Sept. 2, 1941. A. BADMAIEFF 2,254,412

SOUND RECORDING DEVICE

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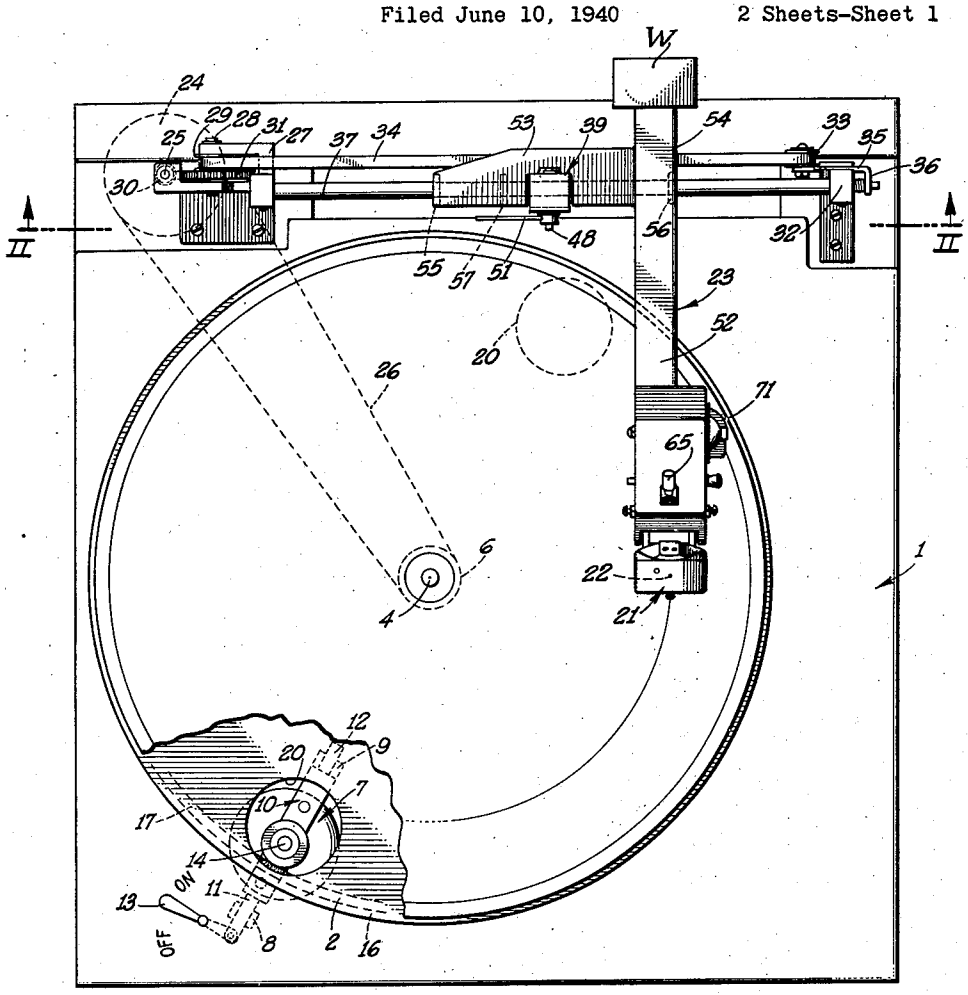


Fig. 1.

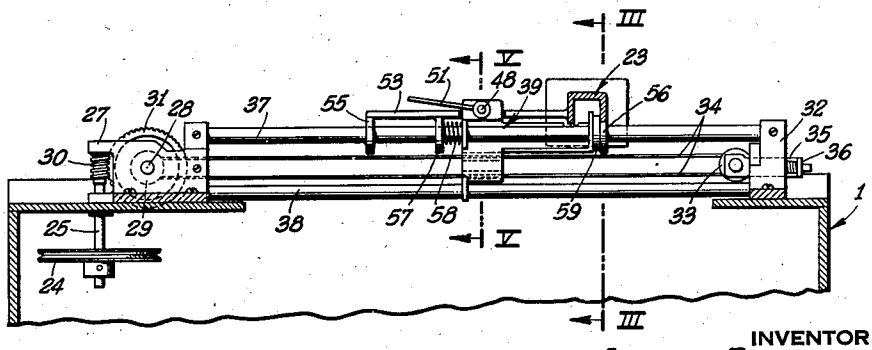


Fig. 2.

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Fig. 3.

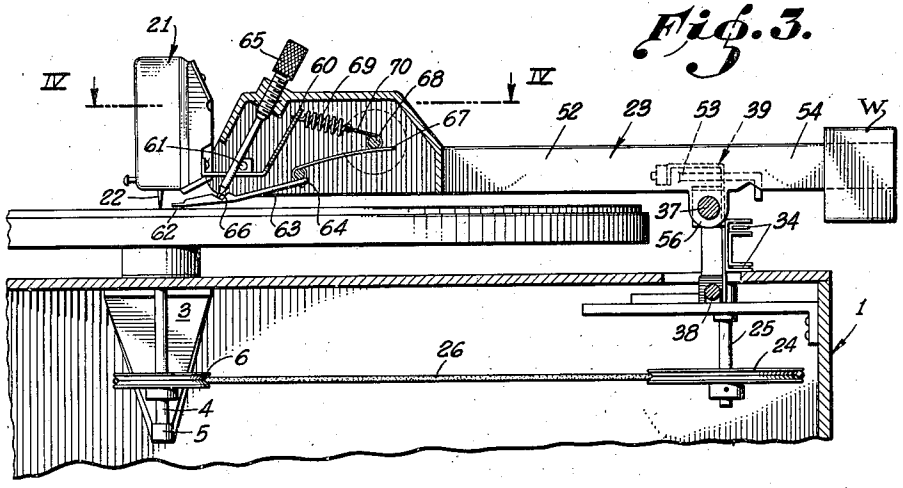


Fig. 4.

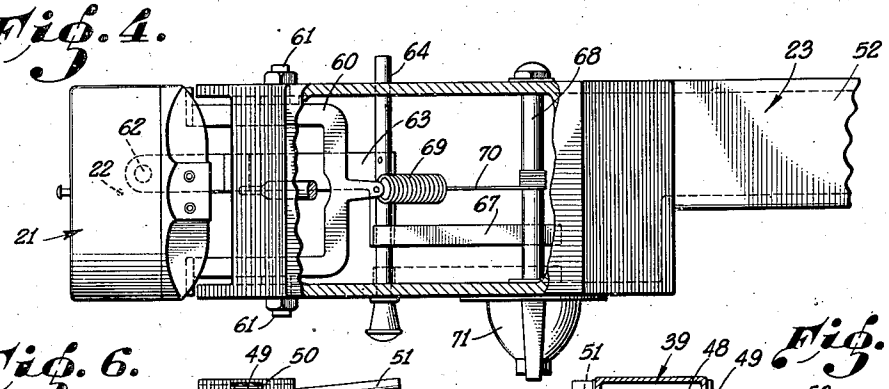


Fig. 6.

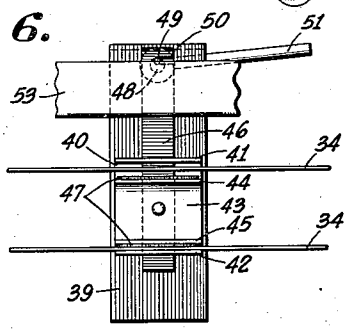


Fig. 5.

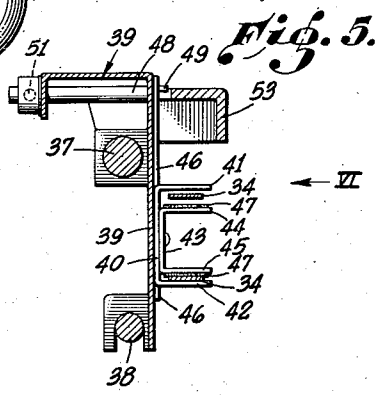
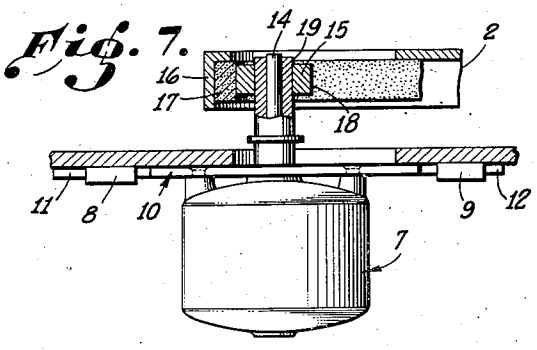


Fig. 7.



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UNITED STATES PATENT OFFICE

2,254,412

SOUND RECORDING DEVICE

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Application June 10, 1940, Serial No. 339,609

5 Claims. (Cl. 274—13)

This invention relates to sound recording apparatus, particularly to apparatus adapted to cut a groove in a disc of wax acetate or other composition, this disc being subsequently employed for the production of a matrix and the manufacture of a plurality of records therefrom or for immediate reproduction directly from the acetate or other composition record. More particularly, the invention pertains to a simple and efficient arrangement of elements whereby sound recorders may be produced in large quantity for home use.

In constructing sound recording equipment of this general type, it has been customary in the past to provide the apparatus with heavy, very accurately cut lead screws and with a rigid stylus arm moved by such lead screws, the stylus arm being then provided with a cutting head at its end. These prior devices were heavy, cumbersome and extremely expensive. The present invention is particularly directed to a simplified construction involving a minimum amount of machine work in its production, and permitting the use of lightweight die cast or molded parts so that the cost of the recorders is reduced to a minimum, and such recording devices are capable of being manufactured in large quantities and assembled with the minimum of effort.

The construction and arrangement of the devices forming the subject matter of this invention include the provision of means for controlling and altering the speed of the disc upon which the recording is being made. Another desirable feature of the present invention involves the provision of means whereby the depth of the groove cut by the stylus in the disc is readily controlled. The device of the present invention permits recording to be made either from the perimeter of the disc inwardly or from a central area of the disc outwardly. Means have also been provided for regulatably controlling the pressure of the stylus on the disc.

It is therefore an object of this invention to provide an improved means for traversing the stylus across the face of a disc upon which the record is being produced.

It is a further object of this invention to provide a means for changing the speed of rotation of the turntable.

It is a further object of this invention to provide a means for accurate control of the depth of the groove cut by the stylus in the surface of the recording disc.

Other objects and advantages will become apparent as the description proceeds. For purposes of illustration reference will be had to the appended drawings in which:

Fig. 1 is a plan of the recorder embodying one form of the present invention,

Fig. 2 is a vertical section of the device of Fig. 1 taken on line II—II thereof,

Fig. 3 is a vertical section taken along line III—III of Fig. 2,

Fig. 4 is a horizontal section of part of the stylus arm of Fig. 3, taken on line IV—IV thereof,

Fig. 5 is a fragmentary vertical section taken along line V—V of Fig. 2,

Fig. 6 is a fragmentary elevation taken in the direction of the arrow VI of Fig. 5, and

Fig. 7 is an elevation of the driving motor and its mounting.

The device illustrated and described is specifically adapted to cutting a wavy line (side wall type) record, although it is to be understood that with certain modifications it can be utilized for other types of record. A supporting base or framework 1 carries mounted thereon for rotation a turntable 2, having a bearing 3 and a shaft 4 extending below the base, the end of the shaft being carried in an outboard bearing 5 at the lower end. A pulley 6 is mounted on shaft 4 and keyed or otherwise secured to rotate with shaft 4.

As a driving means for the turntable, a motor 7 is provided. This motor is mounted in any suitable manner to slide or pivot about a vertical axis, so that its distance from the inner surface of the downwardly extending flange of disc 2 may be varied. In the present instance this is accomplished by the provision of members 8 and 9 secured to the underside of the base 1, and member 10 having portions 11 and 12 engaging bores in members 8 and 9 for sliding movement therein. A lever 13, suitably linked to the sliding member 10 provides a means for controlling the position of the member 10. The motor 7 is secured to the member 10 by any suitable means.

As a driving connection between the shaft 14 of the constant speed motor 7 and the turntable, a friction pinion 15 may be used, and the inner face of the peripheral flange 16 of the turntable may be faced with any suitable friction material 17, such as rubber or fibre. In order that different speeds of rotation of the disc may be obtained, pinion 15 may have two metal-faced portions 18 and 19 of different diameters adapted to alternatively engage the inner face of the peripheral flange 16. This may be accomplished in a number of ways, perhaps the simplest being

to arrange the pinion 15 and shaft 14 so that the pinion may be removed, turned end for end, and replaced, thus bringing either portion into position to engage the flange 16. Or, if desired, the larger portion 18 may be arranged to slide over the smaller portion 19, thus bringing it into engagement with flange 16. In order to facilitate adjustment of the pinion 15, one or more holes in the disc, as 20, may be provided. Upon bringing the hole 20 into registry with the pinion 15, the necessary changes can be made.

If desired, the lever 13, for moving the member 10, may be connected to a suitable toggle switch, so that movement of the pinion 15 away from engagement with the flange is accompanied by a shutting off of the power supply to the motor 7.

For producing the record on the disc, a recording head 21, equipped with a cutting stylus 22 is provided. This head is mounted to traverse the face of the disc being operated upon by means of the stylus arm 23, which is so arranged as to progress over the face of the disc as the turntable is revolved. In order to provide the proper traversing movement of arm 23, a pulley 24 is mounted on a shaft 25, in a position to be driven by an endless belt 26 from the pulley 6 above referred to. This shaft 25 is carried in a pair of bearings in a supporting member 27 secured to or forming part of the base member 1.

Member 27 also carries a second shaft 28, mounted in a horizontal position, which shaft carries a pulley 29. The two shafts 25 and 28 are connected together for driving of shaft 28 by shaft 25, by the provision of a worm 30 on shaft 25, and the worm gear 31 on shaft 28, the two meshing.

At a distance from member 27 there is mounted a second support 32, which carries a second pulley 33, mounted in such a position with respect to pulley 29 that an endless belt or band 34 can be driven upon rotation of pulley 29. This belt is preferably formed of a thin, flexible, metallic strip. In order to keep proper tension on the belt or band 34, and prevent slipping, pulley 33 is preferably resiliently mounted, for movement toward and away from pulley 29. This is most simply accomplished by providing the pulley bracket 35 mounted for sliding movement on support 32, and a small coil spring between the bent-over end 36 of the bracket and a portion of the support 32, the spring being under compression to force the bracket, and the pulley 33 with it, away from pulley 29. The band 34 is thus kept under tension. Thus, it is seen that a band has been provided, which moves in the proper direction to cause the stylus arm to traverse the turntable as the table is rotated.

In order to properly mount the stylus arm 23 for motion by the band 34, a pair of guide rails 37 and 38 are secured to the supports 27 and 32. On these guide rails 37 and 38 there is mounted a carriage 39 for sliding movement along the rails. Secured to the carriage is the U-shaped member 40, having the leg 41 immediately above the upper lay and the leg 42 immediately below the lower lay of band 34, as shown in Figs. 5 and 6. Between the legs 41 and 42, and within the lays of the band 34, is a second U-shaped member 43 having legs 44 and 45. This member is mounted for vertical sliding in any suitable manner, here illustrated as being mounted on a plate 46 which slides between the carriage 39 and a cut-out portion of the U-shaped member 40. It can be seen that if the member 43 is slid upwardly, the upper lay of the band 34 will be engaged between legs 41 and 44, while if the member 43 be slid downwardly, the legs 42 and 45 will grip the lower lay of the band 34. As these lays are moving in opposite directions, selection of which lay to be engaged determines the direction in which the carriage 39 is driven. In order to secure a proper gripping action between the clutch faces formed by the legs of the two U-shaped members, a layer of friction material such as leather may be applied to one or both of the corresponding faces engaging the lays of the band, as shown at 47 in Fig. 5.

Any suitable means may be used to control the position of the sliding plate 46. In the form shown, a shaft 48 is journaled in the carriage 39, and has a small pin 49 in its end set eccentrically to the axis of the shaft. This pin 49 engages a slot 50 in sliding plate 46, so that upon rotation of the shaft, the plate 46 will be driven in an upward or a downward direction. In order to facilitate rotation of the shaft, and also to serve as an indication of the direction in which the carriage will travel, a handle 51 may be keyed to the shaft 48.

The stylus arm 23 is not mounted or supported on the carriage above described, but slides on the upper guide rail 37, and is merely driven by the carriage, as will appear. The stylus arm consists of the long arm 52, a crossarm 53 and a short arm 54. The crossarm 53 has a projecting ear 55 projecting downwardly and furnished with a bore through which passes the guide rod 37. A corresponding ear 56 is furnished on the long arm 52, also equipped with a bore for the passage of the guide rail, and the two cooperate to support the entire stylus arm 23 on the rail 37, but permit it to rotate about the axis of the rail, to permit the arm to be lifted to facilitate the changing of record discs, and to permit the stylus 22 to be placed in a selected position on the face of the disc. The short arm 54 is equipped with a counterweight to nearly balance the weight of the long arm and recorder head 21.

In order that the carriage drive the stylus arm, a compression spring 58 may be placed between the ear 57 and the carriage, as shown in Fig. 2. The ear 56 engages a portion of carriage 39, and is held thereagainst by the spring 58, thus insuring at all times that the parts are accurately positioned. The force of spring 58 is sufficient to maintain the driving carriage firmly against the ears of the stylus arm and prevent play or independent lateral motion between the carriage and the arm. If desired, an anti-friction washer 59 may be provided between ear 56 and the carriage 39.

In order to regulate the depth of the cut in the face of the record being produced, the recording head 21 is attached to a bracket 60, which bracket is in turn attached to the stylus arm. The bracket is, however, mounted for horizontal pivotal movement, so that the bracket and arm may pivot as a whole about an axis passing through the point of pivotal attachment of the bracket 60. As shown in Figs. 3 and 4, the bracket is pivoted to the stylus arm by means of studs 61 passing through the walls of the stylus arm and into holes in the bracket.

With such pivotal arrangement, the entire weight of the recording head would rest upon the stylus 22, which in many cases is too great pressure for proper recording. At the same time,

nothing which has heretofore been described supports the weight of the stylus arm 23 counterbalanced to some extent by the weight W. To provide for these, a movable shoe 62, polished and adapted to slide upon the surface of the disc being cut, is utilized. This shoe is mounted on the elongated member 63, which is in turn mounted on the shaft 64. The shaft 64 is adapted to slide axially, through holes formed in the sides of the stylus arm, whereby the shoe 62 can be placed on either side of the stylus. With this arrangement, the shoe 62 can always ride on the uncut side of the disc, to avoid interference because of chips and burrs on the cut side, and also to preserve the cut side from damage. The position of the shoe can be adjusted, to take care of differences in lengths of the stylus 22 by means of screw 65, working in a tapped hole in the stylus arm. The end of this screw engages the elongated member 63 on the side of the notch 66 cut therein, the purpose of the notch being merely to provide a bearing surface for the end of the screw, to prevent any tendency to bend the screw or cause a jamming of the screw and the member 63. In order to hold the elongated member 63 in its adjusted position against the screw 65, a leaf spring 67 is attached to the shaft 64, and bears against shaft 68, the flexibility of the spring permitting the screw to be adjusted but keeping the member 63 thereagainst.

With the shoe 62 supporting the weight of the stylus arm, the weight of the recorder head 21 still rests entirely, or nearly so, upon the point of the stylus 22. In order to provide a variable, lighter contact on the disc, a spring 69 is attached to the bracket 60, in such a manner that its tension tends to counterbalance the weight of the recorder head 21. This is clearly shown in Fig. 3. In order to vary the tension of the spring, and thus vary the uncounterbalanced weight resting on the point of the stylus, a flexible cable 70 is attached to the spring, and the cable wound about shaft 68 mentioned above. Winding the cable will naturally increase the tension of the spring, and remove some of the weight from the point of the stylus 21. Suitable index means and adjusting knob 71 may be provided to enable duplication of tension as desired.

By permitting the arm 23 to pivot on guide rail 37 (which is on substantially the same level as the record disc being cut), and by permitting the recording head 21 to rise and fall with any undulations in the surface of the disc by reason of the shoe 62, the stylus 22 will cut a groove of uniform depth and linear speed.

It is understood that many variations in structure may be practiced without departing from the spirit or scope of this invention, which is to be determined from the appended claims, rather than the above description, which is intended to be illustrative rather than limitative.

I claim:

1. In a sound recording machine, the combination of: a stationary frame including a horizontally disposed guide means; a pulley rotatably mounted at each end of said frame, a flexible, continuous band carried by said pulleys; a driving carriage slidably mounted on said guide means; a clutch on said carriage, said clutch being adapted to selectively engage and hold either lay of said band; said clutch comprising a pair of stationary face plates and a pair of movable face plates, said movable face plates being fixed relative to each other, and said stationary and said movable face plates being so arranged that movement of the movable plates in one direction causes one of the lays of said band to be engaged by one of said stationary and one of said movable face plates, and movement of the movable plates in the other direction causes engagement of the other lay of said band by the other two face plates.

2. In a sound recording machine the combination of: a stationary frame including a pair of horizontally disposed guide rails; a pulley rotatably mounted at each end of said frame; a flexible continuous metallic belt carried by said pulleys; a driving carriage slidably mounted on said guide rails; a clutch on said carriage, said clutch being adapted to selectively engage and hold either lay of said belt, said clutch comprising a pair of stationary face plates, one immediately above the upper lay and one immediately below the lower lay of said belt, a pair of movable face plates between the lays of said belt; and lever actuated cam means for actuating said movable face plates to selectively engage the belt between a stationary face plate and a movable face plate.

3. In a reversible drive for the stylus arm of a sound recording machine including a rotatable disc table, the combination of: horizontally disposed guide means to one side of said table and substantially on the level of a disc on said table; a pulley rotatably disposed at each end of said guide means; a flexible continuous band carried by said pulleys, a clutch including a movable member selectively movable to engage and hold either lay of said band, and means connecting said clutch to a stylus arm whereby motion of the clutch is imparted to said stylus arm.

4. In a sound recording machine including a rotatable disc table, the combination of: horizontally disposed guide rails to one side of the disc table and substantially in the plane of a disc on said table, a pulley rotatably mounted on each end of said rails; a flexible continuous band carried by said pulleys; a stylus arm pivotally mounted on one of said guide rails; a clutch including a movable member selectively movable to engage and hold either lay of said band; means connecting said clutch to the stylus arm whereby motion of the clutch drives said stylus arm along said guide rail; a contact shoe carried by the end of said stylus arm; and means for adjustably raising and lowering said shoe.

5. In a sound recording machine including a rotatable disc table, the combination of: horizontally disposed guide rails to one side of the disc table and substantially in the plane of a disc on such table, a pulley rotatably mounted on each end of said rails; a flexible continuous band carried by said pulleys; a stylus arm provided with an independently movable stylus head pivotally mounted on one of said guide rails; a clutch including a movable member selectively movable to engage and hold either lay of said band; means connecting said clutch to the stylus arm whereby motion of the clutch drives said stylus arm along said guide rail; a contact shoe carried by the end of said stylus arm in close proximity to said independently movable head; and means for adjustably raising and lowering said shoe.

ALEXIS BADMAIEFF.