Aug. 4, 1936. C. W. NYSTRÖM 2,049,821

SOUND RECORD AND SOUND RECORDING AND REPRODUCING MEANS

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Fig. 1

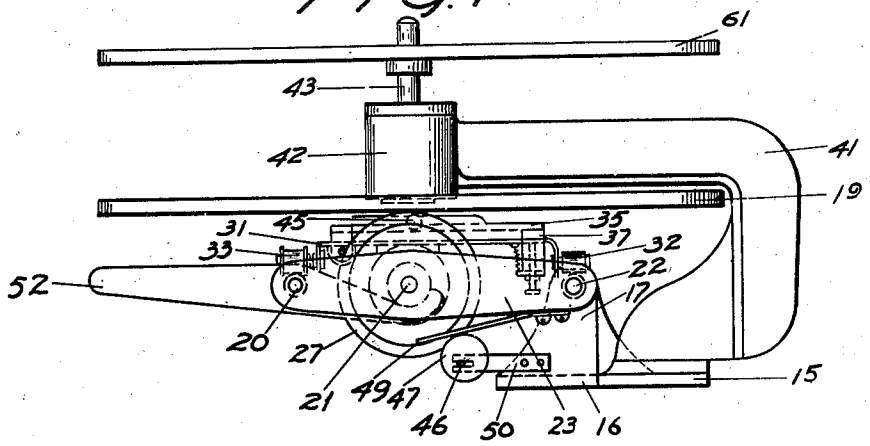
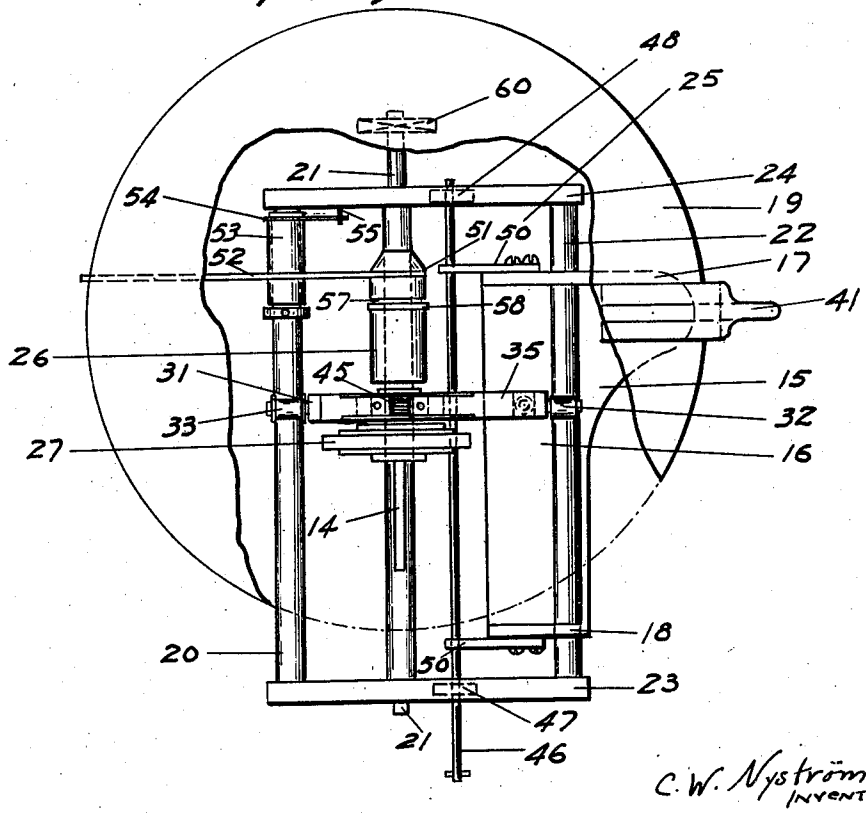


Fig. 2



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Fig. 3

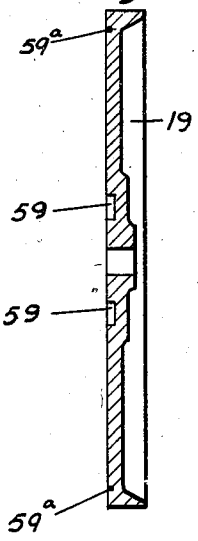


Fig. 4

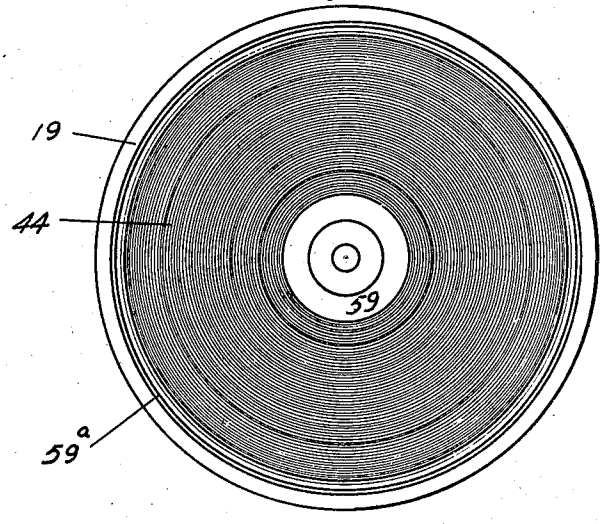


Fig. 5

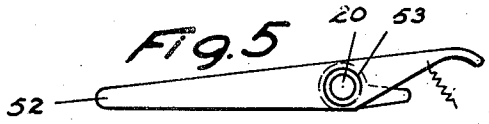


Fig. 6

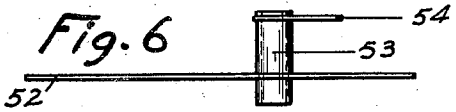


Fig. 7

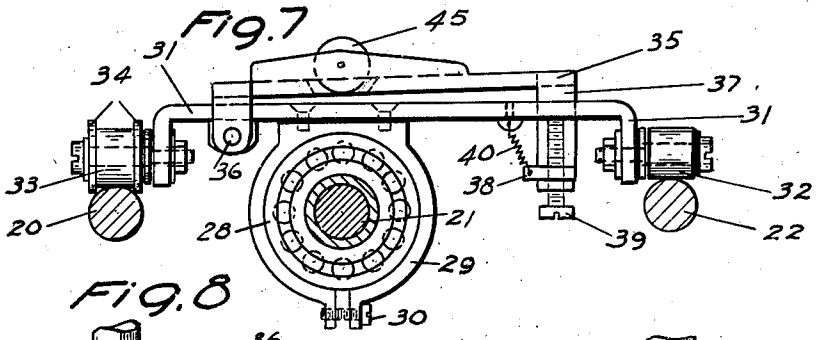
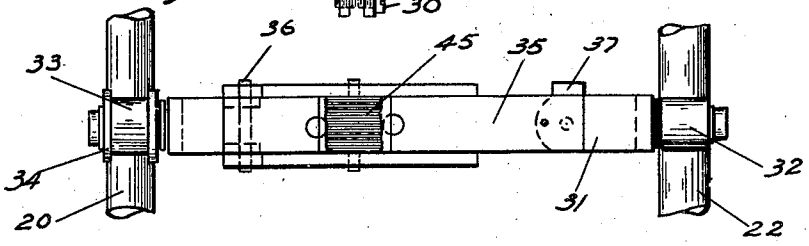


Fig. 8



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SOUND RECORD AND SOUND RECORDING AND REPRODUCING MEANS

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Fig. 9

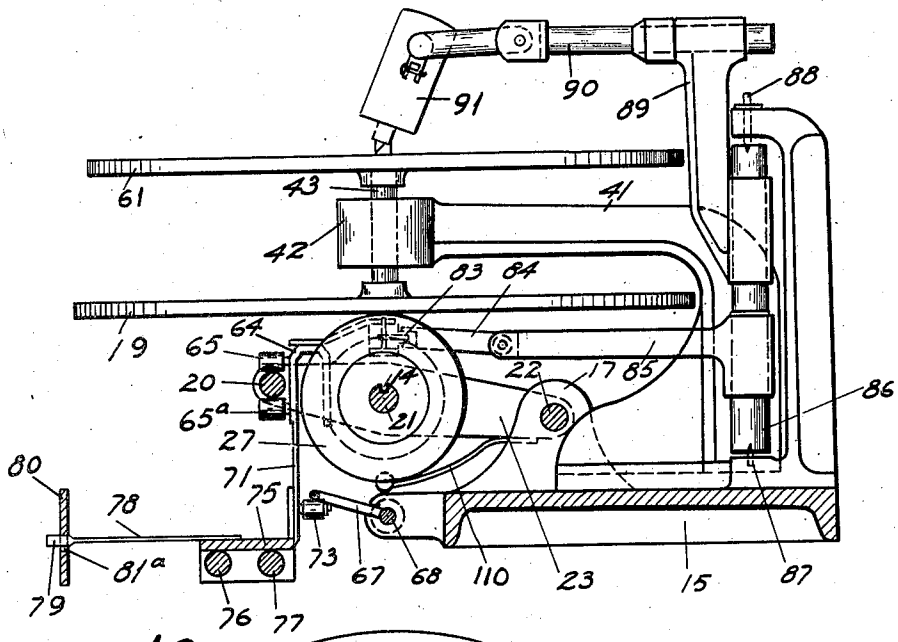
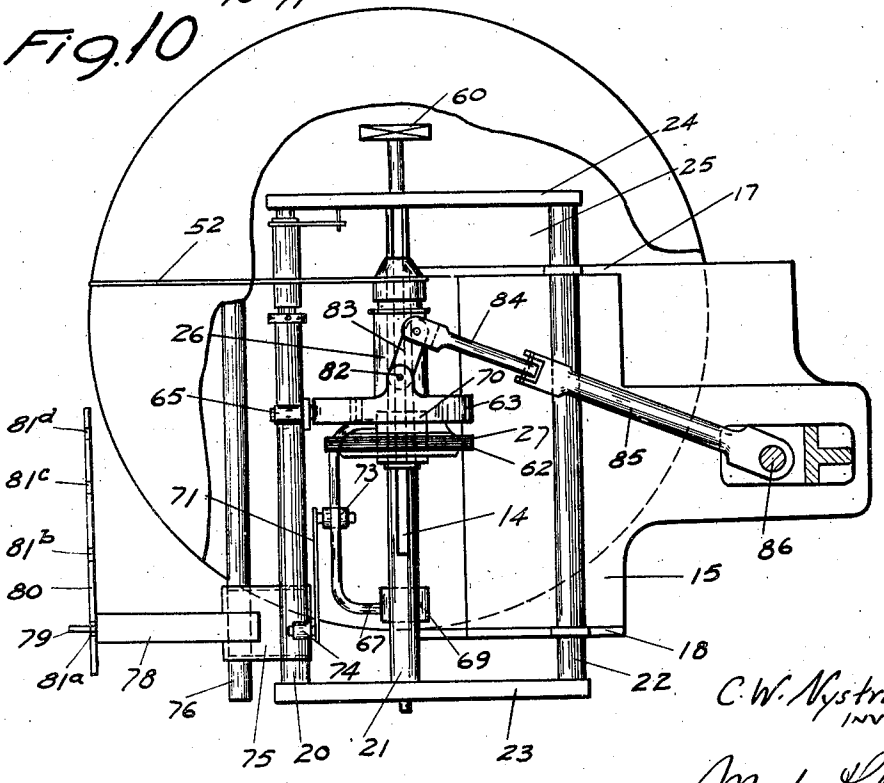


Fig. 10



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SOUND RECORD AND SOUND RECORDING AND REPRODUCING MEANS

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Fig. 11

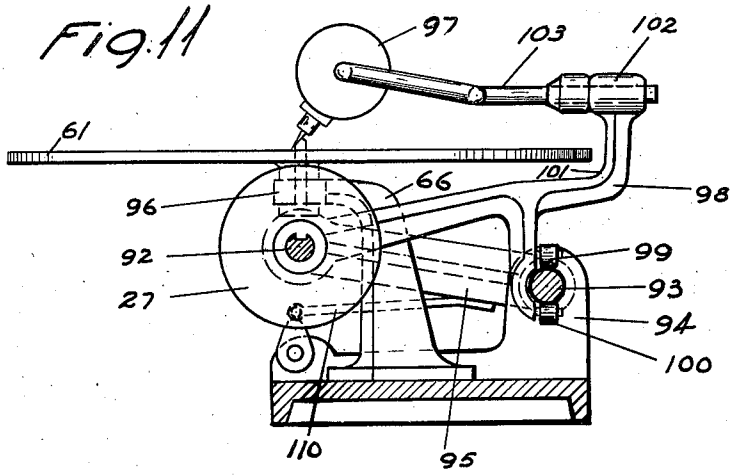


Fig. 12

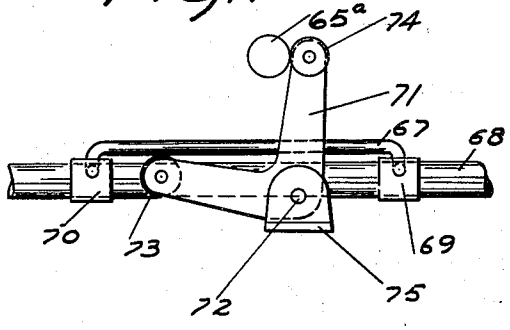
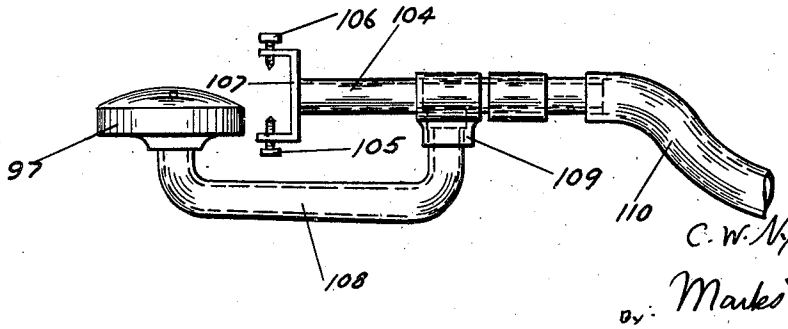


Fig. 13



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UNITED STATES PATENT OFFICE

2,049,821

SOUND RECORD AND SOUND RECORDING AND REPRODUCING MEANS

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Application March 16, 1932, Serial No. 599,307
In Sweden April 2, 1931

4 Claims. (Cl. 274—9)

This invention relates to sound records and sound recording and reproducing means. In apparatuses for recording sound waves on a surface such as a disk and for reproducing the sound records produced on the disk or a duplicate copy thereof it has been customary to drive the disk or surface with a substantial constant velocity of rotation, so that the tangential velocity of the point or points of the disk engaging the recording tool such as a record cutter or its equivalent or the reproducing member such as a stylus or its equivalent will decrease more and more when the cutter or stylus moves from the outer parts of the disk to the centre. As a result the recording of a certain sound at the peripheral parts of the disk requires an essentially larger length of the record than if the same sound was recorded at the inner parts of the disk. It will be obvious that this means an ineffective utilization of the record disk, especially of its peripheral parts.

A principal object of the invention is to enable a better utilization of the surface of the disk by driving said disk in such a manner that the point or points engaging the recording tool hereinafter called the cutter, or the reproducing member, hereinafter called the stylus, is or are imparted a substantially constant tangential velocity, so that the recording of a certain sound always occupies an equal length of the record at any distance from the centre of the disk. In this way a record disk of the usual size can receive about 200% more sound wave records than hitherto, so that the material of the disk is utilized more efficiently. Owing to the fact that the tangential velocity of the points engaging the cutter or the stylus or equivalent tools may be kept at a constant and comparatively low value the wear of the disk and the tool is reduced, and the friction between the disk and the tool does not cause such inconvenient noise as in the known kind of record disks, the outer points of which rotate at comparatively high velocities.

A further object of the invention is to enable the employment of the known kind of records in a reproducing apparatus according to the invention.

The invention also provides means for positively moving the cutter or the stylus in a determined relation to the driving gear of the disk.

Moreover the invention has for its object to provide means for automatically disengaging the driving gear when the cutter or stylus reaches the utmost peripheral parts of the disk.

Further objects and advantages of the invention will be described with reference to the accompanying drawings, which illustrate the invention in some preferred embodiments, and in which

Figure 1 represents a side view of an apparatus embodying my invention,

Figure 2 a plan view thereof with certain parts omitted,

Figure 3 a vertical section through a driving disk and

Figure 4 a plan view thereof,

Figures 5 and 6 detail views,

Figure 7 an end elevation, and

Figure 8 a plan of the driving gear,

Figures 9 and 10 part sectional side and plan views similar to Figures 1 and 2 respectively of a modified construction,

Figure 11 a further modified embodiment,

Figure 12 a part of the apparatus shown in Figures 9 and 10 drawn to a larger scale, and

Figure 13 a carrier for the reproducing and recording tools.

Referring to Figures 1 and 2, 15 is a support comprising a base plate 16 and two stationary bearings 17, 18 and carrying a frame construction for the driving mechanism. The frame comprises three substantially parallel shafts 20, 21, 22 of which the two outer shafts 20, 22 are fixed at their ends to two arms 23, 24, so that the whole construction forms a parallelogram 25, mounted to turn on the shaft 22, which is journalled in the stationary bearings 17, 18 of the plate 16. The shaft 21, which is provided with a slot 14 is rotatably mounted in the arms 23, 24 and carries a friction wheel 27, rigidly attached to a slidable sleeve 26 and having a pin or roller (not shown) fitting into the slot 14. Associated with the wheel 27 (Figure 7) is a bearing 28, preferably a ball-bearing slidably mounted on the shaft 21 and surrounded by a clamping ring 29 which is clamped to the roller-bearing 28 by means of a screw 30. The clamping ring 29 carries at its upper end a U-shaped bar 31 (Figures 7 and 8) having angular ends, each provided with a guide roller 32 and 33 respectively adapted to run on shafts 20 and 22 of said parallelogram, so that the bar 31 is maintained in a substantially horizontal position in relation to the parallelogram 25. As shown on the drawings the roller 33 may also be provided with flanges 34 bearing on the shaft 20 in order to guide the bar 31 transversely.

Pivotally attached to the bar 31 at 36 is a yoke 35, the opposite end of which carries an angular

piece 37 having at its lower horizontal end 38 an adjustment screw 39 bearing on the lower surface of the bar 31. The yoke 35 is caused to occupy a substantially fixed position in relation to the bar 31 by means of a spring 40 attached at one end to the bar 31 and at its other end fixed to the horizontal part 38 of the angular piece 37. The elevational position of the yoke 35 in relation to the bar 31 and the parallelogram 25 may be controlled by the adjustment screw 39. The yoke 35 carries at its upper side a rotatable roller 45, provided with peripheral annular cams, grooves or the like (Figures 2 and 8). It will be understood that the means described compels the friction wheel 27 together with the bar 31, yoke 35 and sleeve 26 to slide on the shaft 21.

Rotation is imparted to the shaft 21 from a spring motor, an electric motor or other suitable power unit, by the interposition of a gear 60, which may consist of a toothed wheel rigidly mounted on the shaft 21. The toothed wheel 60 may be omitted, in which event the shaft 21 is directly connected to the power unit. By means of the engagement of the slot 14 with the pin or roller projecting therein from the friction wheel 27 the rotation of the shaft 21 causes the wheel 27 to be rotated whilst permitting the said wheel at the same time, to slide along the shaft 21 for the purpose described below.

Fixed to the plate 16 is a bracket 41 carrying a disk 19 which is rotatably journalled in a bearing 42 of the bracket 41 by means of an axle 43.

Above the bearing 42 of the bracket 41 the axle 43 of the rotatable disk 19 extends upwardly and this extension carries a plate 61 rotating together with the disk 19. The plate 61 is adapted to support the disk or surface (not shown) adapted to receive or reproduce sound records, the latter disk usually simply being called "the record" or "the record disk."

As stated hereinbefore the parallelogram 25 is mounted to swing about the shaft 21 in the bearings 17, 18. By the aid of eccentric means, preferably comprising a rod 46 and two eccentric sheaves 47 and 48 supported by arms 50, the parallelogram 25 may be lifted or raised to cause the friction wheel 27 to engage the disk 19 and rotate it.

To permit a yielding engagement of the wheel 27 with the disk 19 spring means 49 (Figure 1) are provided attached to the arms 23, 24 and bearing on the eccentric sheaves 47, 48 respectively.

The wheel 27 is adapted to be displaced in a substantially radial direction on the disk 19 simultaneously with its being rotated. For this purpose one surface of the disk 19 (in the embodiment illustrated the lower surface) is provided with a spiral groove 44 (shown in Figure 4 as a series of concentric circles for convenience in drawing) the pitch of which may correspond to the pitch of the sound wave record on the record disk, which usually has eighty spiral turns or more to the inch. The spiral groove 44 in which the several turns of the spiral are spaced preferably at equal distances from each other, is adapted to effect the radial displacement of the wheel 27, preferably by means of an intercoupled member engaging the groove 44 and associated with the wheel 27. The radial displacement of the wheel 27 will always be constant, if the spiral 44 has equally spaced turns. In the embodiment illustrated in Figures 1–8 said intercoupled member consists of the roller 45 and for the purpose stated, the distance between the peripheral annular cams or grooves of this roller corresponds exactly to the space between the turns of the spiral 44 of the disk 19. Preferably the peripheral surfaces of the cams or grooves are of V-shaped cross section to facilitate engagement. Instead of the roller 45 there may be provided needles, pins or plane cams but such devices will cause a certain noise owing to the sliding friction against the disk. The roller 45 is mounted so as to make contact with the disk 19 prior to the engagement between the wheel 27 and the disk 19 upon lifting the parallelogram. By setting the adjustment screw 39 and the spring 40 a very exact adjustment of the position of the roller 45 in relation to the friction wheel 27 and the spiral groove disk 19 respectively may be established so that the roller 45 will engage the disk 19 at the desired moment.

The sound wave records may be made on the record disk by a suitable recording member such as a cutting tool or a cutter (not shown in Figures 1–8) actuating the surface of the record disk. In using the apparatus for reproducing the sound records from the disk or from a duplicate copy thereof the cutter is replaced by a reproducing tool such as a stylus.

In the starting position of the parts the friction wheel 27 and the roller 45 may be placed at the inner turns of the spiral 44 on the groove disk 19, but it will be obvious that the starting position also may be arranged at the outer turns in which event the wheel 27 is displaced to the centre of the disk 19.

In the event that the starting position of the friction wheel 27 and of the roller 45 is arranged at the inner turns of the spiral 44 it is preferred to provide means to automatically indicate the proper starting position. For this purpose the sleeve 26 is provided with an annular shallow groove 51 with which a pivotable lever 52 (Figures 1, 2, 5, 6) will engage when the groove 51 is in alignment with the said lever. This position corresponds to the starting position. The lever 52 is pivoted upon a collar 53 mounted to swing about the shaft 20. Pins 54, 55 are adapted to limit the upward movement of the lever 52.

The forward end of the sleeve 26 has a conical surface so that upon moving the sleeve back to starting position the lever 52 is caused to be lifted by the conical surface and enters the shallow groove 51 so that further inward displacement of the sleeve will be checked thus indicating that the starting position is reached. Since the groove 51 has a shallow shape the lever 52 can easily slide out of engagement with the groove at the beginning of the outwardly radial displacement of the sleeve 26 by means of roller 45 and the spiral groove 44.

The operation of the apparatus will be understood with reference to the drawings. If a constant velocity of rotation is imparted to the friction wheel 27 the groove disk 19 engaging with this wheel by friction will obtain a speed of rotation corresponding to the constant peripheral velocity of the wheel 27. At the same time the wheel 27 is displaced in radial direction in relation to the disk 19, by means of the roller 45 engaging and rolling in the spiral groove 44. Obviously this displacement may be effected either from the inner parts of the disk 19 towards its periphery, or from the peripheral parts of the disk towards its centre. In this

way the velocity of rotation of the disk 19 and also of the supporting plate 61 carrying the record disk will vary according to the position of the wheel 27 on the driving disk 19 so that in the event that the displacement is effected from the inner parts to the periphery of the disk the speed of rotation of the record disk decreases as the wheel 27 moves towards the peripheral parts. It will be clear that the tangential or linear velocity of the points of the disk 19 engaging the friction wheel 27 at every instant will be maintained at a constant value.

Provided that the radial displacement of the cutter or stylus is performed at the same speed as the displacement of the wheel 27, the linear or tangential velocity of the point or points of the record disk engaging the cutter or stylus will also be constant so that a certain sound recorded anywhere on the disk, always occupies a determined length of the record. In reproducing the records the record disk of course must be rotated in the same manner as in making the records.

If it is desired to use the apparatus for the hitherto usual kind of record disks, the roller 45 must be locked in an inoperative position so that the radial displacement of the wheel 27 ceases. To this end the sleeve 26 is provided with a second groove 57, with which the lever 52 engages to lock the sleeve in its position when the sleeve is moved inwardly to a sufficient degree. To limit the inward displacement of the sleeve the forward surface of the groove 57 is provided with a shoulder or wall 58. In this position of the sleeve 26 the roller 45 eventually may fall into a cavity 59 (Figure 3) of the disk 19 inside the turns of the spiral 44 which now is not affected by the roller.

The friction wheel 27 and if desired also the disk 19 may be coated with a suitable friction material such as caoutchouc, leather or the like. Also the engaging parts may be provided with rough surfaces.

It will be understood that the spiral groove 44 may also be provided on the surface of the disk 19 opposite to the friction wheel 27. In this case the spiral groove 44 may be greased with oil to reduce the friction.

Figures 9, 10, 11, and 12 illustrate modified constructions of the invention.

As shown in Figures 9 and 10 the friction wheel 27 is provided with peripheral annular concentric grooves, cams 62 or the like which replace the cams of the roller 45 described with reference to Figures 1–8. In this embodiment the roller 45 is omitted and the friction wheel 27 is adapted not only to drive the disk 19, by friction but also to engage the spiral groove 44 of the disk. The friction wheel 27, normally engaging the disk 19 thus causes the latter to rotate simultaneously as the wheel 27 is displaced in radial direction on the surface of the disk by engagement of the spiral 44 with the annular grooves or cams 62. As described with reference to the apparatus shown in Figures 1–8 the points of the disk 19 engaging the wheel 27 will be rotated at a constant linear velocity if the wheel 27 rotates with constant velocity of rotation. The sleeve 26 is arranged in the same manner and has the same object as described above in connection with the construction shown in Figures 1–8.

The combined friction and feeding wheel 27 is attached to a non-rotatable journal casing 63, which is displaced in the radial direction by the wheel. One end of the casing 63 is provided with a U-shaped member 64 (Figure 9) carrying two guide rollers 65 and 65ª adapted to roll on opposite sides of the shaft 20 of the parallelogram 25 so that the movement of the wheel 27 is guided.

In the embodiment shown in Figures 1–8 the wheel 27 is lifted up to the disk 19 by means of an eccentric device which is hand operated. Figures 9 and 10 illustrate an automatic device for the same purpose adapted to disengage the wheel 27 and the grooved disk 19 at a desired distance from the centre of the disk. Such automatic device enables the disengagement to be effected just at the desired distance which is important if record disks of different sizes are used.

The disengaging means comprises a yoke 67 fixed to a rod 68 by means of two collars 69, 70 and adapted to engage a bell crank lever 71 (Figure 12) pivoted at 72. The rod 68 is connected to an eccentric device similar to that shown in Figures 1 and 2 and co-operating with the arms 23, 24 or another part of the parallelogram 25 through the intermediary of spring means 110, thus controlling the position of the parallelogram. With the wheel 27 in engagement with the disk 19 the parallelogram is maintained in its upper position by said eccentric device and in this position of the parts a roller 73 attached to the lower end of the bell crank lever 71 (Figure 12) is just below the yoke 67. Also the upper end of the lever 71 is terminated by a roller 74 running on the lower side of the shaft 20. The pivot 72 of the bell crank lever 71 is mounted in a frame 75 slidably mounted on two bars 76, 77. The frame 75 is moved on the bars by means of a yielding plate 78, one end of which is attached to the frame 75 whilst the other or free end has a handle 79 which projects through a slotted guide plate 80. The guide plate is provided with several vertical slots 81ª, 81ᵇ, 81ᶜ, 81ᵈ, in which the handle 79 fits and is maintained therein by the yielding action of the plate 78, thus enabling the frame 75 to be set in different determined positions.

When it is desired to make a sound wave record in a record disk carried by the plate 61 or when it is desired to reproduce the records the friction wheel 27 is placed, say in its inner position and during the rotation it is displaced successively to the peripheral parts of the disk 19. The rollers 65, 65ª are then running on their axle 20. After a predetermined time the wheel 27 has been displaced so far that the roller 65ª engages the roller 74 of the bell crank lever 71 (Figure 12) so that the lever 71 is caused to rotate about its pivot 72 in a clockwise direction. The lower roller 73 is now lifted and causes the axle 68 and the eccentric gear to be turned so that the whole parallelogram is lowered under the influence of its own weight. As a result of this movement the wheel 27 is disengaged from the disk 19 and the rotation of the latter will then cease. By suitably setting the frame 75 carrying the bell crank lever 71 the described disengaging gear may be released just at the moment when the wheel 27 reaches the periphery of the record used. If it is desired to use a record of greater or smaller size, the frame 75 may be set in another position by means of the guide plate 80.

In apparatuses of the kind described it is very important that the cutter or equivalent member for recording sound waves and the stylus or

equivalent member for reproducing such records are always exactly in the same position in relation to the wheel 27 since if the contrary be the case there would not be exact correspondence with respect to the speed of the engaging point of the record disk during recording and reproducing respectively. To overcome this difficulty provision is made to establish a positive movement between the wheel 27 and the means carrying the cutter and/or the stylus. For this purpose one end of a link 83 is pivotally mounted on the casing 63 at 82, the other end of the link being pivoted to a rod 84, which in turn is movable on a horizontal axle in a bifurcated lever 85. The lever 85 is fixed to a bracket 86, which is pivotable about two pivots 87, 88. The bracket 86 is fixed to a support 89 adapted to support the carrier 90 of the box 91 of the cutter (or the stylus). By suitable adjustment of the transmission described the cutter and the stylus may be caused to take up exactly the same position in relation to the wheel 27, and this relative position is maintained during the displacement of the wheel 27 owing to the positive movement between the said parts. Of course, the stylus or cutter will move on a circular line, whereas the wheel 27 moves on a straight line but the slight irregularity of the relative positions caused by these facts has no practical importance.

Figure 11 illustrates a further embodiment of the invention. As shown the parallelogram 25 in this case only comprises two shafts 92, 93, the latter of which serves as a pivot and is journalled in bearings 94. The shafts are connected by arms of which only one 95 is shown. The friction wheel 27 is slidably mounted on the shaft 92. The spiral 44 engaging with the grooves 62 of the wheel 27 is provided on the supporting plate 61 itself which means a simplification of the construction. The plate 61 is carried by a bracket 66 supporting the plate by means of a roller bearing 96.

The positive movement between the stylus (or the cutter) and the wheel 27 is adapted to be effected as a parallel straight line movement so that the slight irregularity caused by the circular movement of the stylus (or cutter) is avoided. To this purpose a lever 98, connected to the hub of the friction wheel 27 in adapted to follow the radial displacement of the wheel. The lever 98 guided by means of rollers 99, 100 on the bar 93 is angularly bent at 101 to form a bracket 102 for the carrier 103 of the sound box 97 of the stylus. By means of this arrangement the stylus will be imparted a positive movement which is exactly parallel to the radial displacement of the wheel 27.

Figure 13 illustrates a carrier for the box of the cutter and of the stylus. This carrier may be employed if the apparatus is to be used both as recording and reproducing apparatus. The hollow carrying member of the cutter box is indicated by 104 and is provided with screws 105, 106 in a fork 107 for the cutter box (not shown) so that the latter may be swung upwardly when not used. The sound box 97 of the stylus is so situated as to enable the stylus to engage exactly the same point of the record disk as the cutter. The sound box 97 is connected to a sound arm 108 adapted to be swung about the member 104 at 109. The sound is led from the box 97 through the arm 108 to the hollow member 104.

Since the member 104 and the box 97 are moving during the reproduction, the member is connected to a horn or the like by means of a flexible tube 110, preferably consisting of caoutchouc or resilient ring members.

It will be obvious that the groove disk 19 may be provided with a groove having a larger pitch than that of the record disk. In such event a velocity gear is required for the feeding mechanism.

The cutting tool or the cutter may be actuated as by a diaphragm subject to the action of sound waves or actuated electromagnetically by electric impulses set up by the action of sound waves, as in a microphone. Also any other equivalent recording member may be used.

It will also be obvious that the stylus may be substituted by an equivalent member serving the same purpose.

The record disk may be formed of any suitable material capable of being cut by a record cutter.

It will also be noted that as stated hereinbefore the friction wheel 27 may be displaced from the outer parts of the disk 19 to the centre instead of vice versa.

While a specific embodiment of the invention has been illustrated and described it is to be understood that alterations of the details of construction may be made without departing from the spirit of the invention.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a sound vibration transmitting apparatus, a rotatable record driving disc having a spiral groove therein, a driving system comprising a rotatable body adapted to engage a surface of the driving disc and having a ribbed guiding surface to engage said spiral groove, and means whereby said driving system is mounted for relative displacement with respect to said rotatable record driving disc comprising a frame-like structure having a pair of arms each arranged at opposite sides of the frame-like structure, a driven shaft rotatably mounted on said arms and adapted to receive said driving system for radial displacement as said shaft rotates, a second shaft journalled on said frame and on which said driving system is pivotally supported, and means carried by said frame-like structure for maintaining said driving system in resilient contact with said record driving disc.

2. In a sound vibration transmitting apparatus, a rotatable record driving disc having a spiral groove therein, a driving system comprising a rotatable roller adapted to engage a surface of the record driving disc and a guide component having a ribbed surface to engage said spiral groove, and means whereby said driving system is mounted for relative displacement with respect to said rotatable record driving disc comprising a frame-like structure having a pair of arms each arranged at opposite sides of the frame-like structure, a driven shaft rotatably mounted on said arms and adapted to receive said driving system for radial displacement as said shaft rotates, two outer shafts arranged parallel to said driven shaft and fixed at the ends of said arms for supporting said driving system, one of said shafts journalled in bearings provided on the frame-like structure, a bearing member fixedly associated with said rotatable roller and carrying a U-shaped bar, a guide roller at each end of said U-shaped bar adapted to engage said outer shafts, a yoke member pivoted to said bar and carrying said guiding

component for said driving system, and means carried by said frame-like structure for maintaining said driving system in resilient contact with said record driving disc.

3. In a sound vibration transmitting apparatus, a rotatable record driving disc having a spiral groove therein, a driving system for said record driving disc comprising a rotatable roller having a ribbed surface to engage said spiral groove, and means whereby said driving system is mounted for relative displacement with respect to said rotatable record driving disc comprising a frame-like structure having a pair of arms each arranged at opposite sides of the frame-like structure, a driven shaft rotatably mounted on said arms and adapted to receive said driving system for radial displacement as said shaft rotates, two outer shafts arranged parallel to said driven shaft and fixed at the ends of said arms for supporting said driving system, one of said shafts journalled in bearings provided on the frame-like structure, a bearing member fixedly associated with said driving system and carrying at one end oppositely arranged guide rollers adapted to engage the other of said outer shafts, and means carried by said frame-like structure for maintaining said driving system in resilient contact with said record driving disc.

4. A sound vibration transmitting apparatus as described in claim 2 in which said means for maintaining said driving system in resilient contact with said record driving disc comprises a device carried by the frame having eccentric portions to displace said driving system in a direction perpendicular to said record driving disc, and a resilient connection attached to said arms and bearing on said eccentric portions.

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