May 13, 1941. G. SILBER ET AL 2,241,622

RECORD CUTTING DEVICE

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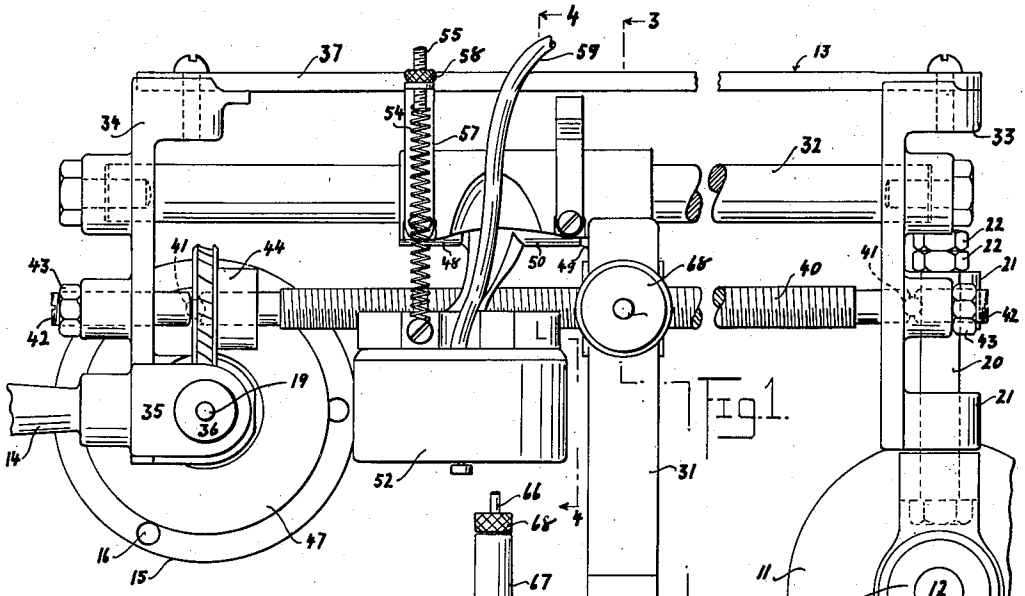


Fig. 1.

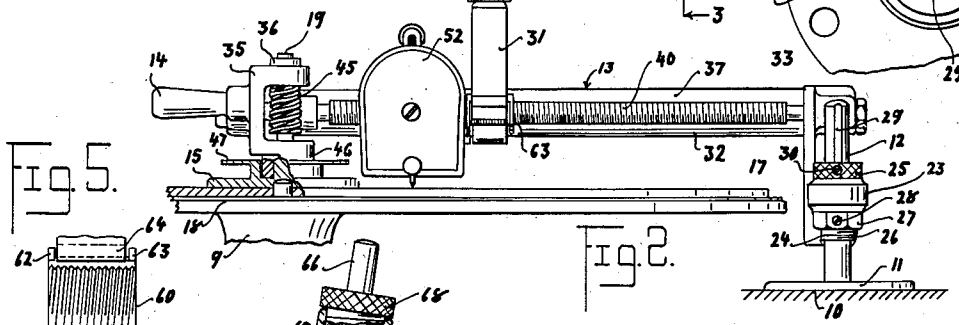


Fig. 2.

Fig. 5.

Fig. 3.

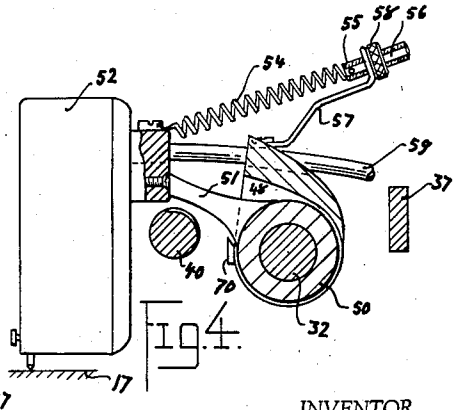


Fig. 4.

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RECORD CUTTING DEVICE

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1 Claim. (Cl. 274—13)

This invention relates to a device for inscribing sound waves, e. g. by a cutter on a record, from which the sound may be reproduced ad libitum. The cutter comprises a cutting tool and means for imposing sound waves upon the tool. At the present state of the art an electrical actuation of the cutting tool is in particular favor, e. g. by a solenoid or electromagnet of a circuit which is adapted for the transmission of sound waves translated into electrical impulses. Such circuit comprises a source or transmitter of an electrically expressed sound, such as a microphone, a radio or a public address system, lends itself readily to modulation, filtration and volume adjustment of and is suited to be electrically connected to the receiver incorporated in the cutter of a record cutting device.

At the present state of the art such a record cutting device must be a precision instrument, because an extremely delicate cutting adjustment of the cutting tool is required in relation to the record, which is, for instance, an acetate layer reinforced by a metallic backing. The carriage or mounting of the cutting tool must move relatively to the record, and the parts effecting this movement must be made and must perform with extreme accuracy, in order not to impose, and as a matter of fact in order to eliminate, any extraneous component of movement of the cutting tool, which component would distort or otherwise impair the fidelity of the sound track produced.

It is a principal object of this invention to provide for a feeding mechanism of the order just referred to, which will not rely upon an extreme accuracy of the parts and will therefore be economical in manufacture and maintenance, and still permits a movement of the cutting tool in faithful and exclusive conformity with the sound wave imposed thereon.

At the present state of the art it is desirable to provide for a record cutting device which can be used in connection with a sound reproducing device adapted for translation of the cut record into sound, such as a gramophone or phonograph. In such cases it is expedient to couple the record cutting device, preferably detachably, to the record carrier, e. g. a turntable, in order to establish the proper relationship between the cross feed of the cutter and the movement, e. g. rotation of the record to be cut.

Where in the manner just suggested, and more particularly for practical reason, the record cutting device is detachably coupled with or connected to the record carrier, additional dangers arise concerning accurate performance of the cutting device. The cutting device, or part thereof is handled as a loose part, e. g. a swing arm, which may readily get out of alignment or adjustment, the cutting device may be improperly or carelessly coupled or connected to the record carrier, or the arrangement may necessitate that the record cutting device connects to the record carrier by way of the record, and may thus suffer if the record or the record carrier is eccentric, uneven in thickness or warped as it will be the case in the customary arrangement, where the cutting device is deposited at one end, for purpose of mechanical drive, upon a record deposited upon a turntable. It is readily understood, that under these circumstances the most accurately constructed and performing cutting device may fail to operate properly, when it is coupled to a surface which wabbles, is uneven, or otherwise causes eccentricity. Under these circumstances the instant invention, as suggested above, assures good performance; in other words, correct guidance, suspension or control of the cutting tool is to be obtained, disregarding any lack of trueness and alignment of the operating mechanism.

These and other objects of the invention are generally obtained, in accordance with the instant invention, by a novel suspension and mounting of the cutter, and will be explained hereinafter at great detail in connection with the description of a specific embodiment of the invention and with the accompanying drawing, the description and drawing being however exclusively submitted in illustration, and not for the purpose of limitation, of the instant invention.

In the drawing:

Fig. 1 is the top view of an embodiment of this invention, which, by way of example, is adapted for use in connection with a phonograph.

Fig. 2 is a corresponding front view, showing the embodiment at a smaller scale, part of the phonograph being schematically indicated.

Fig. 3 shows a cross-section of the embodiment taken at a level indicated by way of dot-dash lines, arrows and the numeral 3 in Fig. 1. This detail view serves in particular to illustrate the arrangement of a carrier on which the cutting tool is suspended.

Fig. 4 is a similar cross-sectioned detail view taken at another level pointed out by the numeral 4 and arrows in Fig. 1, and serving in particular to illustrate the manner in which the cutter is suspended upon the carrier.

Fig. 5 is a detail bottom view of the carriage, directed in particular to an illustration of the jaw, by way of which the carriage engages upon the feed screw of the cutting device.

Similar numerals refer to similar parts throughout the various views.

An embodiment of the kind shown in the drawing has, for instance, a stand 11 from which vertically arises an arbor 12. This stand 11 is shown to be fixedly mounted upon the top board 10 which serves as a partition in a phonograph and extends on top of the mechanism and below the turntable 9. Upon the stand 11, which is thus arranged alongside of a turntable 9 on top of the phonograph, an arm 13 is swingably fulcrumed, so that the said arm 13, by way of a handle 14 arranged at the end thereof, may be swung over the turntable and may be deposited thereon, the said arm carrying for such purpose a driving disc 15 which may frictionally or fixedly, e. g. by way of pins extending into holes 16 in said disc 15, engage upon a record 17 deposited the baize covering 18 of the turntable 9, or, by way of said holes 16, upon pins extending from turntable 9 through record 17.

When the swing arm 13 is in the horizontal position shown in Fig. 2, the shaft 19 of disc 15 extends preferably parallel to the arbor 12 on stand 11, and the shaft and arbor are spaced apart at a predetermined distance, which corresponds to the distance, at which the stand 11 is mounted from the axis of turntable 9 of the phonograph.

From the operative position of the record cutting device shown in Fig. 2 the said device may be swung around the arbor 12 into an inoperative position, in which it fully clears the turntable 9 and is extended alongside of said turntable. If, for instance, the turntable is arranged in a square box upon the square board 10, and the stand 11 is mounted upon a diagonal of said box, the turntable may have to be swung through 45° from the operative position of Fig. 2 into an inactive position alongside of turntable 9. In order to permit the disc 15 to be lifted off the turntable or off the record 17 arranged thereon, the arm 13 should also be swingable around a substantially horizontal axis which crosses or passes close to the vertical axis of arbor 12 and which is disposed substantially in a plane with the bottom face of disc 15. For such purpose the arm 13 is shown to comprise a bracket element 33 with lugs 21, which are journalled upon a hinge pin 20, a pair of nuts 22 serving to position said arm endwise upon the hinge pin 20 against a face of the head 23 at the other end of hinge pin 20.

The head 23 of the hinge pin 20 is provided with a bore extending substantially at right angles to the axis of hinge pin 20, said head being journalled by way of said bore upon a sleeve 24 which carries at its upper end the knurled flange 25, whereas it is provided with an outer thread 26 at the lower end. Thread 26 serves to receive the nut 27, which, by way of a set screw 28 may be fixedly allocated upon the sleeve 24 in a position in which the head 23 is rotatably but endwise fixedly allocated upon said sleeve.

A flat 29 may be provided upon one side of the arbor 12, in order to furnish a space, upon which a set screw 30 in the knurled flange 25 may be engaged at a preferred level upon the said arbor 12. Since the swinging arm 13 thus is vertically adjustably fulcrumed upon arbor 12 by way of the sleeve 24, said arm 13 may be adjusted to be in the horizontal position shown in Fig. 2, when the disc rests upon the turntable or the record. It is more particularly desirable, that arm 13 extend at right angles with the axis of turntable 9, or parallel with the line along which the record cutting operation takes place, when the record cutting device is in the operative position shown in Fig. 2.

When reference was had hereinbefore, generally, to an arm 13, reference was had thereby primarily to a portion thereof, which serves as a level guide for the carriage 31. Such a guide portion provided by a smooth spacing rod 32 which is shown to be fixedly engaged upon and positions relatively to each other the bracket element 33 to the right, which comprises the lugs 21 referred to above, and the element 34 to the left, which carries the handle 14 and the forked portion 15 of which the disc 15 is journalled by way of the shaft 19, collar 36 of shaft 19 serving to retain disc 15 in rotatable suspension upon said element 34.

In order to forestall any risk that the elements 33 and 34 be twisted relatively to each other by way of torsion of the spacing rod 32, such elements are reinforcedly interconnected by a flat bar 27, which is spaced relatively to the spacing rod 32 and is disposed substantially normal to a plane extended through the axis of the spacing rod at the nearest point between the said flat bar and rod.

Flat bar 37 also serves as a back rest for the carriage 31, when such carriage is swung around the rod 32 back into an inactive position. Or said bar 37 offers a means upon which a resilient catch 38 extending from carriage 31 may be engaged, e. g. slid under, thus releasably retaining the carriage 31 in a reclined, inactive position, although the arrangement of the weight of said carriage, and more particularly the counterweight 39 at the front thereof, tend normally to swing said carriage in counter-clockwise direction around the rod 32 into engagement with feed screw 40.

In the prior art the feed screw, i. e. its accuracy as a machine element, its alignment in respect to the guide means of an arm such as 13, and above all the question whether it was running true, presented a decisive factor concerning the value of the record cutting device, because this governed the quality of the cut produced on the record. It also should be taken into purview, that a feed screw must extend over a comparatively wide gap without any support, so that it may readily run out of true, or sag, or its trueness may be impaired by careless handling.

Of course there is no particular difficulty in providing an accurate pitch or lead and the correct form of thread on a feed screw. But in addition to these features the prior art found it an indispensable prerequisite, that the feed screw ran true under all circumstances, and such an ideal object is difficult to carry out; therefore the necessity thereof has been substantially avoided by this invention. A screw being selected to be of correct pitch and shape of thread and of sufficient strength not to sag, is hung, between centers so to speak, into the rigid frame provided by the spacing rod 32, the flat bar 37 and the end elements 33 and 34. Opposite ends of the screw are for such purpose shown to be engaged upon balls 41. These balls 41 are socketed in the ends of headless screws 42, and these headless screws 42 may be adjusted in axial alignment with each other in the elements 33 and 34 by way of locknut 43 engaged thereon, so that the screw 40 is

rotatably suspended without play in the arm 13, and extends substantially parallel with the spacing rod 32.

For purposes of a drive feed screw 40 carries near one of its ends the worm wheel 44, and worm wheel 44 is engaged by worm 45 mounted upon the shaft 19 in the forked portion 35 of element 34.

Around the hub 46, which extends from the forked portion 35 down onto the disc 15 an auxiliary disc 47 is spacedly assembled with the disc 15, such arrangement presenting a spool and serving for diverting or collecting shavings thrown up by the cutter 52 engaged upon the record 17, so that such shavings do not enter upon the worm drive nor upon the bearings by way of which the worm is journalled upon the element 34.

The carriage 31 is slidably fulcrumed upon the spacing rod 32, e. g. by way of two spaced lugs 48 and 49. A lug 50, which is connected by way of bracket 51 to and supports the cutter 52, is endwise engaged between said lugs 48 and 49, so that it must partake in the movement of the carriage 31 in the direction of the spacing rod 32, but the cutter 52 may still be swung on rod 32 in a plane normal to said rod independent of the swinging of the carriage 31. This independently swingable cutter 52 is resiliently suspended on the carriage 31 by way of a coiled tension spring 54, which extends from the bracket 51 connecting lug 50 with cutter 52 to a headless screw 55. Screw 55 is non-rotatably slidably accommodated in an extension 57 of the carriage 31 and transmits, by way of a knurled nut 58, the reaction of tension spring 54 to extension 57. Rotation of the headless screw 55 in extension 57 is prevented by providing flats on one or more sides of the screw 55 and by accordingly contracting the opening in the extension 57, in which that screw is accommodated.

The cutting tool 53 is mounted to extend from the bottom of the cutter 52, and the electric mechanism in cutter 52 for actuating cutting tool 53 is to be connected by the flexible leads 59 extending from cutter 52 to a suitable source of electrically converted sound wave.

The distance to which the cutter 52 depends in counterclockwise direction from the carriage 31 is determined and adjusted by the knurled nut 58.

If the instant cutting device were carried out in accordance with the teachings of the prior art, the carriage 31, would directly though detachably engage upon the feed screw 40, so that any "throwing" caused by any eccentricity of the feed screw 40 would cause the carriage to rock or sway and such movement would be transmitted to the cutter 52 by way of the means 54, 55, 56, 57, 58 suspending the cutter upon the carriage.

But such rocking and swaying is prevented in accordance with the instant invention, even though the feed screw may run slightly off center or be uneven, by providing a "floating suspension" in place of a rigid engagement of the carriage upon the feed screw.

In such a floating suspension the carriage is rigidly coupled to the feed screw in the direction of the axis of the feed screw, so that the carriage is predeterminedly and correctly propelled by rotation of the screw in order to produce evenly spaced convolutions of a spiral or helix upon the record. Whereas the carriage is only loosely coupled onto the feed screw in all other directions, i. e., radially to the feed screw, and does therefore not participate in any rocking movement of said screw. This is provided in the instant improvement by predeterminedly weighting the carriage, so that a jaw 60 is pressed into firm engagement with the feed screw 40, and so that the said jaw is positively fed in the direction of the axis of the screw by reason of the engagement of the jaw on the carriage. The weight of the carriage may be supplemented for this purpose by a suitably dimensioned and allocated counterweight 39, but a direct reaction of such weight to any off-center movement of the screw is prevented by interposing between the carriage and the jaw a fully balanced cushioning medium, such as a spring.

For such purposes the carriage 31 is provided for a clearance serving as a cage floatingly retaining the jaw 60. The jaw 60 is provided upon opposite sides and on opposite ends with flange like extensions 62 and 63, which by way of parallel surfaces extending normal to the axis of the feed screw engage upon corresponding surfaces upon opposite sides of the carriage, for instance upon the opposite ends of the stops 64 extending in the front and in the back into the clearance 61 of a carriage. The jaw 60 itself is predeterminedly spaced from the front and back walls of clearance 61.

Jaw 60 represents half a nut meshing upon the thread of feed screw 40 and on the side opposite to the threaded groove a pin 66 extends from the jaw 60 and is swivelled, e. g. loosely guided near its far end upon the carriage 31. For such purpose a hub 67 extends up from the carriage which has a clearance opening commodiously accommodating the said pin 66 and the compression spring 65 surrounding said pin and carries on its upper, threaded end a knurled bushing 68. Bushing 68 closes the upper end of hub 67, except that it has a central opening which accommodates with play the pin 66 extending therethrough. By way of a washer or sleeve 69, which may fit pin 66, but which should have play in bushing 68, the compression spring 65 reacts between bushing 68 as part of the carriage 31 and the jaw 60.

When carriage 31 is swung out of engagement with feed screw 40 and is, for instance, engaged in a reclined position by way of the catch 38 upon the flat bar 37, the compression spring 65 will depress the jaw 60 into a lowest position, in which it rests upon the stops 64. Under these circumstances the cutter 52 will also be reclined, bracket 51 resting against the top section of the carriage 31, which interconnects the spaced lugs 48 and 49. When the arm 13 is thus swung back from the operative position shown in Fig. 2, disc 15 resting in operative engagement upon a record 17 superimposed upon the turntable 9 of a phonograph and sleeve 24 being adjusted at such height on arbor 12 that the smooth spacing rod is substantially parallel to the surface of record 19, then the carriage 31 may be slid on rod 32 to a position nearest to element 34, and the carriage 31 is swung forward from its reclined position. While the carriage 31 is thus swung to the front, the cutter 52 will also drop forward, unless it is intercepted by the hand of the operator, onto a stop 70 provided for said cutter 52 upon the carriage 31. During the frontward movement of the carriage 31 the jaw 60 will strike and rest upon the feed screw 40 and then the stop 64 will be lowered from jaw 60 together with the carriage until the compression of spring 65 counteracts the weight of the carriage and of coun-

terweight 39. The carriage will find its own level in reaction to the pressure of spring 65, such a position being approximately indicated in Fig. 3 of the drawing. Now the cutting tool 53 extending down from the cutter 52 has also come into abutment upon the record 17, so that the cutter has been lifted off the stop 70. The carriage 31 has in the meantime assumed an average position relatively to the feed screw 40, such average position approximating that indicated in Fig. 3, and the pressure, at which the cutting tool 53 engages upon and in the record 17 may be adjusted by way of rotation in clockwise or counter-clockwise direction of nut 58. Thereafter the cutter 52 or the carriage 31 together with the cutter 52 may be lifted ad libitum out of an engagement with the record or out of engagement with the record and the feed screw, respectively.

But when the parts are in the adjusted position of Fig. 3 and the turntable 9 is in rotation, any sound arriving at the cutter 52 by way of the leads 59 will be inscribed by the cutting tool 53 onto the record 17, while the cutting tool describes a spiral path upon the rotating record 17 by virtue of the cross feed mechanism of the record cutting device described. It will be noticed that the feed screw 40 may run off-center, but that the carriage 31 will float while it is positively and accurately advanced in the feed direction.

Having thus described our invention in detail, yet we do not wish to be limited thereby, except as the state of the art and the appended claims may require, for it is obvious that various modifications and changes may be made in the form of the embodiment of our invention, without departing from the spirit and scope thereof.

What we claim is:

In a record cutting device, in connection with a feed screw and a carriage to be moved by said screw, a jaw adapted to mesh with said screw when moved onto said screw in a predetermined direction, tension means reacting between said carriage and jaw in said direction, a rod extending from said jaw in said direction, a guide means on said carriage loosely accommodating said rod so that said jaw may swing relatively to said carriage substantially in an arc around said guide means at right angles to the axis of said screw, and guide means fixedly allocating said jaw upon said carriage in the direction of the axis of said screw.

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