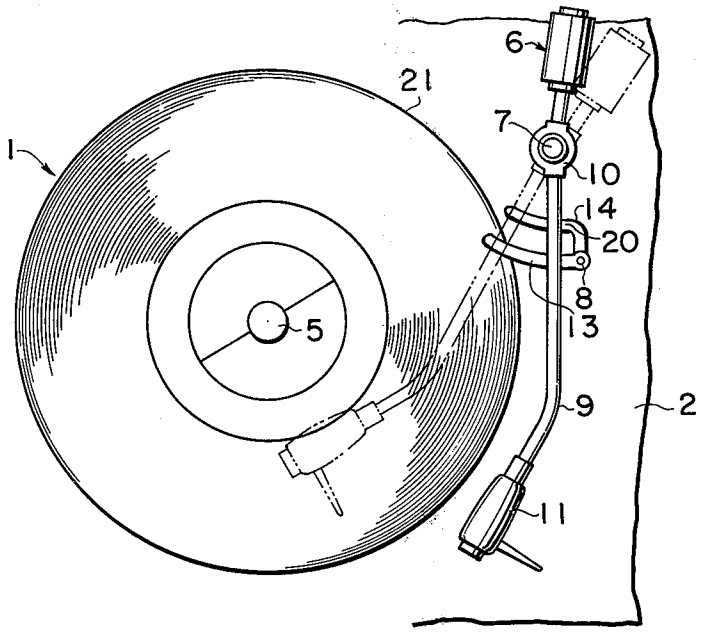


FIG. 3

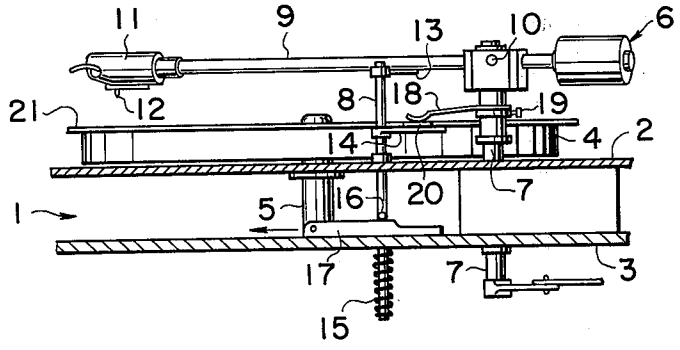


FIG. 4

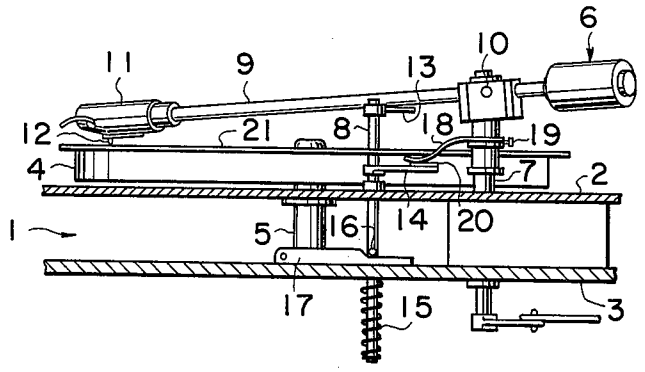


FIG. 5

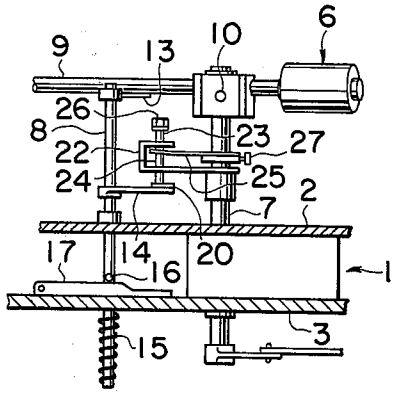


FIG. 6

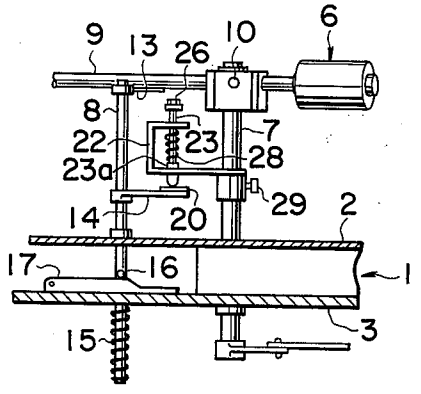


FIG. 7

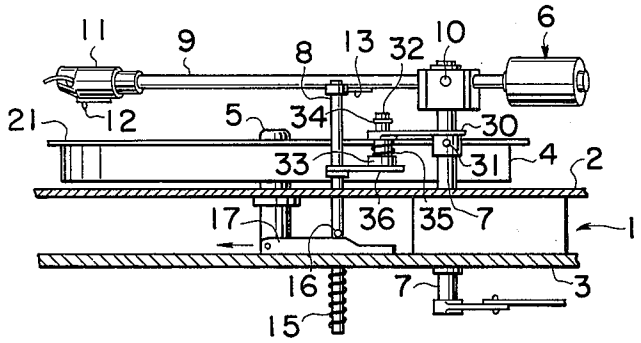


FIG. 8

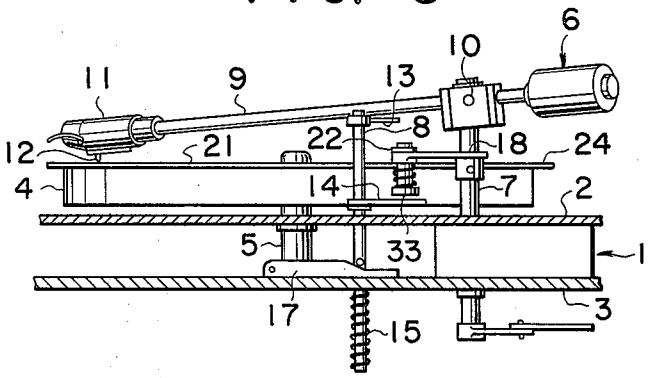


FIG. 9

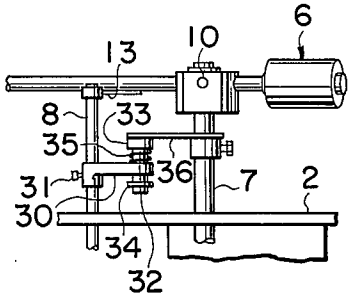
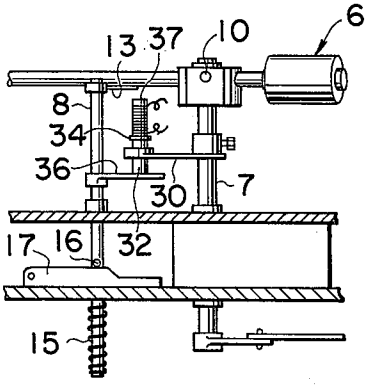


FIG. 10



APPARATUS FOR PREVENTING OBLIQUE MOVEMENT OF A PICKUP FOR A RECORD PLAYER DURING ITS ASCENDING OR DESCENDING MOVEMENT

PRIOR ART

This is a continuation of application Ser. No. 256,968 filed May 25, 1972, now abandoned.

As known in the art, when a stylus of a pickup is tracing a sound track of a rotating record disc, there is produced an inside force, that is, a force acting on the stylus in a direction from the peripheral portion of the disc record toward the center thereof. This inside or inwardly acting force is required in order to gradually guide the pickup (the stylus) along the sound track from its outer periphery to its inner periphery. Normally, the inside force acting on the stylus is greater when the pickup stylus lies in the sound track of the outer periphery and becomes smaller as the pickup stylus moves toward a middle portion and again becomes greater when it is in the inner periphery. Since the variation of this inside force acts on the stylus as an irregular horizontal side pressure, a fidelity of reproduction is lowered. Particularly in the reproduction of stereo record, distorsion between the left and right reproduced sounds appears notably.

Recently, for the purpose of eliminating the above difficulties, there has been developed an apparatus for introducing counteraction force in connection with a pivotal movement angle of the pickup for cancelling extra inside force and it has been put into practice. (Hereinafter, such a counteraction force is referred to as a cancelling force and the apparatus for producing such a force is referred to as an inside force canceller.)

The pickup provided with such an inside force canceller may always assure the best stylus pressure condition whichever stylus is tracing a sound track on an inner periphery of the record disc or on an outer periphery of the record disc.

However, while the inside force is produced only when the pickup stylus is tracing the sound track on the record disc, the cancelling force from the inside force canceller always acts on the pickup stylus. Accordingly, when the pickup is tracing the sound track, the inside force and the cancelling force cancel each other leaving an inside force just sufficient to trace the sound track. But when the stylus is elevated away from the sound track, the inside force no longer appears in the pickup and only the cancelling force acts on. Accordingly, the pick up in a floating position would receive a cancelling force which tends to move the pickup away from a rotational center of a turn table (record).

For this reason, upon playing the record, when the pickup is descended to the record disc or the pickup is elevated to move away from the record disc, the pickup tends to move in a diagonal or oblique direction. Namely, upon descending movement of the pickup (stylus), the stylus descends diagonally or obliquely toward the outer periphery of the record disc as shown with dotted arrow in FIG. 1*a*, while upon ascending movement of the pickup the stylus diagonally or obliquely elevates toward the outer periphery of the record disc. Thus, difficulties are encountered in positioning the pickup (the stylus), which is very inconvenient to the operating of an auto-player mechanism. In addition to this, there exists a danger in that a record disc may be damaged or the stylus and a cantilever may be broken.

SUMMARY OF THE INVENTION

In the light of the above, the present invention is intended to eliminate the above difficulties by defining the ascending and descending movement of the pickup relative to the turn table, in a right vertical direction.

According to the present invention, means for provided in connection with an auto-player mechanism for operating the pickup for preventing the oblique movement of the pickup due to the cancelling force as described above by utilizing a constant braking force during a time period from the beginning of the movement of the stylus away from the sound track of the record disc to the time at which the stylus elevates to a predetermined height or from the beginning of the descending movement of the stylus to the time immediately before the stylus makes contact with the sound track.

The apparatus in accordance with the present invention is characterized in that said braking force is frictionally or magnetically produced. The frictional braking force may be produced by bringing a member, which is displaced in connection with the ascending and descending movement of the pickup into a frictional contact with a plate member of a pivot shaft of the pickup, or by a frictional spring contact. The magnetic braking force may be produced by mounting a member of magnetic material on one of the members which are displaced relatively in connection with the ascending and descending movement of the pick up and by mounting a permanent magnet or an electromagnet on the other of the members to produce an attractive force therebetween. Depending upon whether the braking force is frictional one or magnetic one, the form in which the present invention is embodied differs. Through specific description on respective embodiment(s) the features of those embodiments S will be fully understood.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1*a* and 1*b* illustrate displacement of a stylus of prior art relative to a record track.

FIG. 2 illustrate a first embodiment which is a basic one of the present invention, showing a plan view of a major portion of a device utilizing frictional braking force.

FIGS. 3 and 4 are front view and side view partly in section, respectively, thereof.

FIG. 5 is a side view of a major portion of a second embodiment associated with the first embodiment.

FIG. 6 is a side view of a major portion of a third embodiment associated with the first embodiment.

FIGS. 7 and 8 show a fourth embodiment which is another basic one of the present invention, showing cross-sectional side views of a major portion of a device utilizing magnetic braking force.

FIG. 9 is a side view of a major portion of a fifth embodiment associated with the fourth embodiment.

FIG. 10 is a side view of a major portion of sixth embodiment associated with the fourth embodiment.

DETAILED DESRCIPTION OF THE PREFERRED EMBODIMENTS

As described above, a major part of an apparatus of the present invention for guiding the stylus in a right vertical direction lies in the construction for producing frictional braking force or magnetic braking force.

The first embodiment, which is a basic one, shows a principal structure utilizing frictional brake and the second and third embodiments are modifications of the first embodiment. The fourth embodiment, which is another basic one, shows a principal structure utilizing magnetic braking force and the fifth and sixth embodiments are modifications of the fourth embodiment.

Each of the embodiments will now be explained more specifically with reference to the drawings in which the corresponding reference numerals are used for the similar parts throught the embodiments.

EMBODIMENT 1 (See FIGS. 2–4)

The apparatus of this embodiment is a basic one for producing frictional braking force due to resilient contact under pressure between a movable member (friction plate) and a surface of a portion of a leaf spring.

In the drawings, on frames **2** and **3** of a record player **1** there are mounted in upstanding position a rotary shaft **5** of a turn table **4**, a pivot shaft **7** pivotally supporting a pickup **6**, and a tone arm guiding member **8**. The turn table **4** may be driven by a motor (not shown) or the like, and the pivot shaft **7** extends to a mechanism for operating the pickup **6**. A tone arm **9** of the pickup **6** is supported by an arm carrying shaft **10** mounted on the pivot shaft **7**, and has a cartridge **11** and a stylus **12** mounted at its extreme end. The tone arm **9** is movable in a vertical direction, that is, makes a descending and ascending movement, and is further movable about the pivot shaft **7** in a horizontal direction, that is, in a direction perpendicular to the vertical direction. The tone arm guiding member **8** is provided with a support plate **13** for supporting the tone arm **9** and a friction plate **14** for preventing oblique or diagonal descending or ascending movement of the pickup **6**, the support plate **13** and the friction plate **14** being formed in arcuate shape so that they are within a pivot angle of the pickup **6**. The tone arm guiding member **8**, which is always urged downwardly with the spring action of a coiled spring **15**, is arranged to be moved upwardly against the spring **15** with an arm elevating cam plate **17** which is advanced or retracted with a well-known auto-play mechanism (not shown) and a pin **16** fixed to the arm **8**. Mounted to the pivot shaft **7** is a leaf spring **18** which is urged to the friction plate **14**, making spring contact or frictional engagement with an upper surface of the friction plate **14**. The leaf spring **18** is mounted on the shaft **7** by a screw **19** so that it may be adjusted in fixing position. While a frictional force is produced between the upper surface of the friction plate **14** and a lower surface of the leaf spring **18**, a rubber piece **20** may be adhered to the surface of the friction plate **14** in order to increase the degree to which the frictional engagement is made.

Although not shown in the drawings, the inside force canceller hereinbefore defined may further be provided. A coiled spring is usually used as the inside force canceller and is streched between the one arm **9** and a stationary part, so that the cancelling force hereinbefore defined acts on the stylus **12** to cancel the inside force.

The operation of the present embodiment thus constructed will now be described.

When it is described to operate the record player **1**, a record disc or disc record **21** is first placed on the turn table **4** before the auto-play mechanism, motor or the like is put in operating condition.

The record player **1**, prior to play, has its pickup **6** supported on the tone arm guiding member **8** as shown in FIG. **3** while the friction plate **14** and the leaf spring **18** resiliently making contact with each other. When the turn table **4** rotates for the play and the auto-play mechanism begins to operate, the arm elevating cam plate **17** is moved with the auto-play mechanism in the direction of the arrow in FIG. **3** so that the guiding member **8** descends by a distance equal to the displacement of a cam surface of the cam plate **17** under the influence of downward force of the spring **15**. Through the descending movement of the guiding member **8**, the stylus **12** of the pick up **6** is placed on a predetermined sound track of the record disc **21** as shown in FIG. **4**. Until immediately before the stylus **12** approximates to the surface of the record disc **21**, the friction plate **14** and the leaf spring **18** makes frictional contact due to the resilient force of the spring **18**, but they disengage the friction contact and are apart from each other when the stylus **12** makes contact with the sound track of the record disc **21**.

Accordingly, so long as the leaf spring **18** makes frinctional contact with the friction plate **14**, the pickup **6** is subject to braking force due to the frictional contact under pressure even if the cancelling force hereinbefore defined is applied to the pickup **6** or a horizontal force is applied by any other reasons, so that the pickup **6** may right vertically descend as shown by a solid line arrow of FIG. **1***a* without any sidewise oscillation or movement.

On the other hand, when the pickup **6** (the stylus **12**) is to be lifted from the surface of the record disc **21**, the cam plate **17** is returned to its original position with the auto-play mechanism to lift tone arm guiding member **8**, the support plate **13** of which simultaneously lifts the tone arm **9** of the pick up **6**. Again, immediately after the stylus **12** leaves the sound track of the record disc **21**, a frictional braking force is applied between the friction plate **14** and the leaf spring **18** so that the pickup **6** is lifted right vertically as shown by a solid line arrow in FIG. **1***b*.

In this manner, until immediately before the stylus **12** of the cartridge **11** is placed on the sound track of the record disc **12** following the descending movement of the pickup **6**, or immediately after the stylus **12** of the cartridge **11** has left sound track of the record disc, the pickup **6** is subject to frictional braking force. Thus even if the cancelling force or any other external force is applied to the pickup **6**, it can move right vertically upward or downward without sidewise oscillation or movement because the cancelling force or other external force may be cancelled with said braking force. As a result, accurate positioning of the pickup **6** is attained, assuring that the autoplay mechanism may operate smoothly. Furthermore, it is assured that the sound track of the record disc **21** and the catridge **11** (particularly its canti-lever and stylus) are unlikely to be damaged.

In order to attain the above effect, the time at which the friction plate **14** and the leaf spring **18** separate from each other and the amount of the frictional braking force at that moment are important factors. In the basic embodiment described above, by changing the vertical position of the leaf spring **18**, that is, the mounting position of the leaf spring **18** with respect to the pivot shaft **7**, the time at which the friction plate **14** and the leaf spring **18** are separated and the amount of the frictional braking force at the moment may be adjusted.

In the above embodiment as well as the second and third embodiments to be explained later, the leaf spring is mounted on the pivot shaft **7** and the friction plate **14** mounted on the tone arm guiding member **8**. However, it should be understood that the friction plate **14** may be mounted on the pivot shaft **7** and the leaf spring on the member **8**.

EMBODIMENT 2(See FIG. 5)

The apparatus of this embodiment is a modification for producing frictional braking force. In this apparatus, a friction rod **23** is forced to contact against the upper surface of the friction plate **14** under the spring action of the leaf spring to produce frictional braking force due to the contact therebetween. Fixed to the pivot **7** is a support arm **22** of U-shape, to which is mounted the friction rod **23** in vertically movable manner. On a pin **24** fixed to the rod **23** the leaf spring **25** makes resilient contact. The friction rod **23** has its upper portion a descending position adjusting nut **26**, and the leaf spring **25** is provided with a screw **27** for changing the mounting position of the spring **25** with respect to the pivot shaft **7** to adjust the spring force.

The apparatus of the present embodiment operates in a similar manner as the basic embodiment **1** described above does. Since the leaf spring **25** is pressed against the friction plate **14** through the friction rod **23** which can descend only by a predetermined displacement, any desired amount of contact pressure and hence the frictional braking force may be obtained during the time when the friction rod **23** is in engagement with the friction plate **14**.

EMBODIMENT 3 (See FIG. 6)

In this embodiment, instead of the leaf spring **25** as in the embodiment **2**, a coiled compression spring **28** is mounted between an upper part of the support arm **22** and an abutment **23***a* of the friction rod **23**. The support arm **22** is fixed on the shaft **7** by means of a screw **29**. The operation of this embodiment is substantially the same as that of the embodiment **2** and hence may be omitted.

Again, in this embodiment, by adjusting spring force of the spring **28** and appropriately establishing the amount of descending displacement of the friction rod **23**, a necessary frictional braking force may be obtained during the time when the friction rod **23** is in engagement with the friction plate **14**. Furthermore, the friction plate **14** and the support arm **22** may be mounted in opposite relation with respect to the pivot shaft **7** or the tone arm guiding member **8** for attaining the same function and effect.

EMBODIMENT 4 (See FIGS. 7 and 8)

The apparatus of this embodiment is a basic one in which magnetic braking force is produced by magnetic attractive force acting between a movable member (braking member) and a magnet. In the apparatus of the present embodiment, a support arm **30** is secured to a pivot shaft **7** by a screw **31** so that the mounting position thereof may be adjustable. At the tip end of the support arm **30**, a movable lever **32** is mounted for vertical movement. The movable lever **32** has a permanent magnet **33** attached at its lower end and a stopper **34** formed at its upper end. The movable lever **32** always tends to descend due to the gravity; however it may be actuated by the spring force of a coiled compression spring **35** disposed between the arm **30** and the magnet **33**. Fixed to the tone arm guiding member **8** is a braking plate **36** of magnetic material which has contour corresponding to pivotal trace of the permanent magnet **33**.

The apparatus of the present embodiment thus constructed will operate in the following manner. When it is desired to play the record player **1**, the record disc **21** is first placed on the turn table and then the motor, the auto-play mechanism or the like is put into operation. Prior to the play, the pickup **7** of the record player **1** is supported by the member **8** as shown in FIG. 7, and the magnet **33** is attracted to the braking plate **36** to lift the movable lever **32**. When the turn table **4** is rotated for play and the auto-play mechanism starts to operate, then the arm elevating cam plate **17** is moved with the auto-play mechanism in the direction of the arrow in FIG. 7, so that the tone arm guiding member **8** is subject to descending force of the spring **15** and descends by the amount equal to the displacement of the cam surface of the cam plate **17**. By the descending movement of the member **8**, the stylus **12** of the pickup **6** is placed on a predetermined sound track of the record disc **21**. Until immediately before the stylus **12** comes near to the surface of the record disc **21**, the braking plate **36** and the magnet of the movable lever **32** are kept attracted by the magnetic attractive force. However, when the stylus **12** is brought into contact with the sound track of the record disc **21**, the braking plate **36** and the magnet **33** are separated from each other because the descending movement of the movable lever **32** is restricted by the contact of the stopper **34** with the support arm **30**. Accordingly, so long as the magnet **33** of the movable lever **32** is attracted to the braking plate **36**, the pickup **6** does not make sidewise oscillation or movement because of the magnetic attractive force, even if the cancelling force or other sidewise-acting force, for some reason, is applied to the pickup **6**.

On the other hand, when the pickup **6** (the sylus **12**) is to be lifted from the surface of the record disc **21**, the cam plate **17** is returned to its original position with the auto-play mechanism to lift the tone arm guiding member **8** and the tone arm **9** of the pickup **6** is lifted by the support plate **13**. Again, in this case, immediately after the stylus **12** leaves the sound track of the record disc **21**, magnetic braking force is applied between the braking plate **36** and the magnet **33**.

Thus, until immediately before the pickup **6** descends and the stylus **12** of the cartridge **11** is placed on the sound track of the record disc **21**, or immediately after the pickup **6** ascends and the stylus **12** of the cartridge **11** leaves the sound track of the record disc **21**, the pickup **16** is subject to magnetic braking force.

In order to attain the above effect, the time at which the braking plate **36** and the magnet **33** separate from

each other and the amount of the magnetic braking force at that moment are important factors. In this basic embodiment, by changing the position of the magnet **33**, that is, the vertical mounting position of the support arm **30** with respect to the pivot shaft **7**, the time at which the braking plate **36** and the magnet **33** are separated and the amount of the magnetic braking force at that moment can be adjusted.

EMBODIMENT 5 (See FIG. 9)

The embodiment is a modification for obtaining magnetic braking force. In the apparatus of the present embodiment, the braking plate **36** is mounted on a pivot shaft **7** and the support arm **30** is mounted to the lift arm **8**. With the braking plate **36** and the support arm **30** mounted in opposite manner with respect to the previous basic embodiment, the vertical relationship between the braking plate **36** and the support arm **30** is also reversed. In such a case, since it is required to force the movable lever **32** supported by the support arm **30** toward the braking plate **36** against the gravity, the coiled compression spring **35** between the arm **30** and the magnet **33** is essential. Since the operation of the present embodiment is similar to that of the previous basic embodiment, the description of the operation may be omitted.

EMBODIMENT 6 (See FIG. 10)

The apparatus of this embodiment utilizes an electromagnet **37** instead of a permanent magnet. Since the electromagnet **37** can be excited and deactuated repetitively by turning on and off the current may be drawn only when the magnetic braking force is required. For example, the electromagnet may be excited only when the pickup is moved upwardly or downwardly, in connection with the upward or downward movement of the tone arm guiding member, through the actuation of a micro-switch or the like, and the electromagnet may be deactuated during other period. By such an arrangement the return movement of the pickup may be effected smoothly.

As described hereinabove, the apparatus in accordance with the present invention effectively prevents unintentional sidewise movement or oscillation of the pickup during its ascending or descending movement so that positioning of the pickup is facilitated and the record disc and the cartridge are unlikely to be damaged, thereby resulting in remarkable effect in a practical aspect.

Particularly in a record player system such as stereo player system or four-channel record player system wherein the variation between, right and left sound tracks is intended to be used to produce a special effect, the apparatus in accordance with the present invention is effective in that it enhances the reproduction fidelity.

It should be noted that the embodiments described and shown are illustration of most preferable ones of the present invention, and hence the present invention should not be limited to those particular constructions but it includes all equivalents known to those skilled in the art at the time of filing. The present invention is restricted only by the claims recited below but it should be noted that any change or modification thereof may be made without departing from the spirit of the invention.

What I claim is:

1. Apparatus of a record player for reproducing sound from a disc record, comprising a tone arm pivotally supported and provided with a stylus positioned over the disc record, said stylus being movable toward and away from the disc record in a vertical direction and further movable in another direction perpendicular to said vertical direction, a first member connected to said tone arm and movable therewith, and a second member located in a confronting relation to the first member, one of said first and second members being a magnet and the other of said first and second members being of a magnetic material, said first and second members being magnetically attracted to, and in contact with, each other when the stylus is moving toward and away from said disc record but out of contact when said stylus is positioned on said disc record, wherein the stylus is prevented from moving in said another direction by the friction force between said members generated by said magnetic attraction.

2. Apparatus as claimed in claim **1** further comprising a tone arm guiding member permitting the stylus to move to and away from the disc record, said second member being fixed to said tone arm guiding member.

3. Apparatus as claimed in claim **1** further comprising a pivot shaft pivotably supporting said tone arm, said first member being fixed to said pivot shaft, thus being connected in turn to said tone arm.

4. Apparatus as claimed in claim **1** further comprising a spring member urging one of said first and second members toward the other of said first and second members.

5. Apparatus as claimed in claim **1** wherein one of said first and second members is adjustable in relative position with respect to the other of said first and second members.

6. Apparatus as claimed in claim **1** wherein one of said first and second members comprises a support arm, and a friction member movably supported by said support arm and resiliently urged to the other of said first and second members.

7. Apparatus as claimed in claim **1** wherein said magnet is an electromagnet.

8. In a record player for reproducing sound from a disc record including a tone arm pivotally supported and provided with a stylus positioned over a disc record, said stylus being movable toward and away from the disc record in both a vertical and horizontal direction and an inside force cancelling means for equalizing the horizontal force exerted on the stylus as said stylus moves from the outside periphery to the inner periphery of said disc record, said force cancelling means tending to move said tone arm away from the rotational center of said disc record when said stylus is being moved toward and away from said disc record, the improvement comprising means for preventing said stylus from moving in said horizontal direction when said stylus is moving vertically toward and away from the disc record, said means comprising a tone arm guiding member permitting the stylus to move toward and away from the disc record, a friction plate mounted on said tone arm guiding member, means for moving said tone arm guiding member and said friction plate vertically with respect to said disc record to thereby move the stylus toward and away from the disc record, a spring member fixedly secured to said record player, said spring member frictionally engaging said friction plate when said stylus is moving toward and away from said

disc record, said stylus being prevented from moving in said horizontal direction by the frictional engagement.

9. The apparatus of claim **8** further comprising a pivot shaft pivotally supporting said tone arm, said spring member being fixed to said pivot shaft and accordingly being connected in turn to said tone arm.

10. The apparatus of claim **8** wherein said spring member and friction plate are adjustable in relative position with respect to one another.

11. In a record player for reproducing sound from a disc record including a tone arm pivotally supported and provided with a stylus positioned over a disc record, said stylus being movable toward and away from the disc record in both a vertical and horizontal direction, the improvement comprising:

means for preventing said stylus from moving in said horizontal direction when said stylus is moving vertically toward and away from the disc record, said means comprising a tone arm guiding member permitting the stylus to move toward and away from the disc record,

a friction plate mounted on said tone arm guiding member,

means for moving said tone arm guiding member and said friction plate vertically with respect to said disc record to thereby move the stylus toward and away from the disc record,

a spring member fixedly secured to said record player, said spring member frictionally engaging said friction plate when said stylus is moving toward and away from said disc record, said stylus being prevented from moving in said horizontal direction by said frictional engagement.

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