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[33] **Netherlands**
[31] **228,905**

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[54] **STEREOPHONIC PHONOGRAPH TRANSDUCER**
6 Claims, 5 Drawing Figs.

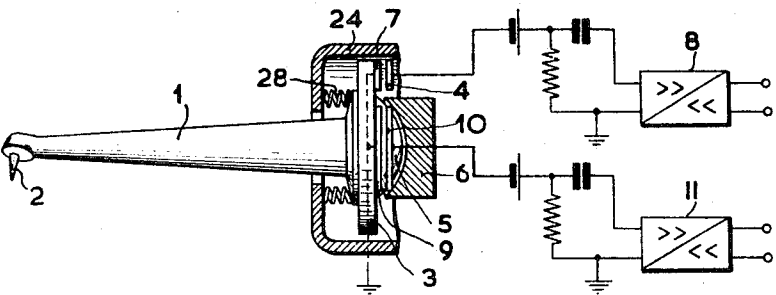
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H04r 19/10
[50] Field of Search **179/100.41**
(ST), 100.41 (VI), 100.41 (ES), 100.41 (ED)

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ABSTRACT: A phonograph pickup, particularly for stereophonic recording and reproduction in which a body for converting movements of a stylus is suspended within a housing to be tiltable in all directions.



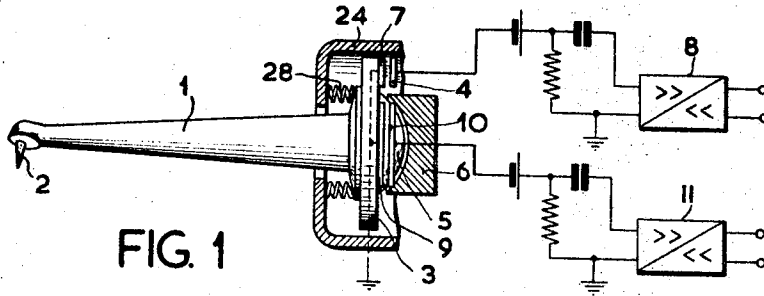


FIG. 1

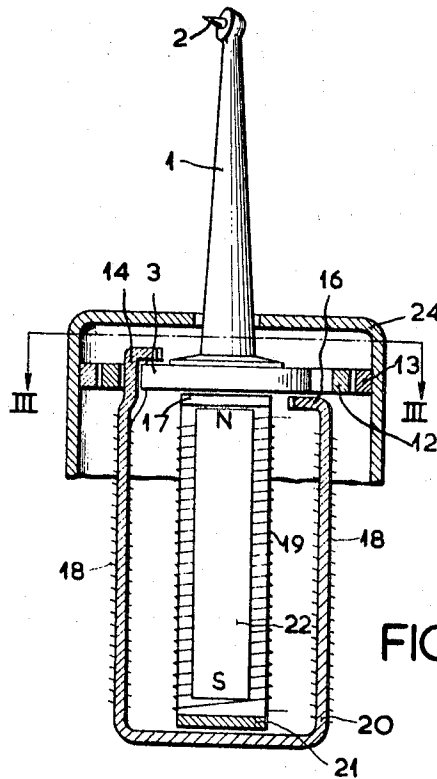


FIG. 2

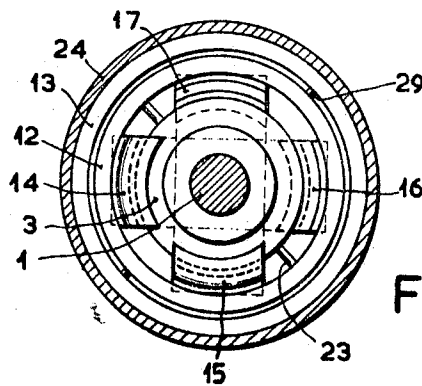


FIG. 3

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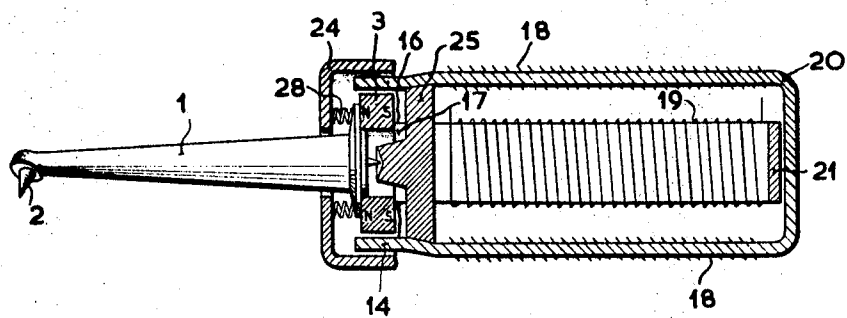


FIG. 4

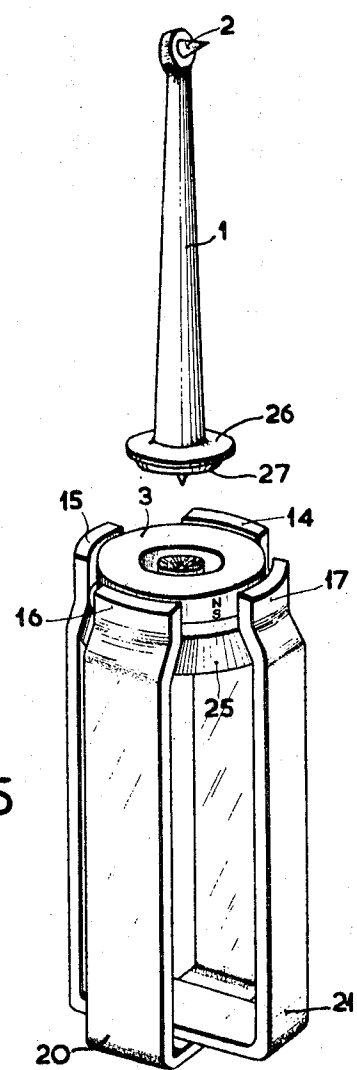


FIG. 5

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STEREOPHONIC PHONOGRAPH TRANSDUCER

This invention relates to converting devices for recording or scanning groove-like record tracks. The converting device according to the invention includes a body which follows the movement of the recording or scanning member and is tiltable in all directions between fixed parts of the device, which, together with the movable body, bring about the conversion. Consequently, such a system has two degrees of freedom for rotation and affords therefore several possibilities of application which could not be realized heretofore with known systems by means of a single body following the movement of the recording or scanning member. In fact, the principle of the tiltable body makes it possible for the recording or scanning member to transmit two vibrations of arbitrary directions, but at right angles or substantially at right angles to each other, either separately or in combination. It may in addition be necessary, after the directions of vibration have been determined, that the above-mentioned fixed parts shall be positioned with respect to the body following the movement of the recording or scanning member by rotation of these parts about the longitudinal axis of the system so that the maximum sensitivity of the converting device for the relevant direction or directions of vibration occurs.

A possibility of application of a device according to the invention consists in recording or scanning records either with depth modulation or lateral modulation, or in recording or scanning both kinds of modulation at the same time in a single groove, one direction of vibration then being at right angles to surface of the record carrier. In the last-mentioned case, the two methods of modulation may be used to record a double information in a single groove. Such double information may consist of a monaural signal and an effect signal, for example a reverberation signal, or of two stereophonically associated signals. Of course, it is also possible that one direction of vibration is recorded or scanned at an angle to the surface of the record carrier differing from 90°.

The tiltable body following the movement of the member may be realized in different ways by either shaping the side of the body remote from the member in the form of a ball-joint, or journaling it in a cardan suspension, or in a trunnionlike part of the device.

When the converting device is used for recording, by means of a common recording member, a groove-like record track in which two signals are recorded simultaneously with different directions of vibration, in one embodiment of the invention the tiltable body is located opposite at least one fixed part, arranged in conformity with said directions of vibration, of two circuits which act upon the body independently of each other in the two different directions of vibration. On the other hand, upon scanning by means of a common scanning member, at least one fixed part of two circuits, which are independent of each other, is influenced by the two different directions of vibration of the body.

The circuits referred to above may be the path of flow for either an electric current or a magnetic flux. In the first-mentioned case, the tiltable body may be provided with at least one metallic coating which constitutes one electrode of at least one capacitor, the other electrode of which is arranged on the fixed parts of the device coating with the body.

In the last-mentioned case, the tiltable body may be a disc-like body of magnetizable material having on its periphery four pole-pieces which constitute pairwise the extremities of two cross-positioned yokes provided with coils, while the permanent magnet feeding the said circuits comprising the yokes and the magnetizable disc is located in one plane of symmetry of the disc so that the axis of the magnet is directed towards the center of gravity of the disc. When a stereophonic groove-like record track is scanned by the common member, the flux passing through each pair of pole-pieces varies as a result of the tilting of the magnetizable disc, so that a separation of the double information is brought about by the said arrangement of the individual magnetic circuits around said common body. On the other hand, upon recording via the

turns surrounding the two individual circuits by means of the common body, the two different signals are combined into a double information in the groove-like record track.

From a viewpoint of relative simplicity, it is particularly advantageous to the magnetizable disc in the shape of a permanent magnet which is common to the two circuits and magnetized in accordance with the centerline of the disc. In this case, the permanent magnet may alternatively be of a different shape, for example spherical or cross-shaped. For saving in weight, in the last-mentioned case, those parts are omitted from the disc which have no pole-pieces opposite them and thus are unimportant for the transmission of the flux.

The portion of the device containing the fixed part of the ball-joint or of the trunnion bearing is preferably fixedly arranged between the limbs of the U-shaped yokes.

In addition, the member which permits the tilting movement is joined to the tiltable body, while that extremity of the holder for the recording or scanning member which is remote from this member may be urged against the first-mentioned member and/or the tiltable body. For this purpose a resilient element, for example a compression spring, may be arranged between the extremity of the holder remote from the member and a fixed part of the device.

In order that the invention may be readily carried into effect, several embodiments will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawings, in which identical parts are indicated by the same reference numerals and in which:

FIG. 1 shows diagrammatically a converting device according to the invention which is based upon the electrostatic principle and in which the holder of the member is journaled by means of a ball-joint;

FIG. 2 shows a similar converting device which is based upon the electromagnetic principle and in which the holder for the member is journaled in a cardan suspension;

FIG. 3 is a cross-sectional view of the device of FIG. 2, taken along the line III-III;

FIG. 4 shows a similar converting device which is based upon the magnetodynamic principle and in which the holder for the member is journaled in a trunnionlike part, and

FIG. 5 is a perspective view of the converting device shown in FIG. 4.

Referring now to FIG. 1, this FIG. shows a converting device for recording or scanning a groove-like record track, in which a body 3 which follows the movement of a holder 1 for a recording and scanning member 2 is tiltable in all directions with respect to fixed parts 4 of the device which, together with the movable body, bring about the conversion. For this purpose, the side of the body 3 remote from the member 2 is provided with a semispherical body 5 which can pivot in a cuplike part 6. As shown in the FIG., the tiltable body 3 is provided with a metal electrode 7 which opposes the fixed electrode 4, the electrodes 4 and 7 constituting a capacitor to which or from which the signal voltage is supplied or derived through an amplifier 8.

Such a system, like the other systems which will be described hereinafter, may be readily adapted to stereophony or similar purposes in which the simultaneous recording or scanning of double information is concerned, by adding to the system of a second circuit. A converting device is thus obtained which is suitable for recording or scanning, by means of a common recording and scanning member, a groove-like record track in which two signals of relatively perpendicular or substantially perpendicular directions of vibration are recorded simultaneously. In all these systems the tiltable body is preferably located opposite at least one fixed part, arranged in conformity with said directions of vibration, of two circuits which may be influenced independently of each other by the two different directions of vibration of the body. In such cases, the member 1 thus fulfills the function of the member common to the two directions of vibration, of a device which retains its compatibility with respect to a single signal, since such a signal can always be disintegrated into components

which coincide with the said two different directions of vibration.

When use is made of the first-mentioned system, for recording or scanning double information, the tiltable body 3 has two electrodes 7, 9 each constituting together with the fixedly arranged electrodes 4, 10 respectively a capacitor to which or from which the two components of the double information are supplied or derived through amplifiers 8 and 11 respectively.

FIG. 2 shows a converting device which is based upon the electromagnetic principle and in which the holder 1 for the member 2 is suspended in two cardan rings 12 and 13. The tiltable body 3 comprises a disklike body of magnetizable material having on its periphery four pole-pieces 14, 16 and 15, 17 (see also FIG. 3) which constitute pairwise the extremities of two cross-positioned yokes 20 and 21 provided with coils 18, 19 while a permanent magnet 22 feeding the said circuits constituted by the yokes 20, 21 and the magnetizable body 3 is located in one plane of symmetry of the disc so that the axis of the magnet is directed towards the center of gravity of the disc 3. During tilting the disc 3 rotates about two spindles 23 which diametrically join the disc 3 to the cardan ring 12, which, in its turn, is joined to cardan ring 13 through two spindles 29 located diametrically and in 90° shifted positions with respect to the spindles 23. In the last-mentioned case, it is also possible for the cardan ring 12 to be connected through the spindles 29 to part of the casing 24 of the device.

FIG. 4 shows a converting device which is based upon the magnetodynamic principle and in which the holder 1 for the member 2 is journaled in a trunnionlike part 25. In this case, the tiltable, magnetizable disc 3 constitutes the permanent magnet common to the two circuits, which is magnetized in accordance with the centerline of the disc. The FIG. shows that the disc 3 comprises a ring which is located to be tiltable between two pairs of pole pieces 14, 16 and 15, 17 respectively (see also FIG. 5) which constitute the extremities of two cross-positioned U-shaped yokes 20 and 21 provided with coils 18, 19 respectively. At its extremity remote from the member 2, the holder 1 is provided with a collar 26 having an upright edge 27 which fits into the annular space of the permanent magnet 3 and is joined thereto.

The holder 1 is urged against the stationary part of the journaling bodies, as shown in FIGS. 1 and 4, by means of a resilient element, for example a rubber ring or a compression spring 28, which is arranged freely around the holder 1 and enclosed between the inner wall of the casing 24 of the device and the collar 26 of the holder 1.

We claim:

1. An electrical transducer comprising a stylus holder member having a longitudinally extending portion, a body portion at one end of said longitudinally extending portion, said body portion extending in two mutually perpendicular directions substantially perpendicular to the longitudinal axis of said longitudinally extending portion and having a spherical outer surface, socket means engaging said outer surface, said longitudinally extending portion being rotatable about two mutually perpendicular axes passing through the center of said

spherical surface, and means comprising said body portion and fixed means cooperating therewith for generating two electrical signals each indicative of the degree of rotation of said longitudinally extending portion about a given respective one of said axes.

2. An electrical transducer as claimed in claim 1 wherein said signal-generating means comprises a first electrostatic electrode system secured to said body portion at a point along one of said mutually perpendicular directions and a second electrostatic electrode system secured to said body portion at a point along the other of said mutually perpendicular directions.

3. An electrical transducer comprising a stylus holder member having a longitudinally extending portion, a body portion at one end of said longitudinally extending portion and extending in two mutually perpendicular directions substantially perpendicular to the longitudinal axis of said longitudinally extending portions, said body portion comprising an annular permanent magnet having opposing magnetic poles at opposite end faces thereof, said longitudinally extending portion being rotatable about two mutually perpendicular axes passing through said body portion, a first magnetic yoke member having two arm portions extending toward said magnet and having pole pieces arranged in confronting relationship to the periphery of said magnet at diametrically opposite edge portions thereof, a second magnetic yoke member having two arm portions extending toward said magnet and having pole pieces arranged in confronting relationship to the periphery of said magnet spaced in quadrature position with respect to said first pole-pieces, and electrical signal coils arranged on said yoke members.

4. An electrical transducer as claimed in claim 3 further comprising a frame member, a trunnion support member, a pivot member secured to said body portion and engaging said trunnion member, and spring members interposed between said body portion and said frame member thereby to maintain said pivot member in engagement with said trunnion member.

5. An electrical transducer comprising a stylus holder member having a longitudinally extending portion, a body portion at one end of said longitudinally extending portion, said body portion extending in two mutually perpendicular directions substantially perpendicular to the longitudinal axis of said longitudinally extending portion and having an axial projection extending therefrom, and associated journal means engaging said projection for providing rotational movement of said longitudinally extending portion about at least two mutually perpendicular axes passing through the center of said body portion, and means including said body portion for generating two electrical signals each indicative of the degree of rotation of said longitudinally extending portion about a given respective one of said axes.

6. An electric transducer as claimed in claim 5 wherein said signal-generating means comprises a permanent magnet system secured to said body portion and means comprising an electromagnetic system operatively associated with said permanent magnetic system.