June 30, 1953 L. J. ANDRES 2,643,887

PHONOGRAPH TONE ARM

Filed Aug. 18, 1950

FIG. 1.

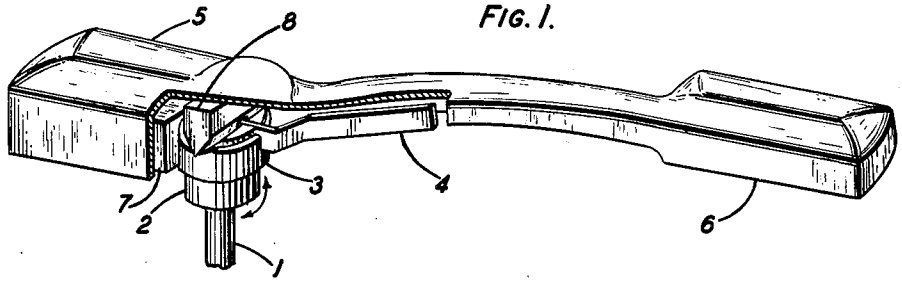


FIG. 2.

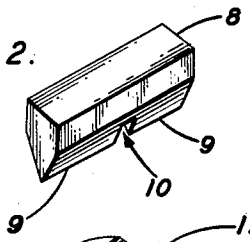
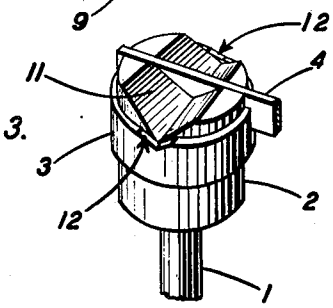


FIG. 3.



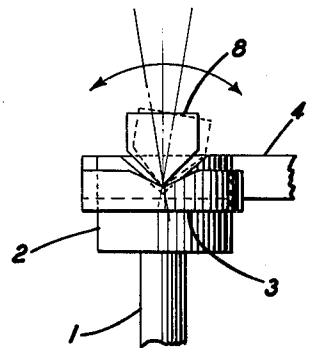


FIG. 4.

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PHONOGRAPH TONE ARM

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3 Claims. (Cl. 274—23)

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This invention relates in general to phonographs and, more particularly, to phonograph tone arms. It is well known that the tone arm in a phonograph must be provided with bearings for sensitive horizontal and vertical movement thereof. The introduction of microgroove records and the relatively small needle force required have resulted in the necessity for greater sensitivity in the tone arm bearings.

In tone arms prior to this invention the bearings were usually cylindrical pins, adjustable cone pivots or thin flexible members, such as flat springs. These methods have inherent faults which militate against faithful reproduction.

In the present invention a highly sensitive knife-edge bearing is provided for the vertical motion of the tone arm in which all lost motion is eliminated by the inclusion of a permanent magnet, which provides the principal object of the invention.

Another object of the invention is the provision of a quickly detachable low mass tone arm which is retained in operative relation with the phonograph mechanism by a permanent magnet acting through a sensitive V bearing.

A further object of the invention is the provision of a permanent magnet as one member of a vertical bearing and a paramagnetic mating bearing in the tone arm post with an intersecting blade of diamagnetic material for laterally positioning the tone arm.

These and further advantages of one embodiment of the invention are shown and described in the following drawing and specification, in which:

Figure 1 is a perspective view of the tone arm with a portion broken away;

Fig. 2 is a perspective view of the magnet element of the tone arm shown in Fig. 1;

Fig. 3 is a perspective view of a tone arm post showing the seating means for retaining the arm shown in Fig. 1;

Fig. 4 is a side elevation showing the magnet of Fig. 2 in operative relation with the seat shown in Fig. 3.

Referring to Fig. 1, a conventional vertical pivot 1 has secured to its upper end a diamagnetic bushing 2, around which is secured a paramagnetic ring or seat 3. A blade 4 intersecting and secured in the upper end of the bushing 2 and the ring 3 provides at its outer end a downward stop for the tone arm and its inner portion provides a guide for engaging and laterally positioning the arm 5, which is shown in its normal position, with a head end 6 adapted to

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retain a transducer (not shown), and a counterweight 7 secured in its opposite end for obtaining the desired vertical needle pressure on the transducer (not shown).

A permanent magnet 8 is secured transversely in the arm 5 as a fulcrum and is better shown in Fig. 2 which illustrates the V shape of the lower knife edge 9 and a transverse slot 10 intersecting the lower edge as shown. A larger V groove 11 is cut through the diamagnetic bushing 2 to provide a path of movement for the magnet when in operating position and to act as a two-way non-magnetic stop for arresting excessive vertical movement of the tone arm. Another V groove 12 is cut through the opposite sides of ring 3 providing a greater obtuse angle than the cut in the bushing 2, and provides a pair of oppositely disposed seats slightly above the apex of the V-groove in the bushing 2 for the knife edge 9 of the magnet 8. It is obvious from Figs. 1 and 2 that when the magnet 8 is seated on ring 3, and the blade 4 is engaged in groove 10, the arm 5 will tilt as shown in the dotted lines of Fig. 4 and in the directions shown by arrow.

The attractive force between the magnet 8 and the ring 3 will retain the entire arm in proper playing position for normal operation. It is now apparent that the magnetically coupled bearing will provide a high degree of vertical sensitivity for vertical playing movement of the tone arm and the magnetically sealed bearing contacts will eliminate any lost motion between the pick-up arm and its support, thus preventing transient vibratory disturbances in the output of the transducer, and thus eliminating the paradoxical condition in conventional tone arm bearing wherein sensitivity must be sacrificed by the elimination of lost motion and vice versa. It is also apparent that the arm may be quickly and simply removed by lifting the arm upward, which will disengage the magnetic attraction between the magnet 8 and the ring 3 for service exchange of needles or repairs to the transducer.

It is also apparent that the magnet element 8 positioned in the tone arm and the seat 3 positioned on the support may be interchanged and provide the same operation and results attained.

Having described my invention, I claim:

1. A self-positioning detachable tone arm comprising a rigid arm member, a paramagnetic support means normally pivoted for horizontal rotation, a pair of V-grooves oppositely disposed in the upper end of said support means, a permanently magnetized bearing having a linear

contact edge secured in said arm member, said edge projecting downwardly and positioned transverse to said arm, said edge of said bearing adapted to rest by gravity and magnetic attraction in line contact on the apex of said V-grooves, whereby said arm is fulcrumed for vertical movement normal to said contact edge, and means secured to said support means and extending at least partially of the length of said detachable arm member having means located beneath said arm for limiting the downward pivotal movement thereof, said means secured to said support means having a part engageable with the permanently magnetized bearing for limiting the lateral movement of said permanently magnetized bearing in a direction in alignment with the apex of said V-grooves.

2. A self-positioning detachable tone arm comprising a rigid arm member, a paramagnetic support means normally pivoted for horizontal rotation, a pair of V-grooves oppositely disposed in the upper end of said support means, a guide member secured to the upper end of said support means positioned between said V-grooves, a permanently magnetized bearing having a linear contact edge secured in said arm member, said bearing having a groove therethrough normal to said edge for freely retaining said guide member when said edge is resting by gravity and magnetic attraction in line contact on the apex of said V-grooves, whereby said arm is fulcrumed for vertical movement normal to said contact edge and is retained in predetermined lateral position with respect to said support means, and means secured to said support means and extending at least partially of the length of said detachable arm member having means located beneath said arm for limiting the downward pivotal movement thereof, said means secured to said support means having a part engageable with the permanently magnetized bearing for limiting the lateral movement of said permanently magnetized bearing in a direction in alignment with the apex of said V-grooves.

3. A self-positioning detachable tone arm comprising a rigid arm member, a support means normally pivoted for horizontal rotation for supporting said arm, a paramagnetic lower bearing secured on the upper end of said support, a pair of V-grooves oppositely disposed in the upper end of said bearing, a permanently magnetized upper bearing secured in said arm member, said upper bearing having a linear contact edge projecting downward and positioned transverse to said arm and adapted to rest by gravity and magnetic attraction in line contact on the apex of said V-grooves, a diamagnetic stop means integral with said support means having an abutting surface positioned above said V-grooves for limiting the motion of said upper bearing when rotated on its contact edge, whereby said arm is fulcrumed for a predetermined limited vertical movement normal to said contact edge, and means secured to said support means and extending at least partially of the length of said detachable arm member having means located beneath said arm for limiting the downward pivotal movement thereof, said means secured to said support means having a part engageable with the permanently magnetized bearing for limiting the lateral movement of said permanently magnetized bearing in a direction in alignment with the apex of said V-grooves.

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