Nov. 4, 1930. L. J. ANDRES 1,780,414

CONTINUOUS SOUND REPRODUCING APPARATUS

Filed Aug. 24, 1928 4 Sheets-Sheet 1

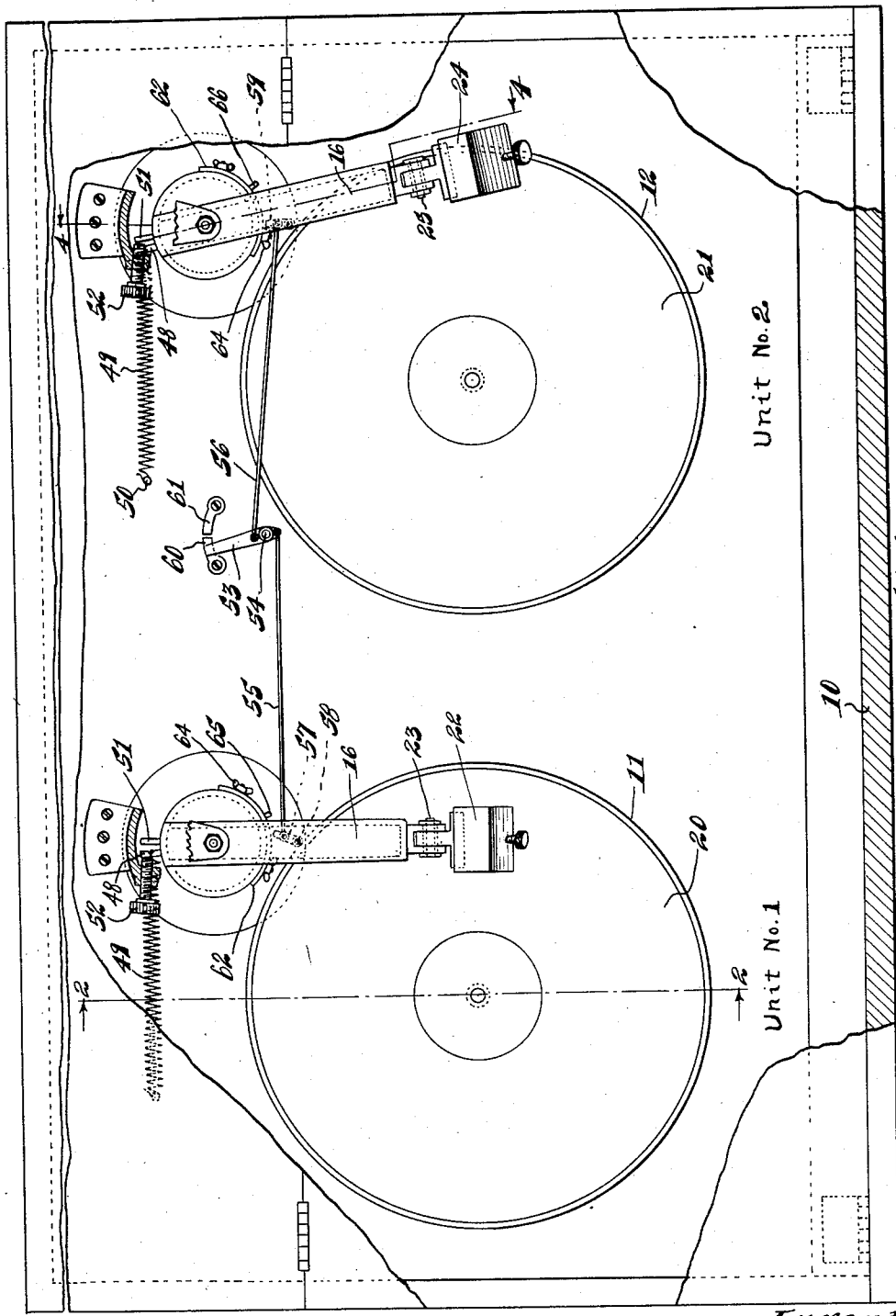

Fig. 1

Witnesses:
C. E. Wessels
F. C. Appleton

Inventor:
Lloyd J. Andres,
By Joshua R. H. Potts
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CONTINUOUS SOUND REPRODUCING APPARATUS

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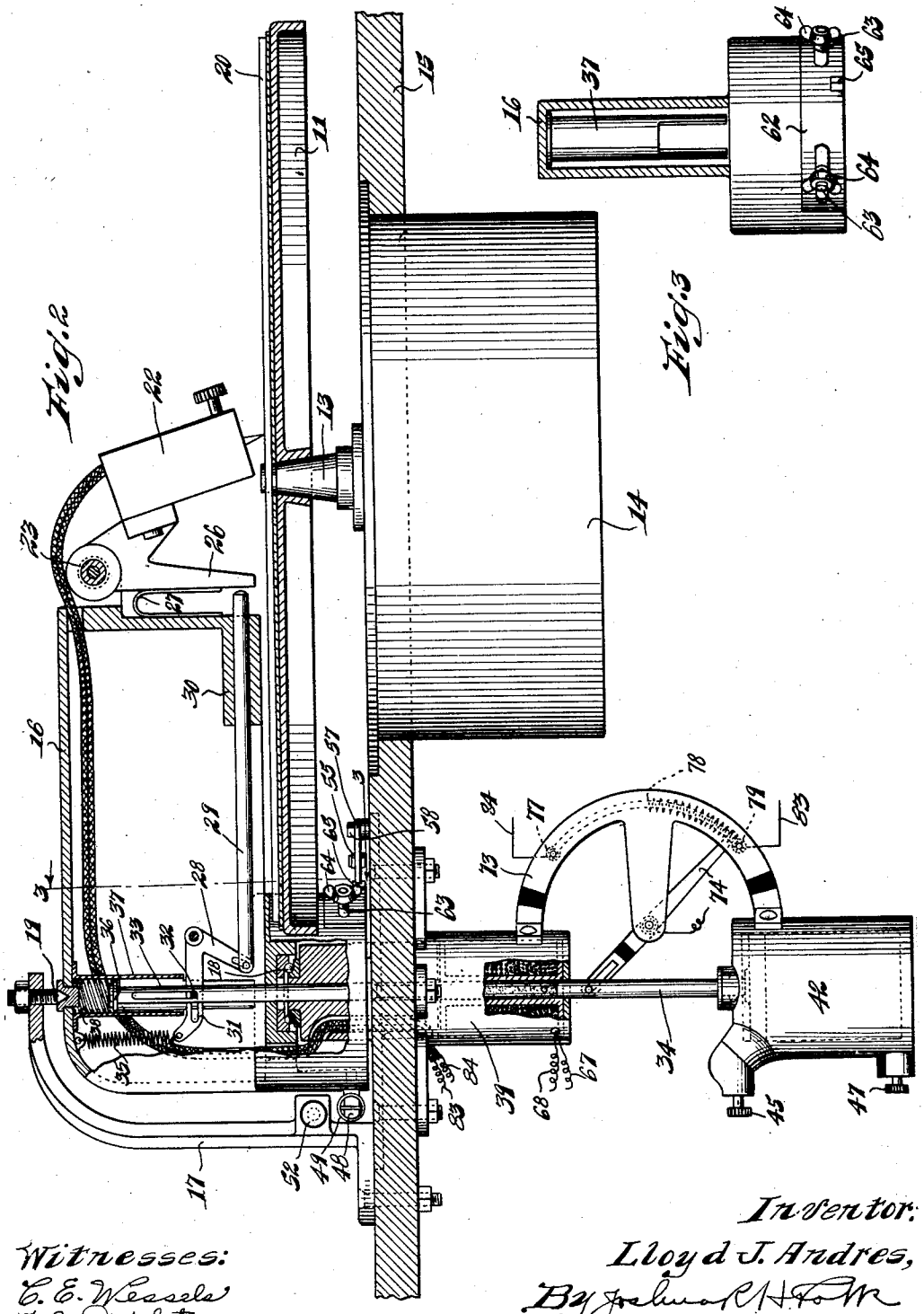

Fig. 2

Fig. 3

Witnesses:
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CONTINUOUS SOUND REPRODUCING APPARATUS

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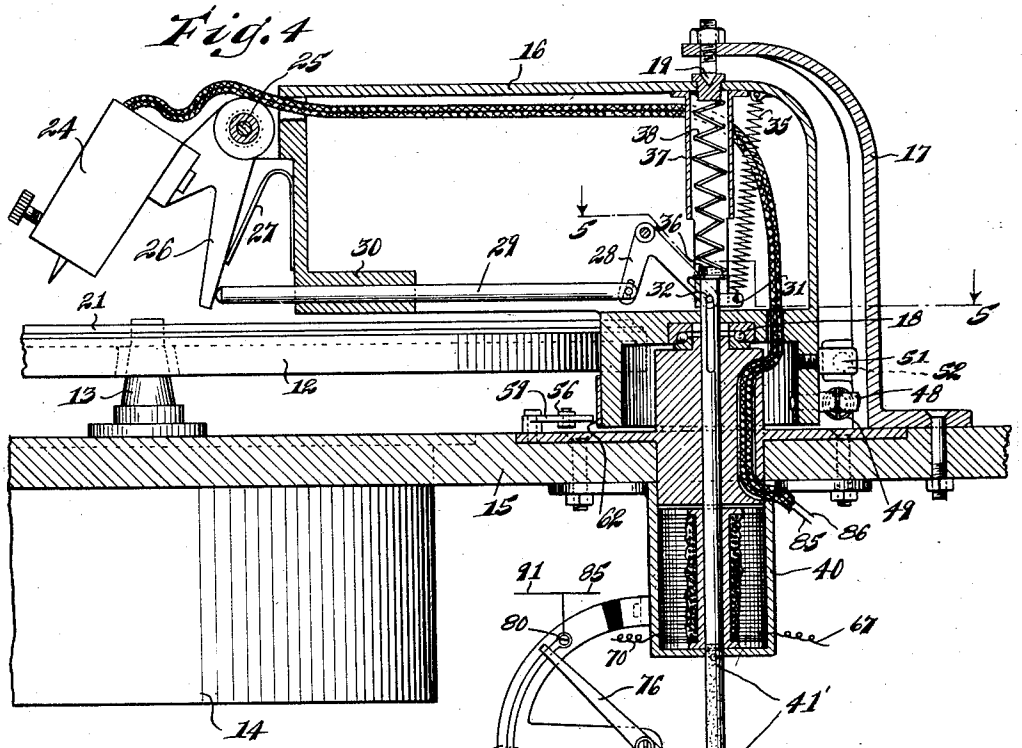
Fig. 4



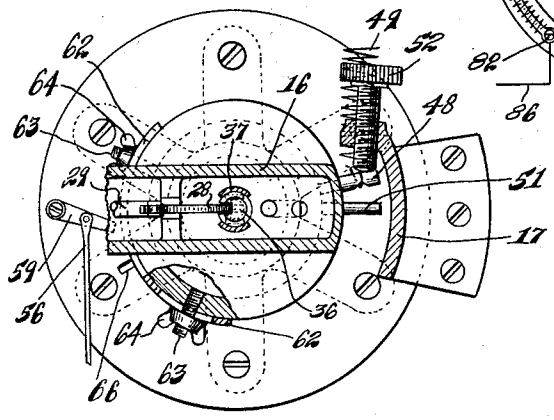


Fig. 5

Witnesses:
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CONTINUOUS SOUND REPRODUCING APPARATUS

Filed Aug. 24, 1928 4 Sheets-Sheet 4

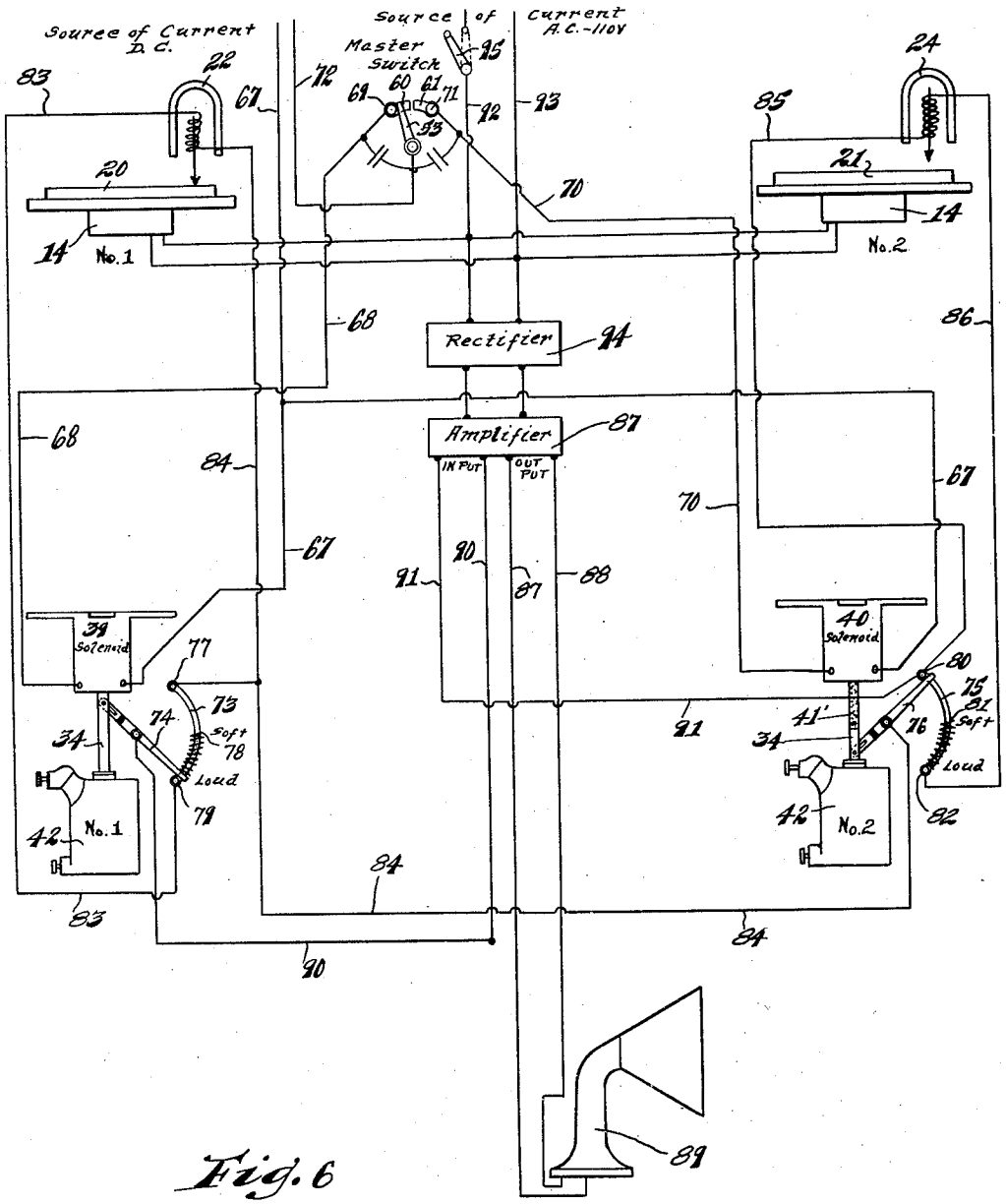

Fig. 6

Witnesses:
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Patented Nov. 4, 1930

1,780,414

UNITED STATES PATENT OFFICE

LLOYD J. ANDRES, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO ELMER E. RULLMAN, OF CHICAGO, ILLINOIS

CONTINUOUS-SOUND-REPRODUCING APPARATUS

Application filed August 24, 1928. Serial No. 301,786.

This invention relates to continuous sound reproducing apparatus and pertains more particularly to the alternate reproduction from phonograph records without interruption in the change from one record to the other and without perceptible indication to the auditors that a transfer has occurred.

An object of the invention is the provision of multiple record sound reproducing units; means for causing the gradual engagement and disengagement of the units with the respective phonograph records alternately employed, and means for automatically causing the engagement and disengagement of the reproducing units with the successive records as well as automatically regulating the volume control at the time the transfer from one record to the other is made.

A further object resides in utilizing the mechanical improvements in conjunction with radio reproduction apparatus.

Other objects will appear hereinafter.

The invention consists in the combinations and arrangement of parts hereinafter described and claimed. The invention will be best understood by reference to the accompanying drawings forming a part of this specification, and in which—

Fig. 1 is a plan view of a preferred embodiment of the invention showing two record turn tables and respective reproducing units, with associated mechanism;

Fig. 2 is an enlarged vertical sectional view taken on the line 2—2 of Fig. 1, with a portion of the reproduction carriage shown in section to illustrate the internal mechanism;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged vertical sectional view taken on the line 4—4 of Fig. 1, and showing the pick-up elevated out of engagement with the record;

Fig. 5 is an enlarged cross sectional view taken on the line 5—5 of Fig. 4; and

Fig. 6 is a wiring diagram of the apparatus.

As illustrated in the drawings, the preferred embodiment comprises a cabinet 10 equipped with two record turn tables 11 and 12 in association with each of which is provided a reproduction unit, and for convenient reference for the purpose of the present description, turn table 11 and the associated mechanism will be designated reproduction unit number 1 and turn table 12 with associated mechanism reproduction unit number 2. Further, the mechanical and electrical elements employed in the two reproduction units are identical with a few exceptions which will be pointed out, and therefore with respect to the two units, like reference characters will indicate like parts. Each of the record turn tables 11 and 12 is preferably supported and adapted to be rotated by a vertically extending shaft 13 forming the extension of an armature of a motor mounted within the casing 14 supported by the upper table portion 15 of the cabinet, and in the present embodiment the driving motors are preferably adapted to operate continuously while the apparatus is in use, deriving electric current from the usual lighting circuit. A swinging carriage 16 is employed in each unit, supported by a bracket 17, mounted upon table 15, and, inasmuch as for the purposes of the present invention it is desirable to have arms 16 movable with the least amount of friction, a ball bearing 18 is provided at the point of supporting engagement of carriage 16, and an adjustable cup and cone bearing 19 supplies the upper pivotal mounting. Thus each carriage 16 is mounted for lateral movement whereby to permit of alternative reproduction from phonograph records 20 and 21 carried by turn tables 11 and 12, respectively. A magnetic pick-up unit 22 is pivotally mounted at 23 upon carriage 16 of unit number 1, and a second magnetic pick-up unit 24 is pivotally mounted at 25 upon carriage 16 of reproduction unit number 2. The bracket support of each magnetic pick-up has a downwardly extending arm 26 and interposed between the adjacent face of carriage 16 and arm 26 is a leaf spring 27, adapted to relieve the weight of the pick-up and avoid excessive pressure of the pick-up needle against the phonograph record which it engages. Pivotally mounted upon each carriage 16 is a bell crank 28 one arm of

which has slotted engagement with a pin mounted upon the extremity of horizontally reciprocating rod 29 which slides in tubular bearing 30. The other arm of bell crank 28 is provided with a slot 31 which engages a headed pin 32 extending through slot 33 of vertically movable rod 34, and the extremity of said second bell crank arm is secured to one end of tension spring 35, the opposite end of which is connected to carriage 16. As will be noted in Figs. 2 and 4, rod 29 is adapted to engage arm 26 upon the pick-up for raising the latter out of engagement with the record, and as shown in Fig. 2, rod 29 is shown withdrawn to permit engagement of the pick-up with the record, whereas as shown in Fig. 4, rod 29 has been shifted to cause elevation of pick-up 24 and consequent disengagement with the record. The upper end of rod 34 is provided with a cap 36 slidable in a tube 37 secured to carriage 16 and a compression spring 38 is interposed between cap 37 and the inner surface of carriage 16. Rod 34 of unit number 1 extends vertically through a solenoid 39 secured to the under side of table 15, and similarly rod 34 of unit number 2 extends through solenoid 40. Each of the rods 34 is adapted to be moved upwardly by the respective solenoid 39 or 40 and for this purpose each rod 34 is preferably composed of non-magnetic material except for a portion of its length indicated at 41′ in Fig. 4 which may be of soft iron to respond to the magnetic pull exerted by the solenoid upon energizing of the latter. Compression spring 38 normally maintains rod 34 in the position shown in Fig. 4, and energizing of the solenoid causes rods 34 to be raised to the position shown in Fig. 2; therefore spring 38 is so constructed that it may be readily compressed by the magnetic pull of the solenoid. For the purpose of controlling the speed with which the rods 34 travel either through energizing of the solenoid or expansion of spring 38 following deenergizing of the solenoid, in connection with regulating the volume control as hereinafter explained, the lowermost extremity of each rod 34 is provided with a piston 41 slidable in a dash pot 42, as clearly shown in Fig. 4.

A ball check valve 43 is mounted upon the upper side of dash pot 42 and is adapted to prevent expelling of air while permitting a free air inlet, but to regulate the air outlet, a by pass 44 is provided with the air opening adjustable by screw 45. Similarly, an opening 46 at the lower portion of dash pot 42 is adapted to be regulated by screw 47. It will be noted that normally spring 38 is distended, causing the respective pick up to be maintained out of engagement with the record as shown in Fig. 4, and that upon energizing of the solenoids 39 or 40, rod 34 is raised to the position shown in Fig. 2, causing the associated pick up to be brought into engagement with the record. Therefore, the purpose of check valve 43 and air discharge regulating screw 45 on the upward travel is to reduce and control the speed so as to avoid too sudden or abrupt engagement of the pick up with the record. In the downward travel of rod 34, check valve 43 permits unimpeded air inlet to the top of dash pot 42 but the speed of the downward travel may be regulated by screw 47 for the purpose of preventing too sudden disengagement of the pick up, which feature is of importance in conjunction with the automatic volume control hereinafter explained.

Adjacent the base of each carriage 16 is a laterally extending lug 48 to which is secured one end of a light tension spring 49, the other end of which is secured to table 15 at 50, and spring 49 is of sufficient tensional strength to swing carriage 16 to the right as shown in Fig. 1 for initial engagement with a record. Also adjacent the base of each carriage 16 is a lateral projection 51 adapted to contact with set screw 52 threaded in an extension of bracket 17, whereby the initial engaging position of each carriage 16 may be adjusted to accommodate different records, and in this manner it is possible to adjust a pick-up so that it will initially engage a record groove at the actual commencement of the recording or the arm may be adjusted to have the pick up engage the record at any desired groove. Mounted upon table 15 is a switch having a contact arm 53 pivotally mounted at 54 and at one side of pivotal mounting 54 a link 55 is pivotally connected and a second link 56 is pivotally connected upon the opposite side, as shown in Fig. 1. Link 55 connects with an arm 57 pivotally mounted to table 15 at 58, and link 56 connects with arm 59 similarly mounted upon table 15. Contact arm 53 is adapted to alternately engage contact plates 60 and 61 by means of alternative actuation of links 55 and 56. For this purpose a circular disk 62 is mounted adjacent the base of each carriage 16 by means of bolts 63 which extend through slots in plate 62 whereby the latter may be adjusted laterally by means of wing nuts 64. Upon plate 62 of unit number 1 is a projection 65 and a similar projection 66 is provided upon plate 62 of unit number 2. Referring to unit number 1, plate 62 is adjusted in such manner that projection 65 will engage arm 57 immediately preceding the conclusion of the record reproduction whereby contact arm 53 is shifted out of engagement with contact plate 60 and into engagement with contact plate 61. Referring to the wiring diagram of Fig. 6, the respective solenoids are energized by a distinct source of electric current which is indicated as the source of current D. C. and lead wire 67 connects with one terminal of each solenoid. Wire 68 connects the other terminal of sole-

noid 39 of unit number 1 with terminal 69 of contact plate 60; and the remaining terminal of solenoid 40 of unit number 2 is connected by wire 70 to terminal 71 of contact plate 61. Thus the breaking of the circuit through contact arm 53 and plate 60 and engagement of contact arm 53 with plate 61, causes deenergizing of solenoid 39 and energizing of solenoid 40. This operation causes disengagement of pick-up 21 after which it is swung to initial record engaging position by means of spring 49. As shown in Fig. 6, contact arm 53 connects with the other lead 72 of the D. C. current.

Mounted for operation with unit number 1 is a potentiometer 73 which carries a pivotally mounted contact lever 74 having slotted engagement with a pin on rod 34 as shown in Fig. 2, and similarly mounted for operation in conjunction with unit number 2 is a second potentiometer 75 identical with 73 having a similarly mounted contact lever 76. Potentiometer 73 is preferably provided with zero resistance from terminal 77 to an intermediate point 78 and from point 78 to terminal 79, an impedance of approximately 25,000 ohms is recommended, assuming that each pick-up represents 400 ohms resistance for the reason that potentiometer 73 is connected in parallel or shunted across the leads from pick-up 22 as explained presently by reference to the wiring diagram. Potentiometer 75 likewise has zero resistance from terminal 80 to intermediate point 81 and approximately 25,000 ohms impedance from point 81 to terminal 82.

Referring now to the wiring diagram, respective pick-ups may be of any approved type, either extraneously energized or self-energizing, but the latter type is preferred and is employed in the present embodiment. Wires 83 and 84, leading from pick-up 22 are connected respectively to terminals 79 and 77 of potentiometer 73 and similarly pick-up 24 is connected by wires 85 and 86 with terminals 80 and 82 of potentiometer 75. An amplification unit 87 of any standard approved type may be employed. The output wires 87 and 88 connect with the loud speaker 89. It will be seen that arm 74 of potentiometer 73 is connected to the input side of the amplifier by wire 90; that terminal 80 of potentiometer 75 is connected to the other amplifier input wire 91; and that terminal 77 of potentiometer 73 is connected to wire 84 which in turn leads to arm 76 of potentiometer 75 thus producing a series connection for the two pick-ups, and which represents the preferred arrangement. Energy for the turn table motors may be derived from wires 92 and 93 which may be connected to the usual alternating current lighting circuit, and which may also be utilized for amplification purposes by interposing a rectifier 94. Further, if desired, current for the solenoids may be taken from the output side of the rectifier or a separate source of battery current may be employed as desired. A control switch 95 is preferably provided in the main current line as is a similar switch in the direct current line for the solenoids.

The operation of the apparatus is as follows: Assuming that the record on unit number 1 is initially played, contact arm 53 is placed in engagement with plate 60 and switch 95 is closed. At this position, carriage 16 of unit number 1 has been swung to starting position by spring 49 and closing of switch 95 energizes solenoid 39 which causes rod 34 to be elevated to the position shown in Fig. 2. During this process arm 74 has engaged potentiometer 73 from terminal 77 to terminal 79. During the travel from terminal 77 to intermediate point 78, rod 34 has completed one-half its upward travel, bringing pick-up 22 in contact with record 20 by means of spring 35. During the remaining half of the upward travel of the rod 34, slot 33 passes over pin 32 and simultaneously arm 74 contacts with the resistance portion of potentiometer 73 from intermediate point 78 to terminal 79, and because of the shunted connection the potential of current generated in pick-up 22 gradually increases, causing a simultaneous gradual increase in the tone volume emanating from loud speaker 89. Pick-up 22 continues in contact with record 20 in the usual manner until at the appropriate predetermined point near the completion of the record, projection 65 engages arm 57 which causes contact arm 53 to be brought into engagement with contact plate 61. The consequent deenergizing of solenoid 39 of unit number 1 enables expansion of spring 38 to lower rod 34 but during the initial half of the lowering travel slot 33 passes over pin 32 which allows the pick-up 22 to remain in complete contact with the record and during this travel potentiometer arm 74 has been moved from contact adjacent terminal 79 to intermediate point 78 causing a gradual reduction in sound volume. During the remainder of the downward travel of rod 34 the upper end of slot 33 engages pin 32 causing pick-up 22 to be raised out of engagement with the record, and as soon as this occurs, carriage 16 of unit number 1 again swings to initial starting position. In the meantime, the circuit having been closed on solenoid 40, pick-up 24 has been brought into engagement with record 21, and as pick-up 24 reaches the final playing grooves on record 21, the adjusted lug 66 engages arm 59 breaking the circuit on solenoid 40 and again closing the circuit on solenoid 39, at which point pick-up 24 is elevated from contact with record 21 and swung to initial starting position by spring 49. While either record is being played, the record on the other turn table may be changed

and thus provision is made for continuous uninterrupted record reproduction. Preferably the gap between contact plates 60 and 61 is slightly less than the width of the engaging surface of contact arm 53 to promote smoothness of the transfer from one record to the other, and the air valve adjusting nuts 45 and 47 permit of the required adjustment whereby the fading out of the tone from one record may be blended with the fading in of the tone from the other record and render the change unnoticable. It will be seen that the adjustment of nuts 45 and 47 is only necessary to obtain the desired result after which the apparatus will operate automatically without further attention and the adjustment of nuts 45 and 47 regulates only the speed of vertical travel of rod 34 which in turn controls the rate of speed with which the pick-up is lowered or raised into or out of engagement with the record, and the connection with the potentiometer is such that the rate of sound volume increase is simultaneously regulated.

While I have illustrated and described the preferred form of construction for carrying my invention into effect, it is capable of variation and modification without departing from the spirit of the invention. I, therefore, do not wish to be limited to the precise details of the construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

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

1. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pick-up unit for each phonograph record electrically connected to said amplification unit; means for causing alternative engagement of said pick-up units with the respective records, and volume control means operatively connected to said alternative engagement means, substantially as described.

2. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pick-up unit for each phonograph record electrically connected to said amplification unit; electric means for automatically causing alternative engagement of said pick-up units with the respective records, and volume control means operatively connected to said alternative engagement means, substantially as described.

3. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pick-up unit for each phonograph record electrically connected to said amplification unit; a solenoid for each pick-up unit, each solenoid adapted to cause engagement of the respective pick-up unit with a record; means for automatically causing alternative energizing of said solenoids, and a volume control unit operable by each solenoid, substantially as described.

4. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pick-up unit for each phonograph record electrically connected to said amplification unit; a solenoid for each pick-up unit, each solenoid adapted to cause engagement of the respective pick-up unit with a record; a volume control unit operable by each solenoid; and a switch automatically operated during the travel of said pick-up units for causing alternative energizing of said solenoids, substantially as described.

5. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; a volume control unit associated with each solenoid and operable thereby; and means for alternately energizing and deenergizing said respective solenoids, substantially as described.

6. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; a volume control unit associated with each solenoid and operable thereby; and a switch alternately operated by said arms for alternately energizing and deenergizing said respective solenoids, substantially as described.

7. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing

to cause engagement of the associated pick-up unit with a record; means for alternately energizing and deenergizing said respective solenoids; and a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume, substantially as described.

8. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; means for alternately energizing and deenergizing said respective solenoids; and a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometer adapted to be alternately operated by means of said solenoids for gradually increasing and decreasing the sound volume, substantially as described.

9. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; means for alternately energizing and deenergizing said respective solenoids; a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume; and means for causing disengagement of each pick-up unit upon deenergizing of the associated solenoid, substantially as described.

10. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; means for alternately energizing and deenergizing said respective solenoids; a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume; means for causing disengagement of each pick-up unit upon deenergizing of the associated solenoid; and a spring connected to each arm for restoring the pick-up carried by said arm to initial record engaging position following each disengagement of said pick-up unit, substantially as described.

11. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; means for alternately energizing and deenergizing said respective solenoids; a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume; means for causing disengagement of each pick-up unit upon deenergizing of the associated solenoid; a spring connected to each arm for restoring the pick-up carried by said arm to initial record engaging position following each disengagement of said pick-up unit; and means for causing gradual engagement and disengagement of said respective pick-up units, substantially as described.

12. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; a switch alternately operated by said arms for alternately energizing and deenergizing said respective solenoids; and a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume, substantially as described.

13. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to

carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; a switch alternately operated by said arms for alternately energizing and deenergizing said respective solenoids; and a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometer adapted to be alternately operated by means of said solenoids for gradually increasing and decreasing the sound volume, substantially as described.

14. An apparatus of the class described comprising, in combination, a plurality of phonograph record supports each adapted to carry a phonograph record; an amplification unit; a pivotally mounted arm adjacent each record support; a pick-up unit mounted upon each arm for engagement with a record and electrically connected to said amplification unit; a solenoid operatively connected to each pick-up unit and adapted upon energizing to cause engagement of the associated pick-up unit with a record; a switch alternately operated by said arms for alternately energizing and deenergizing said respective solenoids; a potentiometer electrically interposed between each pick-up unit and said amplification unit, said potentiometers adapted to be alternately operated by said solenoids for gradually increasing and decreasing the sound volume; and means for causing disengagement of each pick-up unit upon deenergizing of the associated solenoid, substantially as described.

In testimony whereof I have signed my name to this specification.

LLOYD J. ANDRES.