Feb. 25, 1936. M. A. LICHTEN 2,032,062

APPARATUS FOR ENGRAVING SOUND VIBRATIONS ON FLEXIBLE RECORDS

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Fig. 1.

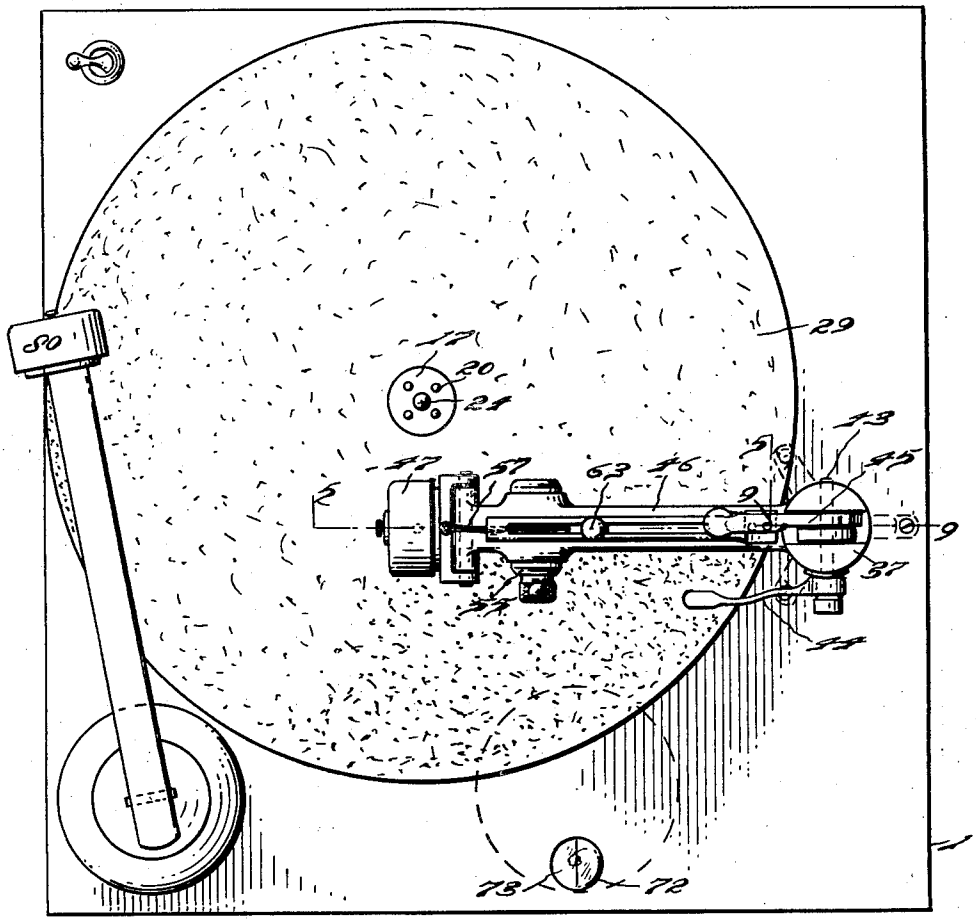


Fig. 2.

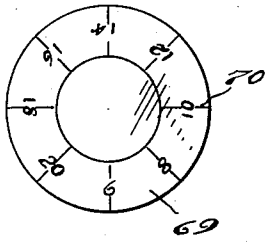
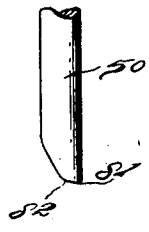


Fig. 3.



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Fig. 4.

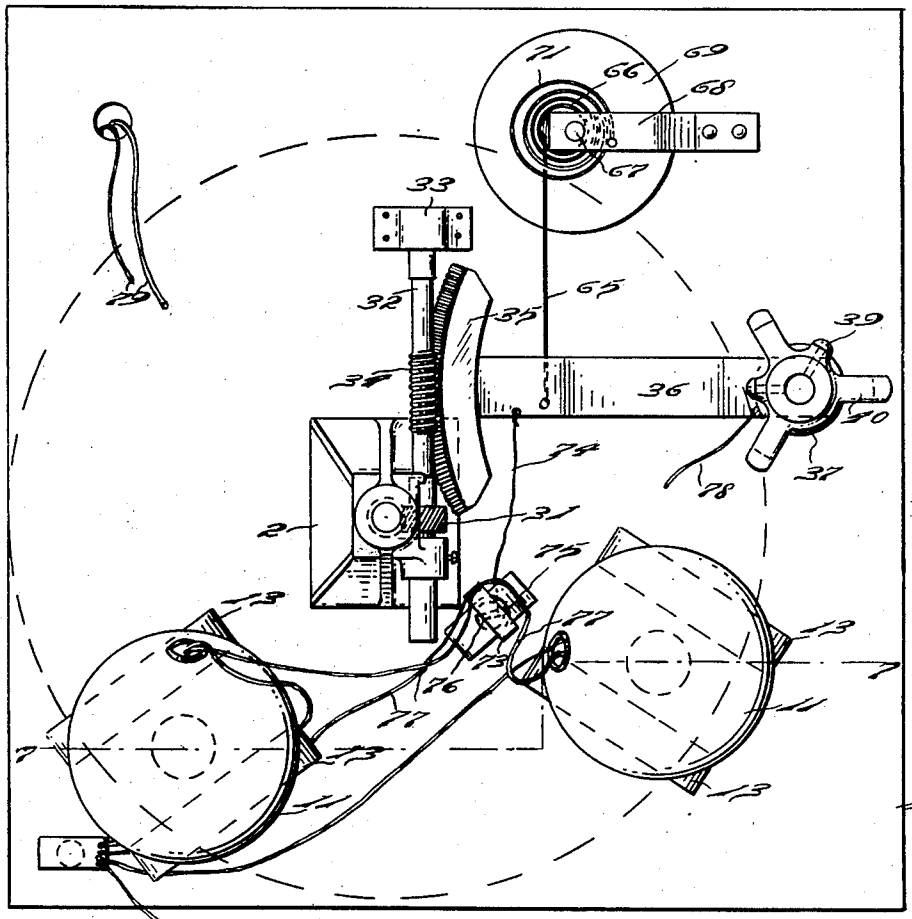
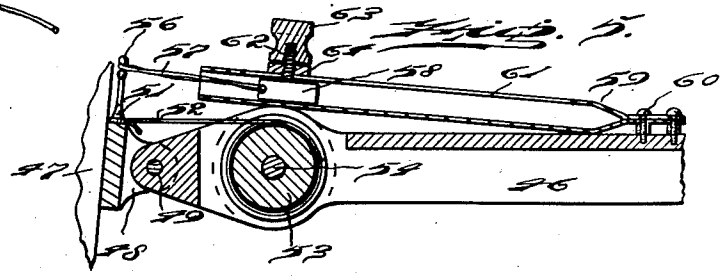


Fig. 5.



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Fig. 6.

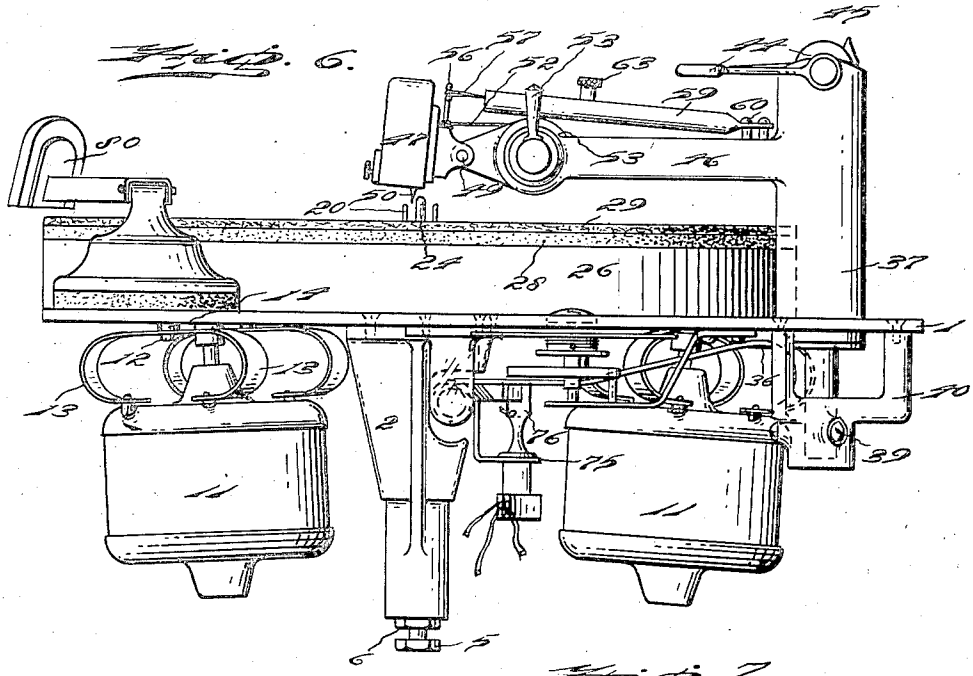


Fig. 7.

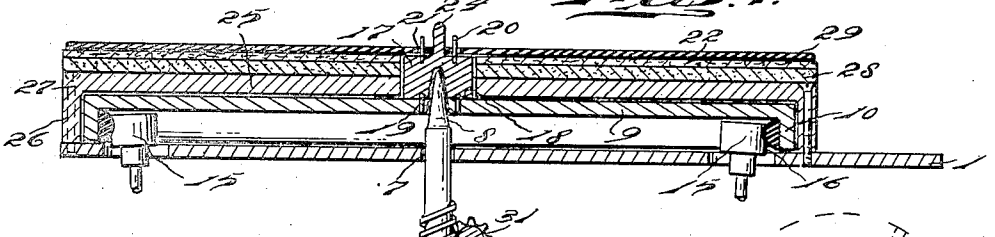


Fig. 8.

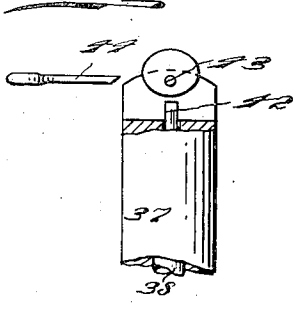
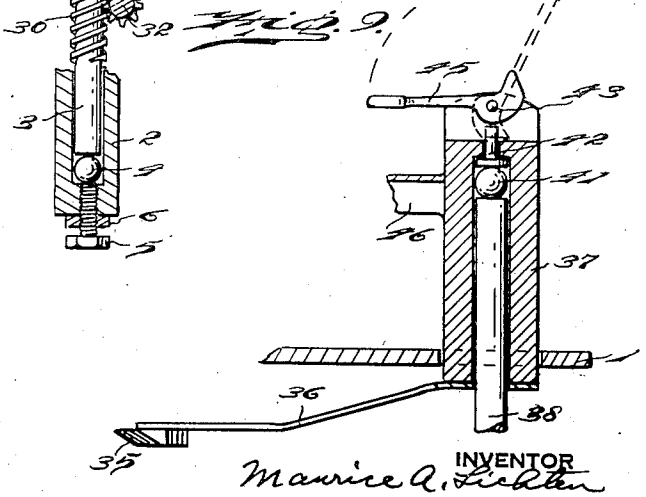


Fig. 9.



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UNITED STATES PATENT OFFICE

2,032,062

APPARATUS FOR ENGRAVING SOUND VIBRATIONS ON FLEXIBLE RECORDS

Maurice A. Lichten, Fort Howard, Md., assignor, by mesne assignments, to Fidelitone Records, Inc., a corporation of New York

Application February 2, 1933, Serial No. 654,782

7 Claims. (Cl. 274—9)

An object of the invention is the provision of improved apparatus adapted for the engraving of sound vibrations from the outside to the inside of flexible records or vice versa whereby the depth of the sound track will be more nearly uniform so that tendencies toward surface noise on reproduction will be reduced and other advantages secured.

With the above and other objects in view, as will hereinafter more clearly appear, my invention comprehends a novel apparatus for engraving sound vibrations on flexible records and wherein a much more constant depth of cut is maintained.

It further comprehends novel means for supporting and for effecting the revolution of a flexible record.

In accordance with the invention, there is provided apparatus wherein flexible records are positively revolved upon a stationary resilient support, thus enabling the cutting of a groove having much greater uniformity than would otherwise be possible and the reproduction of sound in an especially satisfactory manner.

Other novel features of construction and advantage will hereinafter more clearly appear in the detailed description and the appended claims.

For the purpose of illustrating the invention, I have shown in the accompanying drawings a typical embodiment of it, which, in practice, will give reliable and satisfactory results. It is, however, to be understood that this embodiment is typical only and that the various instrumentalities of which my invention consists can be variously arranged and organized, and the invention is not limited to the specific arrangement, organization or function of these instrumentalities as herein set forth.

Figure 1 is a top plan view of one type of machine for engraving sound vibrations on flexible material and embodying my invention.

Figure 2 is a plan view of an indicating dial employed.

Figure 3 is a side elevation, on an enlarged scale, of a novel form of stylus which may be used in connection with the invention.

Figure 4 is a bottom plan view of the construction seen in Figure 1.

Figure 5 is a section on line 5—5 of Figure 1, showing more particularly the details of the cutting head and its supporting arm.

Figure 6 is a side elevation of the construction seen in Figure 1.

Figure 7 is a section substantially on line 7—7 of Figure 4.

Figure 8 is a side elevation, partly in section, of a tubular post, showing more particularly one of the cam members employed.

Figure 9 is a section, substantially on line 9—9 of Figure 1, showing more particularly the manner in which the tubular post is mounted and the manner in which its vertical adjustment is effected.

Similar numerals of reference indicate corresponding parts.

Referring to the drawings:—

The operating mechanism of the machine is preferably mounted on a base plate 1 which may, if desired, be placed in any suitable or conventional type of cabinet. The base 1 has depending from it a bearing member 2 in which is journalled a driving shaft 3. In order to effect vertical adjustment of this shaft its lower end is mounted on a ball 4 against which bears an adjusting screw 5 in threaded engagement with the bearing and a lock nut 6 is provided to fix the adjusting screw in the position to which it has been adjusted. The base plate is apertured, as at 7, to permit the shaft 3 to pass therethrough, see Figure 7, and the upper end of the shaft is tapered, as at 8, in order to adapt it to receive a fly wheel 9 which frictionally engages a tapered portion of the shaft. The fly wheel is preferably in the form of a disc having a depending flange 10 which is driven in a novel manner by means of a motor drive, various features of which are claimed in my co-pending application, Serial No. 51,776, filed November 27, 1935, which is a continuation-in-part of the present case.

One or more electric motors may be employed to drive the fly wheel although only one is necessary. There is sometimes an advantage in having two driving motors and where two are employed they are circumferentially spaced from each other and, as illustrated, the motors 11 are shown as being spaced 120° apart, as brought out more fully in said co-pending application. Each motor 11 has its housing secured to the base plate by means of fastening devices 12 which pass through the springs 13 which are bowed at their free ends and connected with the housing of their respective motor. Each fastening device 12 is positioned off-center and passes through a resilient washer 14, see Figure 6, and is connected with the base plate so that each motor will tilt or turn in such a direction that the motor will tend to cause the flexible driving collar 15 on the motor shaft to always be in driving engagement with the resilient band 16 secured to the depending flange of the fly wheel. As illustrated, the driving collar and the ring are made of rubber.

The motors employed are constant speed motors so that the fly wheel will be driven at a constant speed. The driving shaft 3 cooperates with a driving coupling 17 in the form of a block of material having driving pins 18 which enter openings 19 in the fly wheel 9. This coupling member 17 is provided with upwardly directed driving members or pins 20 which are circum-

ferentially spaced. Any desired number of driving pins may be employed and one or preferably more are used. These pins (four in the present instance) are adapted to enter the openings 21 in the flexible record 22 which is of the character described and claimed in my co-pending application, Serial No. 654,781, filed herewith and is provided with a central opening 23 into which is adapted to extend the centering pin 24 extending upwardly from the central portion of the coupling 17.

It is customary in devices of this character to have the record which is to be engraved carried and driven by a rotatable turn table but in accordance with this invention the flexible record to be engraved is driven by the coupling connection with the driving shaft and a rotatable turn table is not employed.

In accordance with the invention there is provided a stationary record supporting table 25 which surrounds the fly wheel and is provided with a depending flange 26 which is fixed to the base plate by means of suitable fastening devices 27. The stationary table is provided with a layer of sponge rubber 28 and to the upper face of this layer of sponge rubber is secured a layer of felt 29, it being understood that the flexible record to be engraved is supported on the felt surface of the stationary table.

The driving shaft 3 is provided with a worm 30 which is adapted to mesh with a worm 31 on a worm shaft 32 journalled in bearings 33 carried by the base plate and having a worm 34 adapted to mesh with the teeth of a gear segment 35 which is carried at the free end of an arm 36, preferably made of spring material. The outer end of this arm is fixed to the tubular post 37 into which extends a stationary shaft 38, the lower end of which is secured by fastening devices 39 to a bracket 40 depending from the base plate 1. The shaft 38 at its upper end carries a ball 41 on which is placed a flanged plunger 42 which extends through the closed upper end of the tubular post. The base plate has an opening through which the lower end of the tubular post extends. The tubular post 37 has fulcrumed in it a shaft 43 to which a cam lever 44 is fixed and provided with a cam which rides on the top face of the plunger 42. The post also has fulcrumed in it at 43, a second cam lever 45 loose on the shaft and having its cam face adapted to ride on the plunger 42 in order to raise the post and has a dwell at one end which retains the post in its uppermost position as will be hereinafter fully explained. The tubular post 37 has fixed to it one end of an arm 46 which is adapted to be fed across the flexible record.

There may be provided a cutting head of any desired or conventional type. In the exemplified embodiment there is utilized a cutting head 47 having the ears 48 which are movably connected with the forward end of the supporting arm 46 by means of a pivot pin 49. The cutting head 47 carries a cutting stylus 50. The cutting head 47 has secured to it above its pivotal point, as at 51, a cord 52 which passes around a reel 53, the shaft 54 of which is mounted in the arm 46 and a friction washer 55 is provided so that the reel will stay in any position to which it has been adjusted. The cutting head 47 has rising from it a post 56 to which is connected one end of an elastic member 57, the opposite end of which is fixed to a shoe 58 slidable in a tube 59, secured to the arm 46 by suitable fastening devices 60. The tube is provided with a longitudinally extending slot 61 through which extends a threaded rod 62 secured to the shoe 58 and adapted to receive a nut 63 between which and the tube is interposed a washer 64. It will thus be seen that when the nut 63 is tightened the inner end of the elastic member 57 is fixed in the position to which it has been adjusted. The elastic member 57 may be in the form of an elastic or rubber band.

The segment carrying arm 36 has connected with it a cord 65 which passes around a pulley 66 mounted on a shaft 67 carried by the bracket 68 secured to the base plate 1. The pulley 66 has fixed to it an indicator disc 69 having any desired graduations 70 so that the position of the cutting stylus with respect to the surface of the record on the stationary table can be established. A spring 71 has one end fixed to the indicating disc 69 in any desired manner and its opposite end is fixed to the bracket. The base plate 1 has an opening 72 which is covered by a glass lens 73 so that the graduations on the indicating disc 69 will be visible. A cord 74 has one end fixed to the segment arm 36 and the opposite end to a switch in a bracket 75 carried by the base plate and having a controlling arm 76 which is in the path of the gear segment 35 so that when the cutting head 47 reaches the limit of its inward movement the electric motors 11 will have their circuits opened through the conductors 77. Conductors 78 lead from the cutting head 47 and conductors 79 lead from the magnetic pick-up 80 which is mounted in any desired or conventional manner on the base plate 1, as will be understood by reference to Figure 1.

Referring now more particularly to Figure 3, it will be noted that in rear of the cutting edge 81 it is backed off as at 82 in order that it will burnish the sound track which is being cut.

Claims to various of the features referred to above including the novel form of sound head supporting means and the novel form of stylus exemplified are contained in my co-pending application, Serial No. 44,138, filed October 9, 1935, which is a continuation-in-part of the present case.

As before explained, this machine is for the purpose of engraving sound vibrations on flexible records, such as, for example, records which are made of cellulose nitrate or cellulose acetate, although it is to be understood that the sound vibrations can be engraved on any desired type of flexible record. Any desired thickness of flexible record can be employed but the conventional flexible record now in use is about ten thousandths of an inch in thickness.

In engraving a flexible record many difficulties have been encountered and it has not heretofore been deemed possible to cut a sound track having a highly uniform depth from the outside diameter to the inside diameter of the track, or vice versa, with a minimum amount of surface noise. This has been due largely to the flexibility of the material and unevenness in manufacture.

It has heretofore been the practice to have the record which is to be cut mounted on and revolved by a revolving turn table. In accordance with this invention the record is mounted on a stationary table having a resilient supporting surface and is revolved at a constant speed.

In the operation of the particular form of construction exemplified, various features of which, not claimed herein, are claimed in said co-pending application, Serial No. 44,138, and Serial No. 51,776; assuming that the electric motors 11 are revolving it will be apparent that the resilient

driving rolls 15 engage the resilient annulus or band 16 and cause the fly wheel 9 to revolve at a constant speed. As before explained, the motors are mounted off-center so that there is always a tendency for the driving rolls 15 to engage the annulus 16 thereby preventing any jumping or intermittent action in the rotation and the fly wheel 9 will be continuously driven. The drive of the shaft 3 also causes the coupling 17 to be driven and this coupling is connected by the pins 20 with the record so that the record is revolved on the felt surface 29 of the stationary table.

The flexible record is resiliently supported so that when the stylus is cutting against the record it will always cut in substantially the same horizontal plane. If the record is buckled or deformed the pressure is such that at the cutting point a slight curvature is made in the record and this action is permitted due to the provision of the resilient mounting of sponge rubber and felt. The cutting head which carries the cutting stylus is limited in its downward movement by the cord 52, and the cutting head 47 is floating due to the action of the elastic member 57 which maintains a constant resilient pull on the cutting head. The cord limits the downward movement of the cutting head because it is fastened to one side of and above the pivot and the cord is held in adjusted position by the friction reel. If means were not employed to limit the downward movement of the cutting head, the latter would swing downwardly as it is pivotally supported at one side. If a high or hard spot is encountered in the record being cut, the cutting head is allowed to freely float upwardly so that a constant depth of cut is always maintained. The depth of cut is governed by the position of the shoe 58 in the tube 59 and this can be adjusted by loosening the nut 63, moving the shoe 58 to proper position, and then tightening the nut 63.

If a record is to be changed the lever 45 is used which raises the post 37 to its extreme upward position and retains it in such position. The arm 36 is flexible so that when the adjustment is made for the angle of the cutting stylus the gear segment 35 will remain in mesh with its drive worm 34, but, when the cam lever 45 is moved upwardly into the position seen in dotted lines in Figure 9, then the gear segment 35 will be disconnected from its driving worm 34. When the cutting head reaches the limit of its inward movement the gear segment 35 engages the switch 76 to throw such switch and cause the opening of the circuit for the motors 11 so that the machine cannot be injured by the cutting head overrunning its stop position. The downward movement of the cutting head is limited by the cord 52 and the reel or spool 53 will stay in any position to which it has been adjusted due to its frictional mounting on the supporting arm 46. As the segment carrying arm 36 turns it will be apparent that the indicator disc 69 will turn with it so that one can always determine by the indicating mechanism the position of the cutting stylus.

It will be apparent that as the driving shaft 3 revolves it will revolve the worm shaft 32 and thereby the worm 34 causing a swinging movement of the gear segment 35 in one direction and, of course, a corresponding movement of the arm 46 which carries the cutting head.

The circuit is opened by movement of the segment arm to its starting position due to the provision of the cord 74 connected with the switch.

By having the record resiliently supported so that it can be slightly deformed at the cutting location, I am able to cut flexible records which are wavy, deformed or buckled and still obtain a much more uniform depth of cut and a smoother cut.

One or more driving pins can be employed and one or more can be simultaneously driving. I preferably employ a plurality of such driving pins which are circumferentially spaced so as to engage openings in the central portion of the record and to provide an even drive on all portions of the record.

It will now be apparent that I have devised a new and useful method of and apparatus for engraving sound vibrations on flexible records which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which will give in practice satisfactory and reliable results, it is to be understood that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

1. In a machine for engraving sound vibrations on flexible records, a stationary support having a resilient record supporting surface and means to revolve a flexible record on said support.

2. In a machine for engraving sound vibrations on flexible records, a stationary support having a resilient record supporting surface and means to revolve a flexible record on said support, said means including a plurality of driving members adapted to extend into openings in the record.

3. In a record engraving machine, a stationary table, a layer of rubber thereon, a layer of felt above the rubber, and means to revolve a flexible record on said table.

4. A portable record engraving machine, comprising a stationary table for supporting the record, means to revolve a flexible record on said stationary table, and means to cut a sound track in the record.

5. The combination with a stationary support, of a flexible record thereon, having at its central portion circumferentially spaced openings, and a revoluble driving member having driving pins entering said openings to revolve said record on said stationary support.

6. The combination with a stationary support having a central opening, of a driving coupling extending into said opening and having upwardly directed pins, and a flexible record having openings to receive said pins and revolved thereby on said stationary support.

7. A recording or reproducing machine comprising a stationary support having a resilient surface for supporting a flexible record member, and means including a rotatable member having a multiplicity of pins adapted to enter openings near the center of a flexible record on said support to revolve said record.

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