May 7, 1940. E. W. SPARLING 2,199,420

SOUND RECORDING AND REPRODUCING APPARATUS

Filed July 12, 1937 3 Sheets-Sheet 1

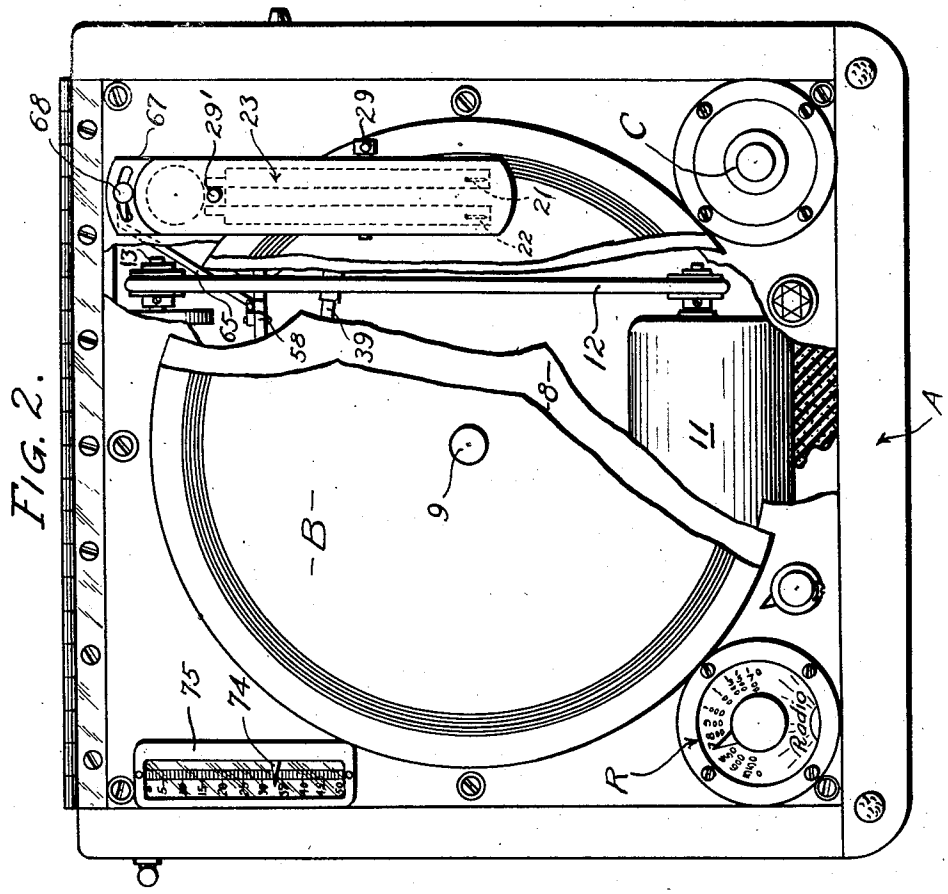


FIG. 2.

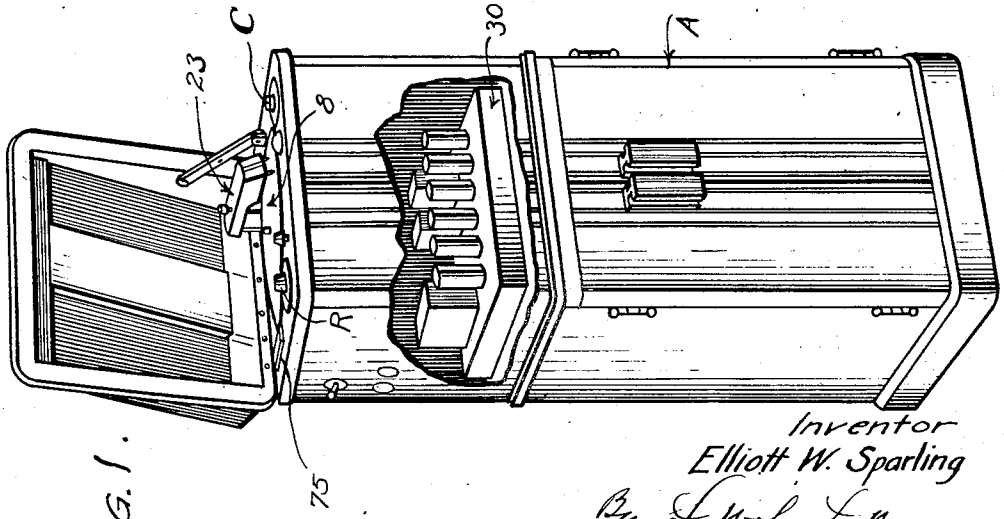


FIG. 1.

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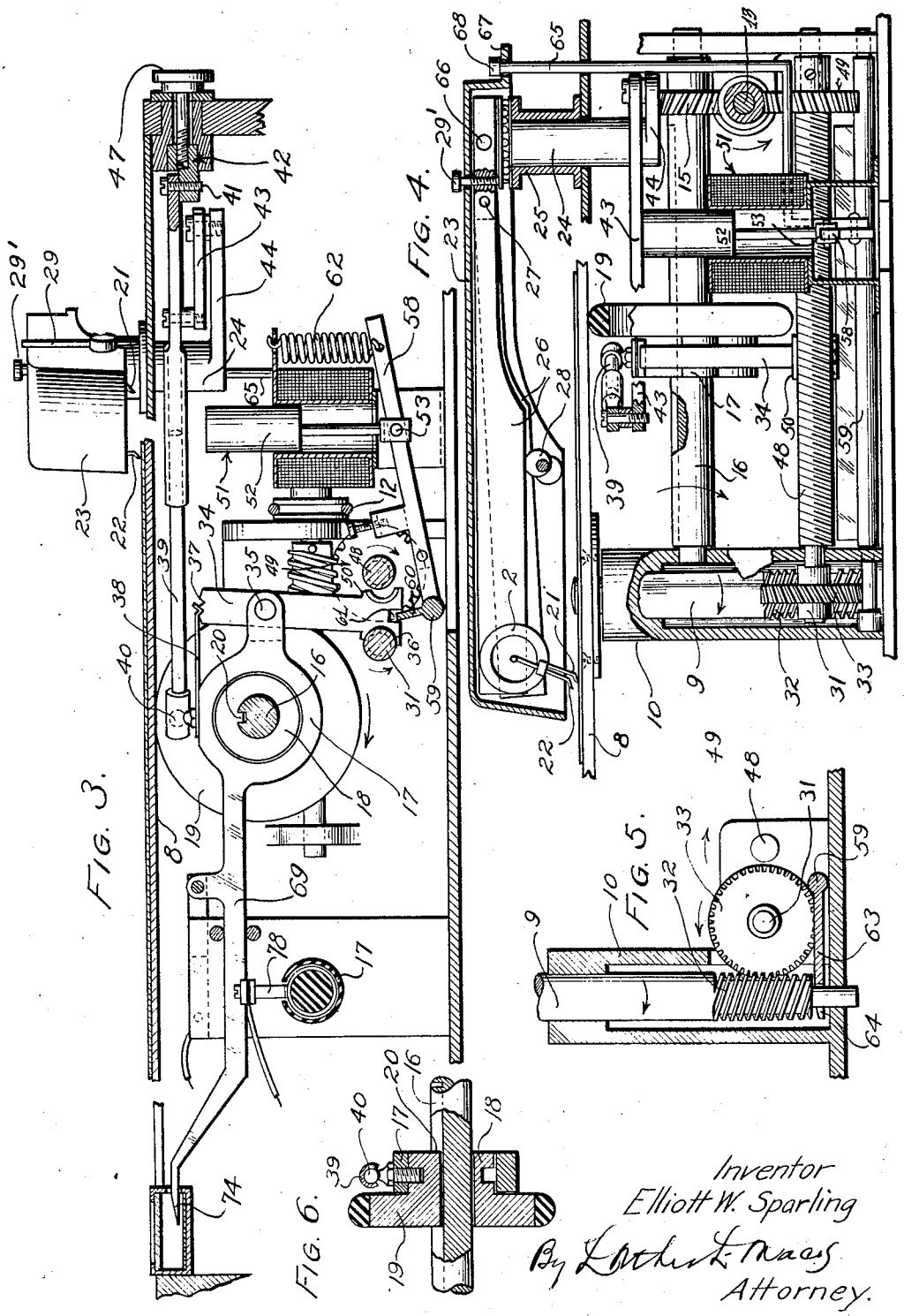


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

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SOUND RECORDING AND REPRODUCING APPARATUS

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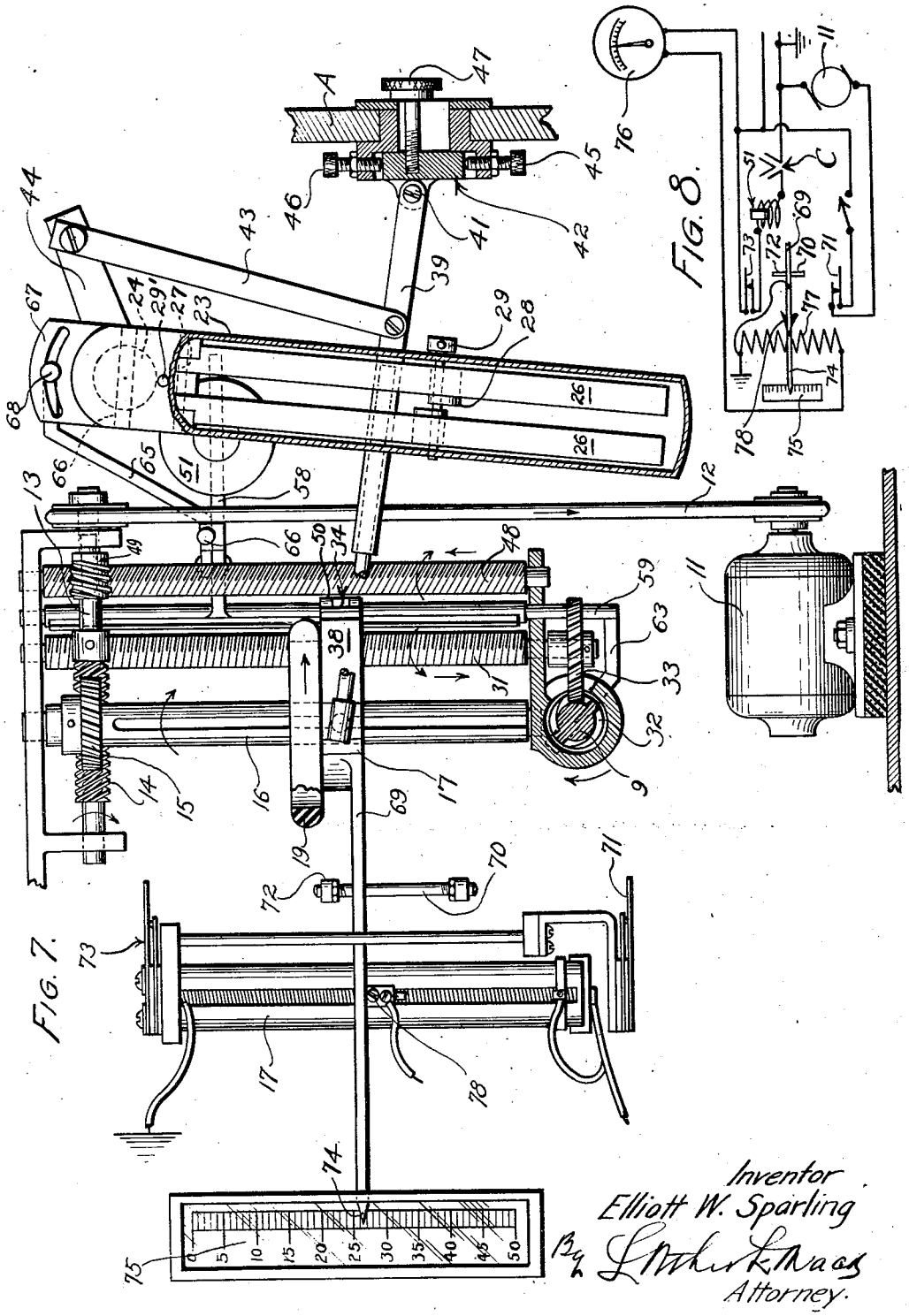


FIG. 7.

FIG. 8.

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Patented May 7, 1940

2,199,420

UNITED STATES PATENT OFFICE

2,199,420

SOUND RECORDING AND REPRODUCING APPARATUS

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Application July 12, 1937, Serial No. 153,098

5 Claims. (Cl. 274—9)

This invention relates to and has for an object the provision of sound recording and reproducing apparatus which is particularly well suited for use in connection with inter-office and other inter-communication systems for selectively recording and reproducing sounds and signals transmitted by, in and to such systems, as well as adapted for home and commercial recording and reproducing uses, due largely to the provision for both recording and reproducing with a single compact machine and because of the particular construction, relative arrangement of the parts and mode of operation of the apparatus hereof.

Another object is to provide sound recording and reproducing apparatus of the character described, which is characterized by an improved operating means for causing the record to rotate at a substantially constant surface speed at the points of its contact with the reproducing stylus or the recording stylus throughout the length of the sound groove, whereby the recording capacity of the record is increased and the quality of the recordings and reproductions is greatly improved.

A further object of this invention is to provide sound recording and reproducing apparatus of the character described, which is constructed so that it may be controlled from points remote therefrom.

Another important object of this invention is to provide sound recording and reproducing apparatus which includes back-spacing means operable at will at points remote from the apparatus or otherwise, for back-spacing the recording and reproducing styli to any point throughout the range of movement thereof.

A further object is to provide sound recording and reproducing apparatus which is particularly adapted for recording and reproducing business dictation, conferences and the like, the said apparatus being subject to electrical combination with loud speaker systems or with earphones or with radio equipment in a particularly efficacious manner.

Yet another object is to provide recording and reproducing apparatus characterized by a single arm movable relative to the record and supporting a recording head and a reproducing head in a particularly novel manner and whereby either may be applied to the record at will.

I have shown in the accompanying drawings a preferred form of sound recording and reproducing apparatus embodying my invention, subject, however, to modincation, within the scope of the appended claims, without departing from the spirit of my invention.

Referring to the drawings:

Fig. 1 represents a perspective view of recording and reproducing apparatus constructed and arranged in accordance with this invention,

Fig. 2 represents a top plan view of the apparatus shown in Fig. 1 with the cover or lid of the cabinet removed and portions of the apparatus broken away for the sake of clarity of illustration,

Fig. 3 is an enlarged cross section of the apparatus of this invention with parts broken away and parts shown in elevation,

Fig. 4 is an enlarged fragmentary sectional view of the apparatus shown in Fig. 3 but taken at right angles thereto.

Fig. 5 is an enlarged fragmentary section showing the gear connection between the turntable and the lead screws,

Fig. 6 is a sectional view taken through the friction drive wheel showing the manner of mounting the same on the drive shaft,

Fig. 7 is an enlarged top plan view of the apparatus taken below the plane of the turntable showing certain parts broken away and other parts in section, and

Fig. 8 is a diagram of the electrical circuits employed in this invention.

In carrying out this invention one form thereof, as particularly shown in the accompanying drawings, is housed within a suitable cabinet A and comprises a turntable 8 mounted upon a rotary post 9 in a bearing 10 and adapted for supporting a record B.

Means for driving the turntable comprises a motor 11 which through a belt drive 12 rotates a shaft 13 carrying a worm 14 engaged with a worm wheel 15 on a drive shaft 16. The drive shaft 16 is extended radially from one side of the bearing 10 and slidably supports a carriage 17 which latter is in the form of a yoke surrounding the hub 18 of a friction drive wheel 19. This hub is splined on the shaft 16 as at 20, whereby the wheel 19 will be rotated in driving contact with the underside of the turntable.

A recording head 21 and a reproducing head 22 are supported side by side on an arm 23 which at one end is pivoted on the cabinet by means of a post 24 mounted in a suitable bearing 25. These heads 21 and 22 are fixed upon supporting bars 26—26 which have a common pivot 27 within the arm 23. Either of these heads may be lowered into and raised from record contacting position by means of a double cam device 28 cooperating with the bars 26 and having an operating handle 29 on one side of the arm 23. An adjusting screw 29' provides for a slight lifting and lowering of arm 23 for setting the bars 26 in different positions whereby to vary the extent of contact or pressure of the styli of the recording and reproducing heads with reference to the record.

The heads 21 ad 22 may be electrically con-

nected, as is common in the art, with a thermionic "radio" type amplifying unit 30 mounted in the cabinet and serving to suitably amplify the sound to be recorded and reproduced. Suitable loud speakers or other units, not shown, may be connected with this amplifying unit. A radio receiving set, not shown, may be suitably housed in the cabinet and will be controlled by the tuning means R.

To provide for increasing the capacity of the record and improving the quality of recordations and reproductions, the apparatus is arranged so that the record is caused to rotate at a constant speed where engaged with the stylus in operation, whether the recording or reproducing stylus, and throughout the "groove" length of the record. This is accomplished by moving the friction drive wheel 19 radially of the turntable during the driving of the latter and by also moving the arm 23 in predetermined relation to the said drive wheel. Accordingly, a lead screw 31 is driven by the turntable post 9 through worm 32 and gear 33, which latter is fixed to said lead screw. The drive connection between said lead screw and said carriage 17 is effected by means of an arm 34 pivoted as at 35 on the carriage and having a screw threaded portion 36 adapted to engage said lead screw. The upper end of the arm 34 is notched as at 37, and a spring detent 38 is adapted to engage said end and to hold the arm 34 in predetermined positions.

Movement of the recording and reproducing arm 23 is effected by means of a telescopic lever 39 having a ball and socket connection 40 with the upper side of the carriage 17 and a pivoted connection 41 with an adjustable fulcrum member 42 on the side of the cabinet A. A link 43 is connected with the lever 39 and with a crank arm 44, which latter projects from the lower end of the post 24. It will thus be seen that as the carriage 17 and drive wheel 19 are moved radially of the turntable, the arm 23 carrying the recording and reproducing heads will be correspondingly moved so that the surface speed of the record at the point of its stylus will be substantially uniform throughout the record.

Inasmuch as the recording and reproducing heads are mounted side by side, a compensating adjustment must be made when setting one of the heads in operation. This is accomplished by moving the adjustable fulcrum 42 laterally between adjustable stops 45 and 46. Movement of this block is effected by using screw 47 as a handle and upon tightening said screw, the fulcrum will be held in adjusted position.

Provision is made for a back-spacing movement of the arm 23 by remote control or otherwise. This means comprises a back-spacing lead screw 48 rotatably mounted adjacent the lead screw 31 and driven from the shaft 13 by the worm gearing 49. The arm 34 has a screw threaded portion 50 disposed for engagement with the lead screw 48 when said arm is swung to the right of its position shown in Fig. 3. When in this position the arm 34 will cause the carriage 17, drive wheel 19 and arm 23 to be reversed as to movement, compared to movement thereof when actuated by the lead screw 31.

The means here shown for swinging the arm 34 from its normal position into back-spacing position comprises a solenoid 51 having its armature 52 pivotally connected as at 53, with a crank arm 58 extending from a rotary shaft 59. This shaft has a short crank arm 60 extending upwardly therefrom, for engagement in a recess 61 in the lower end of the arm 34. A spring 62 is connected with the solenoid and the crank arm 58 so as to hold the latter and the armature in the raised position shown in Fig. 3. In this position the crank arm 60 maintains the screw threaded portion 36 in engagement with lead screw 31. When the solenoid is energized the armature 52 moves downwardly and pushes the crank arm 58 downwardly against the action of the spring 62, whereby the shaft 59 is rotated in a clockwise direction and swings the arm 34 to cause the threaded portion 50 to engage the shaft 48. Upon deenergization of the solenoid 51 the spring 62 lifts the crank arm 58 and rotates the shaft 59 in a counter-clockwise direction, whereby the short crank arm 60 will swing the arm 34 back into engagement with the lead screw 31. With this arrangement it is seen that a circuit closer C provided on the cabinet A or at some point remote therefrom, will permit of back-spacing of the reproducing and recording head at will. This circuit closer is preferably of the push button type and when released, the back-spacing movement will automatically cease and the spring 62 as aforesaid, will restore these parts to position for a normal progressive movement of the reproducing or recording head of the record on the turntable, whereby to resume recordation or reproducing as the case may be.

Means is provided for automatically disengaging the turntable and friction drive wheel 19 and for lifting the arm 23 so that the reproducing or recording head as the case may be, may be moved clear of the record on the turntable. This means is automatically operated at the time of energization of the solenoid 51. As here shown, it comprises an angular crank arm 63 on the end of the shaft 59. The crank arm 63 has a bifurcated end 64 which embraces the post 9 as particularly shown in Fig. 5, the worm 32 on said post providing a shoulder for engagement of said bifurcated end. Thus when the shaft 59 is turned in a clockwise direction, the crank arm 62 will lift the post 9 and consequently the turntable is lifted clear of the drive wheel 19. At the same time, an angular link 65 secured at one end as at 66', to the crank arm 58 and at its other end to the arm 23, operates to tilt said arm on a horizontal pivot 66 as shown in Fig. 4. The connection of the link 65 with the arm 23 is effected by means of a slotted extension 67 at the inner end of said arm, through the slot of which extension the link 65 projects so that a head 68 on the link rests on top of said projection. The slot in said extension is arcuate whereby the swinging movement of the arm 23 is unhindered. By this connection it is now seen that the energization of solenoid 52 causes the link 65 to be pulled downwardly whereby to tilt the arm 23 and raise the reproducing and recording heads thereon from the record on the turntable. Upon deenergization of solenoid 51, the link is lowered and the arm 23 with the recording and reproducing heads thereon is restored to operative position.

Means is provided for automatically shutting off the motor 11 when the end of the groove in the record is reached in the recording and reproducing operations. This means comprises an extension 69 on the carriage 17 and a projection 70 extended at right angles thereto for operating a circuit breaker 71. The circuit breaker 71 is normally closed and is in series with the motor and source of current as shown in the diagram

of Fig. 8. As soon as the carriage is moved to disengage the projection 70 from the circuit breaker 71, the spring action of the latter causes it to resume circuit closing position, whereby the motor will again be started.

Provision is also made for automatically de-energizing the solenoid 51 when the outer limit of travel of the arm 17 is reached while engaged with the back-spacing lead screw 48. This means comprises a projection 72 similar to projection 70 and adapted to engage and open a normally closed switch 73 which is in series with said solenoid. When the solenoid is deenergized, the spring 62 operates as previously described, to swing the arm 34 back to engagement with the lead screw 31 so that the recording or reproducing operation as the case may be, is automatically resumed.

The projection 69 may be extended to serve as a position indicator or pointer as at 74, with relation to an indicator scale 75 which may be mounted on the top of the cabinet. By this means the operator may readily determine the position of the reproducing or recording head and the movement thereof yet permitted during recording and reproducing operations.

In the case of remote control as indicated in the diagram in Fig. 8, the operator at said remote point may also ascertain the position of the recording or reproducing head with reference to the record by means of a volt meter type indicator 76, which is energized by a rheostat member 77 mounted on the cabinet. The member 69 carries the movable element 78 of the rheostat 77 so that the electrical potential in said volt meter circuit will be varied as the member 78 is moved back and forth with the member 69. The volt member indicator will have indicating characters thereon corresponding to those on the scale 75, whereby to indicate the position of the recording and reproducing heads at all times.

I claim:

1. Sound recording and reproducing apparatus including a record supporting turntable, a rotary drive member for frictionally driving said turntable, means supporting said drive member for bodily movement substantially radially of the axis of said turntable, means for rotating said drive member, means geared to said turntable for bodily moving said drive member in one direction, including a lead screw, a threaded member, means supporting said threaded member on said drive member for movement relative thereto into and out of engagement with said screw, a stylus adapted to engage a record on said turntable, supporting means for said stylus, means of connection between said drive member and said supporting means for moving the stylus in correspondence with the bodily movement of said drive member, and back-spacing means operable at will for correspondingly moving said drive member and stylus in the opposite direction, including another lead screw geared to the means for rotating said drive member, means for moving said threaded member from the first to the second named lead screw and means for automatically moving said threaded member from the second-named lead screw to the first named lead screw at the cessation of operation of said back-spacing means.

2. Apparatus for recording or reproducing sound, including a turntable for supporting a sound record, a rotary drive member frictionally engaged with said turntable, means supporting said drive member for bodily movement in both directions substantially radially of the axis of said turntable, means for rotating said drive member, a stylus for engagement with a record on the turntable, supporting means for the stylus, means of connection between the supporting means and drive member, whereby the stylus will follow the bodily movement of said drive member and means for bodily moving said drive member in both directions, including a driven screw threaded shaft geared to said turntable, another screw threaded shaft geared to the means for rotating said drive member, a threaded drive connection carried by said drive member for movement relative thereto into driving engagement with either of said shafts and means for selectively moving said drive connection into screw threaded engagement with the two last named shafts.

3. In apparatus of the character described, a turntable adapted to support a record, means for rotating said turntable including a friction drive member movable bodily substantially radially of and frictionally engaging said turntable, means for slidably supporting said drive member, means for rotating said drive member, lead screws rotatable in opposite directions, means geared to said turntable for rotating one lead screw, means geared to said rotating means for rotating the other lead screw in an opposite direction from the first named lead screw, a threaded drive connection, means pivotally supporting said connection on the drive member for movement into engagement with either of said lead screws, a movable stylus, means for supporting said stylus, means of connection between the drive member and stylus supporting means for moving the stylus in correspondence with bodily movement of the drive member and means for selectively moving said threaded member into driving engagement with said lead screws.

4. In apparatus of the character described, a turntable adapted to support a record, means for rotating said turntable including a friction drive wheel, having a hub means cooperating with said hub for supporting said drive wheel for movement towards and away from the axis of said turntable, means for rotating said drive wheel, means for moving said drive wheel towards and away from the axis of the turntable, including lead screws adapted to be rotated in opposite directions, gearing connecting said screws with said turntable and said rotating means, for rotating said lead screws in opposite directions, a yoke member mounted on said hub so as to be movable therewith an arm pivotally supported by said yoke member, threaded members fixed on said arm for engagement with said lead screws, means for moving said arm to selectively dispose said threaded members in engagement with said lead screws.

5. Apparatus of the character described, including the apparatus defined in claim 4, and a stylus adapted to engage a record on the turntable, a supporting means for the stylus and means of connection between the supporting means and yoke member for moving the stylus substantially radially of the turntable in correspondence with such movement of said drive wheel, said means of connection between the stylus support and yoke member including a telescopic lever pivotally connected with the yoke member, an adjustable fulcrum for said lever, and means of operative connection between said lever and said stylus support.

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