

June 9, 1936.

F. CRUDO

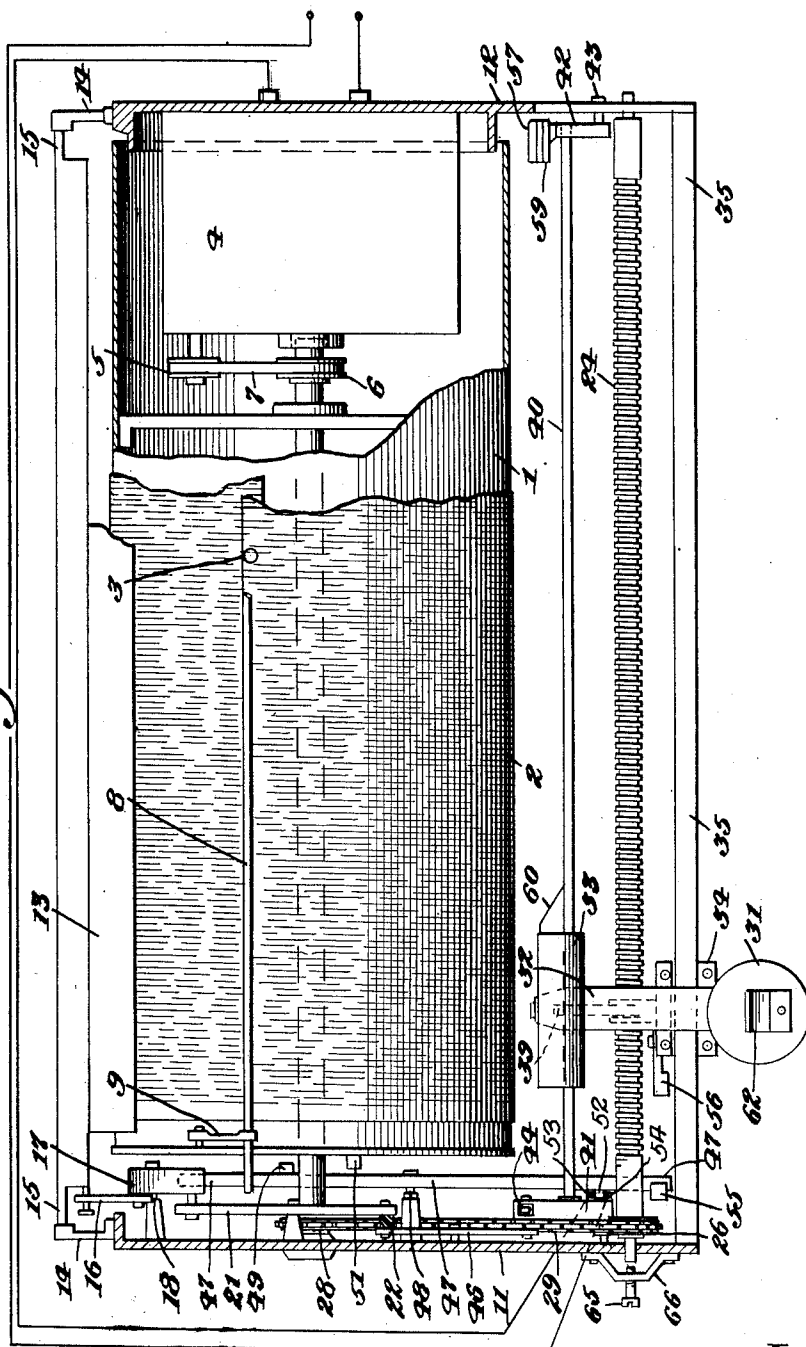
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

Filed Dec. 13, 1934

7 Sheets-Sheet 1

Fig. 1.



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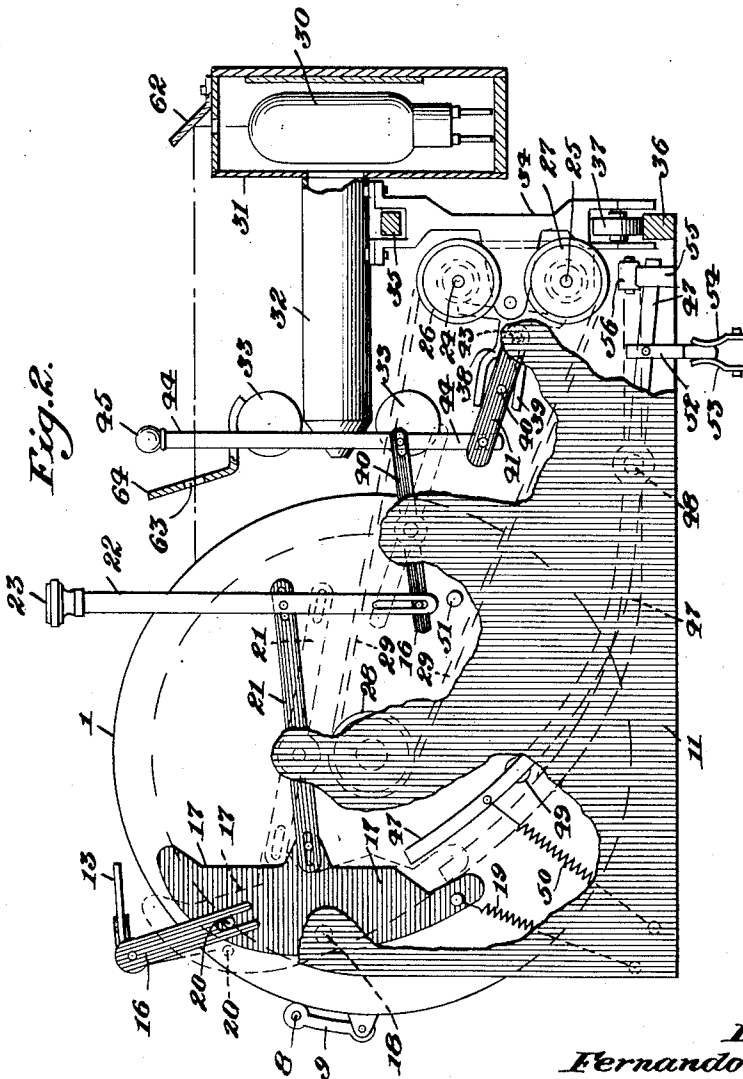
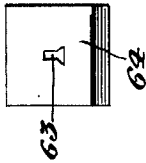
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

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7 Sheets-Sheet 2

Fig. 3.



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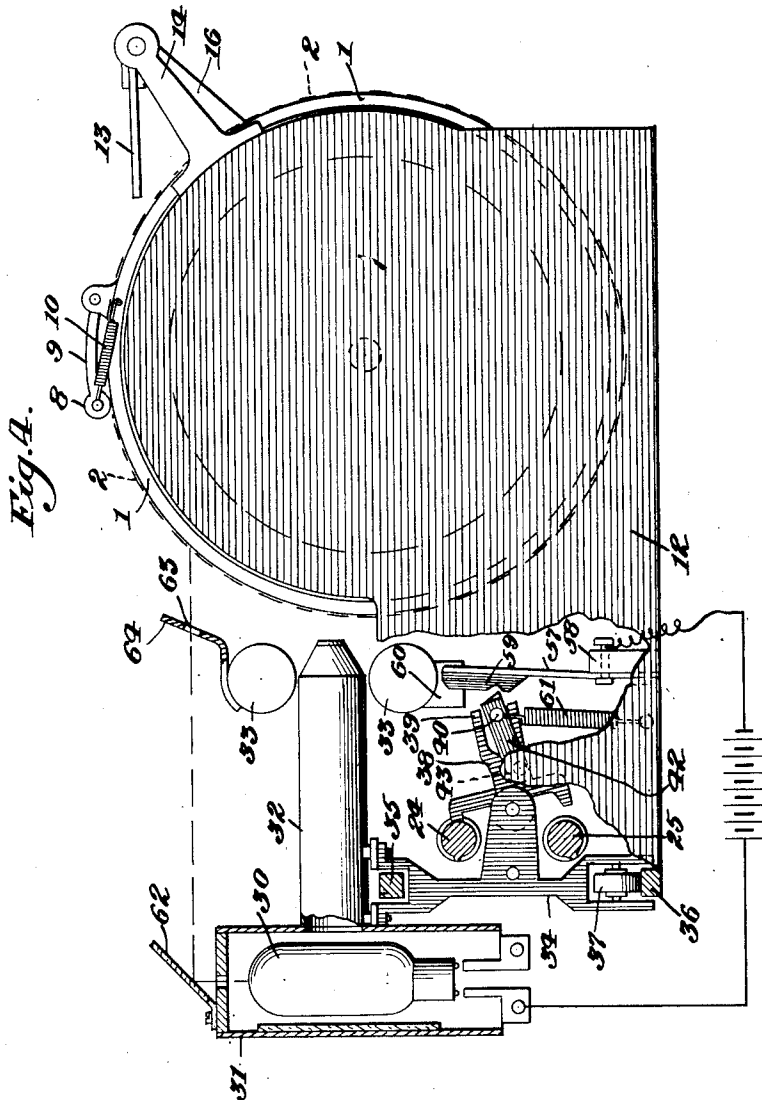
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

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7 Sheets-Sheet 3



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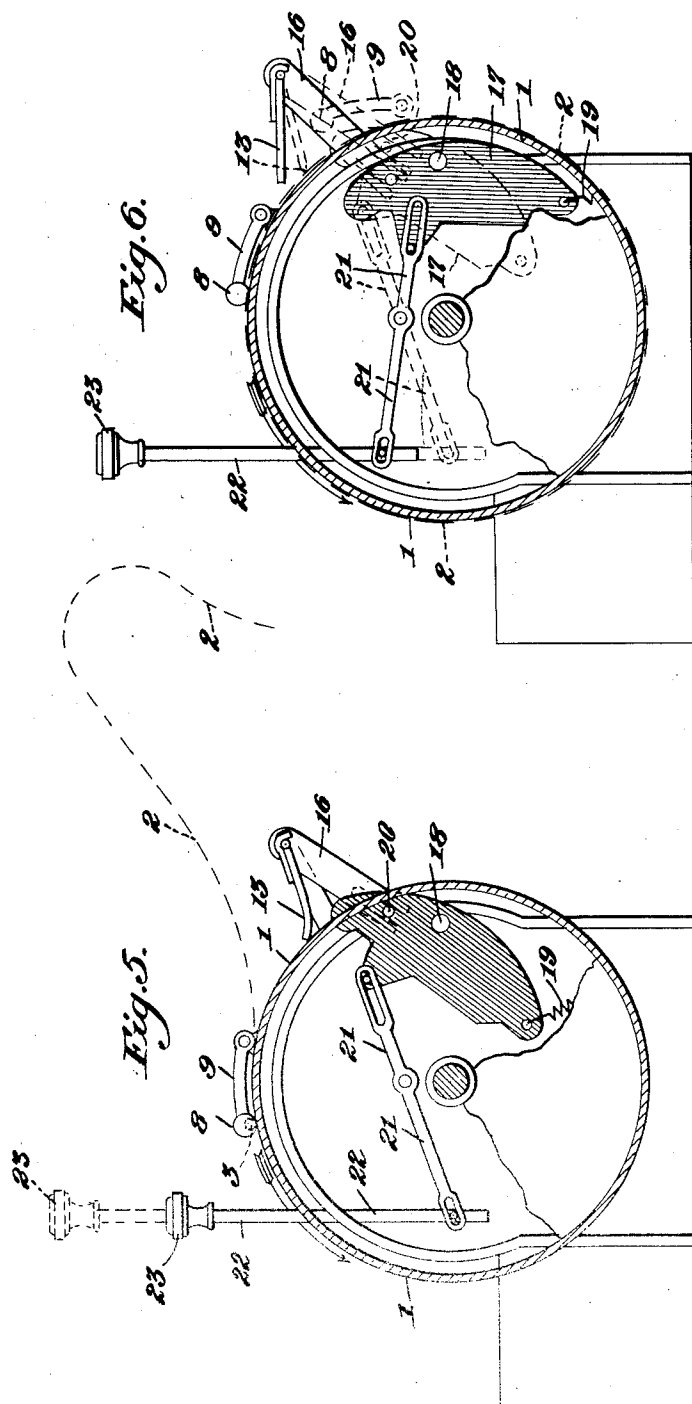
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

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7 Sheets-Sheet 4



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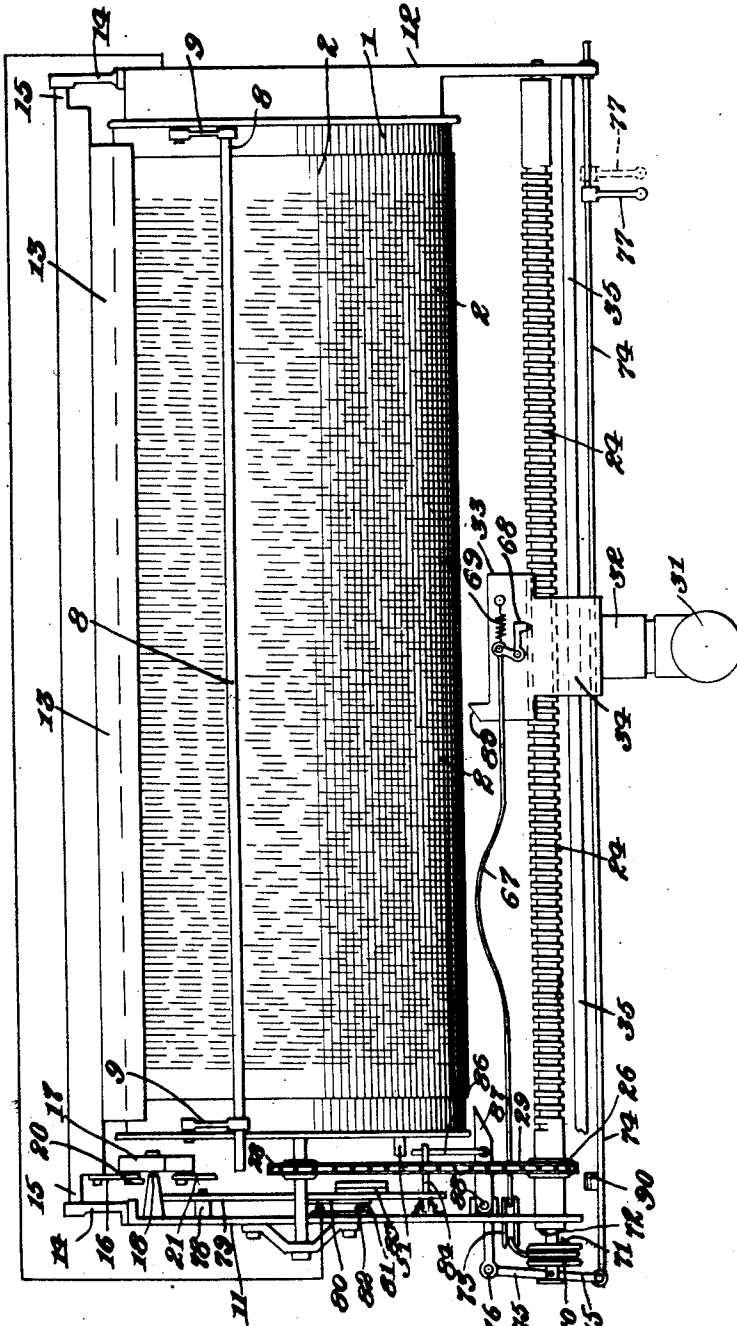
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

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7 Sheets-Sheet 5

Fig. 7.



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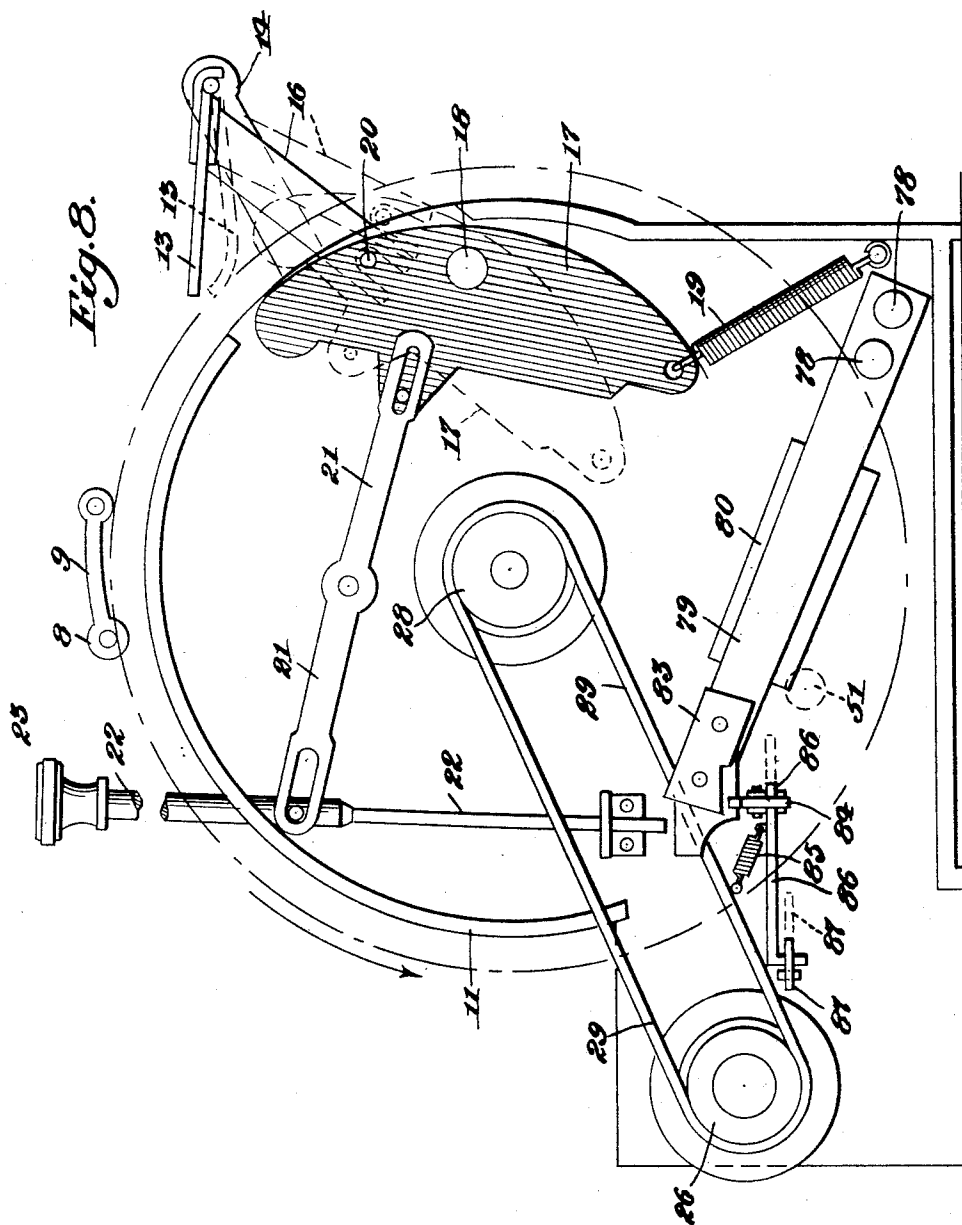
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

Filed Dec. 13, 1934

7 Sheets-Sheet 6



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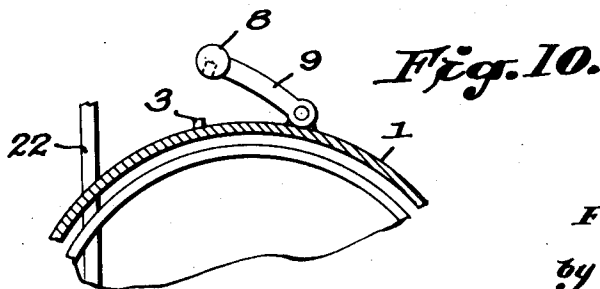
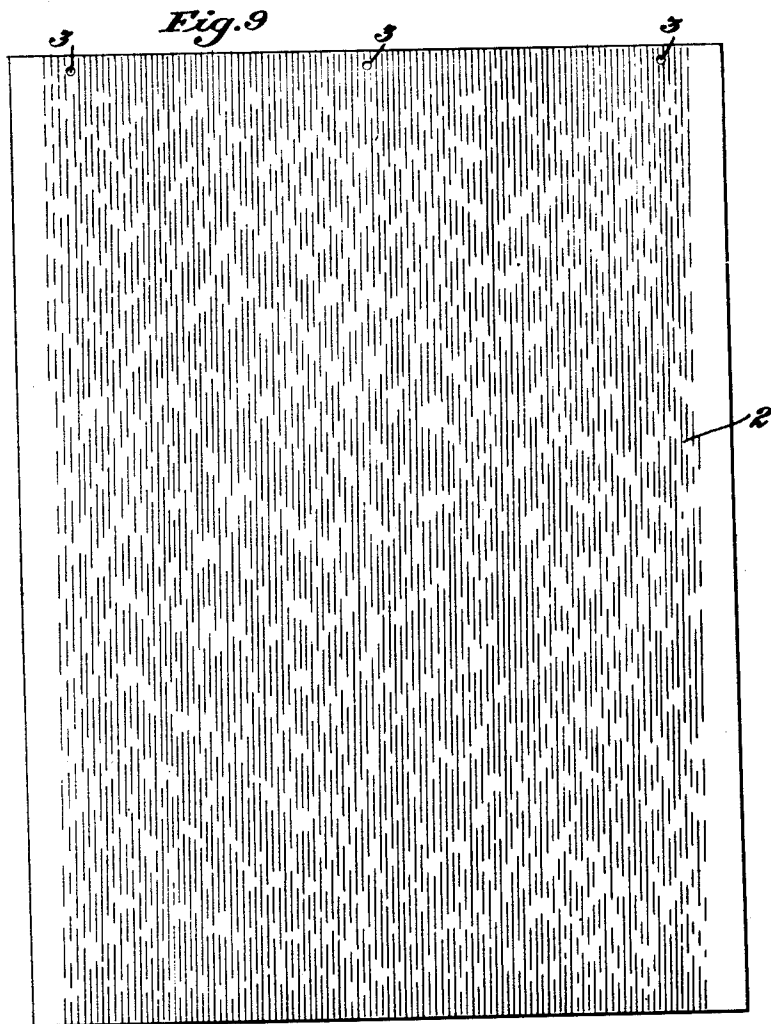
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PHOTOELECTRIC SOUND RECORDING OR REPRODUCING APPARATUS

Filed Dec. 13, 1934

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,043,884

PHOTOELECTRIC SOUND RECORDING OR
REPRODUCING APPARATUS

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Application December 13, 1934, Serial No. 757,410
In Germany June 22, 1934

16 Claims. (Cl. 274—5)

This invention relates to improvements in that type of photoelectric sound recording or reproducing apparatus which is provided with rotary cylinders, which improvements permit automatic operation thereof.

The present invention satisfies a want in the field of flexible phonograms of sheet-like shape, adapted for use in photoelectric sound reproducing apparatus, which, as is well known, consist principally of a rotary cylinder and a photoelectric collector, comprising an exciting lamp, a lens system, and one or more photoelectric cells.

Until my invention, disposing of the phonograms on the phonogram carrier was an extremely difficult problem and one subject to errors. The solution of this problem is, however, made easy by the present invention, which permits the exact location of the phonogram on the cylinder and, if desired, the energization of all the parts of the assembly through the movement of a single control.

The main feature of my present invention is the automatic placing of the phonogram on the cylinder.

Other novel features are present, such for example as the provision of means for causing the backward motion of the photoelectric collector to the initial point; the provision of means for causing the cylinder to stop always in a correct position for beginning anew; and the positioning of the motor in the interior of the cylinder. Certain regulating devices are employed, to be described more fully hereinafter. All of the foregoing is for the purpose of causing an automatic operation, and for obtaining, at the same time, an apparatus of reduced dimensions.

In order that the invention may be more clearly understood, I have illustrated certain typical examples thereof. Throughout the accompanying drawings the same reference characters indicate like or equivalent parts or elements.

In the drawings Figure 1 is a plan view of the apparatus as a unit, showing the location of the motor in the interior of the cylinder, and also showing the means for automatically applying and fixing the phonogram on the cylinder, the means for causing the forward and backward motion of the photo-electric collector, and other devices assisting in the automatic operation of the apparatus, as well as the supply circuit for the motor.

Figure 2 is a side view of the apparatus, showing the automatic devices.

Figure 3 shows a detail of Figure 2.

Figure 4 is a side view of the side of the apparatus opposite to that of Figure 2, showing the means for causing the automatic backward motion of the photo-electric collector, and at the same time permitting the interruption of the supply of the exciting lamp.

Figure 5 is a side view of the phonogram-carrying cylinder, showing graphically the manner in which the process is started of positioning the flexible sheet-like phonogram on the cylindrical carrier therefor.

Figure 6 is a view similar to Figure 5, but in which the phonogram is fixed on the cylinder with the joint formed by the two ends thereof being secured in fixed relation to the cylinder by means of the holding rod.

Figure 7 is a plan view of the device showing other means for effecting the backward motion of the photo-electric collector, as well as another type of brake for the phonogram carrier or cylinder, while

Figure 8 is a side view on enlarged scale, of the braking device of Figure 7.

Fig. 9 is a plan view of a phonogram having eyelets along one end thereof.

Fig. 10 is a fragmentary transverse section, better illustrating the buttons 3.

Referring more particularly to Figure 1, the cylinder 1 has the phonogram 2 applied thereon, the cylinder having a line of buttons 3 (see Figs. 1 and 5) coinciding with buttonhole perforations 2' formed in the phonogram 2 (Fig. 9). The relation of the button 3 with the remainder of the construction is best shown in Fig. 10.

In the interior of the cylinder, which is broken away in the drawing at the right hand end thereof, is the motor 4, which actuates the cylinder by suitable means such as pulleys 5 and 6 and the belt 7. The cylinder is provided with a rod 8, which may be threaded or have any other convenient shape, fixed thereto by movable arms 9, and which rod is urged by a spring 10 (Fig. 4) against the cylinder.

At each side of the cylinder are the end pieces 11 and 12 on which latter the motor 4 rests; while the rotation shaft of the cylinder 1 and the other devices for the automatic operation rest on the end piece 11.

A brush 13, preferably made of rubber, and the purpose of which will be more fully described hereinafter, is fixed to the end pieces 11 and 12 by means of the arms 14 and the axle 15 (see Figs. 2 and 4). This axle has formed integral therewith and extending laterally therefrom an

arm 16 which serves for the control of the brush 13.

Mounted on the end piece 11 is a plate-like lever 17 pivotal about shaft 18, and hinged by spring 19 secured to the frame. The lever 17 carries a pin 20 received in a groove in the arm 16.

The plate or lever 17 is shown as connected to the control key 23 by means of the link 21 and shaft 22.

10 The end pieces 11 and 12 also support the ends of the screws 24 and 25 (Figs. 1 and 2) which, by means such as the gears 26 and 27, the pinion 28 of the cylinder 1, and the chain 29, rotate synchronously with the cylinder 1.

15 The photoelectric collector is shown as consisting of the exciting lamp or light source 30 with its corresponding casing 31, together with the lens system 32 and the photoelectric cells 33 disposed above and below the lens system (Fig. 2).

20 The photoelectric collector is mounted on the carriage 34, the construction of which can be determined from Figures 2 and 4, taken in connection with Figure 1, which carriage slides on guides 35 and 36, solely by friction on the former and 25 by means of the wheel 37 on the latter.

The said carriage 34 of the collector has a preferably yoke-shaped meshing piece 38 extending laterally therefrom, which meshing piece, in its extreme positions, meshes at one end with the advance screw 24 and at the other end with the backward motion screw 25. This meshing piece has a fork-shaped end 39 embracing a rod 40, which rod 40 (Fig. 1) extends parallel to the screws 24 and 25 and is fixed to the arms 41 and 35 42 pivoted to stub-shafts 43.

As can be seen from Figure 2, the arm 41 is elongated in the manner of a lever, and is pivoted at one end to shaft 44 provided with a knob 45. Thus the lever 41 can be racked about the stub-shaft 43. A link 46 interconnects the shaft 26 40 and the shaft 22.

An elongated cam 47 is shown in Figs. 1 and 2 as extending transversely of the cylinder, near the left hand edge of Fig. 1, and rocking about 45 stub shaft 48. A spring 50 normally biases the cam 47, which has a stop 49 provided thereon. This stop 49, when the cam is in its lowered position shown in dotted lines in Fig. 2, comes into the path of the stop 51 of the cylinder 1 (Fig. 1).

50 The cam 47 is shown as having fixed thereto a contact jack 52 (Fig. 2) which in its lowermost position is jacked into the contacts 53 and 54 in the supply line of the motor 4 (Fig. 1). This downward position of the contact stem 52 is normally maintained by a hook 55 (Figs. 1 and 2) 55 which engages over the end of the cam 47.

As can be seen in Figures 1 and 2, the carriage 34 carries a pivoted arm 56, the end of which is so contoured that when it engages the hook 55, it will push it clear from the cam 47, leaving this latter to be retracted into its dotted line lowered position (Fig. 2) by the spring 50.

A spring plate 57 is mounted at the other end of the cylinder, and is shown in Figure 4 as disposed on a base 58 of insulating material, the hook 59, fixed to the plate 57, being shown as holding in raised position the arm 42 which supports the rod 40, thereby closing, through the contact pin extending through the base 58, the 70 supply circuit of the exciting lamp 30.

The photoelectric collector carries a stop 60, (Figs. 1 and 4), which is so contoured as to move the hook 59, when it contacts the latter, out of contact with the arm 42, thus freeing said arm so 75 that it can be retracted by spring 61.

As is evident from Figures 1, 2 and 4, a small mirror 62 preferably disposed on the upper part of the casing 31 of the exciting lamp 30, said mirror being adapted to reflect a pencil of light and to direct said pencil onto the phonogram 2 5 as the latter rotates past the scanning window 63 of the opaque screen 64 (Figs. 2 and 3), mounted on the carriage 34. This device permits the ready and immediate determination of whether the photoelectric collector is correctly 10 focussed on the recording track of the phonogram, since this reflected pencil is in the same radial plane as the pencil concentrated by the lens system 32. Regulation in accordance with the reflected light pencil is obtained by suitable means 15 such as the screw 65 held by the supporting bracket 66, which screw 65 rotates the feed screw 24, and hence the carriage 34.

In the modification shown in Figure 7, the advance motion of the carriage 34 is effected only 20 by means of the screw 24, while the backward motion is accomplished by means of the traction cord 67. This cord is fixed to the pawl 68, normally biased into its operative position by the spring 69. A sheave or the like 70 is shown as 25 rotating freely on an extension of the screw 24, said sheave preferably being provided with a tooth 71 cooperating with a corresponding tooth 72 formed on the extension of the screw 24. The sheave 70, which is capable of sidewise displacement, is shown as cooperating with a further 30 sheave 73 fixedly mounted on the end piece 11 of the apparatus.

As can also be seen in Figure 7, at the same height of the screw 24 and just in front thereof 35 is a rod 74 capable of longitudinal displacement. This rod is pivoted to the link 75 which is pinned to the support 76 fixed to the end piece 11. At its approximate center the lever 75 bears against the sheave 70. On the rod 74 is a sliding stop 77 40 serving to limit the advance of the carriage 34 of the photoelectric collector.

Figures 7 and 8 also illustrate a further automatic braking device of the apparatus. A resilient arm 79 is fixed on the end piece 11 by means 45 such as the screws 78, said arm 79 being provided with a current interrupter 80 interposed in the supply circuit of the motor 4, the contact 81 on the interrupter 80 coinciding with the contact 82 fixed to the end piece 11 (Fig. 7). The resilient arm 79 also has fixed thereto a leather block 83 which, when the arm 79 is free, rubs against the end piece of the cylinder 1. The arm 79 at its free end has the shape of a blade coinciding with the hinged stop 84, which is drawn upwardly 55 by the spring 85 fixed to the end piece 11 and to the rod 86, said rod sliding in an orifice 84 serving as a stop, and being pivoted at its opposite end to the arm 87 movable about its shaft 88. According to these devices, the carriage 34 60 of the collector carries a stop 89 designed to actuate the arm 87. Also in accordance with these devices, the manually actuable stem 22 has its lower end shaped as a wedge, so that when it descends it will contact the free end of the arm 65 79 and cause it to be separated from the cylinder, and so that at the same time it will cause the closing of the contact of the interrupter 80 and the blocking in of the stop 84.

As can be seen in Figure 7, the rod 74 carries 70 fixed thereto a stop 90.

The operation of the apparatus according to the present invention is effected in the following manner:—

One end of the phonogram 2 is placed on the 75

cylinder in such manner that its eyelets 2' will fit on the buttons 3 of the cylinder 1, and the holding rod 8 is then applied over that end of the phonogram. When the control key 23 is depressed, then by means of the shaft 22 and the link 21, the lever or plate 17 is tipped, thus rocking the cam 47 and causing its front end to depress and engage with the hook 55, which fixes the cam 47 in its locked position; at the same time the stop 49 is raised out of the path of the stop 51 of the cylinder 1, and since the supply circuit from the motor 4 (Fig. 1) has also been closed by means of the contact stem 52, the cylinder starts rotating. The phonogram which has been positioned around the cylinder is dragged by the brush 13 which, as may be seen in Figure 5, is brought into contact with the phonogram when the key 23 is depressed. This same figure shows how the cam plate 17 extends slightly beyond the cylinder when the key is depressed, and in Figure 6 it will be seen that during the movement of the said cam plate the holding rod 8 is brought out of contact with the cylinder, as shown in dotted lines, at which moment the free end of the phonogram is automatically housed under the rod 8, which falls immediately thereafter and fixes the phonogram in place. While the foregoing is taking place, the rod 40, by means of the link 46, rod 44 and arm 41, is carried upwardly, lifting the fork 39 and engaging the meshing piece 38 of the collector with the advance screw 24. The rod 40 is maintained in this position by the hook 59 (Fig. 4), as a result of which the exciting lamp 30 is energized. When the manually-exerted pressure thereon is terminated, the key 23 is returned to its idle or rest position as a result of the spring 10, the cylinder continuing to rotate. Synchronously with the cylinder the photoelectric collector advances over the phonogram, the modulation of the light beam being impressed on an audio-frequency circuit and a loudspeaker.

When the collector reaches the end of its travel (Fig. 4) the stop 60 moves aside the hook 59, so that the spring 61 is free to draw the rod 40 downwardly, the exciting lamp 30 being deenergized and the meshing piece 38 engaging now the endless screw 25. The return travel of the photoelectric collector is thereby started, and this collector, upon reaching its initial position, as will be seen in Figures 1 and 2, pushes by means of its pivoted arm 56 against the hook 55, thereby freeing the cam 47 which, due to the spring 50, breaks the motor circuit at 52, 53 and 54 and interposes the stop 49 into the path of the stop 51 on the cylinder, so that when the two stops engage each other, the cylinder is stopped.

The backward motion or return of the cylinder of Figure 7 is effected in the following manner:—When the carriage 34 of the photoelectric collector reaches the end of its travel in a forward direction (at the right of Fig. 7), it abuts against the stop 77 and thereby longitudinally displaces the rod 74, thereby rocking the lever 75 and carrying the sheave 70 into contact with the end of the screw 24, the tooth 71 engaging the corresponding tooth 72 on the end of the screw shaft, whereupon the sheave 70 is caused to rotate, and winds up the cord 67. This cord exerts tension on the pivoted tooth 68, thereby bringing it out of contact with the screw 24, and then causing the backward motion or return of the photoelectric collector, which according to Figures 7 and 8, on reaching its initial position at the left of Figure 2, pushes the pivoted arm

87 and later the rod 86, past the stop 89 on the carriage, the said rod 86 then being carried downwardly by the stop 51 of the cylinder when the latter passes, the rod 86 having been brought into the path of the said stop. During its downward movement the rod 86 contacts and depresses the stop 84. The resilient arm 79 remains free and forces the leather block 83 (Fig. 8) thereof against the end piece of the cylinder 1, thereby serving as a brake and at the same time disconnecting the motor supply. Simultaneously, the carriage 34 contacts the stop 80, and carries it along, together with the rod 74, thereby unclutching the sheave 70.

It is to be understood that the above-described embodiments of the invention have been disclosed only by way of example, and that numerous modifications in construction may be introduced, but always with the primary purpose of obtaining the automatic positioning of the phonograms and the automatic operation of the machine. For example, instead of the holding bar 8 for the phonogram, other devices filling the same function may be used.

Also, the brush 13 may be replaced by some other device, such, for example, as a rubber roller.

Concerning the forward movement of the photoelectric collector, this movement may also be obtained by means of a rack, and the backward motion thereof may be obtained by means of a rack or a spring.

Also, the screw 65 may be replaced by a lever, an eccentric, etc.

It is also not necessary for the apparatus to stop when the collector reaches its initial position, as it is possible to repeat automatically the reproduction of the phonogram as many times as desired.

The apparatus may also be used for the recording of phonograms, by substituting for the photoelectric collector, and oscillograph or other recording device; and for the phonogram a light sensitized negative, the apparatus in this case being enclosed in a camera forming part of the apparatus.

What is claimed is:

1. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting a phonogram about and securing it to said cylinder, and means also actuated by said switching means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder.

2. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fixing one end of a negative or phonogram to said carrier, and means for fitting and stretching the negative or phonogram about the carrier and for fixing the free end on the carrier, said first-mentioned means also actuating said last-mentioned means to fix the free end of the phonogram.

3. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fixing one end of a negative or phonogram to said carrier, a brush for fitting and stretching the negative or phonogram on the

carrier, and means for fixing the free end of the negative or phonogram on the carrier, said first-mentioned means also actuating said brush and said last-mentioned means to adjust and fix the free end of the phonogram.

4. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier switching means for controlling said motor, means for fixing one end of a negative or phonogram to said carrier, means for fitting and stretching the negative or phonogram about the carrier, means for fixing the free end thereof on the carrier, said first-mentioned means also actuating the two last-mentioned means to adjust and fix the free end of the phonogram, and means also actuated by said first-mentioned means for momentarily and at a given point during the rotation of said cylinder, separating the free-end fixing means from the cylinder, so that on its return to the cylinder, it fixes the free end thereunder.

5. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, and means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, said motor being housed substantially entirely within said cylinder.

6. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, and means for returning the carriage to its initial position.

7. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, and means for returning the carriage to its initial position, at a greater speed than its speed of advance.

8. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric col-

lector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, a screw coupled to said motor for returning said carriage to its initial position, and means for meshing said carriage with said endless screw.

9. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, a cable fixed to one end of said carriage, a sheave over which said cable is wound, means for disconnecting the carriage from the carriage-advancing means when the carriage reaches its limit position, and means for rotating the sheave to cause the cable to wind thereon and return the carriage to its initial position.

10. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, means for returning the carriage to its initial position, and means operable as an incident to the initiation of the return movement of the carriage, to break the energizing circuit of the source of light in the photoelectric collector.

11. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, and means for returning the carriage to its initial position, a reflecting surface on the photoelectric collector, an exciting lamp on said carriage, emitting a pencil of light, a perforated screen on said carriage in front of said reflecting surface through which screen the said surface reflects the pencil of light from said lamp, the said reflected pencil being directed on the phonogram about the cylinder, facilitating the positioning of the carriage and collector relative to the sound track of the phonogram.

12. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-

mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, a screw for slowly advancing said carriage along said cylinder, means for returning the carriage from the limit of its advance to its initial position, and means for longitudinally displacing said screw to orient the carriage and collector properly with respect to the sound track on a phonogram on the cylinder.

13. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a stop on said cylinder near one end thereof, a second stop, and means for moving said second stop into the path of the first stop as an incident to interruption of the motor circuit, to stop the cylinder.

14. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a stop on said cylinder, near one end thereof, a second stop, means for moving said second stop into the path of the first stop as an incident to the interruption of the motor circuit, and a brake also coming into play as an incident to the interruption

of the braking of the motor circuit, to stop the cylinder.

15. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, means for fitting and securing a phonogram to said cylinder, means also actuated by said starting means for actuating said second-mentioned means to fit said phonogram about and to grip it on said cylinder, a photoelectric collector, a carriage for said photoelectric collector disposed on the side of said cylinder and movable therealong, means for slowly advancing said carriage in a positive direction, means for returning the carriage to its initial position, a switch in the supply circuit of the motor, an exciting lamp on said carriage for said collector, a second switch in the supply circuit of the exciting lamp, and means interconnecting both said switches with said starting means, so that they will be actuated thereby to close their respective circuits.

16. A photoelectric sound apparatus for recording or reproducing, comprising a rotary cylindrical phonogram carrier, a motor for actuating said carrier, switching means for controlling said motor, said phonogram having eyelets thereon, stops or buttons on the surface of said cylinder for receiving the eyelets of the phonogram, and means for fitting and stretching the negative or phonogram about the carrier and for fixing the free end on the carrier, said first-mentioned means also actuating said last-mentioned means to fix the free end of the phonogram.

FERNANDO CRUDO.