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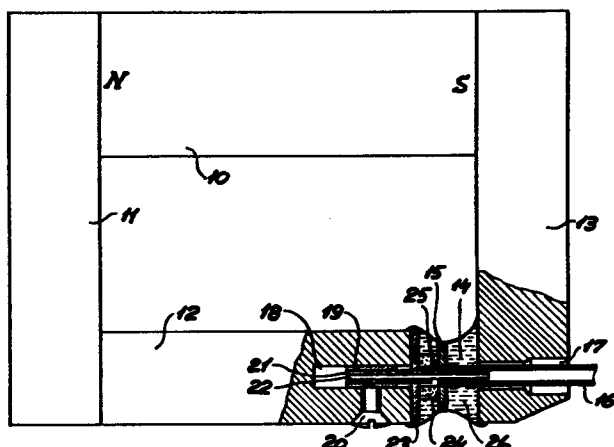
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## EUROPEAN PATENT APPLICATION

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**09.06.78 JP 68990/78**(71) Applicant: **Ortofon Manufacturing A/S, Mosedalvej 11 B, DK-2500 Valby (DK)**(43) Date of publication of application: **11.07.79**  
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Inventor: **Gudmandsen, Robert, Jessensvej 5, DK-2630 Taastrup (DK)**(84) Designated Contracting States: **BE CH DE FR GB IT LU NL SE**(74) Representative: **Opperman, Stuart Richard, Haseltine Lake & Co. Hazlitt House 28 Southampton Buildings Chancery Lane, London WC2A 1AT (GB)**(54) **Pick-up.**

(57) In a pickup having an armature which is movably mounted in a space defined by fixed members and traversed by lines of magnetic force, the armature or another part of the movable system of the pickup is at least partly enclosed by ferro-magnetic damper oil, which is held by the magnetic field in cooperation with adhesive forces.



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PICKUP

The present invention relates to a pickup of the type having an armature which is movably mounted in a space defined by fixed members and traversed by lines of magnetic force.

5           In many pickup structures the armature is supported by a rubber bearing member in the form of a pad in case of a flat armature or a bushing in case of a rod shaped armature, said rubber member serving the double purpose of establishing a restoring force tending  
10   to return the armature to a well defined neutral position after excursions thereof and of damping the oscillations of the armature in order to provide a smooth frequency response. However, the material properties required to  
15   optimize the damping effect are different from those desirable with regard to compliance and

trackability of the pickup, so that a compromise between partly conflicting considerations must be accepted.

The object of the invention is to provide a pickup of the type referred to wherein separate damping means are provided which are independent of the armature bearing element, so that no compromising is required.

This object is attained according to the invention by a pickup unit in which the armature or a portion rigidly connected therewith is at least partly enclosed by a liquid containing in suspension an amount of ferro-magnetic particles sufficient for keeping the suspension in said space.

In such a structure the ferro-magnetic fluid constituted by the suspension will damp the oscillations of the movable system so that the properties of the bearing element supporting the armature may be selected with a view to optimizing other qualities of the pickup such as compliance and trackability. The damping effect may be adjusted at will by proper choice of the viscosity of the ferro-magnetic fluid.

In a conventional type of pickup in which the armature is relatively flat and wound, said space being formed by an air gap between two opposed pole faces, the suspension may appropriately according to the invention bridge the air gap between said pole faces.

In another embodiment of the pickup according to the invention in which said space is defined by a tubular magnet provided with pole pieces at its ends, said space is substantially filled with said suspension.

The invention will be further explained in the following with reference to the drawing in which figures 1 and 2 show vertical longitudinal sections of respective embodiments of the pickup according to the invention.

In Fig. 1 a permanent magnet 10, a rear yoke 11, a generally cylindrical pole piece 12 and a front yoke 13 form a magnetic circuit which further includes an air gap 14 defined between one end of the pole piece 12 and the rear side of the lower end of the front

yoke 13. In said air gap a magnetic, flat, generally square armature 15, which is fixed to the inner end of a tubular stylus arm 16 and is provided with windings (not shown), is pivotally mounted. The stylus arm 16 extends through a stepped bore 17 in the front yoke 13 and carries a stylus (not shown) on its outer end.

In a bore 18 in the free end of the pole piece 12 a sleeve 19 is held firmly by means of a screw 20, which is screwed into a threaded hole extending radially from the bore 18. To the inner side of the sleeve 19 a nickel coating 21 on a piano wire 22 is secured. The nickel coated wire 22 extends into and is secured to the inner side of the inner end of the stylus arm 16. On the end face of the pole piece 12 a cover disc 23 of plastic or elastomeric material is mounted, and between said disc 23 and the armature 15 a rubber pad 24 having a center hole for the passage of the nickel coated wire 21, 22 is compressed by tension in the wire 22. In a small area 25 adjacent the inner face of the armature 15 the nickel coating 21 is interrupted to provide a pivot point allowing the armature to pivot in all directions.

In the air gap a quantity of ferro-magnetic fluid 26 consisting of a colloidal suspension of small, irregular shaped ferro-magnetic particles in a liquid carrier such as a synthetic hydrocarbon is held by the magnetic field in cooperation with adhesive forces. Due to magnetic leakage the ferro-magnetic fluid extends a limited distance along the sides of the pole pieces as indicated on the drawing. The fluid 26 effects damping of the oscillations of the movable system comprising the armature 15 and the stylus arm 16, so that a rubber pad 24 without internal damping properties can be used. The degree of damping obtained depends on the viscosity of the ferro-magnetic fluid which can be selected to match any practical requirements.

The embodiment shown in Fig. 2 has a tubular, generally cylindrical permanent magnet 30, preferably consisting of a samarium-cobalt alloy, the lower portion of which has been cut away leaving a flat lower surface 31 which forms an angle with the axis 32 of the magnet. On each end of the magnet a yoke 33 and 34 respectively consisting of soft iron or another magnetically conducting material is mounted.

The yoke 33 is a generally cylindrical body provided at one end with an annular flange 35, one side of which is conformal with and engages the adjacent end surface of the magnet 30. The yoke 33 is further provided with an axial projection 36 in the form of a truncated cone extending from the circular inner edge of the magnet 30 into the cavity 37 defined by said magnet.

A movable system similar to that shown in Fig. 1 and consisting of an armature 15, a stylus arm 16 and a nickel coated piano wire 21, 22 is supported by the yoke 33 in the same manner as described above with reference to Fig. 1, i.e. by means of an annular rubber pad 24, a bore 18 in the yoke 33 and a screw 20. The stylus arm 16 extends through an opening 38 in the front yoke 34.

The front yoke 34 is generally disc shaped and has an inner annular surface which is conformal with and engages the adjacent end face of the magnet 30. Like the rear yoke 33 it is provided with a truncated cone shaped, inwardly extending projection 39 which together with the first projection 36 define an air gap in which the armature is pivotally mounted by the means described above.

The cavity 37 is filled with ferro-magnetic fluid 40 of the kind mentioned above. The combined effect of the magnetic field on the suspended particles and the adhesion of the fluid to the adjacent solid members keeps the damper fluid within the cavity irrespective of the opening 38.

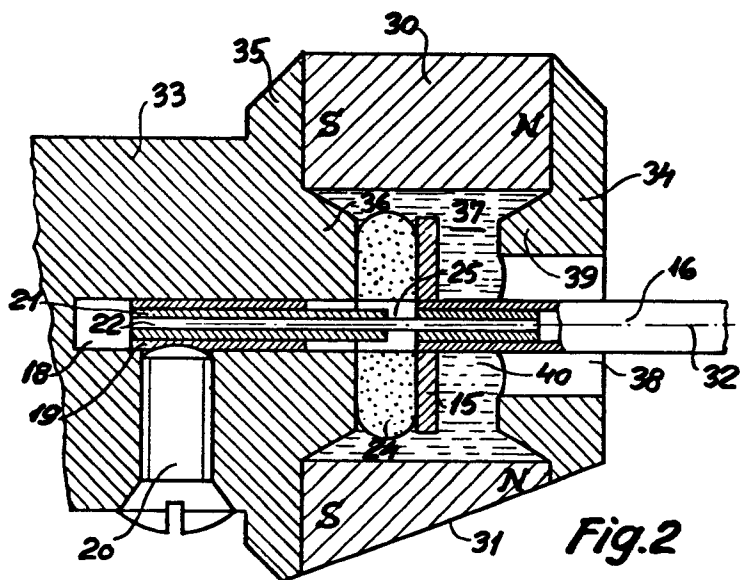
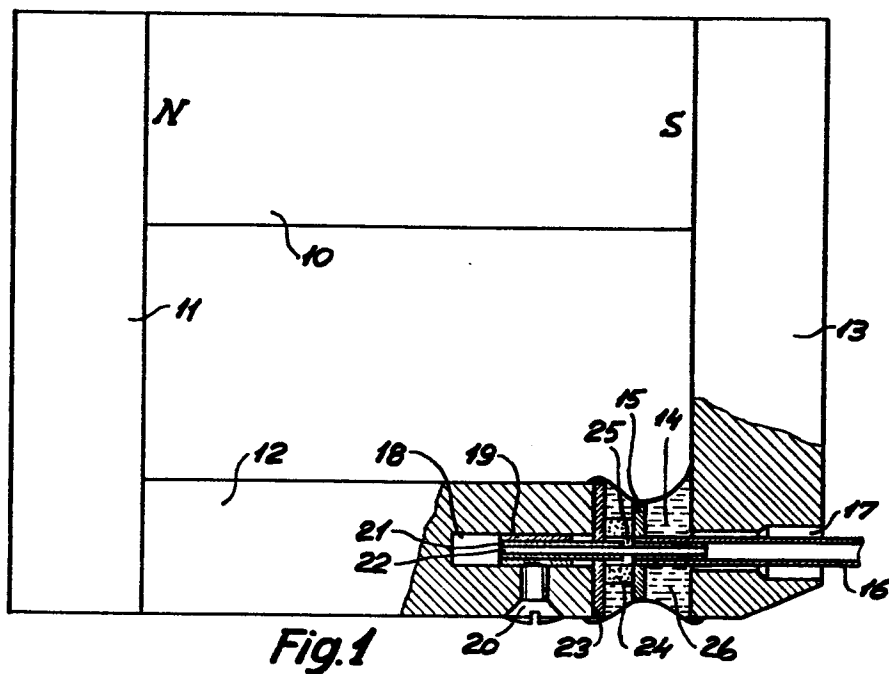
The invention is not restricted to the particular embodiments shown on the drawing and described above. For example the damping effect could be produced by vanes fixed to the stylus arm and movable in a separate space traversed by lines of magnetic force or fixed to a rod shaped movable magnet in case of a magnetic pickup. Also in view of the fact that the armature bearing elements are relieved of the damping function, the rubber pad 24 could be dispensed with by making the piano wire 22 strong enough to carry the pickup unit. Many other modifications are feasible within the scope of the invention.

CLAIMS:

1. A pickup having an armature which is movably mounted in a space defined by fixed members and traversed by lines of magnetic force, characterised in that the armature or a portion rigidly connected therewith is at least partly enclosed by a liquid containing in suspension an amount of ferro-magnetic particles sufficient for keeping the suspension in said space.

2. A pickup according to claim 1 in which the armature is relatively flat and wound, said space being formed by an air gap between two opposite pole faces, characterised in that said suspension bridges the air gap between said pole faces.

3. A pickup according to claim 1, in which said space is defined by a tubular magnet provided with pole pieces at its ends, characterised in that said space is substantially filled with said suspension.



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# EUROPEAN SEARCH REPORT

Application number

EP 78 30 0901

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>2</sup> )
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	GB - A - 930 367 (BANG & OLUFSEN) * Page 1, line 52 - page 2, line 68; page 2, lines 101-106, figures 1 and 2 *	1,2	H 04 R 1/16 9/16
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	US - A - 3 077 521 (E. AHRENS et al.) * Column 3, line 8 - column 4, line 6, figures 1,4,5 *	1	
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	US - A - 2 749 393 (H.O. FUCHS) * Column 1, line 54 - column 2, line 56; figures 1-4 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl. <sup>2</sup> ) H 04 R 1/16 1/18 9/16 9/14 9/12 11/12 11/10 11/08 9/02
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	IEEE SPECTRUM, volume 11, nr. 1, january 1974 New York "Magnetic fluids used for damping and motion control" page 103. * In total *	1-3	
	DE - B - 1 227 684 (ELECTRO-ACUSTIC) * Column 4, line 59 - column 8, line 10; figures 3-8 *	1	CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
	GB - A - 1 000 035 (FONOFILM INDUSTRI) * Page 1, line 50 - page 2, line 3; figures *	1,2	&: member of the same patent family, corresponding document
<p>The present search report has been drawn up for all claims</p>			
Place of search The Hague	Date of completion of the search 02-04-1979	Examiner MINNOYE	