H. T. SCOTT & L. J. PATTERSON.

AUTOMATIC PHONOGRAPH.

APPLICATION FILED APR. 11, 1912.

1,040,034.

Patented Oct. 1, 1912.

3 SHEETS—SHEET 1.

FIG. 1.

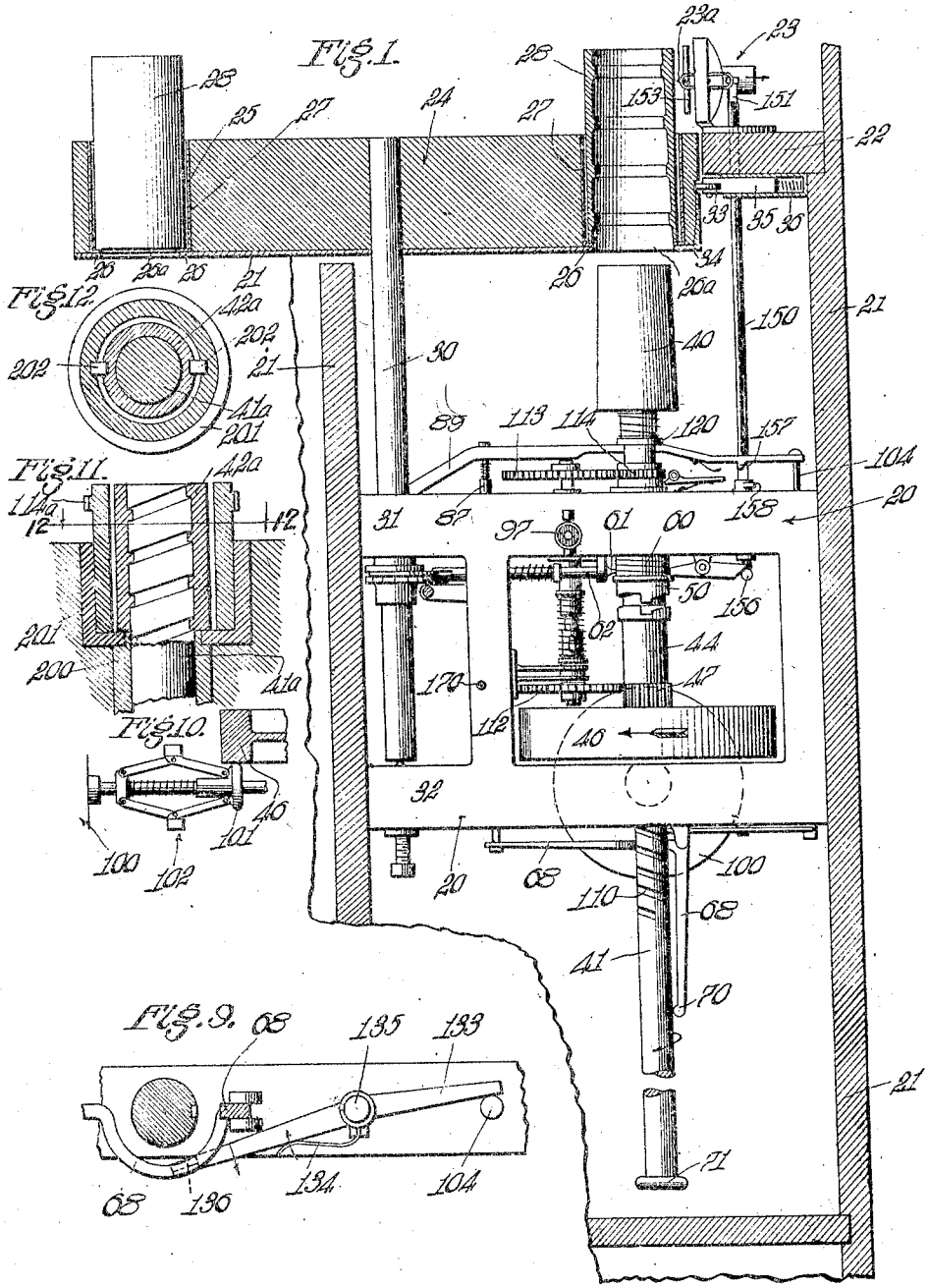

FIG. 12.

FIG. 11.

FIG. 10.

FIG. 9.

Witnesses.
Elwood H. Corbelew
E. Lilley

Inventors,
Harry T. Scott and
Leo J. Patterson,
by James T. Barkelew
their Attorney.

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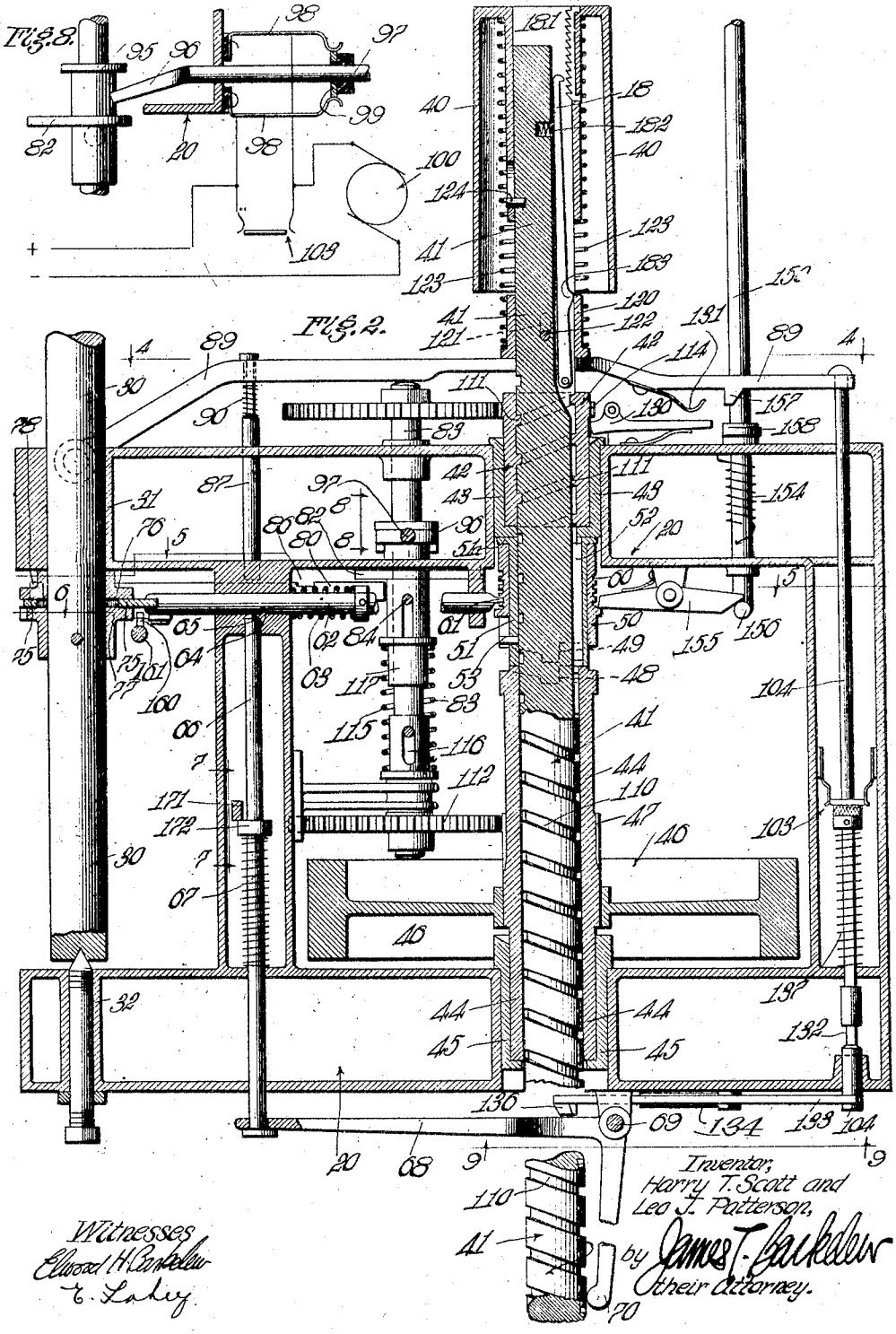
3 SHEETS—SHEET 2.

FIG. 3.

FIG. 2.



Witnesses
Elwood H. Pendleton
C. Lahey

Inventor,
Harry T. Scott and
Leo J. Patterson,
by James T. Pendleton
their Attorney.

H. T. SCOTT & L. J. PATTERSON.

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3 SHEETS—SHEET 3.

Fig. 3

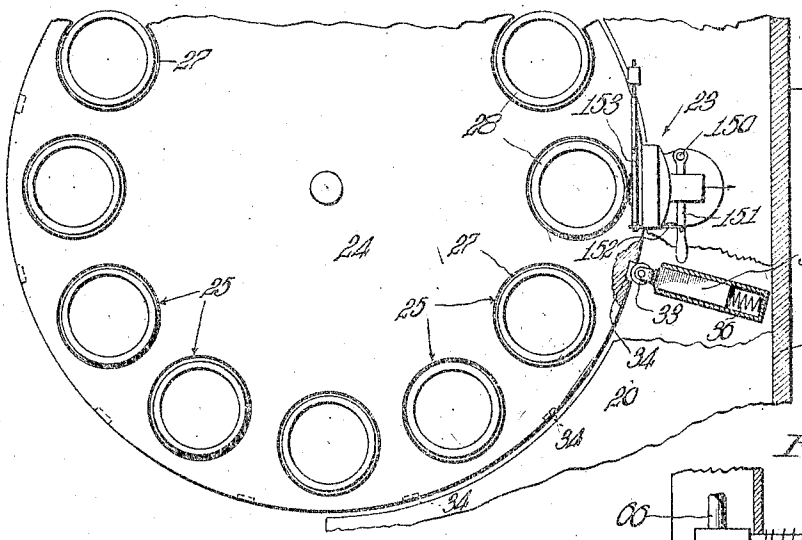


Fig. 7.

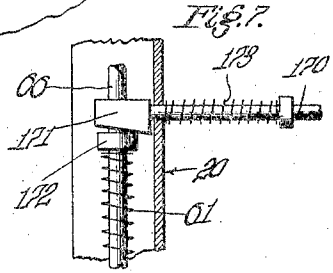


Fig. 4.

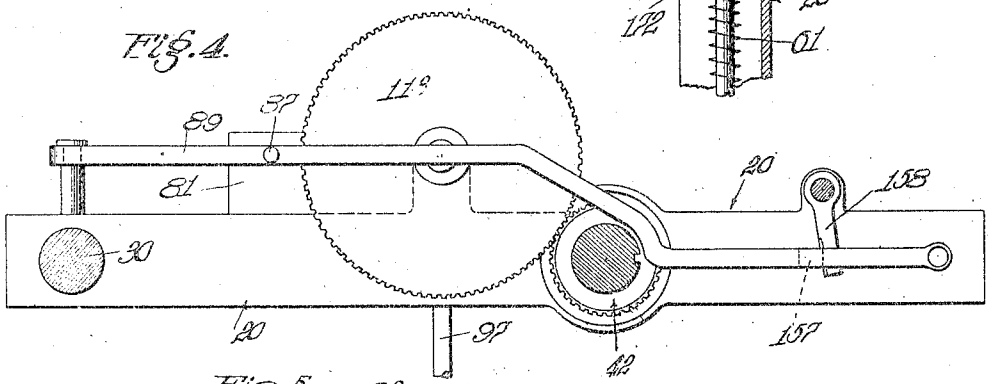


Fig. 5.

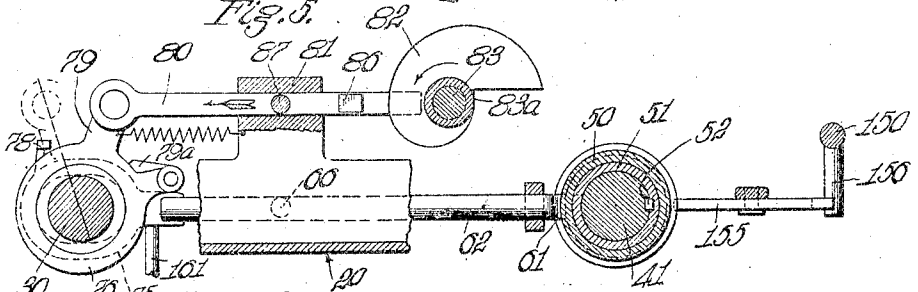
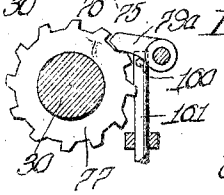


Fig. 6.



Witnesses.
Elwood H. Benkelser
E. Lahey.

Inventors.
Harry T. Scott and
Leo J. Patterson.
by James T. Benkelser
their Attorney.

UNITED STATES PATENT OFFICE.

HARRY T. SCOTT AND LEO J. PATTERSON, OF LOS ANGELES, CALIFORNIA; SAID PATTERSON ASSIGNOR TO SAID SCOTT.

AUTOMATIC PHONOGRAPH.

1,040,034. Specification of Letters Patent. Patented Oct. 1, 1912.

Application filed April 11, 1912. Serial No. 690,116.

To all whom it may concern:

Be it known that we, HARRY T. SCOTT and LEO J. PATTERSON, citizens of the United States, both residing at Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Automatic Phonographs, of which the following is a specification.

This invention relates to an automatic phonograph for playing automatically and successively a number of phonograph records of the ordinary cylindrical, or Edison type and the invention consists primarily in an arrangement of mechanisms whereby the records are carried with their axes in vertical positions and are moved from the carrying member, magazine or table, to a position adjacent the reproducing mechanism, automatic means being employed for then so operating the record and the reproducing mechanism as to reproduce the sound from the record and to then return the record to the magazine or table.

In its specific preferred embodiment, our invention consists of a suitable movable record carrying magazine or table, preferably a horizontally rotating table mounted on a vertical axis, the table having pockets arranged around its periphery in which the cylindrical records are adapted to loosely rest. The records thus stand in their normal vertical positions without forcible contact with a mandrel or any other device; in fact, the records are as free from liability to deterioration and breakage as they are when packed in specially made cases. The records rest on annular shelves in the table pockets, the pockets extending with reduced diameter down through the table, so that there is an opening under each pocket through which the record raising member and record engaging mandrel may pass. The table is provided with an intermittent rotating mechanism so that it may be moved to place successive records over the record engaging mandrel; but it will be seen from the following specification that this table moving mechanism may be thrown out of action temporarily or completely, or that it may be moved by hand instead of by its automatic mechanism. The record engaging mandrel is mounted on the upper end of the vertically movable and rotatable shaft, the action of the shaft being first to move vertically and engage the mandrel with the record immediately above, move the record to a point adjacent the reproducing mechanism, and then to rotate and slowly move downwardly in a manner designed to keep the sound groove of the record in engagement with the reproducing point or stylus. In other words, the record is both rotated and moved longitudinally—given two distinct movements—instead of as heretofore rotating the record and moving the reproducing mechanism longitudinally along the record. In our machine the reproducing mechanism is held stationary, at least so far as movement along the record is concerned. When the record carrying mandrel is moved downwardly to a point where the reproduction of a record is completed, the mechanism allows the mandrel to move quickly to its lowermost position. In addition to this the record is left in its pocket on the table and immediately the mandrel has reached its lowermost position and is free of the table, the table is rotated through a certain portion of a revolution to bring the next record directly over the mandrel. When this has been accomplished the mandrel is again started upward and the whole operation is repeated. We have provided certain devices for the manual control of this mechanism, allowing the records to be played in any desired manner. If desired, the table operating mechanism may be thrown out of action and the table or other record support moved by hand. The records need not then be played in succession as placed upon the table, any desired record being played directly after any other; or the same record may be repeated indefinitely. Manually controlled means are also provided for discontinuing the playing of any record, immediately replacing it upon the record support or table and passing to the next record. These two manually operable devices provide for complete control over the machine. If the magazine or table of the machine will contain a dozen records, the operator may select the dozen or less records he wishes to hear, place them in the machine and pull out the starting button. The machine is preferably operated electrically; and operation of the starting button closes

the electric circuit to the operating motor. The mechanism immediately starts operation, engaging and reproducing the first record, passing immediately to the next one and so on until it has played the entire number selected. Should the operator then desire, the machine will keep on indefinitely repeating the records in succession. When it is desired to stop the machine, the starting and stopping button is pressed; but the machine will not stop until it has disposed of the record then being played. It will either complete the reproduction of that particular record and replace it upon the record table, or the record discontinuing button may be pressed and the operation stopped immediately. But, in whichever way the operation is stopped, the machine will always come to a certain definite position before coming to rest; and in this position it is impossible for any manual operation of the exposed parts of the machine to cause it damage.

One of the prime features of our invention is its extreme simplicity. We are enabled to accomplish the above described operations with an amount of mechanism very little in excess of the machinery sometimes used to reproduce but a single record. There are many different manners of moving the several parts of our machine; but we have adopted what appears to be the most simple mode of operation and will hereinafter describe the mechanism which we conceive to be the simplest and the one which accomplishes its results in the most satisfactory and direct manner. In this preferred form of mechanism a rotatable nut engages with a thread on the mandrel shaft, so that, by rotation of this nut, the shaft may be either raised or lowered, according to the direction of rotation. Means are provided for rotating the nut and the shaft at differential speeds, and for starting and stopping rotation of the nut and shaft at different points in the operation of the machine. The direction of the mandrel screw thread in the present machine is such that, to feed the mandrel shaft downwardly by the differential action, the nut must be rotated slightly faster than the shaft itself; but this may be arranged as desired. For driving the nut a simple gear mechanism is provided connecting the nut with a sleeve rotating about the nut. This sleeve is loosely mounted on the shaft and is suitably rotatably connectible thereto. The gears connect the sleeve with the nut in such manner that the nut travels slightly faster than the sleeve and in the same direction; and the mechanism for starting and stopping the rotation of the nut takes the form of means for simply shifting these gears to throw them into and out of engagement.

The nut and shaft preferably rotate in the same direction; so that it will be seen that, if the arrangement is such that when the nut alone is revolving the shaft is moved downwardly, when the shaft alone revolves in the same direction it will be moved upwardly. The rate of these movements will depend entirely upon the speed of rotation of the nut and shaft and the pitch of the screw thread; and the pitch is made sufficiently coarse to cause the movement of the shaft at considerable velocity when either the nut or the shaft is rotated alone. But when the nut and shaft are rotated together, the differential action causes the slow downward movement of the shaft while it is rotated; and it is during this movement that the reproducing mechanism is thrown into engagement with the record to follow its sound groove. Thus, considered in a broad manner, the operation of the device is as follows: Mechanism controlled by the shaft when in its lowermost position causes the shaft to begin rotating. This immediately screws the shaft upwardly until it reaches its uppermost point. Mechanism controlled by the position of the shaft at its uppermost point causes the nut to begin revolving and the shaft is then moved down differentially while it is rotated. When the shaft has moved downwardly through a portion of its downward motion and the record on the mandrel has completely passed by the reproducing mechanism, mechanism is engaged by the shaft to stop the rotation of the shaft, the nut alone continuing its rotation. This causes the quick downward motion of the shaft to its original position. We have shown this preferred form of mechanism in the accompanying drawings, in which:

Figure 1 is a front elevation with parts in vertical longitudinal section. Fig. 2 is a vertical longitudinal section of the main operating portions of our machine. Fig. 3 is a partial plan showing the record carrying table and the reproducer mechanism. Fig. 4 is a detail horizontal section taken on line 4—4 of Fig. 2. Fig. 5 is a detail horizontal section taken on line 5—5 of Fig. 2. Fig. 6 is a detail horizontal section taken on line 6 of Fig. 2. Fig. 7 is a detail section taken as indicated by line 7—7 of Fig. 2. Fig. 8 is partially a detail section taken as indicated by line 8—8 of Fig. 2 and partially a diagrammatic view showing the electrical connections of the driving motor and the controlling switches. Fig. 9 is a bottom plan taken as indicated by line 9—9 of Fig. 2. Fig. 10 is a sectional detail showing the governor connection of the driving motor to the mechanism. Fig. 11 is a vertical section showing a modified arrangement of mandrel shaft and nut. Fig. 12 is a section taken on line 12—12 of Fig. 11.

In the drawings 20 designates a suitable

frame of any suitable material and preferably mounted in a case 21 of any desired design. This case has an upper shelf or floor 22 on which the reproducing mechanism 23 is mounted and of whose upper surface the revolving record table or support 24 forms practically a continuation. Record table 24 is provided with a plurality of pockets 25 arranged around its periphery, these pockets 25 extending vertically through the table 24. At the lower ends of the pockets annular shelves 26 are provided in any desired manner, and the upper surface of these shelves and the interior surface of the pockets are covered with a protective layer of felt or any other suitable material. Records 28 are placed in these pockets, standing loosely therein on annular shelves 26; and the openings 26ª through the annular shelves are sufficiently large to pass a mandrel which will engage with the interior of the cylindrical records. It will be seen that the records are carried in a manner which precludes entirely their liability to deformation or to breakage by contraction and expansion. Cylindrical records are usually best stored in a vertical position; and our machine has the advantage of holding the records in this most desirable position while they are in our machine. And it will be seen that the records are only engaged on a mandrel while they are actually being reproduced; and this completely obviates breakage by contraction of records on the mandrel which occurs in machines where the records are left on the mandrels for a long period.

Record table 24 is mounted on a vertical shaft 30 supported in suitable bearings 31 and 32 in frame 20. Rotation of the record table about the axis of shaft 30 will bring any desired record 28 opposite the reproducing mechanism 23 and into playing position. We employ a registering device for accurately registering the table in these positions, this device consisting in a spring pressed roller 33 (see Figs. 1 and 3) adapted to enter any one of suitable notches 34 in the periphery of the table. The roller 33 is mounted on a suitable plunger 35 and is pressed toward the table by a spring 36. The engagement of the roller with any one of the notches is sufficient to hold the table securely in position, but insufficient to prevent the table from being moved from one position to the next. The mechanism for moving the table from one position to another will be hereinafter described.

Directly beneath the record pocket which stands opposite the reproducing mechanism 23 there normally stands a record engaging mandrel 40. Mandrel 40 is mounted and supported on mandrel shaft 41, this shaft being adapted for both longitudinal movement along and rotation about its vertical axis. The shaft 41 is preferably not directly journaled in frame 20; but at its upper end it is journaled in a nut 42 which in turn is journaled in a suitable bearing 43 in frame 20, and at its lower end the shaft is journaled in a sleeve 44 which in turn is journaled in a suitable bearing 45 in frame 20. These arrangements are made for sake of simplicity of manufacture and operation. The sleeve 44 is of some vertical longitudinal extent and surrounds the shaft 41 with a running fit. Directly above bearing 45 drive balance wheel 46 is secured to the sleeve 44, being tightly forced on the sleeve in the position shown. Directly above the balance wheel 46 a gear 47 is cut on the sleeve; and at the upper end of sleeve 44 a clutch member 48 is formed adapted to engage with a corresponding clutch member 49 on the lower end of a sliding and revolving sleeve 50. Sleeve 50 surrounds and slides vertically on a sleeve 51 whose lower end engages the upper end of sleeve 44 and prevents sleeve 44 from rising and whose upper end engages the lower end of bearing 43. the sleeve 51 being thus prevented from longitudinal movement. Sleeve 51 is secured by key or spline 52 to rotate always with shaft 41, while sleeve 50 is secured by a pin and slot arrangement 53 to rotate always with sleeve 51 but to be vertically slidable thereon so as to engage and disengage clutch members 48 and 49; and when the clutch members are disengaged and the sleeve 50 is in its uppermost position, the upper end of sleeve 50 engages a flange 51ª on sleeve 51 as a limit to its upward movement. By mounting sleeve 50 on sleeve 51 which has no vertical longitudinal movement, instead of mounting it directly on shaft 41 which has vertical longitudinal movement, it will be seen that all tendency of the vertically moving shaft to move sleeve 50 is avoided.

The sleeve 50 has a screw thread 60 with which the end 61 of a horizontally moving detent 62 is adapted to engage. Detent 62 is mounted in suitable bearings in the frame 20 and is provided with a spring 63 which normally continuously presses the detent toward and into the screw thread 60; but certain stop mechanisms are provided for holding the detent against such movement at certain times. A notch 64 is preferably cut in the under side of detent 62 and the correspondingly shaped upper end 65 of catch rod 66 is adapted to enter the notch when the detent 62 is moved to the left in Fig. 2. Catch rod 66 is normally pressed upwardly by a spring 67 and it may be pulled down and out of engagement with the detent 62 by the action of a bell crank lever 68 pivoted at 69 on the under side of frame 20, the end 70 of one arm of the lever being adapted for engagement by collar 71 on the lower end of mandrel shaft 41 when the mandrel shaft

has moved upwardly to a sufficient extent. Collar 71 has also another function to perform when the shaft 41 is at its uppermost point of movement; this will be later explained.

The detent 62 is connected at its end to a plate 75 confined between a collar 76 and ratchet 77 on table shaft 30. The aperture in plate 75 is sufficient to allow longitudinal movement of detent 62. The plate 75 is provided with a lug 78 which projects outside the periphery of collar 76 and upwardly so as to be engaged by arm 79 extending from collar 76 when the arm 79 has moved to the position indicated in dotted lines in Fig. 5; and the latter part of this movement of arm 79 moves the lug 78 so as to move the detent 62 sufficiently to disengage its end 61 from screw thread 60 of sleeve 50. The arm 79 is moved from the position shown in full lines to the position shown in dotted lines through the medium of a push rod 80 mounted in suitable bearings 81 in the frame and adapted to engage with a cam 82 mounted on differential shaft 83. The cam 82 is mounted on the differential shaft through the medium of a pin and slot arrangement 84 so that it will rotate with the shaft but not necessarily move down with the shaft from its position as shown in Fig. 2. The push rod 80 normally rests in the position shown in Figs. 2 and 5, with its cam engaging end below the cam 82; and it is necessary for the cam to be lowered in order to engag this push rod and to force it to the left in Fig. 5 by virtue of rotation of the cam. The push rod 80 has a notch 86 engageable by a vertically moving catch rod 87 which is hung loosely from lever 89. When lever 89 is moved down from its position shown in Fig. 2, it will press against spring 90 and thus force the catch rod 87 into the notch 86 when the notch 86 is moved below the end of the catch rod; the sequence of operations being such that the catch rod 87 is pushed down before the push rod 80 is moved from its position shown in Fig. 2. The cam 82, as hereinbefore stated, is mounted on differential shaft 83 so as to rotate therewith but not necessarily to move longitudinally therewith. Connected with the cam is a sleeve having a collar 95 on its upper end engageable by an inclined yoke 96 so as to raise the sleeve and the cam 82 to the position shown in Fig. 2 or so as to hold it in that position and not allow it to drop when the differential shaft 83 is pushed downwardly. This yoke 96 is mounted on the end of a push rod 97 manually operable from the front of the machine. Two switch contacts 98 are so mounted on frame 20 that electrical circuit is adapted to be closed between them by a disk 99 carried on push rod 97 when the push rod is in the position shown in Fig. 8 and when inclined yoke 96 is out of engagement with collar 95. When the rod 97 is pushed in to break the circuit between contacts 98 and to stop the machine, then the yoke 96 is placed beneath the collar 95 to hold the cam 82 in the position shown and to prevent it dropping into engagement with rod 80. Thus, whenever the machine is stopped, the automatic operation of the table does not take place until the machine is again started. This will be explained hereinafter.

We have shown a motor 100 for driving the machine, this motor being connected to fly wheel 46 through the medium of a friction wheel 101 controlled by a suitable ball governor 102. The speed of the machine is thus kept uniform. Motor 100 is illustrated diagrammatically in Fig. 8 and the connections to any suitable source of electrical energy are also illustrated. It will be noted that closure of circuit through the contacts 98 will supply current to the motor; and also that closure of circuit through a switch 103 will supply current thereto. This switch 103 is mounted on a rod 104 depending from the outer end of lever 89. When the lever 89 is below the position shown, the circuit through switch 103 will be broken; but, as the lever is only in its lowermost position when the mandrel shaft 41 is in its lowermost position, the switch 103 is only open when the shaft is in its lowermost position and when mandrel 40 is sufficiently low to entirely disengage the table 24. Thus, if push rod 97 is moved inwardly while the mandrel is in one of its upper positions, the machine will continue operation until the switch 103 is opened by the shaft reaching its lowermost position.

We will now explain the preferred mechanism by means of which the shaft 41 is moved longitudinally and rotated in proper relation to its longitudinal movement, and will then explain the complete operation of the combined mechanism.

Shaft 41 is provided with a suitable screw thread 110 in such direction which, engaging with the corresponding threads 111 on the interior of nut 42, will raise the shaft when rotated in the direction indicated by the arrow in the lower portion of Figs. 1 and 2. Nut 42 is also rotatable; and the fundamental feature of this preferred form of mechanism consists in providing certain means for intermittently rotating the shaft and the nut, preferably in the same direction. The nut is started and stopped in rotation at certain points of the operation and likewise the shaft; and the relative speeds of rotation of the shaft and nut are such as to accomplish the movements required of the machine. With the nut rotating in the same direction as the mandrel shaft, to feed the mandrel shaft down-

wardly by differential action the nut must be rotated faster than the shaft; but it will be seen that, by suitable arrangements, this differential action might be exactly reversed. A simple gear mechanism is employed for driving the nut, consisting of a gear 112 mounted on the lower end of differential shaft 83 and meshing with gear 47 on sleeve 44, and gear 113 mounted on the upper end of differential shaft 83 and meshing intermittently with gear 114 on the exterior of nut 42. In the present arrangement gear 113 has more teeth than gear 112, the ratio being such that the nut 42 is rotated $\frac{1}{100}$ times faster than sleeve 44 and shaft 41. This difference in number of teeth of the two gears is so slight as to not require an appreciable difference in diameter of the gears; so that we have found in practice that it is possible to arrange the two gears 112 and 113 on the same shaft, either setting the shaft over slightly at its upper end or cutting the teeth in gear 113 slightly closer together. Any suitable arrangement, however, may be used to accommodate these two gears. The pitch of screw thread 110 is preferably a half inch; so that it will be seen that, when the nut and shaft are both rotating in the same direction, the shaft will be fed downwardly $\frac{1}{200}$ of an inch for each of its own revolutions. Differential shaft 83 is slidable and is held in its upper position, as shown by means of a spring 115. Spring 115 is confined between two sleeves 116 and 117 slidable on shaft 83, the lower sleeve being revolubly secured to the shaft, so that both sleeves and the spring will rotate therewith. This places the spring between two parts which have the same motion and thus eliminates all friction and torsion on the spring. The upper end of shaft 83 comes directly beneath a portion of lever 89 so that it may be pushed down when the lever 89 is pushed down. Lever 89 is moved downwardly by engagement with a collar 120 mounted on mandrel shaft 41 directly beneath mandrel 40. This collar 120 is not rigidly mounted on the mandrel shaft but is provided with a slot 121 engaging a pin 122 to allow a limited vertical movement. Normally, the collar 120 is pressed downwardly by a spring 123 which seats thereon. This spring 123 extends upwardly and supports the hollow mandrel 40 in the position shown, a suitable stop 124 being provided to limit the upward movement of the mandrel. The operation of this mandrel will be hereinafter described; it will here suffice to say that the collar 120 first engaging with lever 89 is pressed upwardly to the position illustrated and then, by further downward movement of the shaft 41, the lever 89 is pressed down and forces the shaft 83 downwardly until gear 113 is out of engagement with gear 114. This stops the rotation of nut 42; and at the same time a small brake 130 is applied to the surface of the nut to keep it from being rotated by frictional engagement with the still rotating shaft 41. Brake 130 is preferably a simple pivoted arm engageable by a suitable spring 131 mounted on lever 89. When the shaft 41 has reached its lowermost point, then rod 104 has moved downwardly until an annular notch 132 at its lower end can be engaged by a catch 133. The lower side of this notch 132 is beveled, as illustrated in Fig. 2, so that when the catch 133 enters its action may be to pull the rod 104 farther down. A spring 134 presses the catch 133 into engagement with the rod 104, the catch being pivoted at 135 on the bottom of frame 20. The catch 133 is in the form of a double armed lever, and its arm opposite that which engages the rod 104 is provided with a lug 136 adapted to be engaged by collar 71 on the lower end of mandrel shaft 41. The action of this collar on the catch 133 is to move the catch in the direction indicated by the arrow in Fig. 9 so as to release it from the notch 132 and allow the rod 104 to be moved to its normal upper position by spring 137 and allow lever 89 to be raised by shaft 83 tending to rise under the action of spring 115.

In describing the operation, we will start with the machine in the position shown. Fly wheel 46 is being rotated in the direction indicated by the arrow, and with it the sleeve 44. Shaft 41 is not now being rotated, the clutch members 48 and 49 being held out of engagement by the mechanism hereinbefore described. (It will be remembered that the only rotary connection between sleeve 44 and shaft 41 is through the clutch members 48 and 49 and the sleeves 50 and 51.) Nut 42 is being rotated in the same direction as fly wheel 46 and is therefore moving shaft 41 downwardly at considerable velocity. This downward movement of the shaft immediately causes the downward movement of lever 89, causing the disengagement of gear 113 from gear 114 and causing the application of brake 130 to the nut to stop its rotation. Simultaneously with this action, the catch 133 engages the notch 132 to hold the lever 89 in its lower position until the catch 133 is released. The shaft 83 being thus held in its lower position, it is still rotated by the engagement of gear 112 with gear 47 on sleeve 44, and the cam 82 will drop down to engage its face with push rod 80 as soon as its lower point 83^a comes opposite the push rod 86. Immediately this has occurred, the push rod is moved in the direction indicated and thus moves the arm 79 and the collar 76 through approximately a twelfth of a revolution. A pawl 79^a moves with the collar 76 and engages the teeth of ratchet 77 so as to

move the ratchet and the table shaft 30 through a twelfth of a revolution. The table is thus moved from one position to the next, being registered in correct position by the registry device hereinbefore described. The catch rod 87 drops into notch 86 and holds the push rod 80 in its position to the left in Fig. 5 and thus prevents another feeding movement taking place while the differential shaft 83 and the cam 82 are in their lowermost positions. During the last portion of the movement of arm 79 it engages the lug 78 to move the lug and to thereby move the detent 62 as hereinbefore described. When the detent 62 is moved its end 61 is moved out of engagement with the screw thread 60 on sleeve 50 and the end 65 of catch rod 66 is allowed to enter notch 64 in the detent to hold it in its left hand position in Fig. 2. The sleeve 50 immediately drops and the clutch members 48 and 49 engage each other and immediately start the rotation of shaft 41. Nut 42 is still held stationary, and the rotation of shaft 41 will thus move the shaft upwardly at a considerable velocity. In its upward movement, the mandrel 40 engages a record 28 and moves it upwardly until its lowermost sound groove is directly opposite or slightly above the stylus point 23^a of reproducing mechanism 23. As collar 71 on the lower end of shaft 41 passes the lower end 70 of bell crank lever 68, it will press the lever 68 outwardly and pull the catch rod 66 downwardly. But the detent 62 is still held in its left hand position by the engagement of lug 78 with arm 79, the arm 79 being held in its left hand position in Fig. 5 as hereinbefore explained by the engagement of rod 87 with notch 86 in push rod 80. The catch rod 66 will therefore be allowed to drop immediately again into notch 64 and to hold the detent 62 in its left hand position until released. When the shaft and mandrel reach their uppermost positions, the collar 71 engages the portion 136 of catch 133 and moves it to release the rod 104. This immediately allows the lever 89 to move upwardly, releasing brake 130 from nut 42 and engaging gear 113 with gear 114 and starting the rotation of the nut. The shaft and nut are now both rotating in the same direction and the downward differential movement of the shaft begins. The reproducer mechanism has been let into engagement with the record by a suitable mechanism and reproduction immediately starts. When the shaft 41 has been fed downwardly by this differential movement through the length of a record, or of the sound grooves thereon, the collar 71 on the end of shaft 41 will engage again with end portion 70 of bell crank lever 68 and will pull the catch rod 66 from engagement with the notch 64 in detent 62. The push rod 80 being no longer held by the rod 87, the detent 62 is allowed to move to the right under the influence of its spring 63 and its end 61 will immediately engage with the screw thread 60 of sleeve 50. Further rotation of the sleeve 50 will cause it to be raised until the clutch members 48 and 49 have disengaged. This immediately stops the rotation of shaft 41; but nut 42 is still rotating. The shaft is thus fed quickly downwardly until it reaches the position shown in Figs. 1 and 2, the record 28 being meanwhile replaced upon the table. The whole operation is then repeated as just described.

The reproducer mechanism is operated through the medium of a suitable reproducer shaft 150 which projects upwardly through the shelf 22 of the case and has an arm 151 engaging with a link 152 and thus adapted to pull the stylus plate 153 of the reproducer back to disengage stylus 23^a from a record. There are spring means in the reproducer mechanism (not shown) for throwing the stylus into engagement with a record when released. The reproducer shaft 150 tends to rotation in the direction indicated in Fig. 2 under the influence of a spring 154; but means are employed to hold the reproducer shaft in the position shown while the sleeve 50 is in its uppermost position or while the lever 89 is in its lowermost position. When the sleeve 50 moves upwardly it moves a small lever 155 having a beveled end engaging a radially projecting arm 156 on shaft 150. The shaft is thus moved to the position shown. When lever 89 moves downwardly a lug 157 thereon engages an arm 158 mounted on shaft 150 and thus holds the shaft 150 in the position illustrated until the lever 89 shall move upwardly. Thus it will be seen that the reproducer point is moved from engagement with a record when the sleeve 50 is raised; and it will be remembered that this sleeve 50 rises when the reproduction of a record has been completed. And the reproducer point is only let into engagement with the record when the lever 89 moves upwardly, or when the mandrel 40 has picked up another record and has reached its uppermost position with it.

We will now explain the means for manually controlling the operation of the machine.

For causing the repetition of a single record, it is only necessary to cause the table 24 not to move from one position to the next. This is simply accomplished by means of a pin 160 adapted to engage pawl 79^a and mounted on the end of a push rod 161. This rod 161 may be manually operated; and its friction is usually sufficient to hold it in position with the pawl 79^a raised so that it will move over the tooth of ratchet 77 which it would otherwise engage to move the

ratchet through a twelfth of a revolution. If rod 161 is thus pushed inwardly and left in that position it will cause the continuous reproduction of any desired record. When it is desired to go on to successive records the rod 161 is pulled outwardly. If it is desired to discontinue a record which is being played and to immediately replace it upon the table and to go on to the next record, it is only necessary to press inwardly upon a rod 170. This rod has upon its inner end a small wedge 171 engaging over collar 172 on catch rod 66. Inward movement of rod 170 will thus move catch rod 66 down, allowing detent 62 to move to the right in Fig. 2 to engage the screw thread 60 of sleeve 50 and thus to raise the sleeve 50 and stop the rotation of shaft 41. Whenever the shaft 41 is stopped in rotation it is immediately fed downwardly by rotation of nut 42, the record upon mandrel 40 replaced upon the table, and the table moved to present a new record. The rod 170 is normally held outwardly by means of a spring 173, so that it will immediately return to its normal position after each operation.

The action of mandrel 40 on mandrel shaft 41 is such as to always accurately place the record on the mandrel into proper position with relation to the reproducing mechanism. Records vary somewhat in their internal diameters, and are also apt to become warped, and will therefore fit at different positions upon the mandrel 40. When the mandrel 40 picks up a record the record settles loosely around its conical surface and the mandrel then moves on upwardly and the record will engage with suitable stationary members (not shown) situated at such a height that, when the upper edge of the record engages them, it will be in correct starting position before the reproducing mechanism. The mandrel shaft is arranged so that it will have a slightly excessive movement upward, and this excessive movement is taken up by the shaft sliding upwardly through the mandrel. A pawl 180 will then engage with ratchet teeth 181 on the mandrel and will hold the mandrel down on the shaft when the shaft has moved to its uppermost position. This pawl 180 is pivoted to the mandrel shaft and is operated by a spring 182. It will thus be seen that the downward movement of a record will always start from the proper position. When the mandrel reaches its lowermost position, the sleeve 120 is pressed upwardly by engagement with lever 89 as hereinbefore described and this upward movement causes the pawl 180 to be pressed inwardly by reason of engagement of the sleeve with a projecting inclined portion 183 on the pawl. The mandrel will then immediately be moved to its uppermost position ready for taking the next record and for being adjusted properly therefor.

In Figs. 11 and 12 we have shown modified forms of mounting the nut 42^a and the shaft 41^a. In this form the shaft is mounted directly in bearings of its own, as at 200, and the nut has no exterior bearing. Around the nut there is a sleeve 201 which carries a gear 114^a, the sleeve 201 being connected with the nut 42^a through the medium of two keys or similar devices 202, the keys being preferably loose in the sleeve 201. This arrangement provides for eliminating all vibration of gears 113 and 114 being transmitted to the mandrel shaft, providing the mandrel with an upper bearing of its own independent of the nut bearing.

Having described our invention, we claim:

1. In a device of the character described, a shaft rotatable and longitudinally translatable, a screw thread on the shaft, a rotatable gear toothed nut engaging the screw thread, a rotating gear toothed sleeve loosely mounted around the shaft, another sleeve keyed to the shaft to slide thereon, inter-engaging means on the sleeves to rotatively connect them, differential gear connection between the first mentioned sleeve and the nut comprising a differential shaft parallel to said first named shaft, gears rigidly mounted on said shaft and engaging with the gear teeth of the nut and loose sleeve respectively, and means controlled by the longitudinal position of said first mentioned shaft to move the differential shaft and attached gears longitudinally to disengage one of them from the gear teeth normally meshing therewith, and means controlled by the longitudinal position of said first mentioned shaft to move said second mentioned sleeve on said shaft relatively to the first mentioned sleeve.

2. In a device of the character described, a vertical mandrel shaft rotatable and longitudinally translatable, a screw thread on the shaft, a rotatable gear toothed nut engaging the screw thread, a rotating gear toothed sleeve loosely mounted around the mandrel shaft, another sleeve keyed to the shaft to rotate therewith and slide thereon, inter-engaging means on the sleeves to rotatively connect them together, differential gear connection between the first mentioned sleeve and the nut comprising a differential shaft parallel to the mandrel shaft, two gears rigidly affixed one at the upper and one at the lower end of the differential shaft, the upper gear normally engaging the gear teeth of the nut and the lower engaging the gear teeth of the sleeve, a spring normally holding the shaft and gears upwardly, means actuated by the downward movement of the mandrel shaft to move the differential shaft and gears downwardly to disengage the upper differential gear from the gear teeth of the nut, and means controlled by the longitudinal position of the

mandrel shaft to move the second named sleeve on the mandrel shaft relative to the first mentioned sleeve.

3. In a device of the character described, a vertical mandrel shaft rotatable and longitudinally translatable, a screw thread on the shaft, a rotatable gear toothed nut engaging the screw thread, a rotating gear toothed sleeve loosely mounted around the mandrel shaft, another sleeve keyed to the shaft to rotate therewith and slide thereon, inter-engaging means on the sleeves to rotatively connect them together, differential gear connection between the first mentioned sleeve and the nut comprising a differential shaft parallel to the mandrel shaft, two gears rigidly affixed one at the upper and one at the lower end of the differential shaft, the upper gear normally engaging the gear teeth of the nut and the lower engaging the gear teeth of the sleeve, a spring normally holding the shaft and gears upwardly, means actuated by the downward movement of the mandrel shaft to move the differential shaft and gears downwardly to disengage the upper differential gear from the gear teeth of the nut, means controlled by the longitudinal position of the mandrel shaft to move the second mentioned sleeve on the mandrel shaft relative to the first mentioned sleeve, a vertical record supporting shaft, ratchet means for rotating said shaft, a cam mounted on and movable with the differential shaft, and a push rod engageable by the cam when the differential shaft is moved downwardly, said push rod by its cam caused motion causing the operation of the said ratchet means.

4. In a device of the character described, a vertical mandrel shaft rotatable and longitudinally translatable, a screw thread on the shaft, a rotatable gear toothed nut engaging the screw thread, a rotating gear toothed sleeve loosely mounted around the mandrel shaft, another sleeve keyed to the shaft to rotate therewith and slide thereon inter-engaging means on the sleeves to rotatively connect them together, differential gear connection between the first mentioned sleeve and the nut comprising a differential shaft parallel to the mandrel shaft, two gears rigidly affixed one at the upper and one at the lower end of the differential shaft, the upper gear normally engaging the gear teeth of the nut and the lower engaging the gear teeth of the sleeve, a spring normally holding the shaft and gears upwardly, means actuated by the downward movement of the mandrel shaft to move the differential shaft and gears downwardly to disengage the upper differential gear from the gear teeth of the nut, means controlled by the longitudinal position of the mandrel shaft to move the second mentioned sleeve on the mandrel shaft relative to the first mentioned sleeve, a vertical record supporting shaft, ratchet means for rotating said shaft, a cam mounted on and movable with the differential shaft, a push rod engageable by the cam when the differential shaft is moved downwardly, said push rod by its cam caused motion causing the operation of the said ratchet means, and means coöperating with said last named shaft controlled means to hold said second mentioned sleeve away from the first mentioned sleeve releasable by the action of said ratchet means.

In witness that we claim the foregoing we have hereunto subscribed our names this 30th day of March, 1912.

HARRY T. SCOTT.
LEO J. PATTERSON.

Witnesses:
JAMES T. BARKELEW,
ELWOOD H. BARKELEW.