

Feb. 10, 1942.

R. I. WILCOX

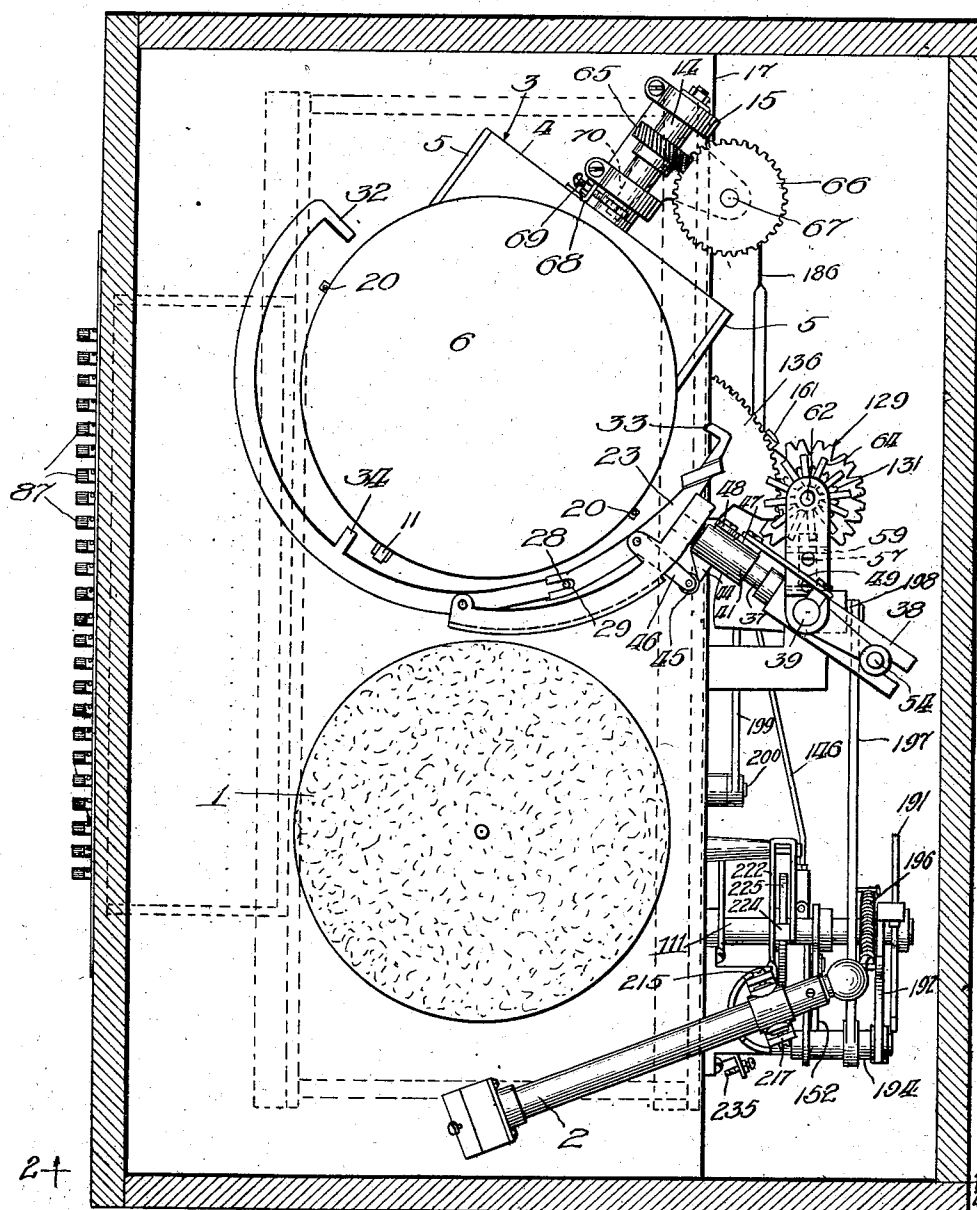
2,272,453

MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 1

Fig. 1.



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Feb. 10, 1942.

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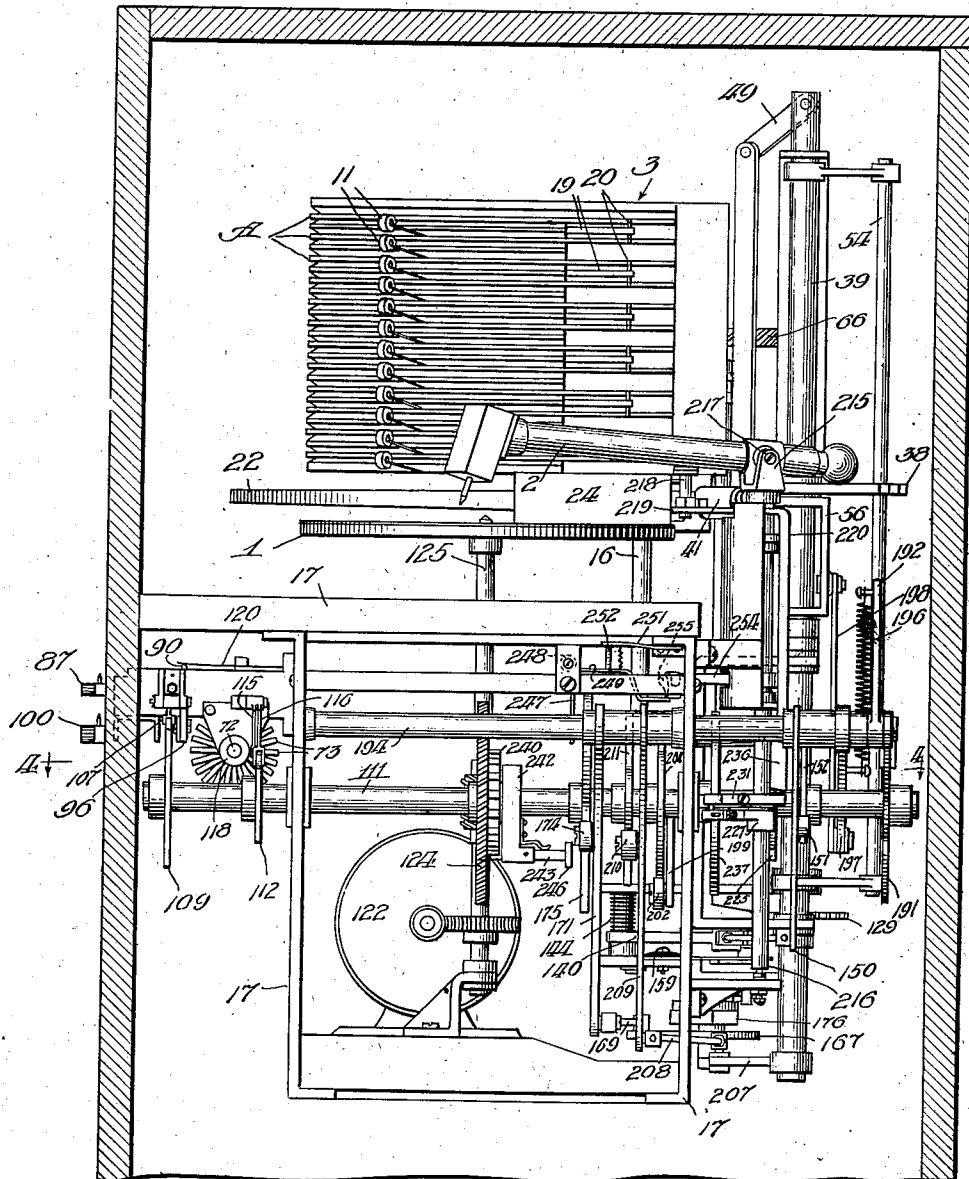
2,272,453

MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 2

Fig. 2



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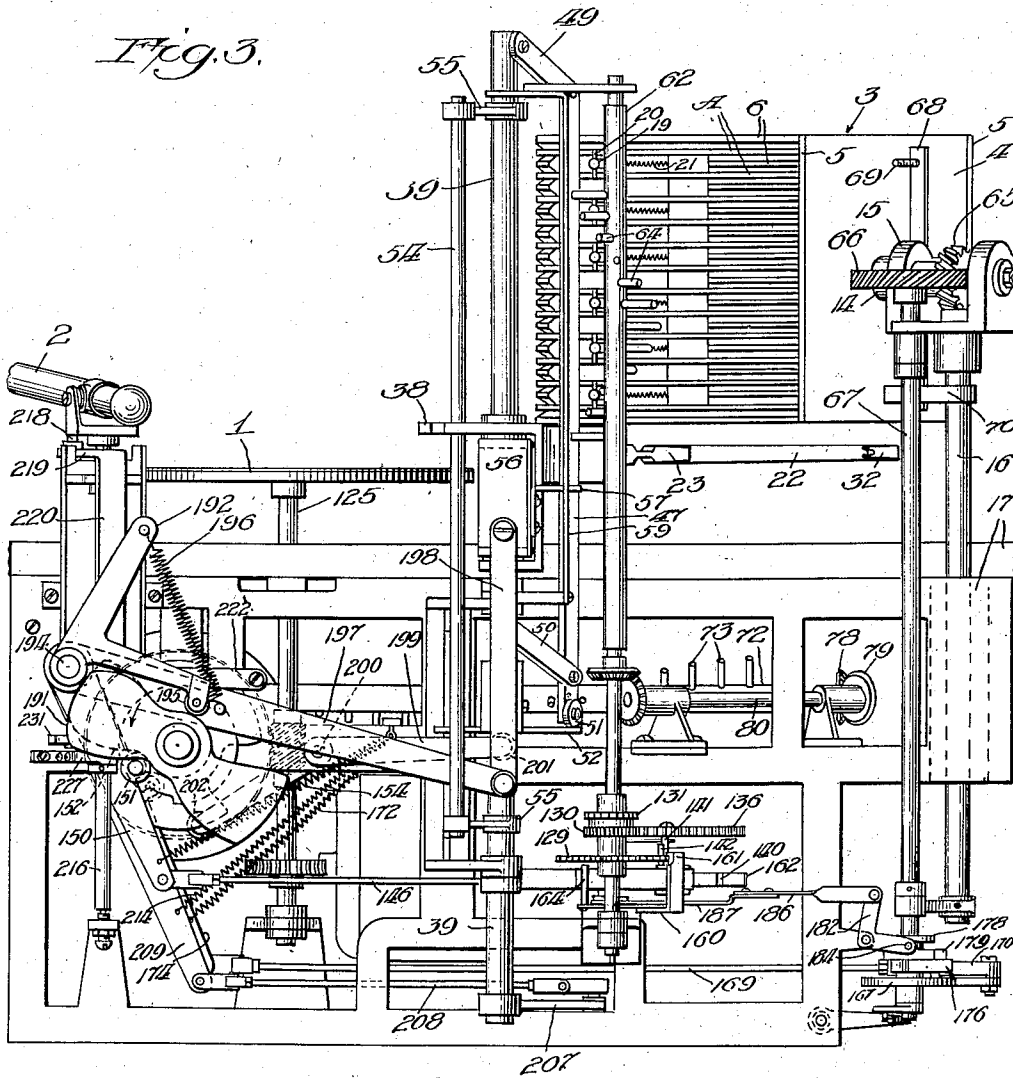
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MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 3



Inventor:

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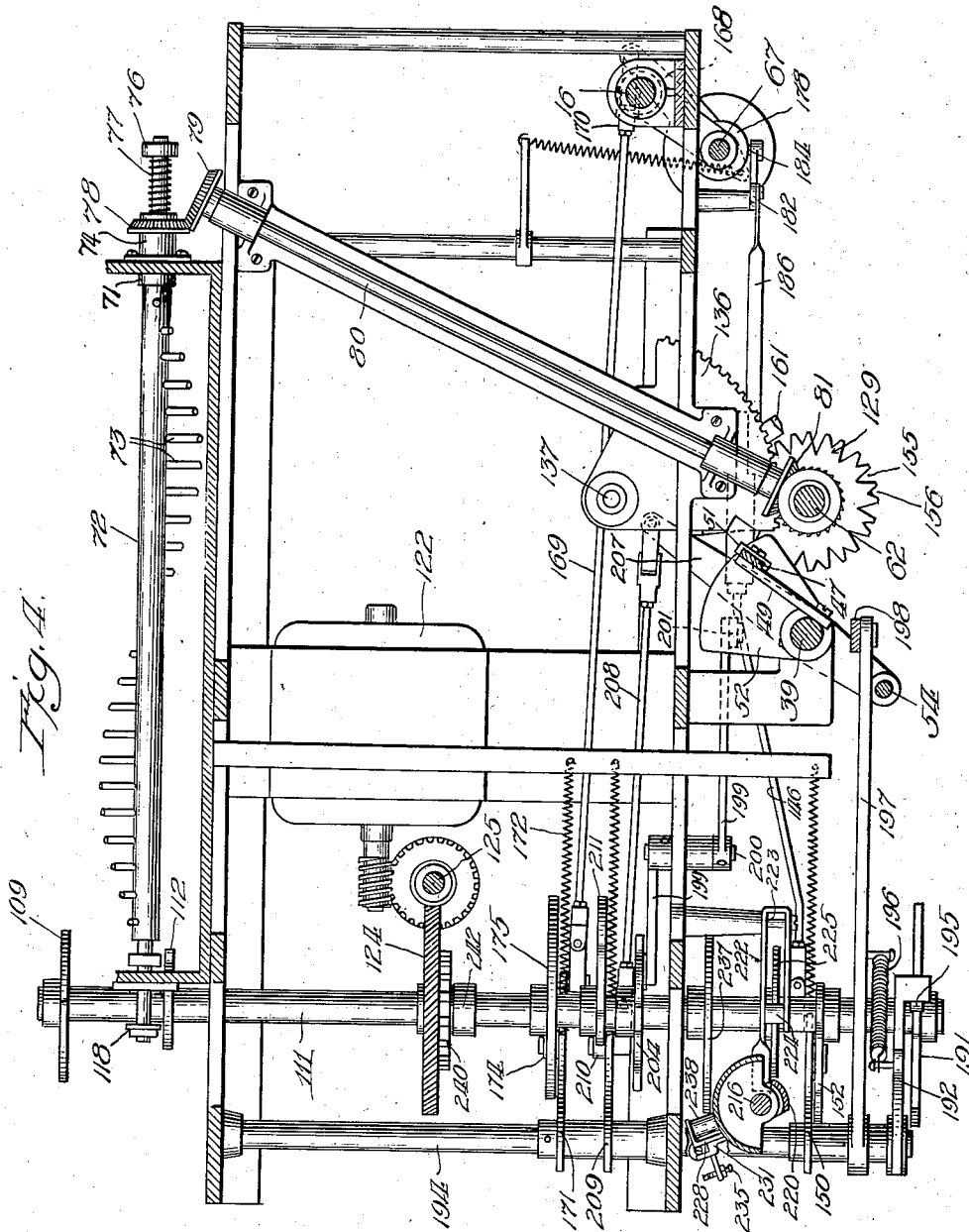
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MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 4



Inventor:

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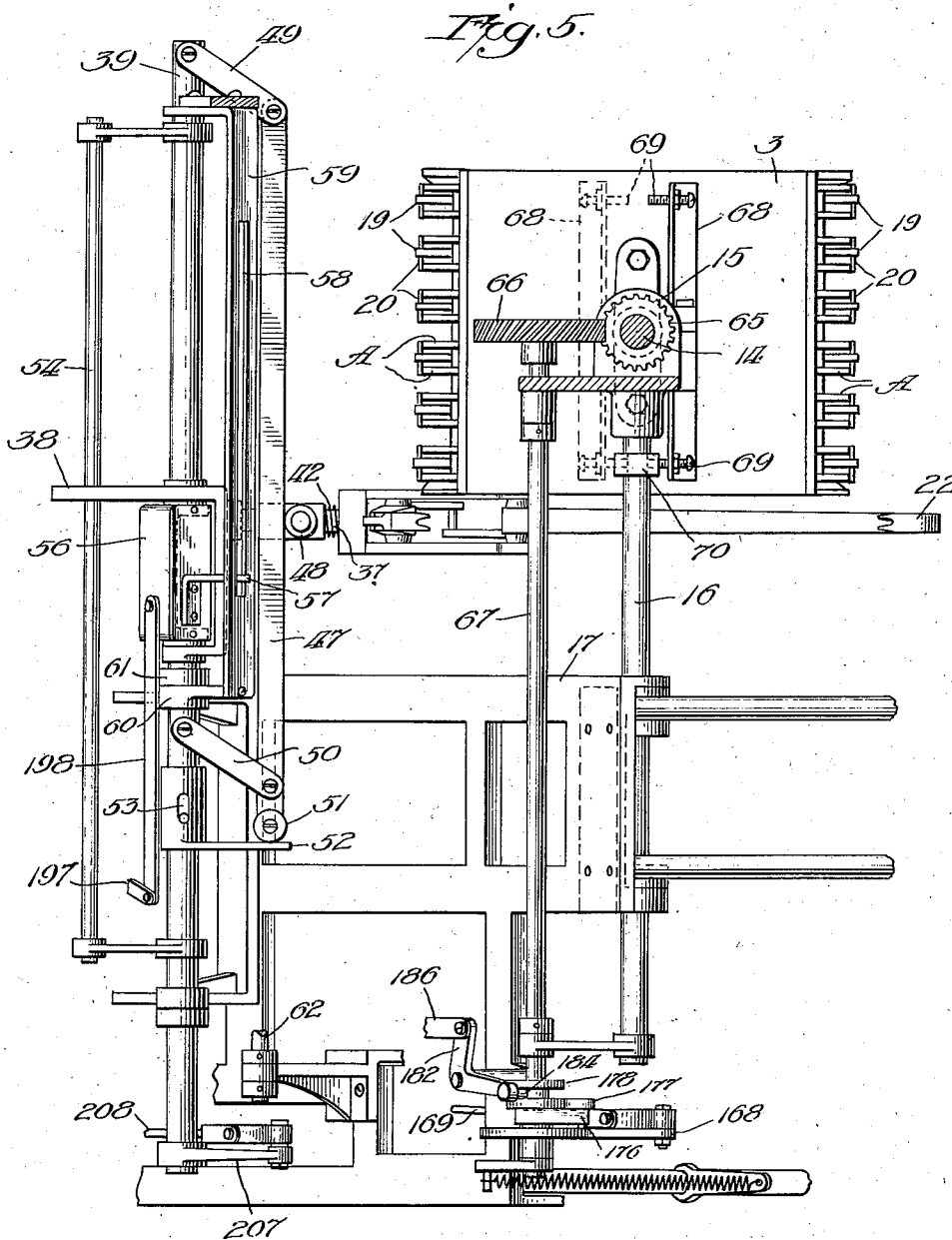
R. I. WILCOX

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MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 5



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Fig. 6.

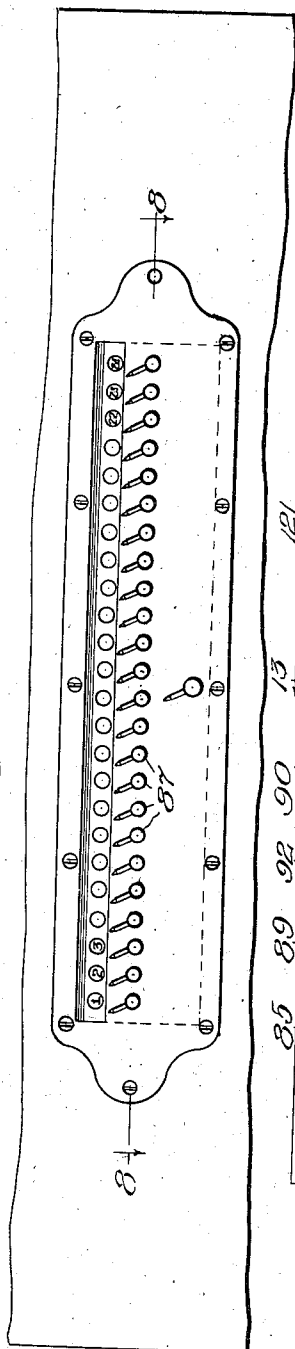
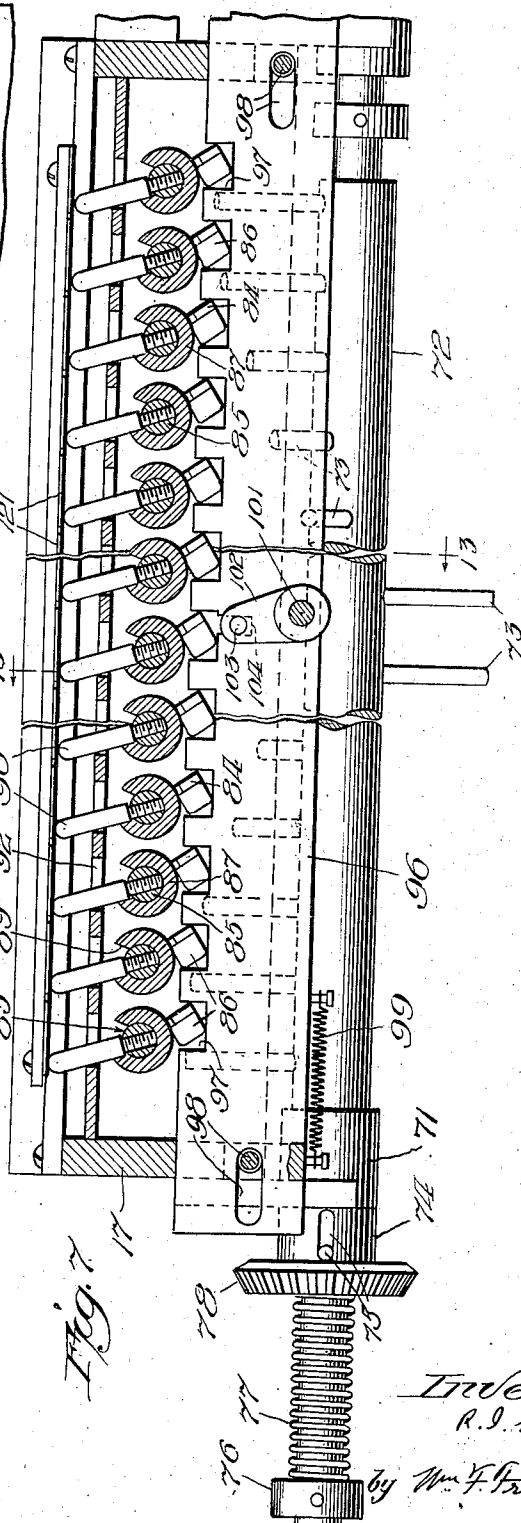


Fig. 7



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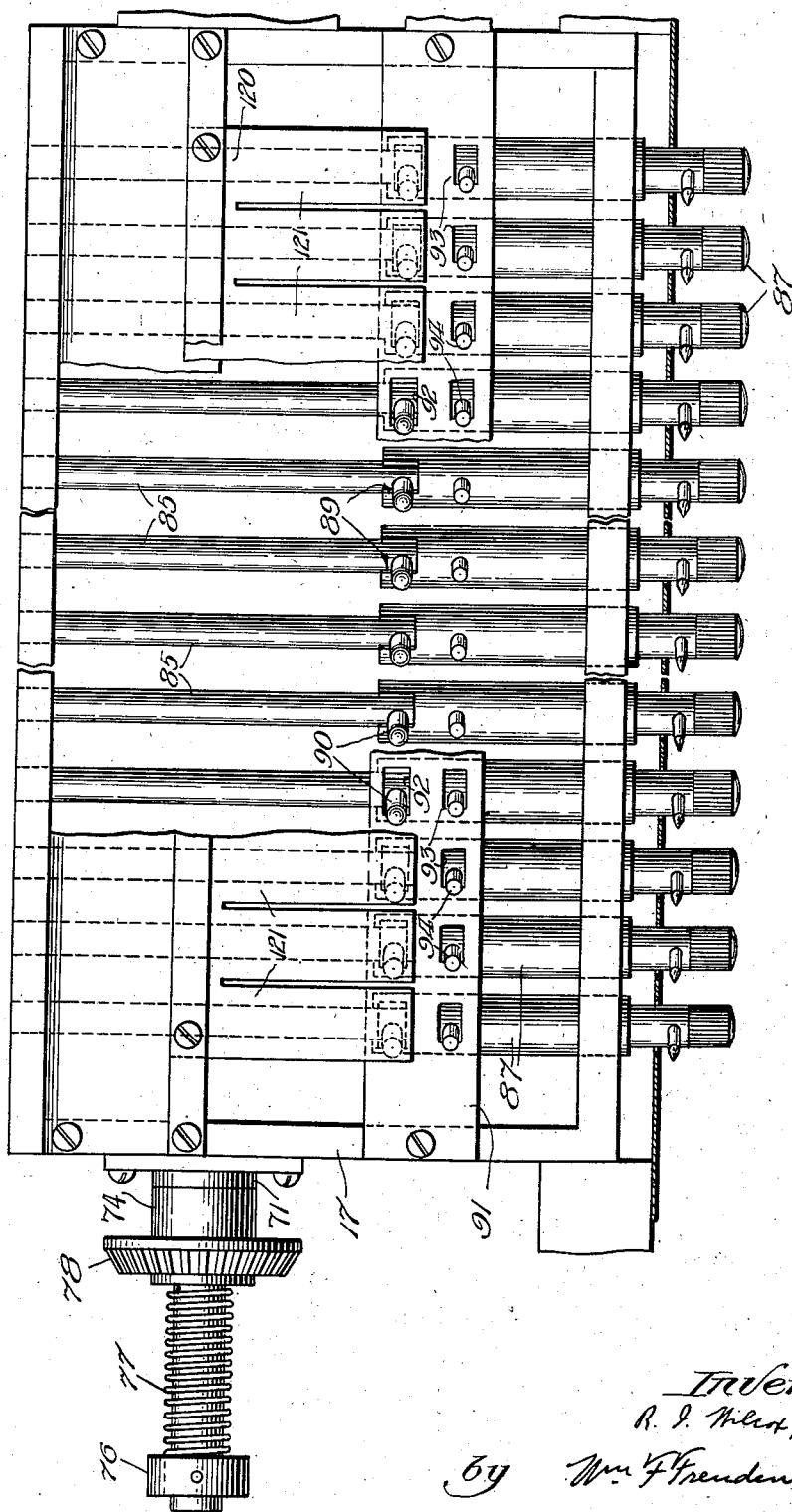
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24 Sheets-Sheet 7

Fig. 8.



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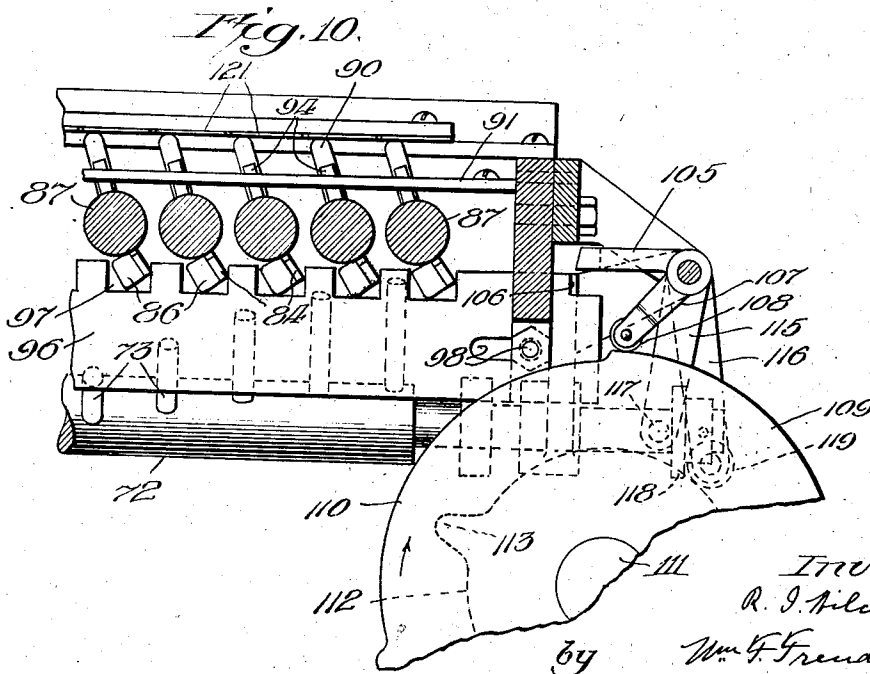
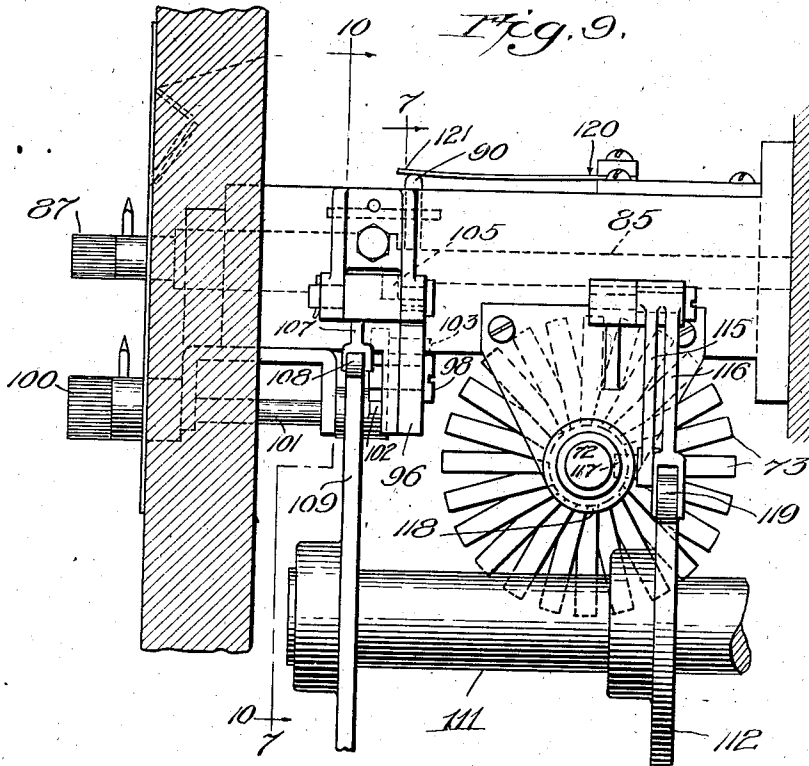
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Inventor:
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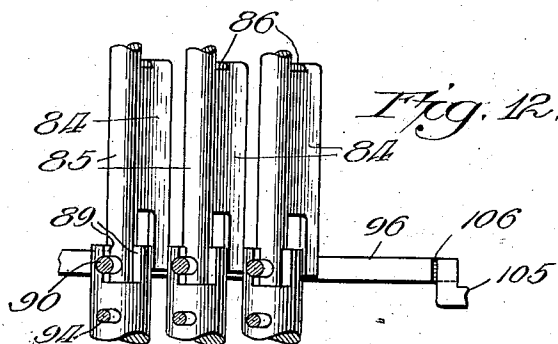
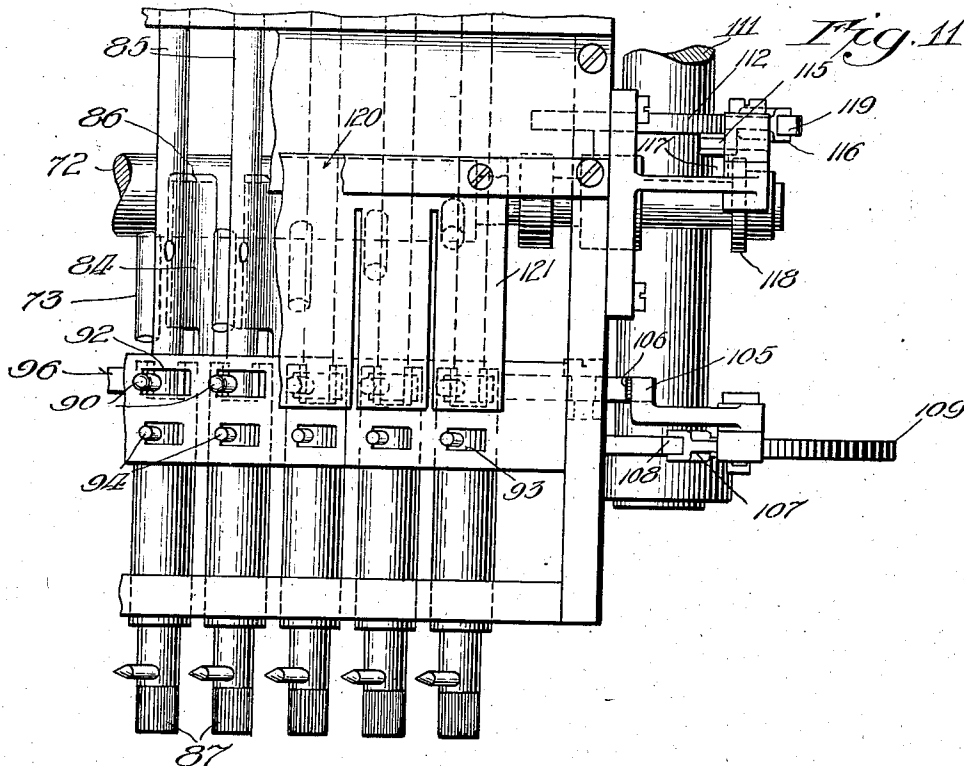
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Inventor:
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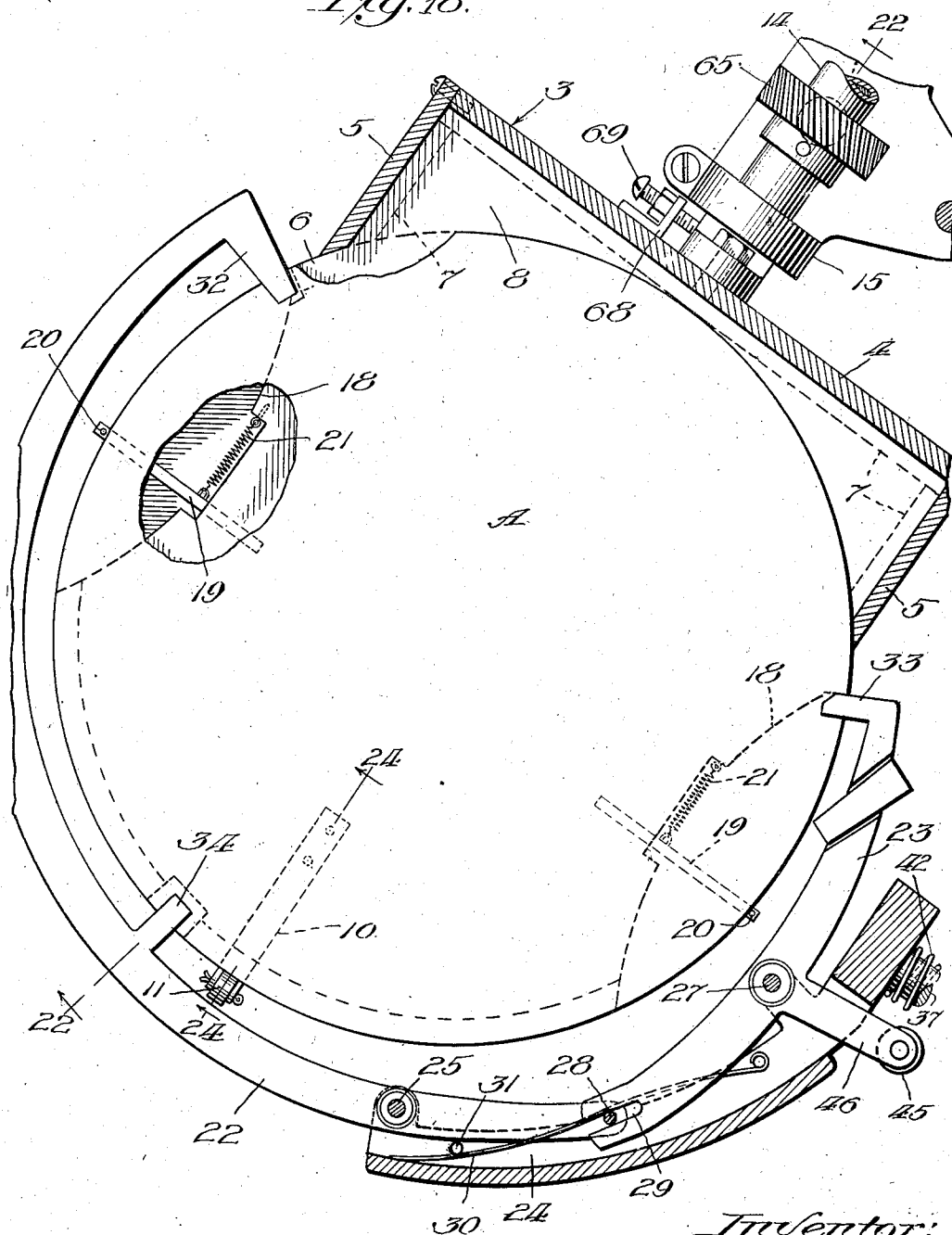
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Fig. 18.



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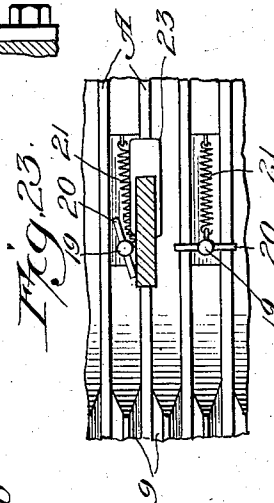
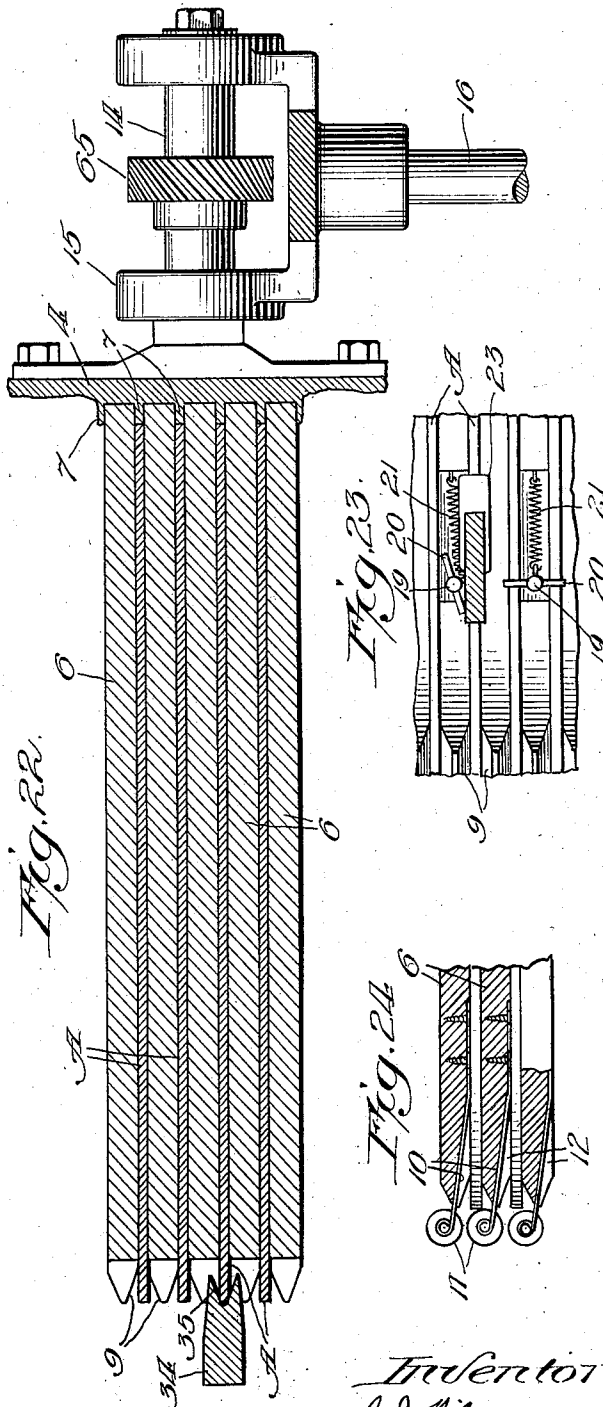
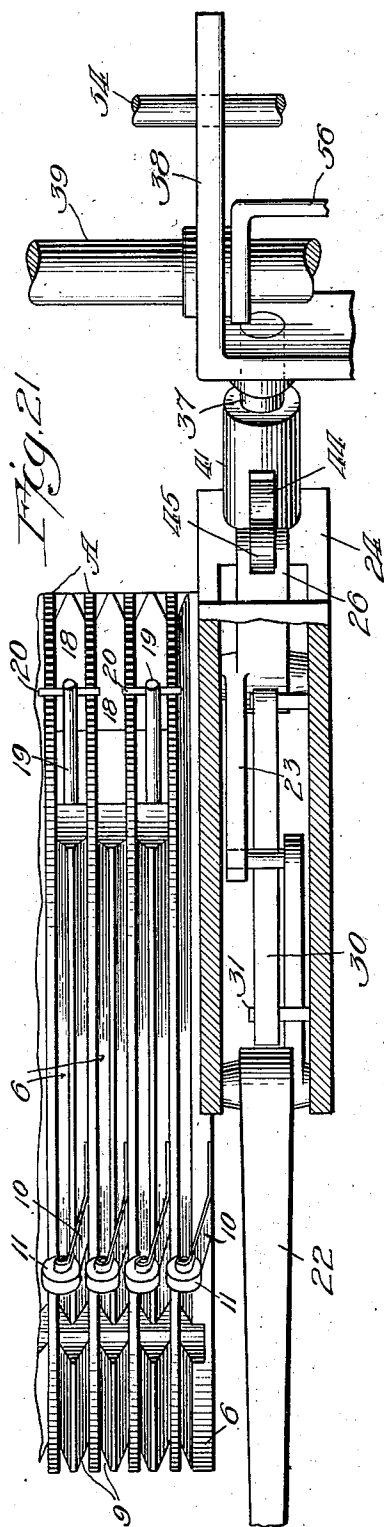
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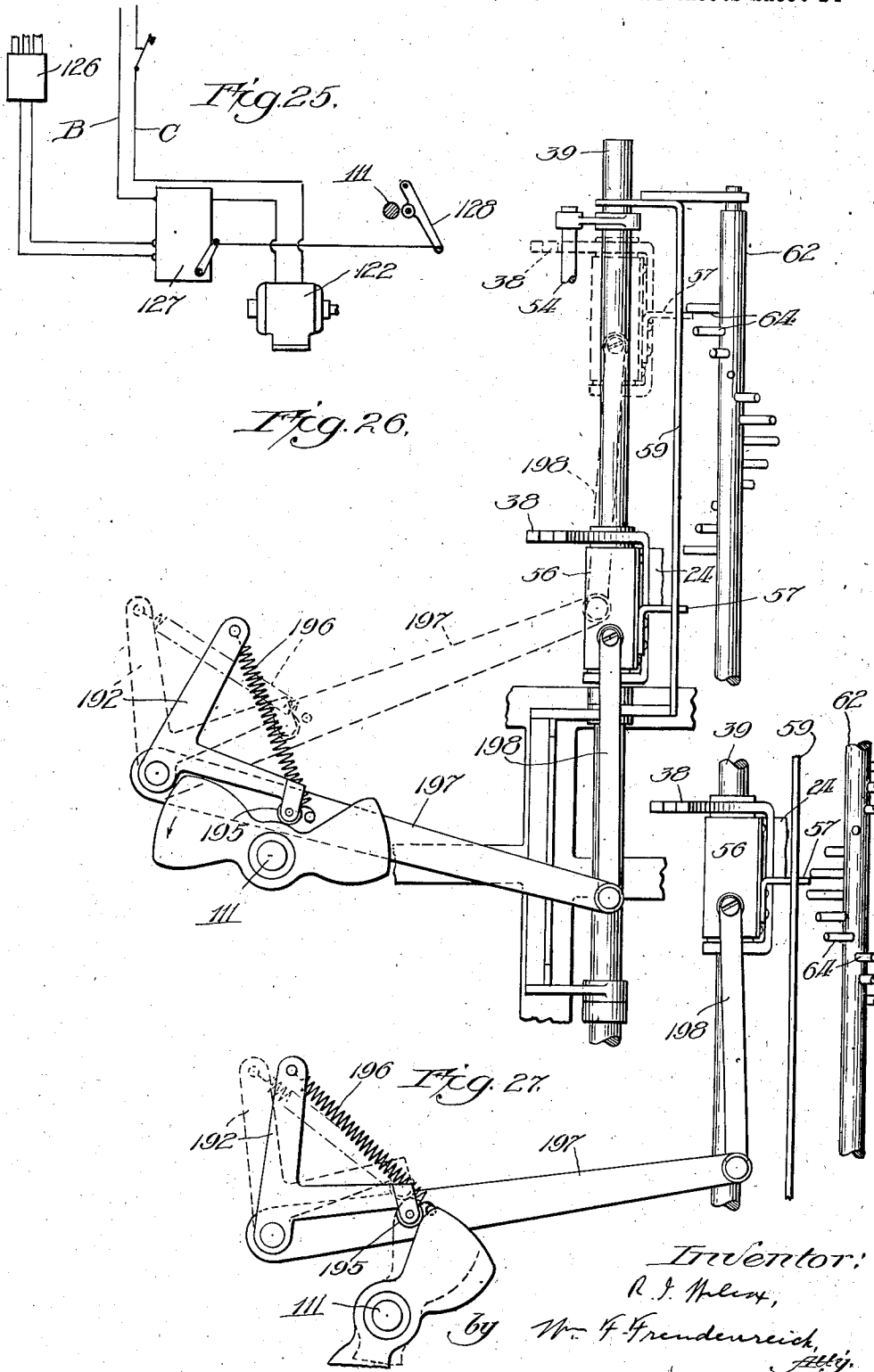
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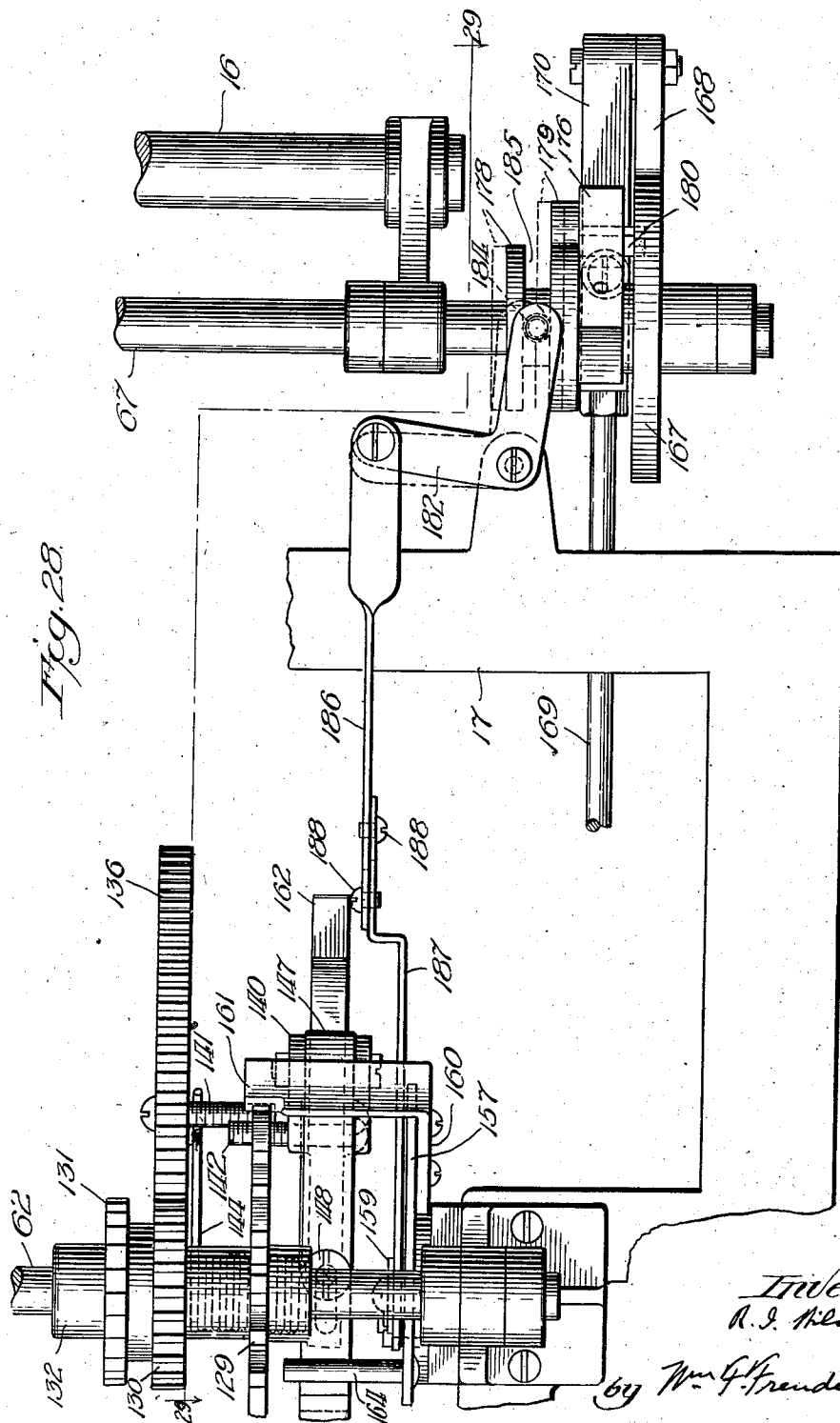
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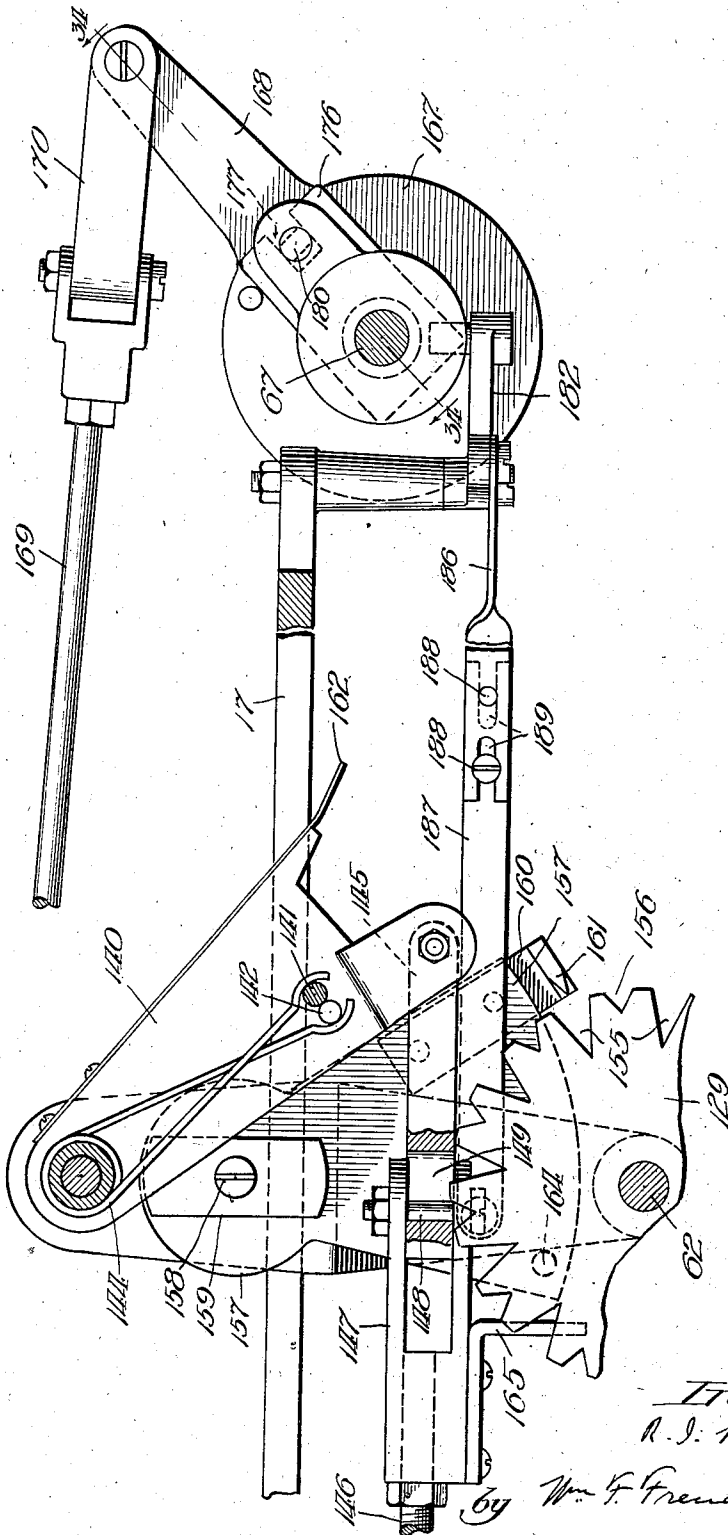
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MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 16

Fig. 29.



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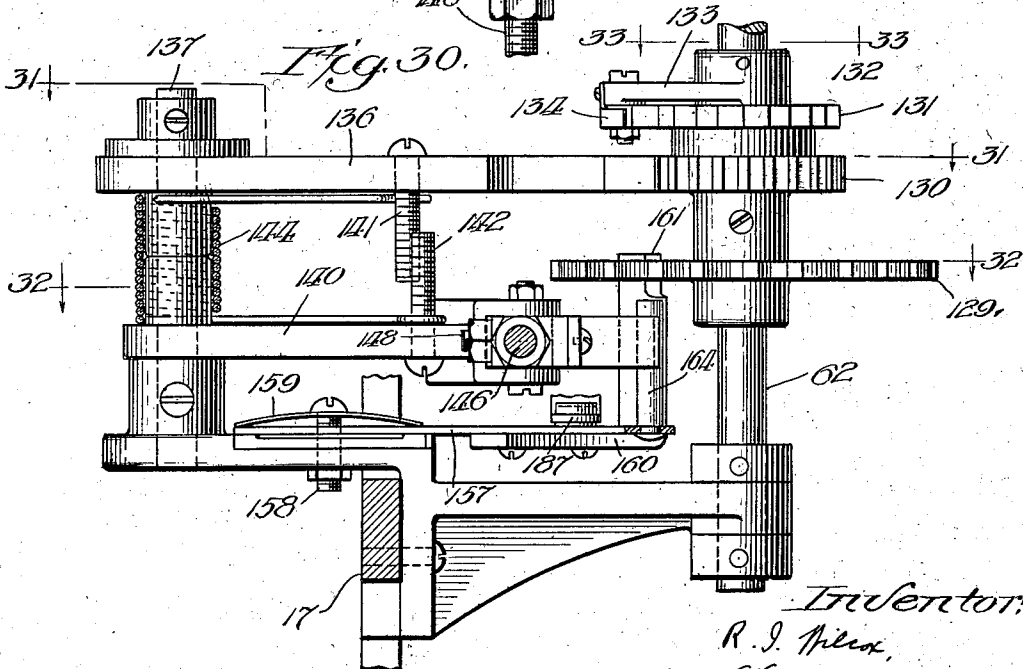
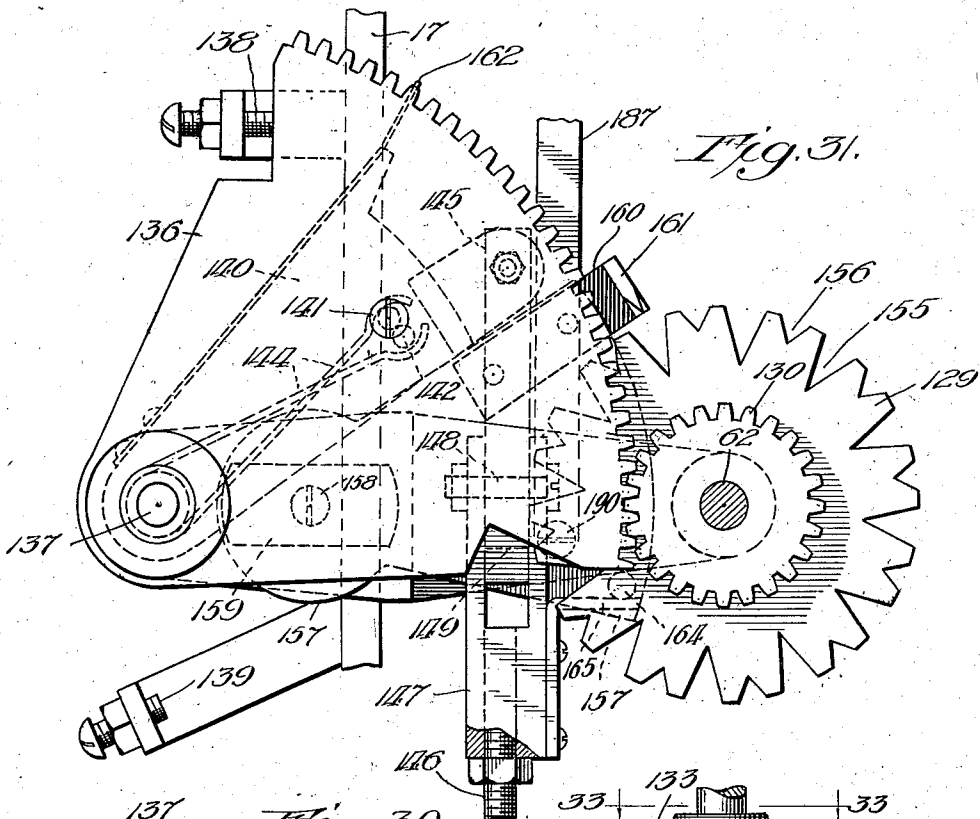
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Inventor:
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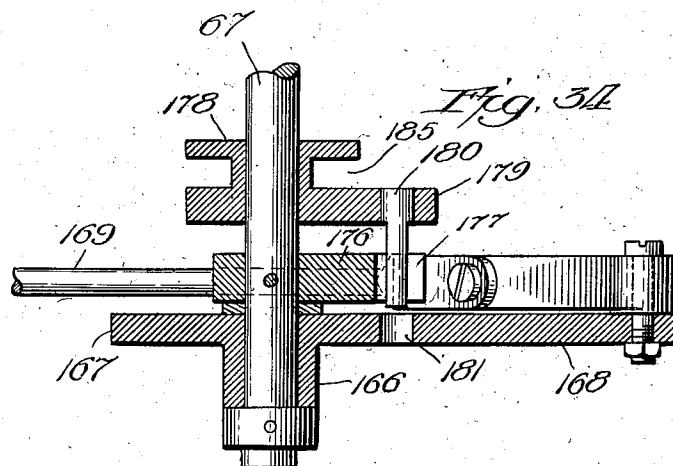
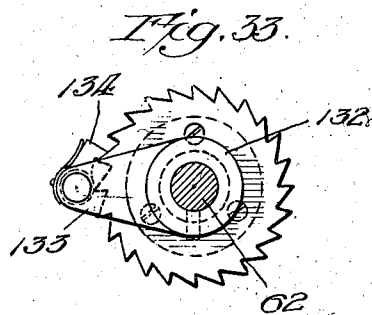
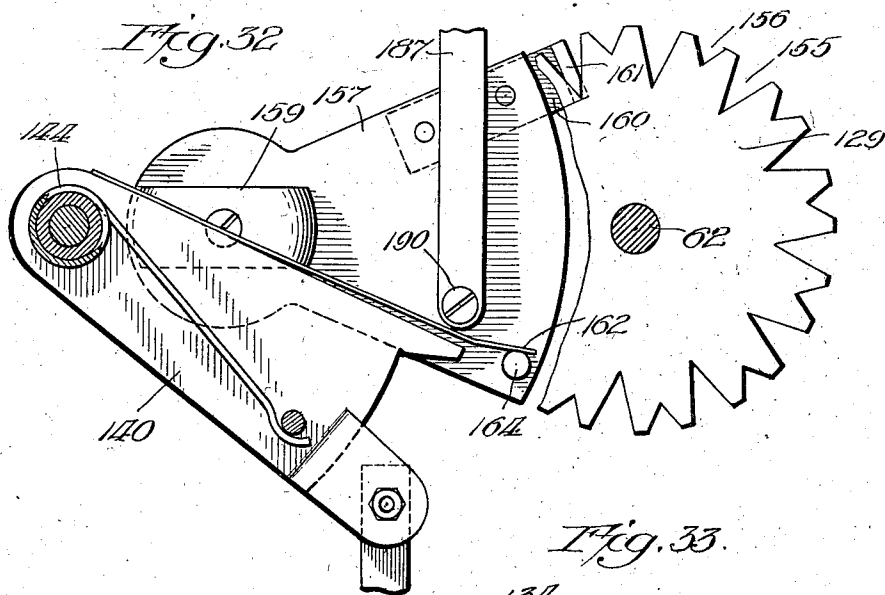
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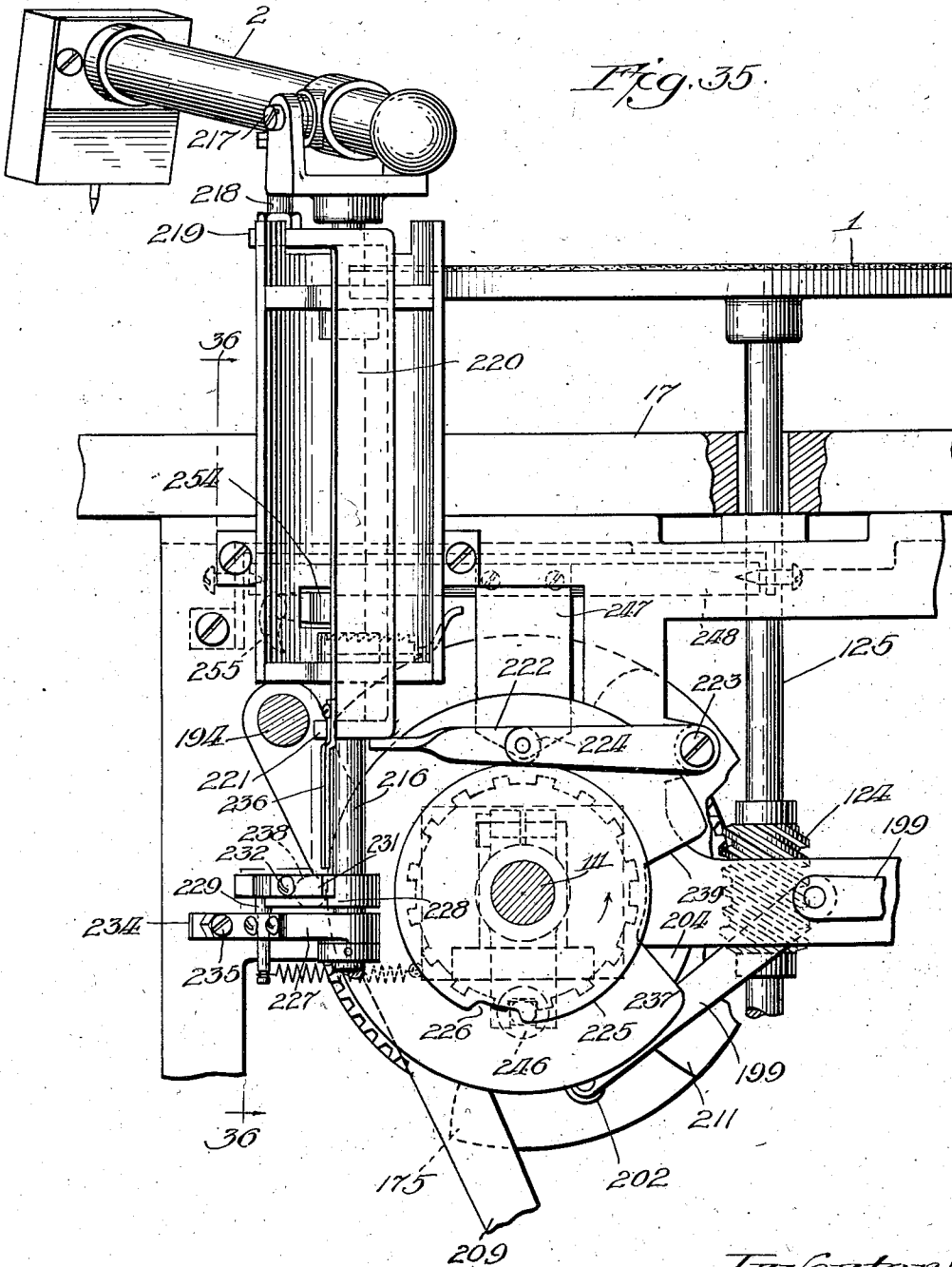
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MULTISELECTION PHONOGRAPH

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24 Sheets-Sheet 19



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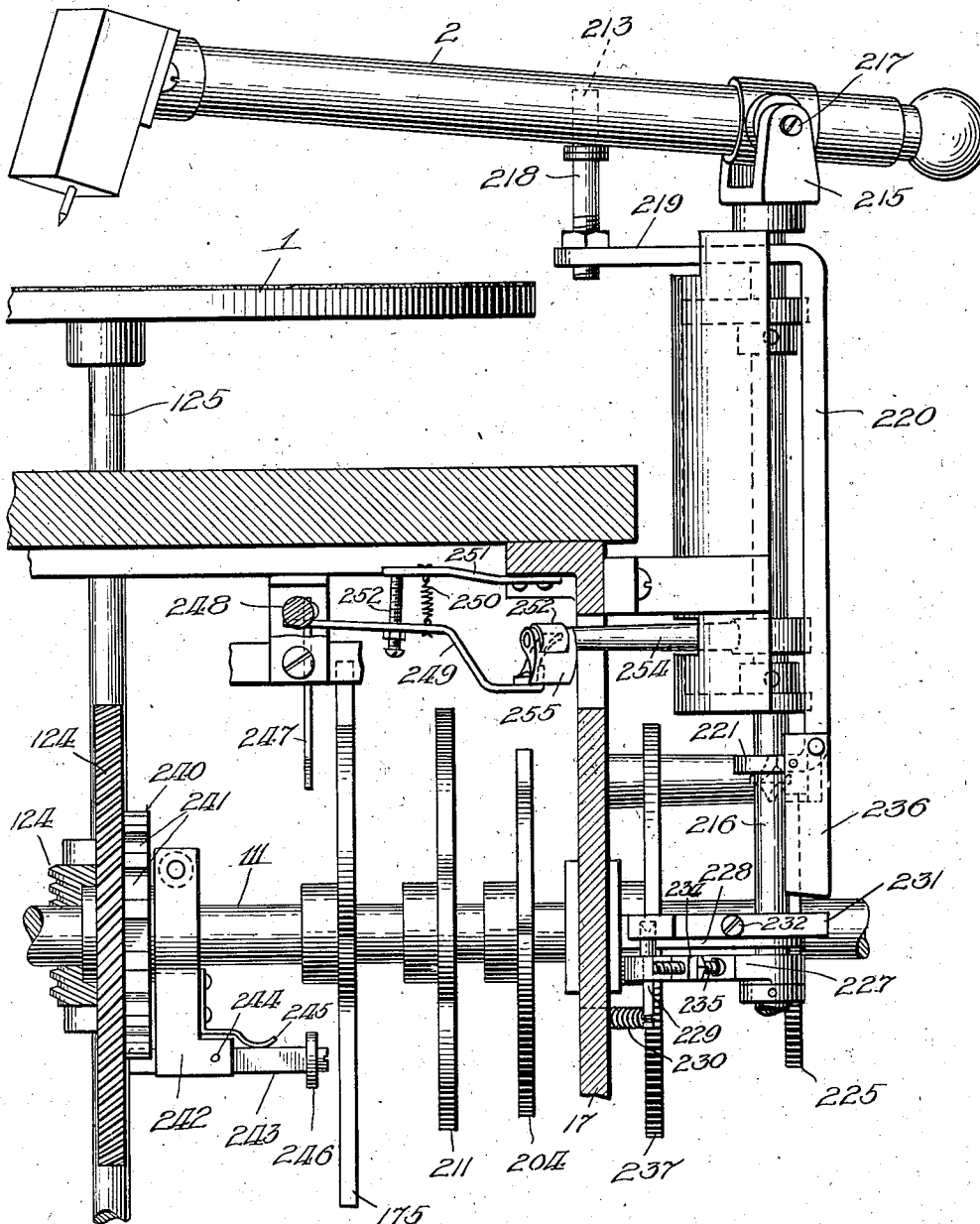
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Fig. 36



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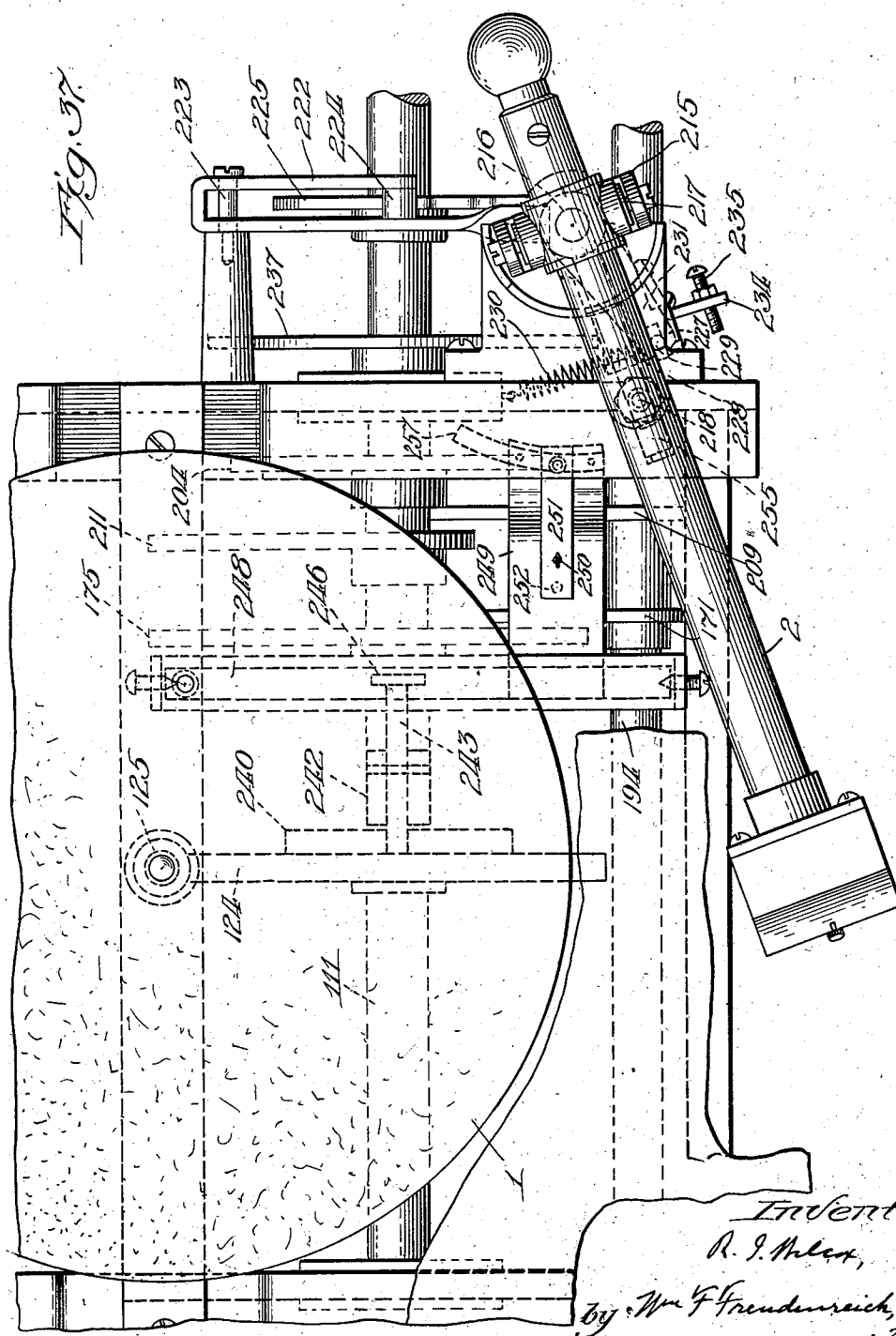
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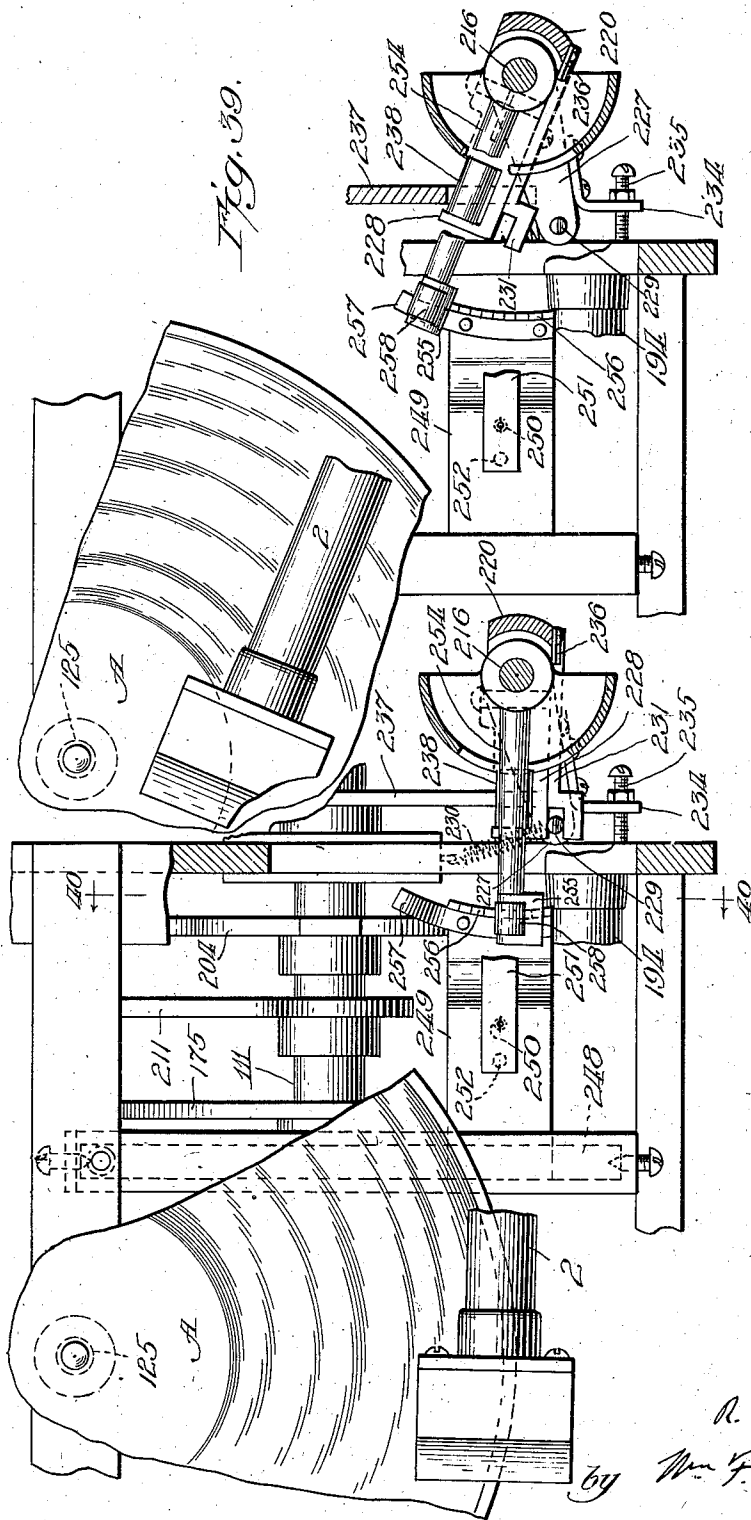


Fig. 38.

Fig. 39.

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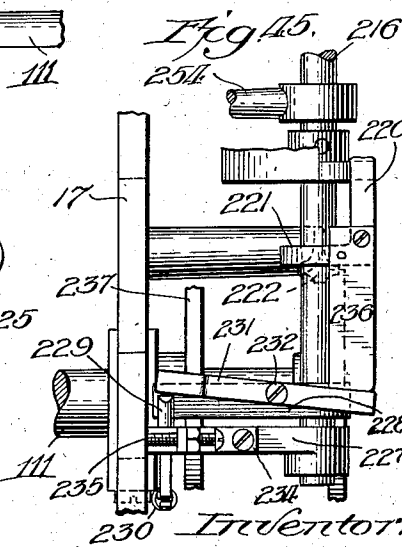
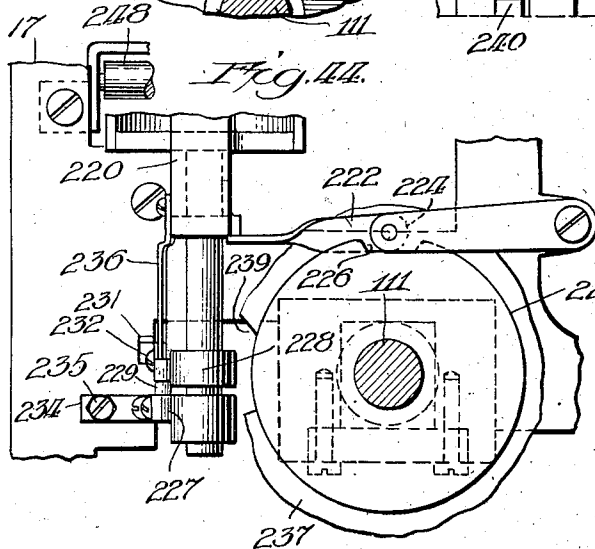
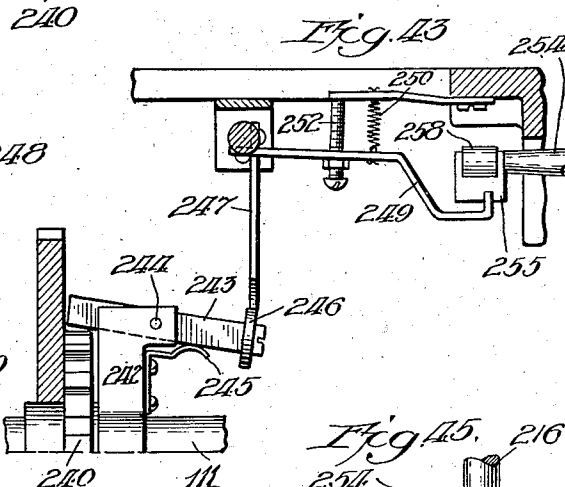
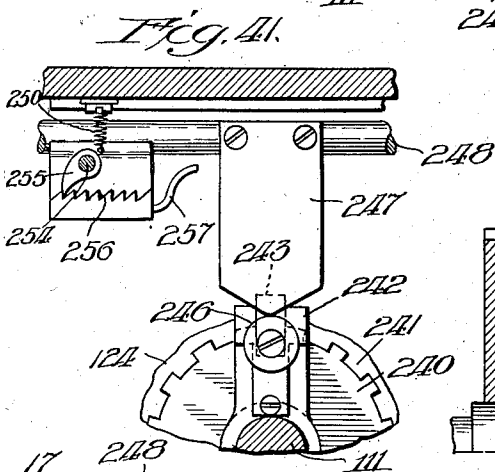
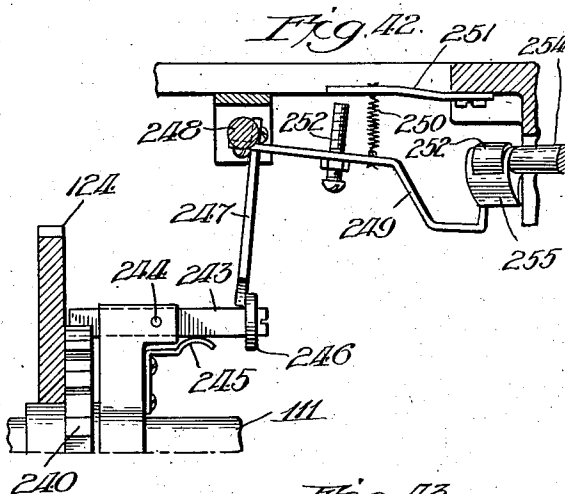
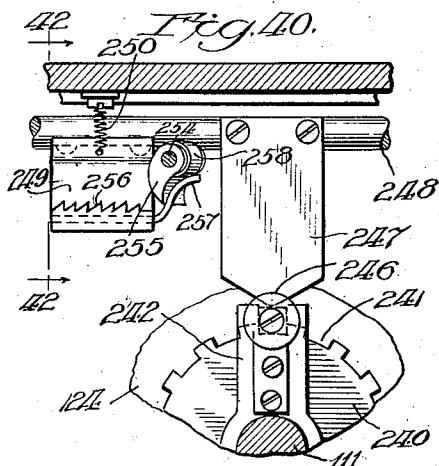
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MULTISELECTION PHONOGRAPH

Filed Jan. 26, 1939

24 Sheets-Sheet 23



Inventor:
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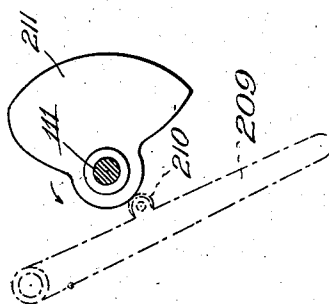
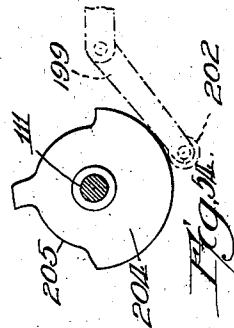
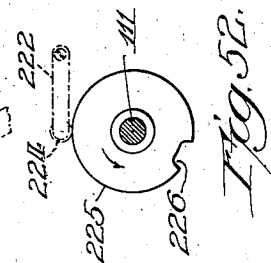
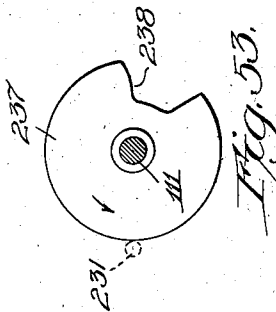
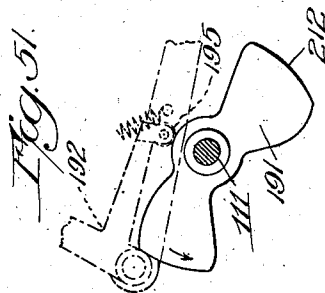
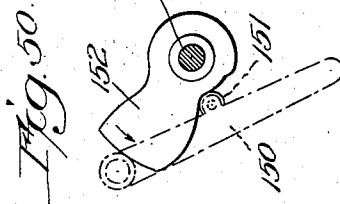
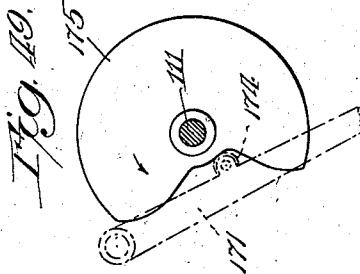
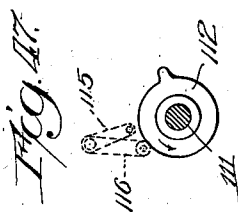
R. I. WILCOX

2,272,453

MULTISELECTION PHONOGRAPH

Filed Jan. 26, 1939

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UNITED STATES PATENT OFFICE

2,272,453

MULTISELECTION PHONOGRAPH

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Wilmette, Ill.

Application January 26, 1939, Serial No. 252,880

24 Claims. (Cl. 274—10)

The present invention has for its object to produce an improved phonograph adapted to permit selective playing of a considerable number of records arranged therein.

A further object of the present invention is to produce a simple and novel phonograph that permits the selective playing of a considerable number of double-faced records arranged therein.

In carrying out my invention, I provide means for supporting records in stack formation, each record being individually supported for removal from the stack without disturbing the others. One of the objects of the present invention is to produce a simple and novel mechanism for transferring a record from the stack to the rotatable table of the machine and then back again after the record has been played.

A still further object of the present invention is to provide means for turning the entire stack of records upside down whenever the impression on the under side of a record is to be brought into play, whereby the transfer of a record between the stack and the table is accomplished in the same way, regardless of which face of the record is to be engaged by the phonograph needle.

Some further objects of the present invention are to produce a novel and more efficient clutch than those heretofore employed to start and stop the record selecting and shifting mechanism; to produce simple and novel manually operable elements or finger pieces for making selections; to produce simple and novel means for preventing the cancelling of a selection until the selected record has been completely played; and to produce various novel devices, mechanisms and combinations of mechanisms for carrying out or performing separate parts of a complete cycle of operations.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a top plan view of a phonograph embodying the various features of the present invention, the casing being shown in section; Fig. 2 is a side view of the phonograph, the casing being in section, or it may be regarded as a section on line 2—2 of Fig. 1; Fig. 3 is a rear view of the phonograph, the casing being omitted; Fig. 4 is a section taken approximately on line 4—4 of Fig. 2, the casing being omitted,

and the scale being slightly larger than that of Fig. 2; Fig. 5 is an elevational view illustrating the parts in which the records are stored and by which they are shifted into and from playing positions; Fig. 6 is a front view of a fragment of the phonograph, including the casing, and illustrating the manually operable selecting elements or finger pieces and the manually operable cancelling element; Fig. 7 is a view on a larger scale than Figs. 1 to 6, showing only a fragment of the machine in the form of a section on line 7—7 of Fig. 9; Fig. 8 is a top plan view of that portion of machine illustrated in Fig. 7, or it may be regarded as a section, on a larger scale, on line 8—8 of Fig. 6; Fig. 9 is an end view of a portion of the manual selector; Fig. 10 is a section on line 10—10 of Fig. 9; Fig. 11 is a view similar to Fig. 8, showing those parts that appear at the righthand end of Fig. 8, with additional mechanisms; Fig. 12 is a section taken on line 12—12 of Fig. 14; Fig. 13 is a section on line 13—13 of Fig. 7; Fig. 14 is a section on line 14—14 of Fig. 13; Fig. 15 is a view similar to Fig. 14, showing only a fragment of one of the selectors and the adjacent portion of the cancelling bar, with the selecting device in selective position; Fig. 16 is a view similar to Fig. 15, the plane of the section being approximately on line 16—16 of Fig. 13; Fig. 17 is a view similar to Fig. 16, illustrating a condition in which the finger piece has been returned to its idle position; Fig. 18 is a horizontal section through the holder for a stack of records, on a considerably larger scale than Fig. 1, the gripping devices for transferring the records being illustrated as gripping a record; Fig. 19 is a view more or less like Fig. 18, showing only a fragment of a record, with the gripping mechanism open, and including the opening devices; Fig. 20 is a view similar to Fig. 19, illustrating a still smaller part of the machine, the grippers being closed; Fig. 21 is an edge view of the lower part of the holder or magazine for the records, on the same scale as Fig. 18, the support for the grippers being indicated in section; Fig. 22 is a section on line 22—22 of Fig. 18; Fig. 23 is a section on line 23—23 of Fig. 20; Fig. 24 is a section on line 24—24 of Fig. 18, showing only a few of the record-supporting shelves; Fig. 25 is a diagrammatic view illustrating the means for controlling the energization of the motor; Fig. 26 is a view showing in elevation the secondary selector rod or shaft with the immediate operating mechanism therefor, some of the parts being shown in full lines in one

extreme position and in dotted lines in the other extreme position; Fig. 27 is a view similar to Fig. 26, showing a smaller portion of the mechanism, with the parts in positions for selecting a record about midway between the top and the bottom of the stack; Fig. 28 is a side view of that part of the mechanism which determines whether the record magazine shall be turned upside down and which brings about that act when it is required; Fig. 29 is a section taken approximately on line 29—29 of Fig. 28; Fig. 30 is an elevational view showing, from a different point of view, the mechanisms appearing at the lefthand side of Fig. 28; Fig. 31 is a section on line 31—31 of Fig. 30; Fig. 32 is a section on line 32—32 of Fig. 30; Fig. 33 is a section on line 33—33 of Fig. 30; Fig. 34 is a section on line 34—34 of Fig. 29; Fig. 35 is an elevational view of the playing table for the records, the tone-arm, and the immediate operating and controlling mechanisms therefor; Fig. 36 is a section taken approximately on line 36—36 of Fig. 35; Fig. 37 is a top plan view of the parts shown in Figs. 35 and 36; Fig. 38 is a view partly in plan and partly in section, showing a fragment of a record on the playing table, with the tone arm in the position corresponding to the beginning of a recording, and some of the tone arm operating means as well as a device by which the tone arm exerts a control over the machine; Fig. 39 is a view similar to Fig. 38, showing the tone arm at the moment the playing of a record has been completed; Fig. 40 is a section on line 40—40 of Fig. 38, the record and the supporting table therefor being omitted; Fig. 41 is a view similar to Fig. 40, showing the parts in unclutching positions, whereas they are in clutching positions in Fig. 40; Fig. 42 is a section on line 42—42 of Fig. 40; Fig. 43 is a view similar to Fig. 42, with the parts in the positions corresponding to those in Fig. 41; Fig. 44 is a view similar to Fig. 35, showing a smaller fragment of the machine, with the parts in the positions which they occupy when the tone arm is lowered, whereas in Fig. 35 the tone arm is raised; Fig. 45 is a view more or less similar to the lower right hand corner of Fig. 36, showing the parts in the positions which they occupy when the tone arm is lowered whereas, in Fig. 36, the tone arm is up; Fig. 46 is an elevation of the cam for locking the cancelling bar at the beginning of a cycle of operations, the element which is directly actuated by the cam being shown in dotted lines; Fig. 47 is a view similar to Fig. 46, illustrating the cam whereby the machine effects automatic cancelling of a selection after playing the same has started; this cam, as well as the cam of Fig. 46 and of all subsequent figures, being mounted on a common cam shaft; Fig. 48 is a similar view of the cam for causing a record to be shifted from the magazine to the playing table and back again; Fig. 49 is a similar view of the cam that causes the record magazine to be turned over, when necessary, and to be again placed rightside up after the playing of the record on account of which the magazine was turned over; Fig. 50 is a similar view, illustrating the cam for turning the secondary vertical selector shaft; Fig. 51 is a similar view of the cam for causing the record-engaging grippers to be raised and lowered according to the position in the stack of the record to be played; Fig. 52 is a similar view showing the cam for raising and lowering the tone arm; Fig. 53 is a similar view, showing the cam that causes the tone arm to be swung into place

at the beginning of a recording and that causes it to be swung back to its normal idle position after a record has been played; and Fig. 54 is a similar view illustrating the cam that causes the gripper members for transferring individual records to be opened whenever a record reaches its destination, either upon the playing table or upon its shelf in the magazine.

In the drawings I have illustrated only a single machine which, however, embodies all of the novel features of my invention; and the detailed description will be confined to this particular illustration, since the manner of employing some of the novel features in other situations will be readily understood. Furthermore, the machine illustrated is designed to accommodate twelve double-faced records, thus giving a choice of any desired number of selections between one and twenty-four; and the detailed description will relate to this particular form, although the number of records that may be stored in a single magazine may be varied within wide limits.

In the machine illustrated in the drawings, 1 represents the usual or any suitable rotatable table on which a record is adapted to be supported; and 2 is any usual or suitable tone arm provided with a needle or stylus for cooperation with a record on a table.

In accordance with one feature of my invention, I arrange beside the playing table a magazine 3 for housing the actual record disks A. The details of the magazine are best shown in Figs. 1, 2, 18 and 21 to 24. Referring to these figures, it will be seen that the magazine comprises a vertical rear wall 4 and narrow vertical side walls 5, 5. Extending at their rear ends into the trough formed by these three walls are sturdy, horizontal shelves 6. In the arrangement shown, these shelves are fitted into grooves between horizontal ribs 7 properly distributed along the inner sides of the walls 4 and 5. The larger portion of each shelf may be of circular shape, a departure being made in the form of a rectangular projection 8 which fits at its edges against the rear and side walls of the casing proper. The shelves are, of course, so spaced apart that records may easily be inserted between them; only one record resting on each shelf. The parts are conveniently so proportioned that the records extend almost to the rear wall of the casing, so as not to waste space. The shelves are preferably made fairly thick, so that when their arc-shaped edges are bevelled from both faces of the shelves, as indicated at 9, a wide mouthed V groove is provided for each compartment or chamber adapted to receive a record, and a record will therefore register itself with its compartment or chamber even though it approaches while being a little high or a little low. Each compartment must be open on the front side for a distance at least as great as one-half the circumference of one of the records, so that the records may slide in and out easily. Each shelf has on the under side thereof, at about the middle of the front edge, a radially-arranged leaf spring 10 sunk at one end into the shelf so as to lie flush with the under face of the latter. Each spring projects out beyond the edge of the shelf and is there provided with a small roller 11. Preferably, the under side of each shelf is notched, as indicated at 12, to receive the free portion of the spring and prevent the latter from interfering with the easy entry of a record. The rollers are of such diameters that the distance between consecutive rollers is less than the thick-

ness of a record, and the rollers may even be in contact with each other. However, assuming that a record is approaching the upper of the two compartments shown in Fig. 24, it will be seen that it will readily pass between the two upper rollers, since the second roller from the top will simply be pressed down far enough for that purpose.

The magazine casing is supported by means of a sturdy trunnion 14 projecting rearwardly from about the middle of the rear wall 4 thereof. This trunnion extends through and is rotatable in the arms of a fork 15 fixed upon the upper end of a shaft or post 16 extending up from the frame 17 of the machine behind the magazine. Consequently, the magazine may be turned about a horizontal axis extending through the same from front to rear; the magazine being mounted far enough above the frame of the machine to permit the same to make a complete revolution. When the magazine is turned over, it is necessary to provide means for preventing the records from falling out at the sides. I have accordingly provided movable closures or barriers across what may be termed the sides of the record-receiving compartments.

In the arrangement shown, each shelf has a fairly long section cut away from each side edge to change that portion of each side edge from a convex shape to a concave contour, as indicated at 18. Extending substantially radially across each of the edge cavities or depressions in alternate partitions are little rods 19 rotatably supported as, for example, by being screwed into the shelves and left slightly loose so as to permit them to turn. On the outer end of each rod is a cross pin 20 long enough to project upwardly past the edge of an overlying record and down past a record on the immediate underlying shelf, when the pin is vertical, as shown in Figs. 18 and 21 and at the bottom of Fig. 23. When these rods are turned through an angle of ninety degrees or somewhat less, as indicated in the upper part of Fig. 23, each is carried clear of both of the records with which it previously engaged, and thus constitutes no obstacle to the passage of a record into or out of the magazine. Each of the rods 19 is yieldingly held in such a position that its pin stands upright, conveniently by a spring 21. Therefore, if a rod be turned so as to shift its pin out of the paths of the two adjacent records, the spring will return it to its locking position when free to do so. The rods are turned into their release positions, as will hereinafter be described, by the grippers which take hold of a record and transfer it between magazine and playing table.

The grippers are illustrated in the several figures to which I have just been referring, and even more in detail in Figs. 19 and 20.

It will be seen that each gripper comprises a long arc-shaped arm 22 and a short arc-shaped arm 23. The long arm extends at one end into the trough of a rigid, horizontal channel-like member 24 and is pivotally connected to the latter by a pin 25. The arm 23 extends from beyond the opposite end of the member 24 into the trough in the latter and is pivotally connected to the member 24 by a pin 27. The inner end of the long arm 22 has thereon an upwardly projecting pin 28 that is entered in a slot 29 in the adjacent end of the member 23 which overlaps the inner end of the member 22. There is arranged in the trough of the member 24 a leaf spring 30 secured at one end to the member 24 and slid-

ably engaged underneath a stationary pin 31 extending across the trough near the pivot pin 25. The initial shape of the spring 30 is such that it tends constantly to swing the outer ends of the arms 22 and 23 toward each other. At the outer end of the arm 22 is a nose 32 extending inwardly in a more or less radial direction, and there is a similar nose 33 at the outer end of the arm 23. Furthermore, the arm 22 has a second radial nose 34 between the pivot point and the feed end. It will be seen that each of the noses 32, 33 and 34 has in its end edge face a V-shaped notch 35. When the gripper is bodily moved toward a record, while the arms lie in the plane of the record and are spread apart, and the arms are released and left unconstrained, the spring 30 acts to close the jaw of the gripper on the record, the edge of which sets itself in the three notches. It should be noted that the arms of the gripper are of such length that they extend more than half way around a record when closed on the latter and are therefore effective to carry the record bodily if the gripper be moved outwardly in a horizontal direction. It may also be noted that when a gripper is moved outwardly, which is toward the bottom of the sheet, as viewed in Fig. 18, the noses 32 and 33 will strike the pins 20 on the corresponding radial rods 19 and, riding over them, cause them to be depressed out of the way of the record. As will hereinafter be seen, the records are all in horizontal positions at this time, so that the second record that is left clear by the turning of the two rods 19, has no tendency to leave its station in the magazine.

As best shown in Figs. 1, 5, 19 and 20, the member 24 carrying the gripper arms is fixed at one end to a round bar or shaft 37 that projects from a frame 38 slidable and rotatable upon a vertical shaft 39. In the arrangement shown, this frame is a U-shaped member having short horizontal arms and a long vertical connecting member between the arms. The upper arm of the frame is carried laterally and beyond the shaft 39 and its outer end has a deep notch 40. On the shaft 37 is a slidable sleeve 41 normally pushed away from the member 24 by a compression spring 42. Projecting from one side of the sleeve 41 is a cam lug 44 engaged with a cam roll 45 on the end of an arm 46 projecting radially in the outward direction from the gripper arm 27 in the vicinity of the pivotal axis of the latter. The parts are so proportioned that when the sleeve 41 is pushed against the resistance of the spring 42 toward the member 24, the cam lug 44 swings the arm 46 in the clockwise direction, as viewed in Fig. 19, and therefore causes the grippers to open or spread. On the other hand, when the sleeve 41 is moved back toward the shaft 39, as in Fig. 20, the arms of the gripper are adapted to close on a record.

The sleeve 41 is moved in the direction to open the jaws by a vertical bar 47 the forward edge of which contacts a roller 48 on the opposite side of the sleeve from that at which the cam lug 44 is located. As clearly shown in Fig. 3, the bar 47 is connected to the shaft 39 by two parallel, downwardly-inclined links 49 and 50 of equal lengths; the link 49 being arranged between the upper ends of the shaft and bar and the link 50 between the lower end of the bar and the shaft. The lower end of the bar 47 has thereon a roller 51 which rests on a horizontal segmental shelf 52 slidable up and down on the shaft 39; the angular width of the shelf being somewhat

greater than the turning movement that the shaft has. The weight of the bar 47 and the shelf on which it rests is sufficient to cause these members to drop down, except when the shelf is held up, and move the bar toward the shaft and thus permit the spring 42 to push the sleeve 41 backward and thus allow the gripper arms 22 and 23 to swing toward each other. It is therefore only necessary to provide means to raise the shelf at proper points in the cycle of operations in order to open the gripper device and release a record therefrom. The vertical movements of the shelf are preferably limited, as, for example, by a pin and slot connection between a hub on the same and the shaft, as indicated at 53 in Fig. 5.

The swinging movements of the gripper device to transfer a record from one station to the other are produced by simply oscillating the shaft 39. Since, in the particular arrangement illustrated, the gripper-carrying frame 38 is not keyed to the shaft 39, I provide the shaft with a long guide rod 54 supported therefrom in parallel relation thereto by brackets 55. This rod extends through the notch 40 in the upper arm of the frame 38 and thus guides this frame as it moves up and down to pick up and transfer records. The frame 38 is moved up and down by means of a box-like member 56 loose on the shaft 39 and lying between and engaging the upper and lower arms of the members 38. The member 56 has a sturdy finger 57 projecting laterally therefrom through a long vertical slot 58 in a stationary vertical bar 59 whose lower end is fastened to a stationary bracket 60. This bracket has a bearing for the shaft 39 and the shaft has fixed thereto a collar 61 that rests on this bracket. The finger 57 therefore does not turn with the shaft 39 but always remains in the same vertical plane for co-operation with a record-selecting device as will hereinafter appear.

In order that the gripper device shall pick out any desired record when the machine is set in operation, it is necessary that some means be provided to cause the gripper device to stop in the plane of that record at that point in the cycle where it is to withdraw a record from the magazine. This I accomplish by placing near the shaft 39, behind the record magazine, a vertical rotatable shaft 62, having thereon a series of radial pins 64 equal in number to the record discs and arranged in the form of a helix. The shaft 62 is so close to the bar 59 that any one of the pins 64 may be placed in the path of the finger 57 and serve as a stop therefor when the gripper device is moving upwardly. The parts are, of course, so proportioned that whenever the finger 57 engaged with one of the pins on the selector shaft 62, it is at the proper elevation to pick up the record corresponding to that pin. Consequently, by making it possible to control the angular position of the selector shaft, any one of the twelve records may be taken out of the magazine and played.

Each record is double faced so that there are twenty-four possible selections, although there are only twelve selector pins. Each pin, however, does double duty due to the fact that the record magazine may be turned upside down. To make this double duty of each selector pin possible, the selector shaft is caused to have twenty-four distinct angular positions, and the finger 57 is made wide enough, as shown in Fig. 1, to engage each pin in two different angular positions.

It may be noted here that the record magazine is turned by turning its supporting trunnion

14. For this purpose the trunnion has thereon a spiral gear 65 that meshes with a complementary gear 66 on a rotatable vertical shaft 67 supported from the stationary shaft or post 16; the gear ratio being 1 to 2 so that a quarter of a revolution of the shaft 67 produces a half revolution of the record magazine. As best shown in Fig. 3, the rear wall of the record magazine has thereon a long rib 68 arranged vertically and provided at opposite ends with set screws 69, one of which strikes a collar 70 on the stationary shaft 16 when the magazine is right side up, as indicated in full lines; while the other engages the collar when the magazine is turned over, as indicated in dotted lines.

While the shaft 62 with its pins is a selector, what may be regarded as the primary selector shaft, however, is a horizontal shaft 72 located near the front of the machine and having thereon twenty-four pins 73 arranged in a helix, as shown in Figs. 4 and 7. On one end of the shaft 72, outwardly from and abutting against a bearing 71 for the shaft, is a loose sleeve 74. A pin and slot connection 75 between the sleeve and the shaft permit relative lengthwise movements but compel the sleeve and the shaft to rotate together. Between the outer end of the sleeve and a collar 76 on the shaft is a compression spring 77. Since the shaft is free to slide lengthwise in the bearing at the opposite end, the spring tends constantly to hold the shaft at the left-hand limit of its movement, as viewed in Fig. 7. On the sleeve 74 is a bevel gear 78. This gear meshes with a similar gear 79 on a shaft 80 that extends diagonally from front to rear of the machine and is there provided with a bevel gear 81 meshing with a similar gear 82 on the vertical selector shaft 62. It will therefore be seen that, whenever the shaft 62 turns, the shaft 72 turns through a corresponding angle.

The pins on the shaft 72 are adapted to engage stops adapted to be shifted from idle to working positions by means of suitable finger pieces which may, therefore, be regarded as the actual selective devices. These stops and finger pieces are fully illustrated in Fig. 1 and Figs. 6 to 17. The stops that are adapted to engage the selector pins 73 are vanes or wings 84 each fixed to and extending downwardly from a short horizontal shaft 85 arranged above and transverse to the shaft 72; there being twenty-four of these short shafts spaced in a manner corresponding to the spacing of the pins 73 lengthwise of the shaft 72. Each vane has at one end a laterally-turned flange 86. Normally, when the vanes stand at an angle to the vertical, as indicated in Fig. 14, they and their flanges lie clear of the paths of movement of the pins 73 when the shaft 72 is rotated. However, when one of the short shafts 85 is turned in the clockwise direction, as viewed from the front of the machine, to bring its vane into an upright position, as viewed in Figs. 15 to 17, the flange of that vane lies in the path of the corresponding pin 73. Then, if the shaft 72 is rotated, its movement will be arrested when pin and flange meet. Therefore, by setting the proper stop, any desired record may be played; and, by setting a plurality of stops, a corresponding number of recordings may be played, one after another.

The setting of the stops is effected by turning knobs 87 arranged at the front of the machine and axially aligned with the short shafts 85. Each knob may be the front end of a short shaft, larger in diameter than the shafts 85 and hav-

ing bored into its rear end a deep hole 88 in which the forward end of one of the shafts 85 is seated. A wide notch 89 is cut through the rear edge of the sleeve-like part of each of the knob shafts, and through each of these notches extends a pin 90 projecting radially from the corresponding shaft 85 and having a diameter much less than the width of the notch. In this way there is provided a lost motion between each knob and the stop-carrying shaft with which it is associated. Overlying the telescoped ends of the knob shafts and stop-carrying shafts is a long, narrow stationary plate 91 provided with two rows of short parallel slots 92 and 93, the long dimensions of the slots extending in the direction from side to side of the machine. The pins 90 extend up through the slots 92 and other pins 94, fixed to and projecting radially from the knob shafts, extend up through the slots 93. Consequently, the angles through which the shafts 85 and the knob shafts may turn are definitely fixed by the pins and slots.

When there is no setting of any of the stops and the parts are in the positions indicated in Fig. 14, the pins 90 and 94 are at the lefthand ends of their slots and the pins 90 are at the lefthand sides of the notches 89. Then, when a knob is turned in the clockwise direction, the corresponding shaft 85 is caused to turn to the same extent; the turning movement of both being stopped when the pins 94 and 90 reach the ends of their slots, as in Figs. 15 and 16. If now the knob is turned back, nothing happens to the shaft 85 which remains in the position into which it was brought by the setting movement of the knob; the wide notch 89 providing a sufficient lost motion, as shown in Fig. 17, to permit this effect to be obtained. The purpose behind this construction is to prevent the person from cancelling the setting of a stop without, at the same time, cancelling all other settings that may have been made.

One may, however, cancel all settings at any time, subject to an exception to be referred to later. This is done by a bar 96 arranged on edge below the shafts 85 and extending transversely of the machine past all of these shafts. In the upper edge of the plate are wide notches 97 into each of which one of the stop elements 84 extends. As shown in Figs. 15 to 17, the notches 97 are wide enough to permit the stop elements to move between working and idle positions without meeting any interference on the part of the bar when the latter is in its normal, idle position. As shown in Fig. 7, the bar 96 is slidably supported in the frame of the machine for limited lengthwise movements; the maximum length of such movements being determined by a pin and slot connection 98 between the bar and the frame. The cancelling bar is normally held in its idle position by a tension spring 99 connected at one end to the bar and at its other end to the frame. At the front of the machine, below the row of knobs, is a knob 100 on the front end of a shaft 101 provided at its rear end with a crank 102 having a crank pin 103 engaged in a vertical slot or notch 104 in the bar. Upon turning the cancelling knob in one direction, the bar is shifted against the resistance of its spring and all of the stops that are in working positions are returned to their idle positions. However, in order to prevent such cancellation from stopping the machine after the latter has begun to operate, there is provided a pivoted dog 105 that drops down behind a shoulder 106, as

soon as the machine starts, and locks the bar in its idle position until such a time that cancellation of a setting will not prevent the machine from completing a cycle. As best shown in Fig. 10, the dog 105 has a rigid arm 107 projecting therefrom. On the free end of this arm is a cam roller 108 that rests on the edge of a cam disc 109 having a low portion 110 of considerable angular length. When the roller drops down on the low portion of the cam, the dog drops behind the shoulder on the bar. The cam is fixed upon a horizontal cam shaft 111 rotatable in the clockwise direction and extending from front to rear of the machine. In Fig. 10 the cam is shown in the position which it occupies when the machine is ready to begin to operate upon the insertion of a coin; and it will therefore be seen that the cam roller 108 will drop upon the low part of the cam immediately after the starting of the machine.

There is also automatic cancellation of each stop setting after the playing of the corresponding selection has begun; this being for the purpose of clearing the way for the playing of the next selection in a series of selections. It will be seen, as best shown in Fig. 13, that when one of the pins 73 is engaged with a stop it is positioned in the angle formed by the body of the stop and its flange. Therefore, if the shaft 72 is drawn lengthwise in a direction to compress the spring at one end thereof, it restores the stop to its idle position. Then, when the pull on the shaft is released, the pin clears the stop and leaves the shaft free to turn so far as that particular stop is concerned. The cancelling movement of the shaft 72 is caused by a second cam 112 on the cam shaft, this cam having a simple peripheral nose or projection 113. Above this cam is hung a rocker member comprising two arms 115 and 116. On the lower end of the arm 115 is a laterally projecting pin 117 that engages with the inner side of a collar 118 on the shaft 72. On the lower end of the arm 116 is a cam roller 119 that rides on the periphery of the cam 112. When the nose or projection 113 reaches the cam roller it swings the rocker device in the counter-clockwise direction, as viewed in Fig. 10, and causes it to pull the shaft 72 toward the right. The shaft is almost immediately released and permitted to resume its normal position so that it may turn until the pin nearest a stop strikes the latter to start a new cycle after the completion of the cycle there under way.

It is desirable that the stops be yieldingly held in both their idle and working positions and that they complete their movements into such positions by a snap action after having been moved slightly more than half way. To this end I have mounted on the frame of the machine above the shafts 85 a long spring plate 120 fixed along one long edge at a considerable distance behind the row of pins 90 and extending forward across and pressing down upon the tops of the pins. The plate is preferably slit from the front edge rearwardly so as to divide the forward portion into wide fingers 121, one of which overlies each of the pins. Each finger acts as a spring to hold the corresponding stop in either of its two positions and to throw it into either position after having been moved slightly past center from the other position.

The cam shaft 111, previously referred to, controls the turning of the record magazine and the operation of the mechanism for transferring records between the magazine and the playing

table, as well as the movements, aside from those caused by the record itself, which the tone arm must make. The cam shaft is driven from a suitable motor 122 through suitable speed-reducing gearing ending in a gear wheel 124 loose on the shaft and adapted to be locked to the same by a clutch. The clutch is, in turn, controlled by the tone arm. The motor drives the vertical shaft 125 that supports the table 1 on which the records rest while being played; the shaft 125 conveniently serving as one of the shafts of the speed-reducing gearing. Thus, the motor should run continuously so long as there remain unpaid selections for which payment has been made in the case of a coin-controlled machine.

In Fig. 25 I have illustrated diagrammatically the control system for the motor. In this figure, B and C are power lines for energizing the motor; 126 and 127 are a coin box apparatus and motor switch which cooperate to keep the motor running until the machine has played the full number of selections corresponding to the value of the coins that have been deposited. The cam shaft in this diagram is shown as having a cam or projection to shift a lever 128 once during each revolution; this lever acting on the mechanism in the switch box to cause the motor circuit to open whenever the number of selections that have been played equals the number for which payment has been made. This control system is old and well known and will not further be described.

It will be evident that while the first operation in a complete cycle is the locking of the selection cancelling bar in its idle position, the next one must be that of turning the two selector shafts. By referring to Fig. 3 and Figs. 28 to 33 of the drawings, it will be seen that the vertical selector shaft 62 has fixed thereon, near the bottom of the machine, a star wheel 129. Loose on the shaft, above the star wheel, are a pinion 130 and a ratchet wheel 131 fastened together and each having twenty-four teeth. Above the ratchet wheel is a hub 132 fixed to the shaft and having a radial arm 133 projecting therefrom. On the outer end of this arm is a pawl 134 engaged with the ratchet wheel. Engaged with the pinion is a toothed segment 135 mounted on the upper end of a short vertical stub shaft 137 for swinging movements in a horizontal plane. Adjustable stops 138 and 139 are provided to limit the angular movement of the segment to a distance equal to twenty-three of its teeth. Therefore, the segment is able to turn the shaft 62 from its normal position through the remainder of its twenty-three of its teeth. Therefore, the segment is able to turn the shaft 62 from its normal position through the remainder of its twenty-four positions. On the stub shaft, below the segment, is a loose, wide arm 140. A screw 141 projects down from the toothed segment and a screw 142 projects up from the arm, the two screws being at the same radial distance from the axis of the stub shaft. A torsion spring 144 surrounds the stub shaft and has its ends extended radially into engagement with the screws 141 and 142; the effect being that normally the screws are pressed against each other by the spring. Attached to the free end of the arm 140 is a connecting rod made in two sections 145 and 146. The member 145 is secured at one end to the arm 140 and extends at its other end into a jaw 147 at the adjacent end of the member 146. A bolt 148 passes through the sides of the jaw and through an elongated slot 149 in the con-

necting rod section 145; thereby providing a lost motion between the two sections of the rod. The connecting rod reaches to the lower end of a lever 150 having thereon a roller 151 that engages with the periphery of a cam 152 on the cam shaft. A spring 154 acts on the lever yieldingly to hold the roller against the cam. This cam is best illustrated in Fig. 50.

When the cam shaft begins to rotate in the counter-clockwise direction, as viewed in Fig. 50, the lever 150 is quickly swung thereby in a direction to draw the arm 140 from the position which it occupies in Fig. 31 to that of Fig. 32. If the selector shaft 62 is free to turn, the spring 144 causes the toothed segment to travel with the arm 140 and the shaft 62 to be turned until it can go no farther due to the engagement of one of the pins 73 on the primary selector shaft with a stop. Since the lever 150 is required to make a complete working stroke, regardless of whether the toothed segment accompanies it, the spring 144 yields whenever the toothed segment comes to rest and permits the lever to complete its stroke. It will be seen that as the cam 152 rotates in the counter-clockwise direction, the lever 150 is moved through a complete working stroke and is held in that position for a short period, after which the cam roller again begins to ride downhill and permits the spring 154 to move the lever through its return stroke in which the parts are in the relative positions illustrated in Fig. 31 whereas, at the end of the working stroke, the arm 140 is in the position illustrated in Fig. 32.

The mechanism just described rotates the vertical selector shaft so as to bring the selected pin thereon in the proper position above the wide finger 57. Should the angular position of the selector shaft correspond to a recording on the upper face of one of the records, nothing further need be done to the selected record except to take it out of the magazine and place it on the playing table. However, should the selected recording be on the under face of one of the records, then it becomes necessary to turn the record magazine over in order to bring that recording to the upper side of the record as it rests upon the playing table when subsequently transferred thereto. The star wheel 129 on the vertical selector shaft 62 determines when the magazine must be turned over. It will be seen that this star wheel has twelve equally spaced, deep V-shaped notches which divide the marginal portion of the wheel into twelve wide parts or teeth 155. In the outer end of each of the teeth is a shallow V-shaped notch 156. On a part of the stationary structure, below the arm 154, is a horizontal segmental plate 157, illustrated as being held in place by a vertical bolt 158 arranged between the shaft 62 and the stub shaft 137, but near the latter shaft. Under the head of the bolt is a spring washer 159 which frictionally holds the plate 157 in any position into which it may be brought. Fastened to the upper end of the plate 157 adjacent to what may be termed the trailing radial edge is a piece of metal 160 having a blade-like arm 161 rising from the same to a horizontal plane slightly above the star wheel. The parts are so proportioned that when the plate 157 is swung in one direction, the blade-like element 161 will enter any one of the peripheral notches which may lie in its path, as illustrated in Fig. 32, and thus serve not only to lock the shaft 32 but accurately to register it. When the plate is shifted in the

opposite direction, the blade is carried clear of the star wheel, as illustrated in Fig. 31.

The swinging of the arm 140 through a working stroke, as heretofore explained, serves also to swing the blade 157 into its locking position. This is accomplished, as best shown in Fig. 32, by a leaf spring 162 extending along the trailing edge of the arm 140 and projecting somewhat beyond the free end of the arm; the spring being fastened to the arm in any suitable way in the vicinity of its inner end. The plate 157 has thereon a pin 164 which projects upwardly therefrom in the path of the projecting portion of the spring member 162. The parts are normally in the positions illustrated in Fig. 31, the spring member 162 being positioned far in the rear of the pin 164. Therefore, when the arm 140 is swung in the direction to turn the selector shaft, it almost completes its stroke before the spring member 162 comes in contact with the pin 164; but, when this occurs, the plate 157 is caused to swing through a small angle sufficient to carry the blade 161 into the bottom of one of the deeper notches in the star wheel. In other words, the plate 157 need not travel through any large angle because only enough movement is needed to shift it between a position in which it just clears the star wheel to a position in which it is seated in the bottom of one of the deep notches in the latter. Since the driving of the plate 157 is done by a yielding spring member, the arm 140 is enabled to continue to the end of its working stroke even when the blade 161 enters one of the shallow notches; the spring member 162 yielding sufficiently for this purpose.

Means must be provided again to disengage the blade 161 from the star wheel, because the arm 140 serves only to move the blade in one direction. I have therefore provided the section 146 of the connecting rod with a finger 165 projecting laterally therefrom a distance greater than the distance between the pin 164 and the rod, and in a plane between the upper and lower ends of the pin. When the cam pulls the connecting rod toward the left, as viewed in Fig. 29, the lost motion between the two sections of the rod is first taken up, and then the arm 140 begins to move. This permits the finger 165 to move away from the pin 164 on the plate 157, as shown in Fig. 29, which illustrates the position of the parts at the moment that the lost motion between the two sections of the connecting rod has been taken up. It will be seen that when the cam 152 allows the spring connected with the lever 150 to throw the connecting rod back to the starting point, the section 146 of the rod continues to travel through the length of the slot 149 while the arm 140 remains stationary. Shortly before the end of the return stroke of the connecting rod, the finger 165 engages the pin 164 which is at this time far enough toward the left, as viewed in Fig. 29, to permit the blade 161 to be engaged in the deep notch in the star wheel with which the blade is shown as registering. Consequently, while the section 146 of the rod is moving along through the length of the slot 149, the finger 165 pushes the pin 164 ahead of it, swinging the plate 157 in the counter-clockwise direction, as viewed in Fig. 29, bringing the pin and the blade 161 into the positions which they are shown as occupying in Fig. 29; Fig. 31 illustrating the final positions of all of the parts of this device.

The swinging plate 157 is employed to operate a clutch between the vertical shaft 67 and the

means for turning the latter at once when the record magazine must be turned over, as shown in Figs. 28, 29 and 34. Surrounding the lower end of the shaft 67 and loose thereon is a sleeve 166 provided at the top with a disc-like part 167 of considerable diameter, the part 167 having a radial arm 168 projecting therefrom. The outer end of this arm is fastened to one end of a long connecting rod 169 by means of a link 170; the connections with the ends of the link involving hinge pins arranged at right angles to each other. As best shown in Fig. 3, the connecting rod 170 extends to the lower end of a lever 171 beyond the cam shaft. This lever, as in the case of the lever 150, is provided with a spring 172 which holds the cam roller 174 on the lever against its cam 175. The cam is shown in detail in Fig. 49 which also illustrates, in dotted lines, the lever 171 and the cam roller 174. Assuming that the cam 175 is initially in the position illustrated in Fig. 49, it will be seen that shortly after the cam shaft begins to turn, the lever starts through a working stroke and is then held at the end of its working stroke while the cam shaft continues through considerably more than half a revolution. Then the cam roller drops down quickly to the low point of the cam; the drop in the cam face being almost precipitous.

Fixed to the shaft 67, just above the disc 167, is a short arm 176 having in its free outer edge a deep notch 177. Loose on the shaft 67 above the arm 176 is a clutch sleeve 178 which is slidable on and also rotatable around the shaft. This sleeve has a radial projection 179 provided with a downwardly extending rigid pin 180 that passes through the notch 177 in the arm 176 at the same radial distance from the axis of the shaft as is a hole 181 drilled through the disc 167. With this arrangement, when the pin 180 and the hole 181 are brought into registration with each other, and the clutch actuating sleeve is lowered, the pin enters the hole 181 and thus, through the medium of the arm 176, locks the disc 167, with its arm 168, to the shaft. Therefore, during each working stroke of the connecting rod 169, the shaft 67 is caused to be turned through a predetermined angle, provided that the pin 180 is in the hole 181. However, should the clutch sleeve be raised into the position illustrated in Fig. 34, so that its lower end is somewhat above the top of the disc 167, the movements of the connecting rod 169 have no effect on the shaft. It will thus be seen that by permitting the connecting rod to turn the shaft 67 through the proper angle, an overturning of the record magazine may be effected; the magazine being quickly turned upside down and remaining there while the cam shaft is making more than half a turn, and finally being returned to its upright position when the cam roller drops down the steep slope to the low point of the cam.

The clutch sleeve just described is actuated by a bell crank lever 182 which is best shown in Fig. 28; one arm of this lever being provided with a pin 184 that enters the usual deep annular groove 185 in the periphery of the sleeve. The free end of the other arm of the bell crank lever is secured to a connecting rod which is preferably composed of two sections 186 and 187 connected together by means of screws 188 and slots 189 to permit adjustment of the overall length of the rod. The section 187 of the connecting rod, as perhaps best shown in Fig.

32, extends over the top of the plate 157, toward the free end of the latter, and is there attached to the plate by a screw 190. It will thus be seen that whenever the plate 157 is shifted in one direction or the other, the clutch sleeve is caused to move up or down, as the case may be.

The reason for the varying depth of the notches in the periphery of the star wheel will now be apparent. The distance through which the clutch sleeve is raised during each cycle of operations depends upon the angle through which the plate 157 is shifted. Thus, if the centering and locking blade 161 drops into a deep notch, as in Fig. 32, the clutch sleeve is raised sufficiently high to cause the clutch pin 180 to be lifted clear out of the opening 181. On the other hand, if the blade 161 drops into one of the shallow notches, the clutch sleeve will not rise far enough to permit the clutch pin 180 to clear the hole 181, and the shaft remains locked to the disc 167 and must therefore turn with the latter. Each deep notch in the star wheel therefore represents an upright position for the record magazine, while each shallow notch represents an inverted condition of the magazine.

The vertical selector shaft 62 having been set in the proper angular position, the next thing to be done is to carry the selected record to the playing table. The first step to be taken in this connection is to raise the record gripping unit until the finger 57 strikes that pin on the vertical selector shaft which lies within the path of the finger as the gripping unit rises. This, as best shown in Figs. 3, 5, 26 and 27, is accomplished by means of a cam 191 on the cam shaft. Positioned above the cam 191 is a bell crank lever 192 mounted, as are many of the levers cooperating with cams on the cam shaft, on a horizontal shaft 194 above and to one side of the cam shaft. One arm of this bell crank lever has thereon a cam roller 195 engaged with the periphery of the cam. The other arm of the bell crank lever extends upwardly and has connected to its upper end a tension spring 196 that extends downwardly and inwardly in a diagonal direction; the lower end of the spring being secured to a long, almost horizontal lever 197. The lever 197 is supported at one end on the shaft 194 and has its other end connected to the lower end of a connecting rod 198 whose upper end is attached to the part 56 of the gripper apparatus. The parts are so proportioned that the inner end of the lever 197 lies near the vertical shaft 39, so that the connecting rod 198 is approximately vertical.

With the cam 191 in the position shown in Fig. 3 and in full lines in Fig. 26, it will be seen that shortly after the cam shaft begins to rotate in the counter-clockwise direction, the cam roller 195 is pushed upwardly, rocking the bell crank lever 192. As the bell crank lever rocks in a counter-clockwise direction, the long lever 197 is swung upwardly by means of the spring 196. The spring is strong enough to lift the entire gripper apparatus. In Fig. 26 the levers and the gripper apparatus are shown in full lines at one limit of their movements and in dotted lines at the other limit; the entire range of movement of the gripper apparatus required being that which will permit the finger 57 to drop below the lowermost pin on the selector shaft 62 and to move up at least to and preferably a little beyond the horizontal plane of the uppermost pin. The cam and the bell crank

lever of course complete precisely the same movements for each revolution of the cam shaft, whereas the lever 197 is permitted to swing up only until the movement of the gripper apparatus is stopped by means of one of the selector pins. This lagging of the lever 197 behind the bell crank lever is permitted by the spring 196 which begins to stretch as soon as the finger 57 makes contact with one of the selector pins, and permits the bell crank lever to continue its movement. In Fig. 27 the cam is shown in full lines as having been turned for enough to cause the finger 57 to engage with a selector pin at about the middle of the series. The lever 197 travels no farther during this cycle, but the cam and the bell crank lever continue into their respective dotted line positions.

Immediately after the gripper apparatus has been brought to the level of the selected record, the gripper arms must be closed on the record. As heretofore explained, the gripper arms close automatically when the cam lug 44 is retracted from the position shown in Fig. 19 to that illustrated in Fig. 20; this being accomplished by permitting the vertical bar 47 to swing downwardly and toward the shaft 39. Normally, the shelf 52 on which the lower end of the bar 47 rests is held raised by a lever 199 pivotally supported by the frame, between its ends and at a point between the cam shaft and the vertical shaft 39, as indicated at 200; one end of the lever having thereon a roller 201 with which the actual engagement with the under side of the shelf is made, and the other end of the lever having thereon a cam roller 202. The roller 202 is in engagement with the periphery of a cam 204 shown in detail in Fig. 54. It will be seen that when the cam shaft is stationary, before beginning to rotate at the start of a cycle of operations, the roller 202 is on the high part of the cam and that the cam shaft must make about a quarter of a turn before the roller starts downhill. This allows time for the performance of the other operations that must precede the release of the gripper arms so as to permit them to grasp a record, before such release occurs. At any rate, when the cam roller 202 drops down on the first low section 205 of the cam, the grippers are closed and remain closed while the record is being removed from the magazine and brought into a position above the playing table. Thereupon, the cam roller becomes engaged with the second high section 206 of the cam, causing the gripper arms to spread and leaving the record without other support than the playing table. As will hereinafter be explained, the cam shaft remains stationary while the record is being played. After the playing of the record has been completed, and the cam shaft again turns, the series of steps described is reversed; the grippers being again permitted to close on the record and the record being then carried back to the magazine and the grippers again opened.

After the gripper device has been closed on a record in the magazine through the dropping of the cam roller 202 upon the first low section 205 of the cam 204, everything is in readiness to swing the record out of the magazine and over to the playing table. This is accomplished by turning the shaft 39. As shown in Figs. 2, 3, 4 and 5, the shaft 39 is provided at its lower end with a long radial arm 207. The free end of this arm is attached to the inner end of a connecting rod 208, the opposite end of which is connected to the lower end of a long lever 209 hung from its

upper end on the shaft 194. On this lever is a cam roller 210 engaged with the periphery of a cam 211 on the cam shaft. This cam is shown in detail in Fig. 48 from which it will be seen that at the beginning of a cycle of operations the cam roller lies on the low part of the cam and that the cam must turn through a considerable angle before the lever 210 is caused to begin its working stroke. When the cam shaft reaches a predetermined point in each revolution, the lever 209 begins to swing in a direction to turn the shaft 39 so as to cause the record held in the gripper apparatus to be swung into position directly over the playing table. It then becomes necessary to lower the gripper apparatus so as to set the record down upon the table. This is of course accomplished by the cam 191 which permits the lever 197 to swing down and the entire gripper unit to be lowered into its lowermost position. This will be understood from an inspection of Fig. 51, which shows the condition at the beginning of a cycle; the cam roller 195 being on one of the two low parts of the cam. As the cam rotates, upon setting the cam shaft in motion, the cam roller rides up to the first high portion of the cam and remains there for some time; thus permitting the gripper apparatus to be raised from the position shown in Fig. 3 and allowing time for the grippers to close on the selected record and for the shaft 39 to be turned to carry the record above the playing table. At this latter point in the cycle the cam roller 195 leaves the high portion 212 of the cam and starts downhill again. Theoretically, it is not necessary that the downward movement of the gripper apparatus be delayed until the lateral swinging movement thereof be completed, because the gripper apparatus may begin its descending movement as soon as the record has cleared the magazine; but, actually, the record is not lowered until it is practically above the playing table.

As heretofore stated, the gripper apparatus remains in position again to pick up the record from the table until after the playing of the record is completed and until the record can again be grasped by the grippers. The cam roller 195 then starts uphill on the cam 191, causing the gripper to rise; and, after the record has been lifted from the table, the cam roller 210 starts downhill and the return movement of the shaft 39 to carry the record back to the magazine is brought about through the pull of a spring 214 which constantly acts on the lever 209 to hold the cam roller against the cam. All of the other cams heretofore described have continued to perform their intended function so that at the end of the cycle the record is back in the magazine and the gripper apparatus is in its normal position of rest, which is its lowermost position, as shown in Fig. 3.

When a record is finally deposited upon the playing table and left free to rotate therewith, the playing of the record may begin; the first step being to shift the tone arm 2 from an idle position, as indicated in Fig. 1, to a position in which the needle carried thereby rests on the record at the beginning of the recording on the latter. The record is then played in the usual way, the record itself being the means that swings the tone arm toward the center of the record as the playing progresses. After a recording has been played, the tone arm must again be lifted and returned to its idle position.

As shown in Fig. 2, the tone arm is mounted in a jaw 215 on the upper end of a vertical shaft

216; the immediate supports for the arm being screws 217 that serve as journals which permit the tone arm to swing up and down relatively to its shaft.

The tone arm is held in a raised position, as best seen in Fig. 36, by a little post 218 rising from a horizontal bar 219 that underlies the arm near the hinge axis of the latter; this arm projecting laterally at right angles from the upper end of a vertical bar 220 the lower end of which has a short arm 221 on the same side as the arm 219 and parallel with the latter. The shaft 216 extends through these arms in a manner to permit the member 220 to slide up and down on the shaft. Any suitable means may be provided to prevent the member 220 from turning relatively to the shaft. In the arrangement shown, this is done by providing the post 218 with a pin 213, smaller in diameter than the same and extending loosely up into the tone arm. Normally, the member 220 is held up, as best shown in Fig. 5, by means of a long finger 222 hinged at one end, as at 223 to a part of the frame, and projecting at its other end underneath the arm 221. Between the ends of the finger is mounted a roller 224 that rests on the periphery of a cam 225, on the cam shaft; this cam being circular except for a short peripheral notch 226. When the roller 224 rests on the main portion of the cam, the finger holds the member 220 in a position sufficiently elevated to keep the needle on the tone arm well above the plane of the playing table. When the cam has rotated far enough from the starting position illustrated in Fig. 35 and also in Fig. 52, to bring the notch 226 under the roller 224, the roller drops into the notch and permits the support for the tone arm to drop and the tone arm to swing down low enough properly to cooperate with a record on the table. It will be seen that the cam shaft must make half of a revolution after the starting of a cycle of operations, before the tone arm is lowered.

On the tone arm shaft, at some distance below the slidable support for the tone arm, are two radially projecting arms 227 and 228. The arm 227 is loose on the shaft and the arm 228 is fixed thereto. These two arms extend inwardly from the tone arm shaft toward the frame of a machine. At the inner end of the arm 227 is a pin 229 extending vertically through the same. A spring 230 is connected between the lower end of the pin and a part of the frame of a machine, so as to tend constantly to swing the tone arm into a playing position when the arm 229 is locked to the tone arm shaft. The upper end of the pin 229 extends up behind the arm 228, meaning by this that when the tone arm is swinging into a playing position the pin is at the trailing edge of the arm 228. The arms 227 and 228 may be locked together by means of a latch 231 which extends along the trailing edge of the arm 228 and is secured to this arm by a horizontal screw or headed pin 232, which permits the latch to swing in a vertical plane. The parts are so proportioned that at times when the pin 229 contacts the trailing edge of the arm 228, the latch may be swung down behind the pin and thus prevent relative turning movements between the two arms.

The arm 227 is provided with a rearwardly projecting bracket or ear 234 through which extends a set screw 235. This set screw is intended to engage with a stationary part of the machine, such as the frame and arrest the swinging movement of the tone arm away from its idle position.

In other words, assuming that the arms 227 and 228 are latched together, and that the tone arm is swung from its idle position toward a playing position, such movement will cease whenever the set screw 235 strikes the member which acts as a stop therefor. By properly adjusting the set screw, the preliminary inward swinging of the tone arm may be caused to bring the needle accurately over the point in the record at which the playing is to begin.

The outer end of the latch 231 lies directly below a finger 236 fastened to and extending down from the bar 220; the parts being so proportioned that when the tone arm is allowed to drop, the finger 236 engages with the top of the outer end of the latch, forcing it down, as illustrated in Fig. 45, and raising the inner end high enough to clear the pin 229. By this means the tone arm shaft is left free to follow the groove in the record from the periphery toward the center.

The spring 230, of course, swings the tone arm from its idle position to the point where playing is to start, being normally constrained by a cam 237. This cam is engaged by a roller 238 rotatably secured within a jaw in what may be termed the front edge of the arm 228, with its axis of rotation radial with respect to the tone arm shaft. The cam 237 is simply a disc provided with a comparatively wide, deep notch 239 which, with all of the parts of the machine in their idle positions, lies about half a revolution of the cam from the point to which the roller 238 is permitted to drop into the same. Therefore, the tone arm being at this time in the idle position, as illustrated in Fig. 1, the cam shaft must make a little less than half a revolution before the tone arm can swing into playing position. It will be seen that the roller 238 drops into the notch 239 before the roller 224 enters the notch 226; thereby insuring that the needle is brought above a record on the table before being lowered; thereby preventing scratching of the record which would occur if the needle were lowered too soon. The roller 238 does not drop into bottom of the notch 239, the actual stopping of the swinging movement of the tone arm being accomplished by the set screw 235. Thus there remains room in the notch to permit further swinging of the tone arm while a record is being played in the usual way.

During the time that a record is being played, it is desirable that all of the moving parts not required for the actual playing operation be at rest. I have therefore provided means for disconnecting the cam shaft from the motor upon the lowering of the tone arm into actual working relation to a record. The means for accomplishing this are best shown in Figs. 36 and 40 to 43. It will be seen that the last gear wheel of the speed reducing drive between the motor and the cam shaft has secured to one side thereof a wheel 240 provided in the periphery with equally spaced notches 241. Fixed to the cam shaft, beside the wheel 240, is a sturdy radial arm 242 carrying at its outer end a sturdy cross bar 243 pivoted to the arm between its ends, as indicated at 244. One end of the bar overlies the periphery of the wheel 240 and, when it drops into one of the notches, it locks the toothed wheel and the cam shaft together. In other words, the wheel 240, together with the arm 242 and its swinging cross piece, constitute a simple clutch. The arm member of the clutch is provided with a spring 245 engaged with the under edge of the outer half

of the cross bar, and thus constantly serving to hold the cross bar in its working position. On the outer end of the cross bar is a roller 246. As the cam shaft revolves, this roller travels in a vertical plane in which is located a roller-engaging element. In the arrangement shown, this roller-engaging element is a flat plate 247 somewhat pointed at the other end and fastened at its upper end to a small oscillatory shaft 248 mounted above and at right angles to the cam shaft. The shaft 248 has an arm 249 projecting laterally therefrom toward the tone arm shaft. A light spring 250, connected at one end to the needle of the arm 249 and at its upper end to a stationary bracket 251 tends constantly to swing the arm upwardly. The arm is provided with a set screw 252 for engagement with the under side of the bracket 251 and thereby limiting the upward movement of the arm and causing the stop plate 247 normally to remain in the path of travel of the roller 246.

The parts are so proportioned that when the tone arm is lowered upon the record, the cam roller 246 engages with the sloping under edge of the stop plate 247, and is forced down thereby until the bar member 243 of the clutch is lifted clear of the wheel 240, as shown in Fig. 43. From this time until the clutch is again thrown in, the cam shaft and all of the mechanisms operated thereby, with the exception of the tone arm itself, remain stationary and soundless. After the playing of a record has been completed, however, the clutch must again be thrown in, so that all of the mechanisms may be restored to their normal starting positions.

The throwing in of this clutch is accomplished by the tone arm itself. For this purpose I have provided the tone arm shaft with a radial arm 254 long enough to extend at its free end over the free end of the arm 249. On the free end of the member 254 is a pawl 255 which simply hangs loosely and is therefore reversible by simply throwing it past center from one position to the other. The arm 249 is in the form of a plate, a marginal portion across the free end of which is bent upwardly and is provided with ratchet teeth 256. Extending transversely across the arm 249, just inwardly from the upturned marginal portion, is a little bar 257 that extends well beyond one side of the arm and is there turned upwardly, as best shown in Fig. 40. In the arrangement shown, the pawl 255 consists of a body member and two arms spaced apart from each other; the ear portions being the part of the pawl that is engaged with the arm 254. On the arm, between the ear portions of the pawl, is a roller 258. The parts are so proportioned that as the tone arm swings across a record, the pawl drags over the ratchet teeth on the arm 249, thereby preventing the tone arm from being moved backward until the end of the recording has been played. Thereupon, the roller 258 rides upwardly on the inclined end of the bar 257. Because the arm 254 is rigid, and the arm 249 is simply held up by the light spring 250, the arm 249 yields under the pressure of the roller so as to cause the shaft 248 to oscillate far enough to swing the stop plate 247 out of the normal plane in which it lies, as shown in Fig. 43, into the slightly inclined position illustrated in Fig. 42. In this latter position its lower end lies on one side of the roller 246 on the bar member of the clutch, so that this bar member is no longer constrained against shifting into its working position and immediately does so.

As soon as the clutch is thrown in, the cam shaft begins to turn and all of the operations previously described are reenacted, but in reverse order. The first operation in the second half of the cycle consists, of course, in lifting the tone arm off the record,—whereas the preliminary swinging of the tone arm, after the initial starting of the machine, occurs before the lowering of the tone arm—so that it is necessary to raise the tone arm before it starts to swing. The two cams 225 and 237 that control these movements are so proportioned that after the cam shaft clutch has been thrown in, following the playing of a record, the cam 225 lifts the tone arm and then the cam 237 swings the tone arm back into its original idle position. As the tone arm swings back, the latch 231, which has been allowed to drop down, is lifted up by the bevelled upper edge 259 of the pin 229 and, after passing the pin, drops down again so that the arms 228 and 227 are again coupled together and must travel in unison with each other until the latch is again tripped at the proper point in the next cycle.

It should be noted that as the shaft for the tone arm begins to turn backward from the position corresponding to that of the pawl in Figs. 40 and 42, the pawl simply reverses itself and rides over the tops of the ratchet teeth on the clutch controlling arm 249; the pawl no longer having the capacity to check this backward movement.

The machine does not necessarily stop entirely with the playing of a record, but will continue to run as long as there remain selected records that have not yet been played.

The arrangement which I have illustrated is one which requires, in the event that selecting knobs are numbered consecutively, that the upper faces of the twelve records be given the odd numbers from one to twenty-three, beginning at the top of the stack, and that the under faces of the records be given the even numbers, beginning with number two for the lowermost record in the stack and ending with number twenty-four for the underside of the topmost record.

As heretofore stated, any desired number of the controlling finger pieces or knobs may be set into playing positions before a coin is inserted. Thereupon, after the insertion of sufficient coins, the machine will start and will play the records one after another, regardless of whether the recordings are on the upper sides of the records, in the normal position of the magazine, or whether some or all of them are on the under sides, and will stop after all of the records have been played. Should a coin be inserted without manipulating any of the finger pieces and, thus, without setting any of the stops, one record will be played and the phonograph will then stop. If enough coins are inserted to play all of the twenty-four selections, without the setting of any of the stops, all of the recordings will be played, one after the other, before the machine stops. This is for the reason that the maximum turning movements of the selector shafts, during each stroke of their actuator, is through twenty-three of their twenty-four positions, because the segment 136 can swing through an angular distance corresponding to only twenty-three of its teeth, whereas the pinion on the vertical selector shaft has twenty-four teeth. Consequently, if the machine is started and permitted to run, without first setting any stops, the selector shafts will each be left one position ahead of its previous

position, during each cycle of operations, and therefore a different recording will be played during each of a series of twenty-four cycles.

While I have illustrated and described with particularity only a single preferred form of my invention, I do not desire to be limited to the exact structural details thus illustrated and described; but intend to cover all forms and arrangements which come within the definitions of my invention constituting the appended claims. I claim:

1. In a phonograph, a magazine for records open at the front and containing shelves each adapted to support a single record, a vertical shaft beside the magazine, a gripper unit slidable up and down on the shaft and having gripper arms movable from and toward each other adapted partially to embrace a record in the magazine when brought into the plane thereof, means to close the arms on a record to grip the same and to spread the arms, to release the same, means to move said unit up and down, and means to swing said shaft back and forth.

2. In a phonograph, a magazine for supporting records one above another and independently of each other, record-grasping means movable up and down, a rotatable selector device comprising a vertical shaft near the magazine and having thereon a series of projections cooperating with said means to determine the height to which the latter may rise in any given cycle, a second rotatable selector device having thereon projections corresponding in number to the number of separate recordings that may be played from a full magazine, a driving connection between said selector devices, a series of movable stop pieces each movable from an idle position to a working position in the path of a projection on the second selector device, and finger pieces for shifting said stops individually into their working positions.

3. In a phonograph, a magazine for supporting records one above another and independently of each other, record-grasping means movable up and down, a rotatable selector device comprising a vertical shaft near the magazine and having thereon a series of projections cooperating with said means to determine the height to which the latter may rise in any given cycle, a second rotatable selector device having thereon projections corresponding in number to the number of separate recordings that may be played from a full magazine, a driving connection between said selector devices, a series of movable stop pieces each movable from an idle position to a working position in the path of a projection on the second selector device, finger pieces for shifting said stops individually into their working positions, and means simultaneously to shift all of the stops that are in their working positions into their idle positions.

4. In a phonograph, a rotatable selector shaft having projecting pins distributed along and around the same, a series of stop devices mounted adjacent to the shaft to swing around axes at right angles to the shaft between working positions in the paths of the pins and idle positions beside said paths, means including finger pieces to set said stops individually in their working positions, said shaft being movable lengthwise through a short distance, a spring tending constantly to hold said shaft in its normal working position, each stop device having a flange adapted to lie close to the path of the corresponding pin on the side of the pin which is in advance

when the shaft moves lengthwise out of its working position, and means automatically to shift the shaft lengthwise out of its working positions at a predetermined point in each cycle of operations of the phonograph.

5. In an automatic phonograph, a series of parallel short shafts each having a stop member projecting therefrom and each adapted to oscillate between idle and working positions, finger pieces in the form of shaft sections having at their rear or inner ends deep recesses in which the front ends of the stop-carrying shafts are rotatably engaged, the outer ends of the finger pieces constituting heads or knobs for turning them, a pin and slot connection between each finger piece and the corresponding stop-carrying shaft to permit relative angular movements as great as the angular movement required of the latter shaft to shift from its idle position to its working position.

6. A gripper device for grasping and holding a phonograph record comprising a support, a pair of curved arms interlocked at their inner ends and each pivoted to the support a short distance from its inner end, a spring means between the support and both arms yieldingly to hold the arms in gripping positions, and means adapted to act on one of said arms and shift it in a direction to spread the arms apart.

7. In a phonograph, a rotatable selector shaft, a pinion loose on said shaft, a pawl and ratchet device one member of which is on the shaft and the other member of which is on the pinion to cause the pinion to turn the shaft when the pinion is driven in one direction, an oscillatory toothed segment meshing with said pinion, an arm underlying the segment and mounted to swing about the axis of the segment, means to oscillate said arm, pins projecting from said segment and said arm past each other at equal distances from said axis, the pin on the segment trailing the other pin during shaft-turning movements of the arm, and a spring connecting the arm and the segment and normally holding said pins in contact with each other while permitting the arm to move in the shaft-turning direction while the segment remains stationary.

8. In a phonograph, a rotatable selector shaft, a pinion loose on said shaft, a pawl and ratchet device one member of which is on the shaft and the other member of which is on the pinion to cause the pinion to turn the shaft when the pinion is driven in one direction, an oscillatory toothed segment meshing with said pinion, an arm underlying the segment and mounted to swing about the axis of the segment, means to oscillate said arm, pins projecting from said segment and said arm past each other at equal distances from said axis, the pinion on the segment trailing the other pin during shaft-turning movements of the arm, a spring connecting the arm and the segment and normally holding said pins in contact with each other while permitting the arm to move in the shaft-turning direction while the segment remains stationary, a wheel fixed to said shaft and having alternating deep and shallow notches in the periphery, a magazine for records, means to support the magazine for movements from an upright position to a reversed position, means including a clutch to reverse said magazine, and a clutch-releasing device having a part movable from and toward the notched wheel and adapted to enter the notches to register the shaft and to cause the

release of the clutch when a deep notch is entered.

9. In a phonograph, a vertical tone arm shaft, a tone arm mounted on the shaft for swinging movements, a member movable vertically on the shaft to raise and lower the tone arm, two radial arms on the shaft one above the other and one loose on the shaft while the other is fixed to the shaft, a spring tending constantly to swing the loose arm in the direction to carry the tone arm to a playing position, a cam having a high portion acting on the arm fixed to the shaft to hold the latter in its idle position and having a low portion to permit the tone arm to move across a record in the playing of the latter, a latch securing the loose and the fixed arms on the shaft together and positioned in the path of the said vertically movable member so as to disconnect said arms from each other when the tone arm is lowered, and a stop to limit the swinging movement of the loose arm to a point which corresponds to a position of the tone arm at the beginning of a recording on a record.

10. In a phonograph, a magazine for records, means to support the magazine for movements from an upright position to a reversed position, a horizontal selector shaft, a vertical selector shaft beside the magazine, each shaft having pins projecting therefrom and distributed along and around the same, there being twice as many pins on the horizontal shaft as on the other, connections between said shafts to cause them to turn in unison, manually-controlled stops for the pins of the horizontal shaft, means controlled by the pins on the vertical shaft to move the records from and to the magazine, and means controlled by the vertical shaft to cause the magazine to be reversed only in each of one-half of the angular positions in which it may be stopped and which alternates with its remaining positions.

11. In a gripper device for grasping and holding a phonograph record, a vertical shaft, a support mounted on said shaft, a pair of curved arms interlocked at their inner ends and each pivoted to the support a short distance from its inner end, a spring means between the support and both arms yieldingly to hold the arms in gripping positions, a vertical bar beside the shaft, links connecting the upper and lower ends of said bar to the shaft and inclined downwardly from the shaft to the bar, means adapted to be moved against one of said arms by said bar when the bar is raised and shift it in a direction to spread the arms apart, and means alternately to move said bar upwardly and permit it to drop down.

12. In a phonograph, a rotatable selector shaft, a pinion loose on said shaft, a pawl and ratchet device one member of which is on the shaft and the other member of which is on the pinion to cause the pinion to turn the shaft when the pinion is driven in one direction, an oscillatory toothed segment meshing with said pinion, a wheel fixed to said shaft and having alternating deep and shallow notches in the periphery, a magazine for records, means to support the magazine for movements from an upright position to a reversed position, means including a clutch to reverse said magazine, a clutch-releasing and shaft-registering device having a part movable from and toward the notched wheel and adapted to enter the notches to register the shaft and to cause the release of the clutch when a deep notch is entered, an actuator for the segment, and means associated with said actuator to shift said clutch-releasing and shaft-registering device into an idle position as the actuator approaches

one end of the stroke and into a working position when the actuator nears the other end of its stroke.

13. In a phonograph, a vertical magazine for records comprising a series of shelves one above the other and supported at their rear ends, a vertical shaft beside the magazine, a member slidable vertically on and rotatable about said shaft, gripper arms movably mounted on said member and shaped partially to embrace a record resting on any one of the shelves and serve as the support therefor, and means for moving said member vertically and also angularly, and means for closing and opening said arms alternately to grip and release a record.

14. In a phonograph, means for supporting records one above another and independently of each other, record-grasping means movable up and down beside the means for supporting the records, a vertical rotatable selector device adjacent to said record-grasping means, and having thereon a series of projections distributed lengthwise and around the same, an element on said record-grasping means in position to be engaged by any one of said projections and be arrested thereby during the upward movement of said element while that projection is positioned in a predetermined plane extending radially from the axis of said selector device, means to shift said selector device angularly to bring said projections, one at a time, into said plane, means for raising and lowering said record-grasping device and causing it alternately to grasp and release a record.

15. In a phonograph, a magazine for supporting records one above another and independently of each other, record-grasping means movable up and down beside said magazine, a vertical rotatable selector device beside said record-grasping means and having distributed along and about the same a series of step-forming projections, means to shift said selector device to bring any one of said projections into a given vertical plane, an element on said record-grasping means for engaging the projection which lies in said plane during an upward movement of the record-grasping means, an actuator for moving said record-grasping means into position to engage the topmost record in the magazine, and a yielding connection between said actuator and said record-grasping means to enable the actuating device to allow the upward movement of the record-grasping means to cease when said element engages with any one of said projections.

16. In a phonograph, a rotatable shaft having thereon a series of pins distributed along and around the same, a corresponding series of short shafts transverse to the aforesaid shaft, each short shaft being rockable between a working position and an idle position and having thereon an element lying in the path of the corresponding pin when in its working position, a rotatable finger piece associated with each of said short shafts a connection between each finger piece and the corresponding shaft including a pin and a circumferential slot whose angular length approximates the angle of movement of the short shaft, and means to limit the turning movements of each finger piece to an angle corresponding to that of the shaft with which it is associated.

17. In a phonograph, a series of elements movable between idle and working positions and each serving to select a record to be played, a corresponding series of finger pieces, mechanical

connections between said elements and the finger pieces to enable the latter to shift said elements individually only from their idle positions to their working positions, a member for shifting all of said elements together into their idle positions, a finger piece for actuating said member, a catch for holding said member against element-shifting movement, and means for automatically releasing the catch during a predetermined portion of each cycle of operations.

18. In a phonograph, a series of elements movable between idle and working positions and each serving to select a record to be played, a corresponding series of finger pieces, mechanical connections between said elements and the finger pieces to enable the latter to shift said elements individually only from their idle positions to their working positions, a member for shifting all of said elements together into their idle positions, a finger piece for actuating said member, a catch for holding said member against element-shifting movement, a shaft rotatable during the operation of the phonograph, and a cam on said shaft for releasing the catch during the record-playing portion of each cycle.

19. A gripper device for grasping and holding a phonograph record comprising a support, a long curved arm pivoted to said support near one end, a short arm pivoted to said support at some distance from said end of the long arm and extending in the opposite direction from the latter arm, the adjacent ends of said arms being interlocked to cause them to move in unison from or toward each other when either is moved, and a spring yieldingly holding said arms in record-gripping positions.

20. A gripper device for grasping and holding a phonograph record comprising a support, a long curved arm pivoted to said support near one end, a short arm pivoted to said support at some distance from said end of the long arm and extending in the opposite direction from the latter arm, the adjacent ends of said arms being interlocked to cause them to move in unison from or toward each other when either is moved, a spring yieldingly holding said arms in record-gripping positions, said short arm having a part extending outwardly therefrom in the vicinity of its pivotal axis, and a roller on said part for engagement with an actuator.

21. A gripper device for grasping and holding a phonograph record comprising a shaft, a member slidable upon and rockable about the shaft, a stub shaft projecting from said member radially of the other shaft, a support on the outer end of said stub shaft, record-gripping means on said support formed of relatively-movable members which may be closed and opened to grip and release a record, an arm on said means extending past and lengthwise of the stub shaft and having on its free end a roller, and a cam device slidable on said stub shaft for engagement with said roller to move said arm.

22. In a phonograph, a vertical tone arm shaft, a tone arm mounted on the shaft for swinging movements, two radial arms one of which is fixed on the shaft while the other is loose, means acting on the fixed arm to hold the tone arm against moving across a record, a latch securing the loose and the fixed arms on the shaft together, a spring acting on the loose arm in a direction to carry the tone arm to a playing position, and vertically-movable means on the shaft to raise and lower the tone arm and to trip the latch when the arm is lowered.

23. In a phonograph, a vertical tone arm shaft, a tone arm mounted on the shaft for swinging movements in unison with the shaft and for vertical swinging movements relatively to the shaft, a spring, a latch for connecting the spring to the shaft and causing the spring to act in the direction to carry the tone arm to a playing position, a cam which in one position prevents the shaft from being turned by the spring and in another position permits the spring to become effective, and a member movable up and down on said shaft to raise and lower the tone arm and to trip said latch when lowered.

24. In a phonograph, a vertical tone arm shaft, a tone arm mounted on the shaft for swinging

movements in unison with the shaft and for vertical swinging movements relatively to the shaft, a spring, a latch for connecting the spring to the shaft and causing the spring to act in the direction to carry the tone arm to a playing position, a cam which in one position prevents the shaft from being turned by the spring and in another position permits the spring to become effective, a member movable up and down on said shaft to raise and lower the tone arm and to trip said latch when lowered, and a stop preventing the spring from swinging the tone arm past a position that corresponds to the beginning of a recording on a record.

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