PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

A device for the production or playing back of a two-signal grooved sound track

We, TELDEC Telefunken-Decca Schallplatten G.m.b.H., of 25, Heussweg, Hamburg 19, Germany, a German Company, 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:-

This invention relates to devices for the manufacture of gramophone records in which two signals are recorded in the same grooved sound track in such a manner that the directions of vibrations caused by each signal are at right angles to one another. The invention also relates to a play-back device of such gramophone records in as much as the constructional principle is the same in the recording device and in the play-back device. The invention may be used to particular advantage for stereophonic sound recording and reproducing.

The invention in particular relates to a device for producing a grooved sound track by recording sumultaneously two signals in directions at right angles to one another in a plane perpendicular to the groove tangent and for playing back from such a sound groove, of the kind described in the United Kingdom specification No. 816,678. This device includes a moving-coil electromechanical or mechanico-electrical transducer comprising a magnetic circuit which has an annular gap across which a steady magnetic flux is or can be established, a first coil which is arranged within the annular gap co-axially with the latter and which has all the turns wound in the same sense so that current can flow through all the turns at any instant in the same direction, a second coil having one portion within the annular gap at one side of a plane through the gap axis, another portion within the annular gap at the other side of the said plane and connections between the said two portions disposed outside the annular gap, the connections being such that at any instant a current would flow in opposite directions through the said coil portions which lie in the annular gap, and a stylus connected with the two coils.

It is the object of the present invention to improve the device of the kind above described and in particular to suppress to a higher degree cross talk and distortions. To this end, in a device of this kind the arrangement is made such that the said annular gap is bounded by conical surfaces. The generatric of each conical surface that includes the annular gap is preferably inclined to the axis of the gap at an angle between 40 and 50°.

The invention and in particular its advantages will now be described in more detail with reference to the accompanying drawings. Fig. 1 shows a section through the device according to the invention with the needle pointing upwards. Fig. 2 serves to explain the mode of operation of the system and in particular shows the position of the magnetic lines of force and the arrangement of the coils. Fig. 3 shows the mechanical construction of the coil carrier and its mounting.

As shown in Figs. 1 and 3, a resilient tubular arm 9 is fixed at one end

in a bearing block 10 and supports at its other free end a stylus 2 and a coil carrier 11. The coil carrier 11 is shown in section in Fig. 1. It is co-axially arranged in relation to an annular gap formed by a central core N and an outer ring S which form the poles of a magnetic circuit. The annular gap is bounded by spaced co-axial conical surfaces with their generatrices at 45° to their axis. The coil carrier 11 has the form of a disc with a conical skirt, the latter being parallel to the conical surfaces bounding the annular gap and extending into this gap. The conical skirt of the coil carrier carries a first coil 12 the turns of which are all circular and are wound in the same sense so that current can flow through all these turns at any instant in the same direction. The coil carrier carries another coil which has one semi-circular portion 13 within the annular gap at one side of a plane through the gap axis, another semi-circular portion 14 within the annular gap at the other side of the mentioned plane, and these two portions are connected in series opposition by cross-over connections 13' and 14' respectively across a diameter of the coil carrier lying in the said plane. Thus the second coil has a figure-of-eight shape. The cross-over connections lie in a diametral slot in the magnet core N into which projects the corresponding portion of the coil carrier 11.

An explanation will now be given with reference to Figure 2 of how one signal voltage is induced in the windings 12 and another signal voltage is induced in the series connected winding portions 13 and 14 when playing back. It is assumed that the stylus 2 is being guided by a sound groove and is executing upward and downward movements in the direction of the axis of the annular gap corresponding to a signal recorded by vertical recording, and that in addition, the needle also performs lateral movements corresponding to a signal recorded by lateral recording. Both these movements are followed by the coil carrier 11 and by the coils which it supports. In Figure 2, the direction of the movements corresponding to the vertical recording is indicated by *y*, and the direction of the movements corresponding to the lateral recording by *x*. Only a single turn of each of the windings 12, 13 and 14 is illustrated. Let it be assumed that the individual turn 12 executes movements in the direction of the axis *y*. In this case, it follows from diagram *a* of Fig. 2 that the components in the direction *x* of the magnetic field passing through the annular gap at 45° to the axis of the annular gap are cut. Accordingly, a voltage corresponding to the upward and downward movements of the needle 10 is induced in the coil 12, and has the same direction over all the longitudinal elements of the coil. But, the coil 12 executes movements in the *x* direction also, according to the movements of the needle. It will be seen from diagram *a* that with these movements the field components lying in the *y*-direction are cut. With this movement, however, voltages are induced in both coil portions which lie on both sides of a plane perpendicular to the plane of the drawing and passing through the axis of the annular gap, which voltages have the opposite direction in relation to the axis of the annular gap. These voltages therefore cancel each other so that, on movements in the *x*-direction, no voltage appears at the ends of the coil 12. The coil 12 is therefore adapted solely for reproduction of the components of the vertical recording and supplies no signal voltage for lateral movements.

The coil portions 13 and 14 participate in the movements of the coil carrier 11. It will be seen from diagram *b* of Fig. 2 that no resulting voltage appears in these series-connected coil portions when a movement takes place in the *y*-direction, because of their opposite directions of winding. In this case, although the field components lying in the *x*-direction are cut, nevertheless these induce voltages in opposite directions in the two coil portions. Now if the coils 13 and 14 are moved in the *x*-direction, the field components lying in the *y*-direction will be cut and the voltages induced as a result lie in the two coil portions in such a manner that they combine additively. Accordingly, the coil formed from the coil portions 13 and 14 is sensitive only to movements which correspond to the lateral recording in the groove.

WHAT WE CLAIM IS:

1. A device for producing a grooved sound track by recording simultaneously two signals in directions at right angles to one another in a plane perpendicular to the groove tangent and for playing back from such a sound groove, which device includes a moving-coil electro-mechanical or mechanico-electrical transducer comprising a magnetic circuit which has an annular gap across which a steady magnetic flux is or can be established, a first coil which is arranged within the annular gap co-axially with the latter and

which has all the turns wound in the same sense so that current can flow through all the turns at any instant in the same direction, a second coil having one portion within the annular gap at one side of a plane through the gap axis, another portion within the annular gap at the other side of the said plane and connections between the said two portions disposed outside the annular gap, the connections being such that at any instant a current would flow in opposite directions through the said coil portions which lie in the annular gap, and a stylus connected with the two coils, the arrangement being such that the said annular gap is bounded by conical surfaces.

2. A device according to claim 1, wherein the generatrix of each conical surface that includes the annular gap is inclined to the axis of the gap at an angle between 40 and 50°.

3. A device according to claim 1 or 2, wherein the said second coil has a figure-of-eight configuration, each lobe of the eight forms a semi-circle and is arranged within the said annular gap at one side of the said plane, whilst the cross-over connections are accommodated on a common diameter lying substantially within the said plane.

4. A device according to any one of the preceding claims, wherein the two coils are mounted on a coil carrier which is supported at one end of a resilient rod or tube the other end of which is rigidly mounted.

5. A device according to claim 4, wherein the coil carrier is supported in such a manner that it is only free to carry out translational movements.

6. A device for producing a grooved sound track by recording simultaneously two signals in directions at right angles to one another in a plane perpendicular to the groove tangent and for playing back from such a sound groove, substantially as described with reference to and as illustrated in the accompanying drawings.

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845,904 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale.,

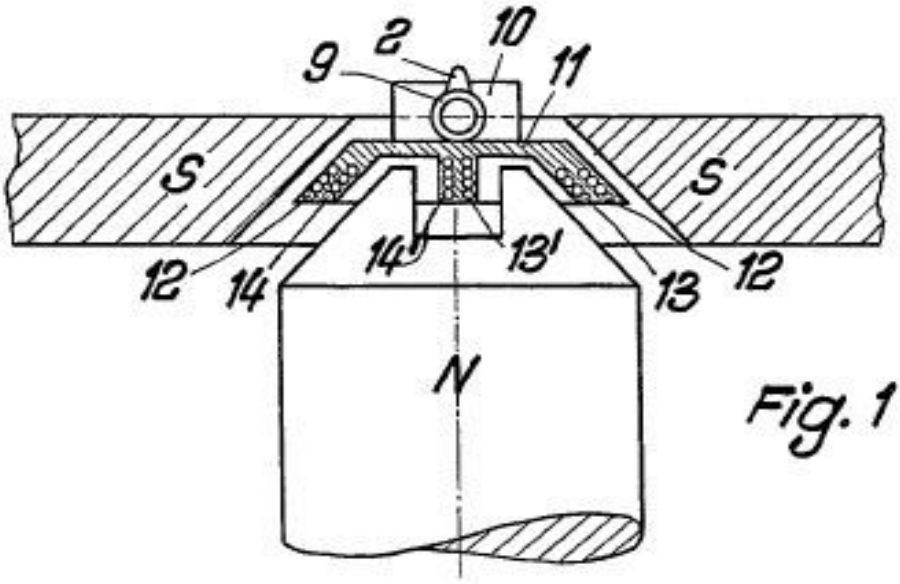

Fig. 1

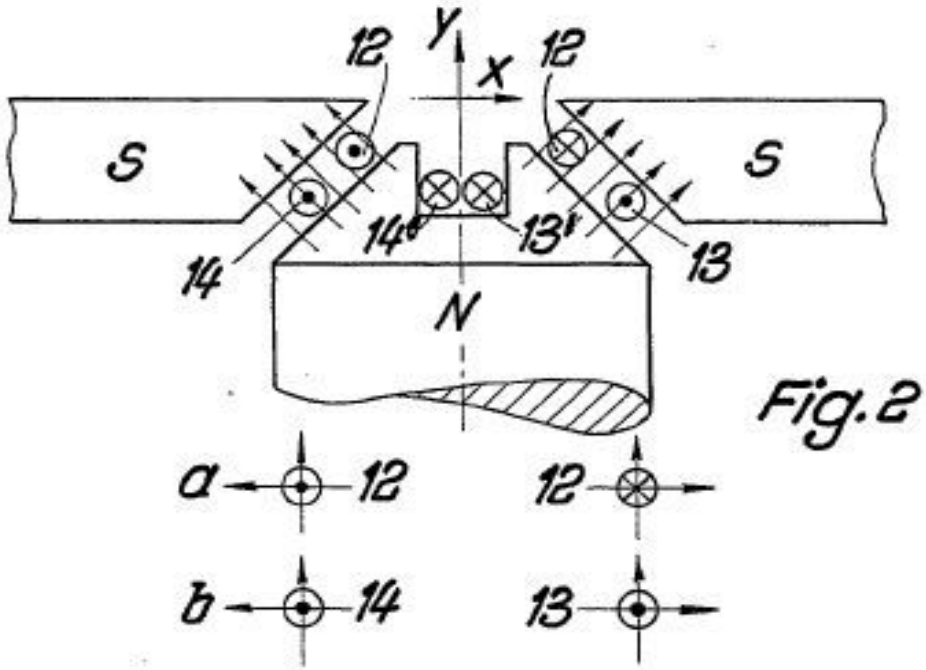

Fig. 2

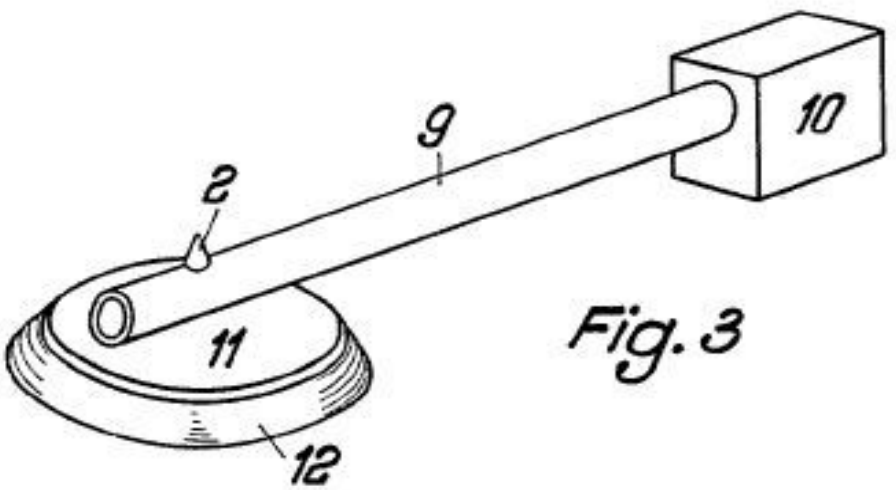

Fig. 3