June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 1

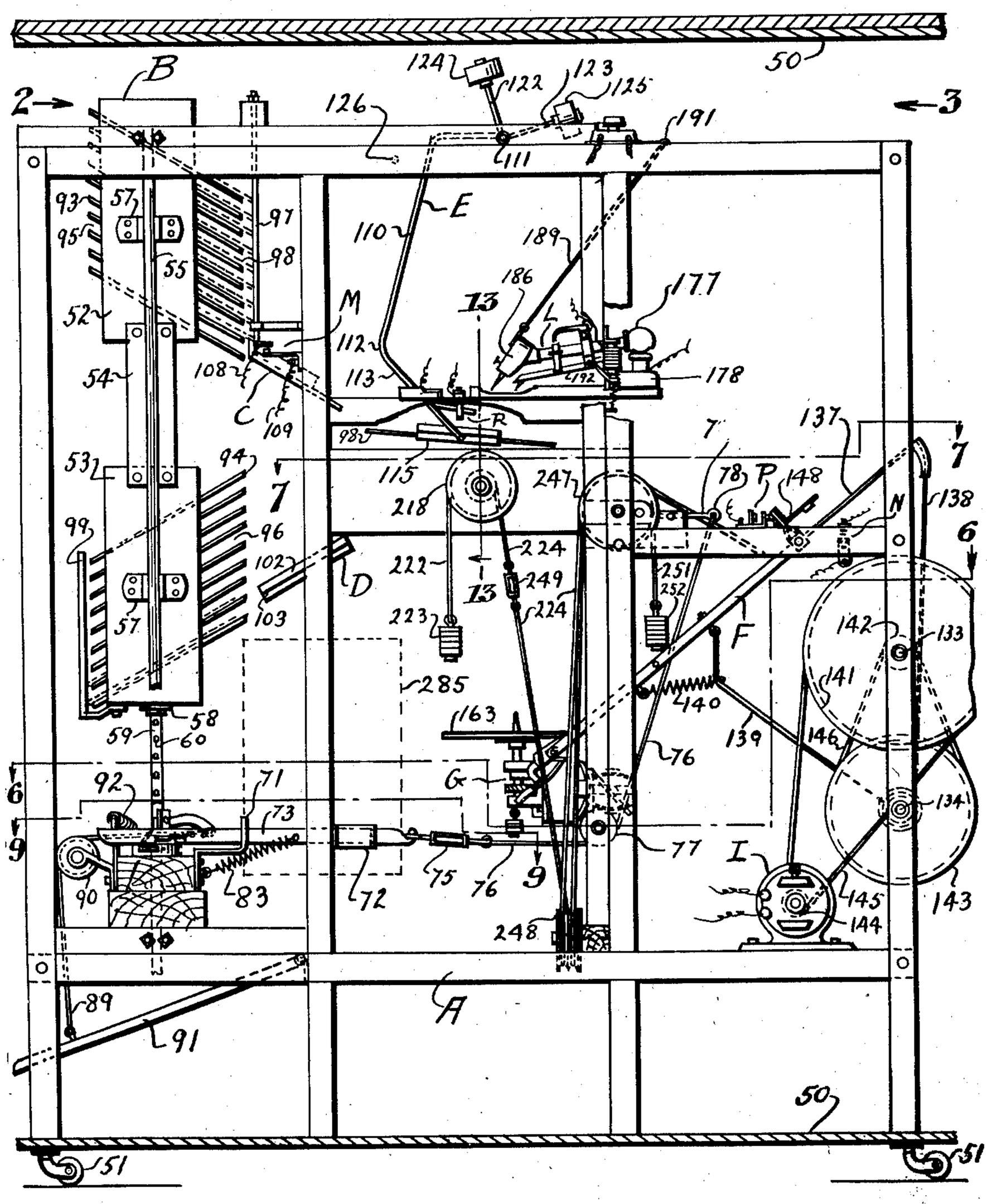

Fig. 1.

INVENTOR.
ALFRED W. INGALL.
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APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 2

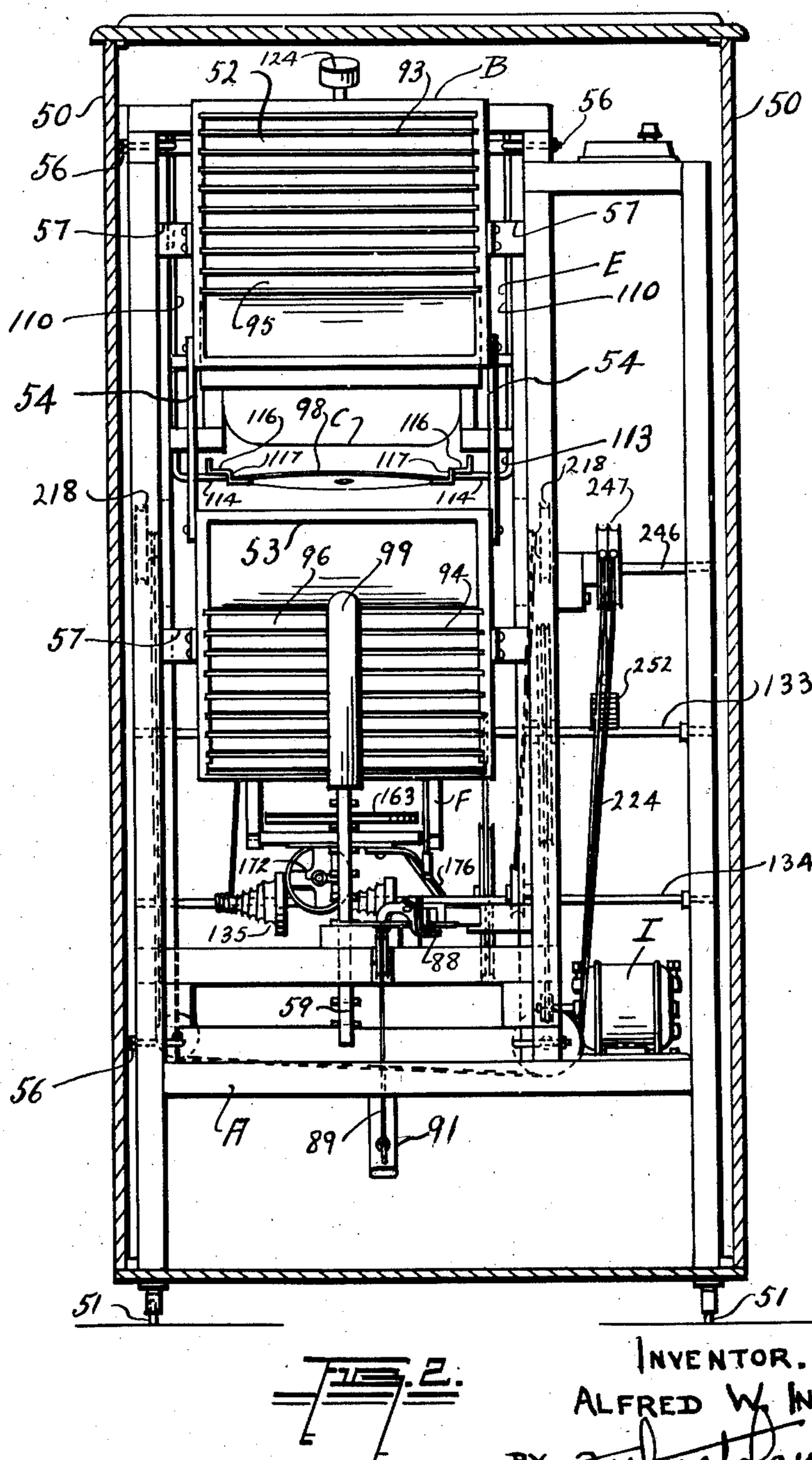

FIG. 2.

INVENTOR.
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APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 3

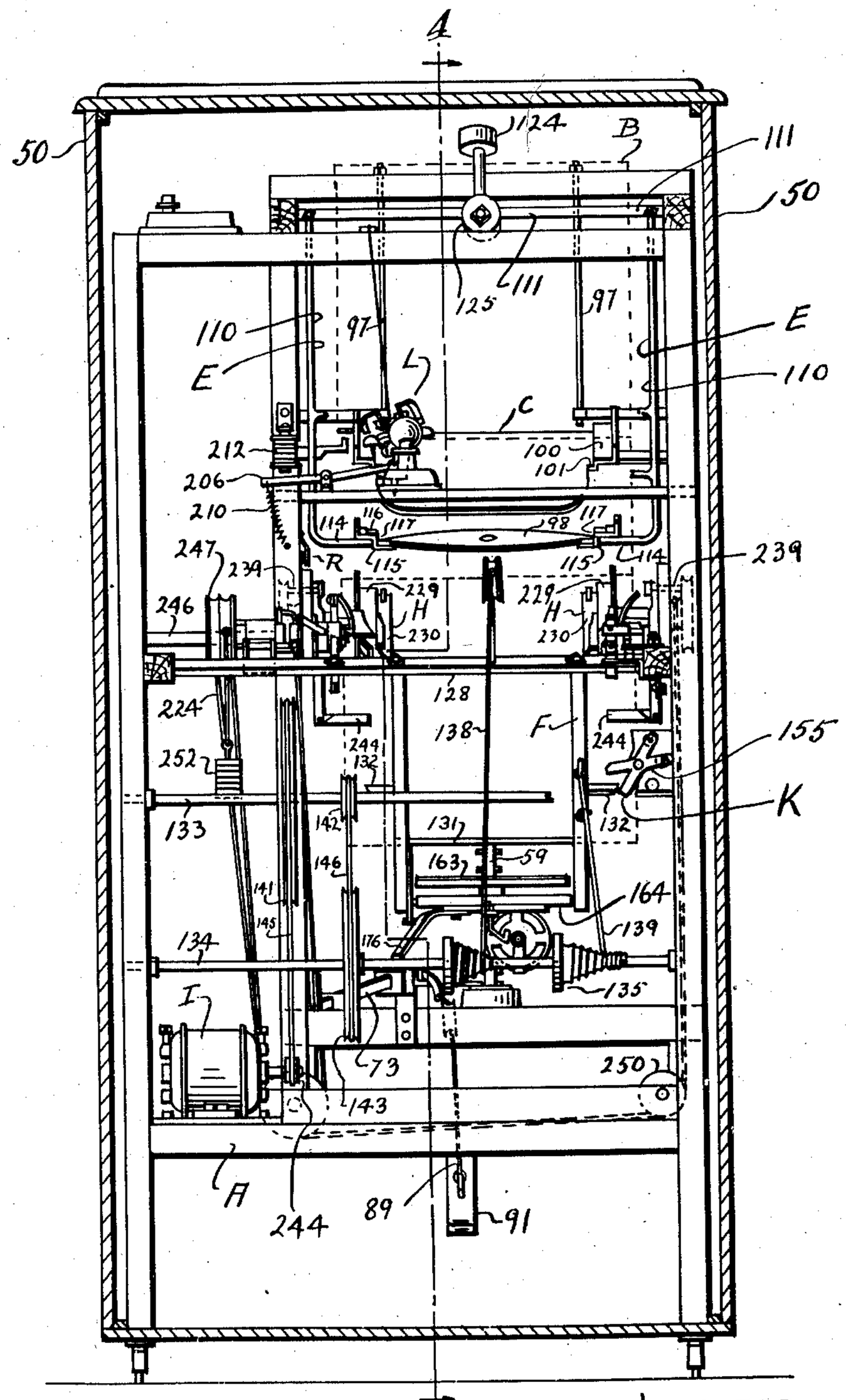

Fig. 3.

INVENTOR.
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 4

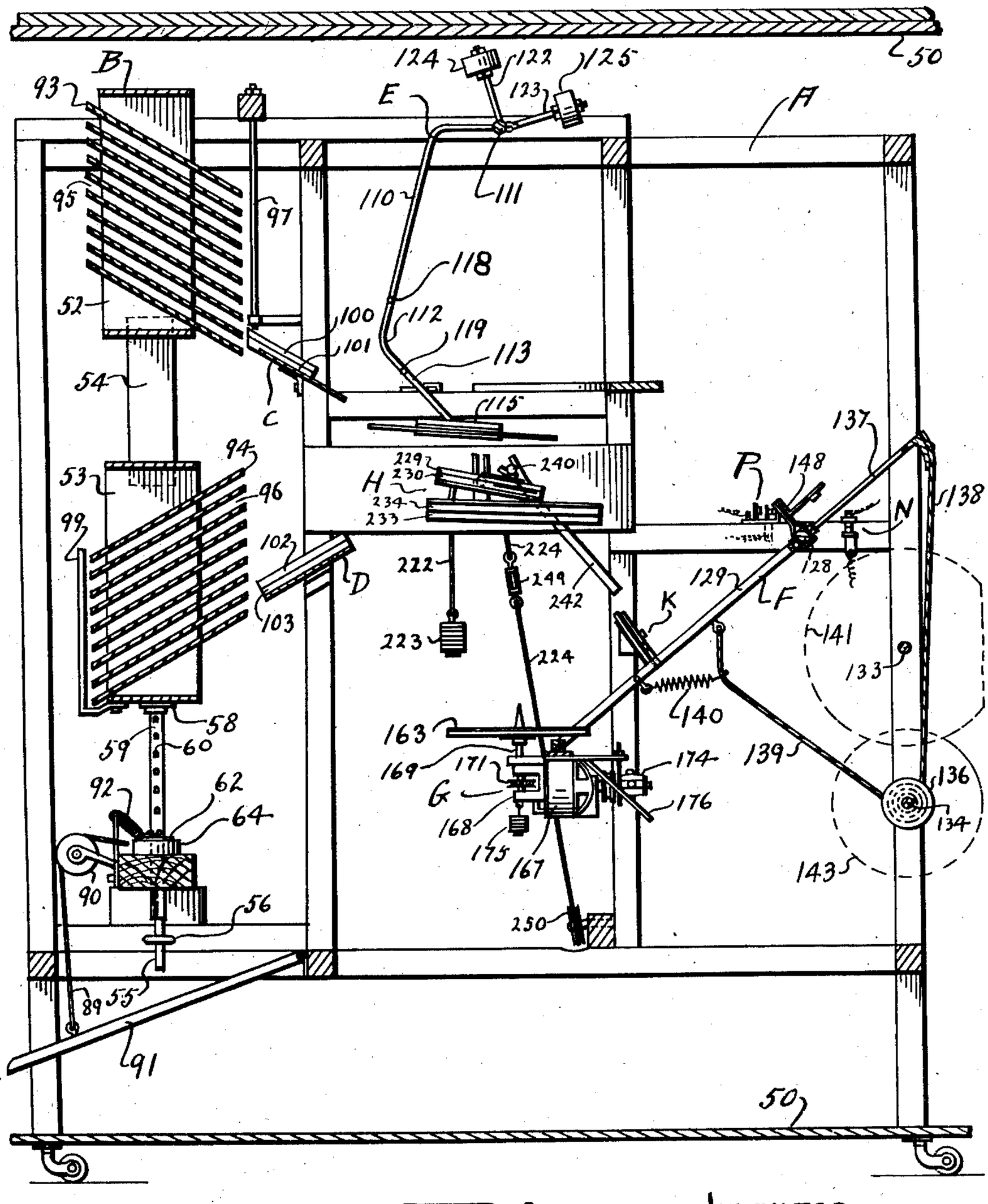

FIG. 4.

INVENTOR.
ALFRED W. INGALL
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 5

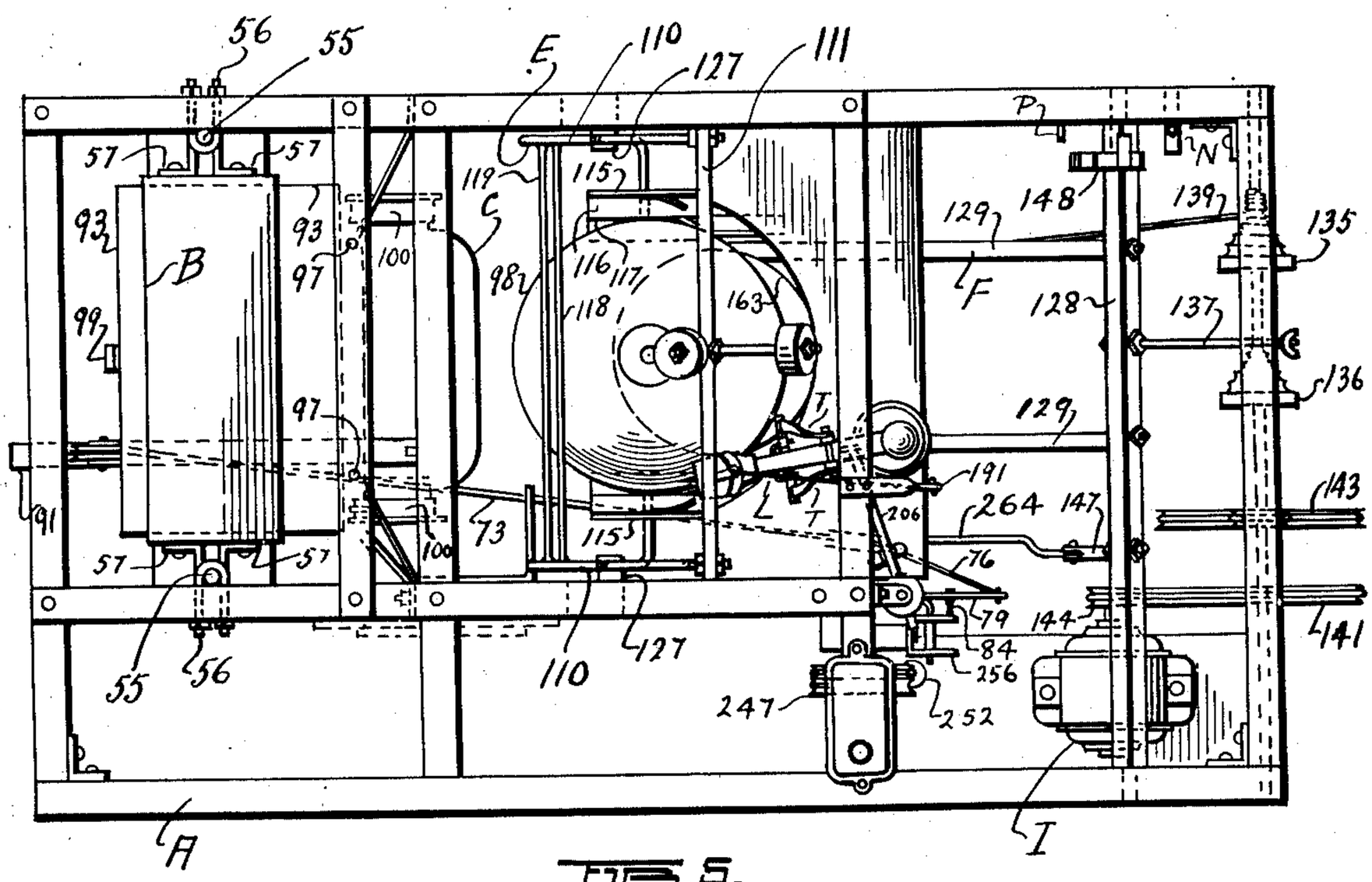

FIG. 5.

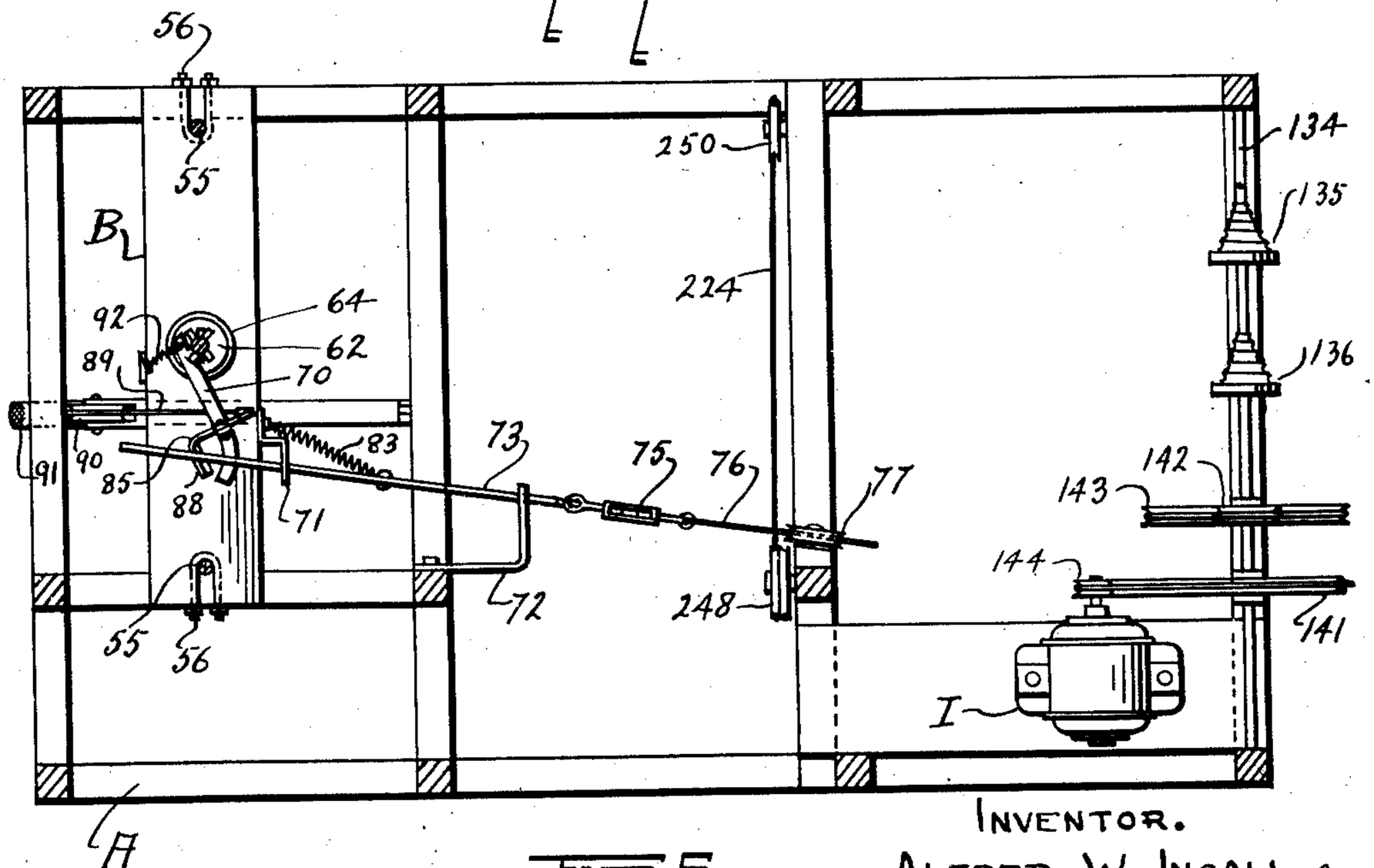

FIG. 6.

INVENTOR.
ALFRED W. INGALL.
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 6

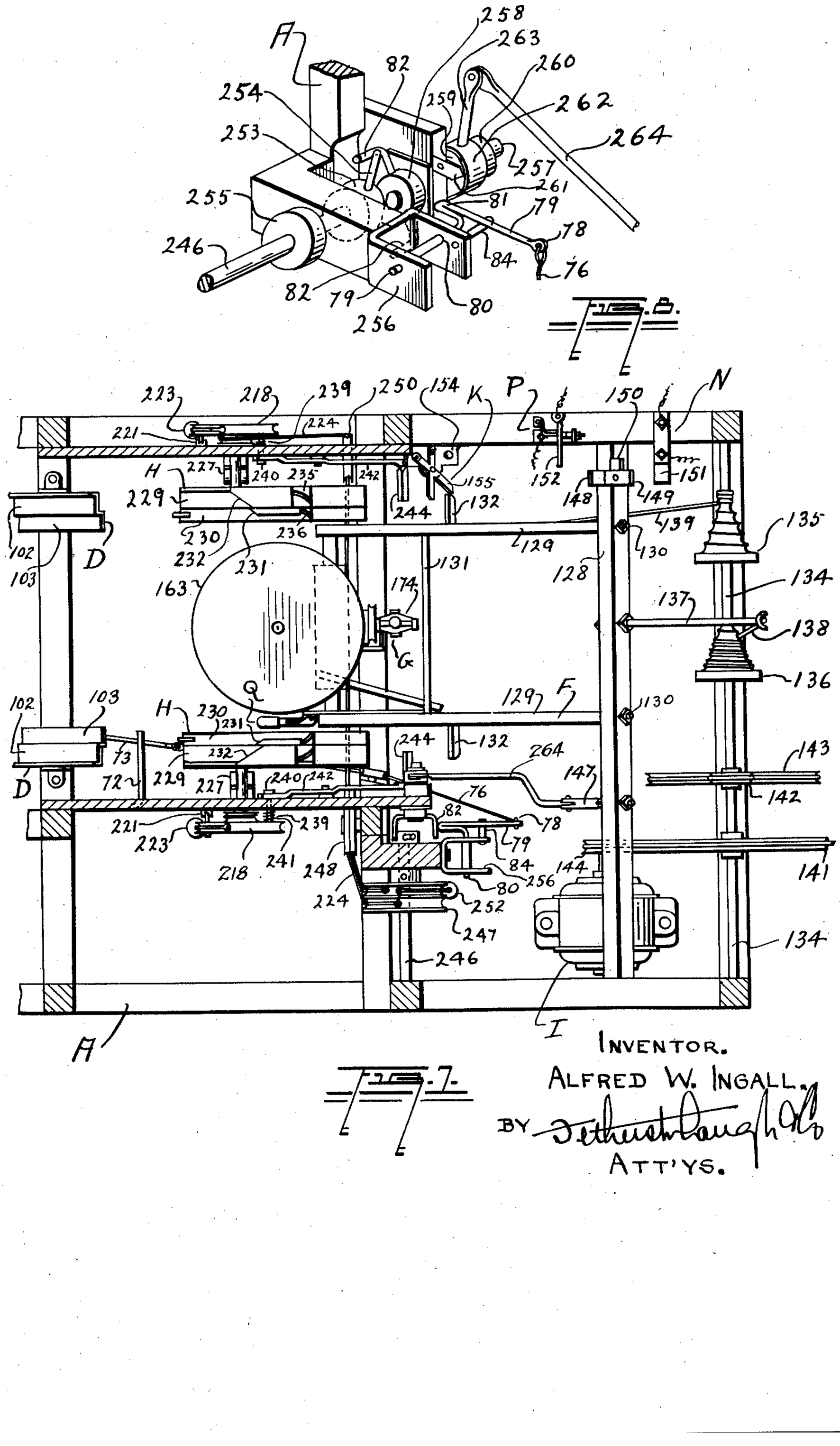

FIG. 7.

INVENTOR.
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 7

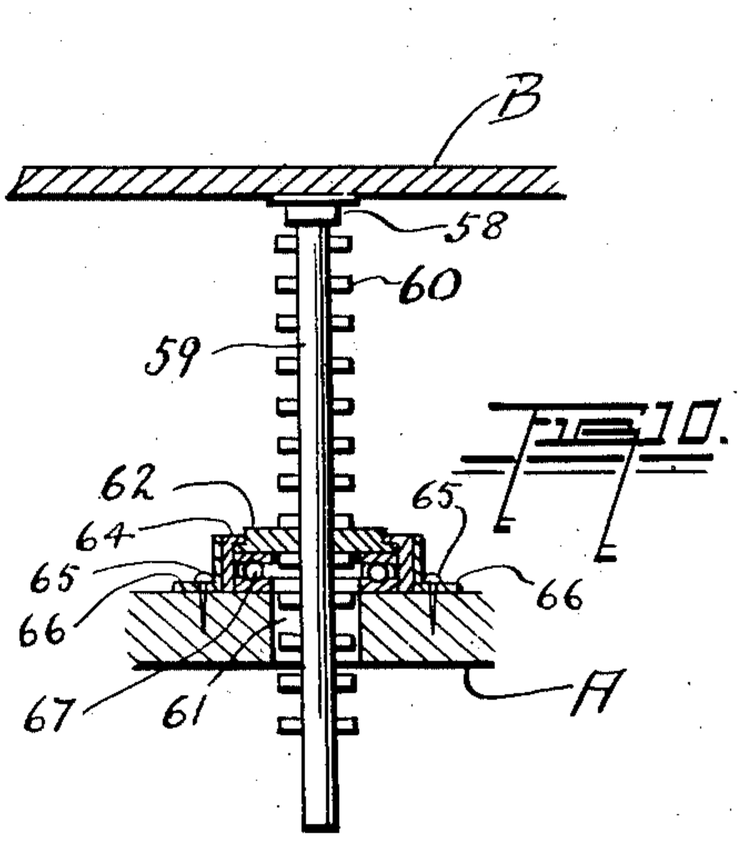

FIG. 10.

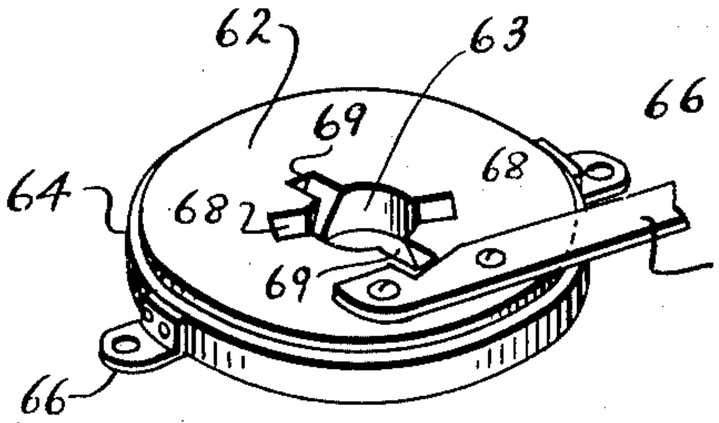

FIG. 11.

FIG. 12.

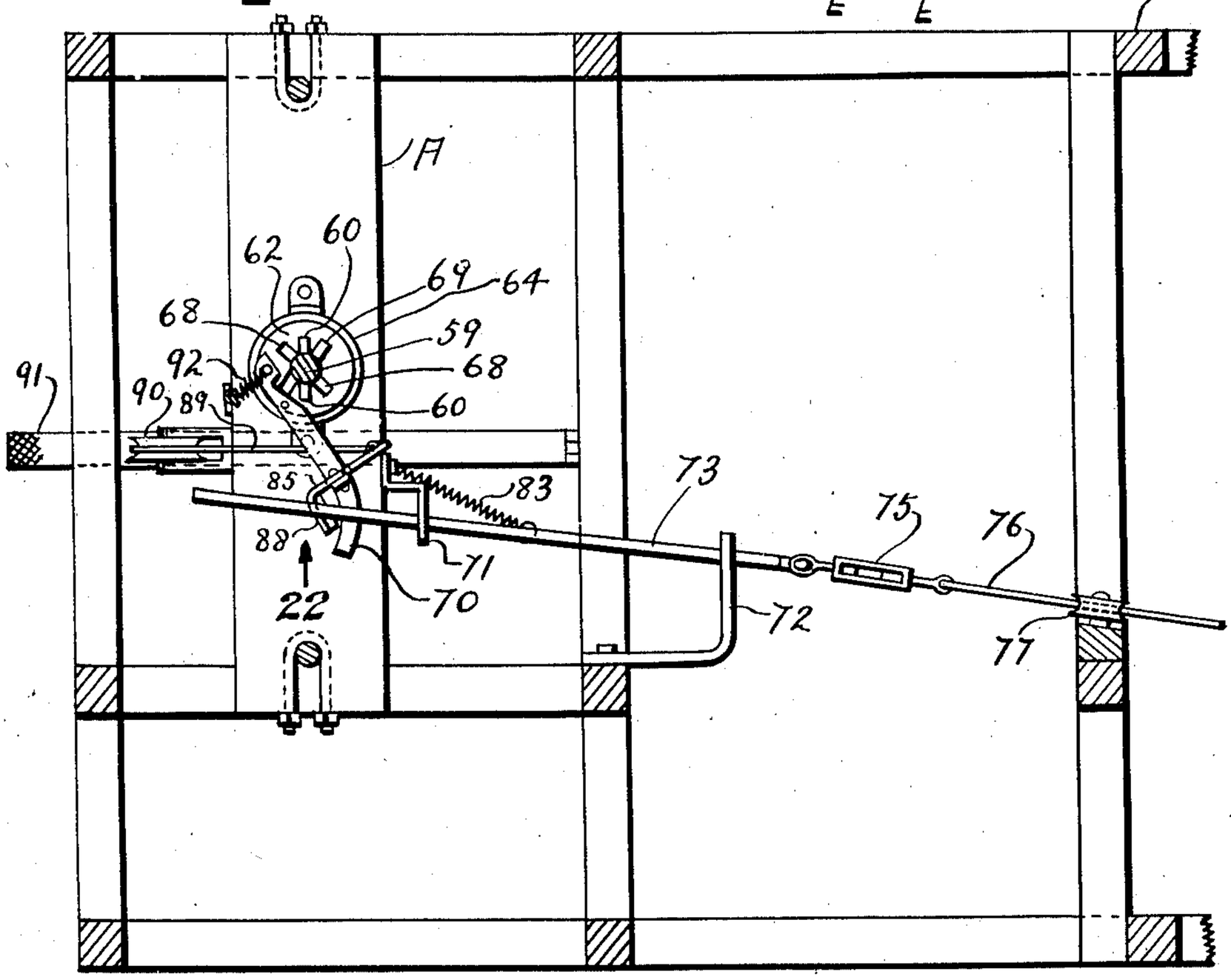

FIG. 9.

INVENTOR.
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 8

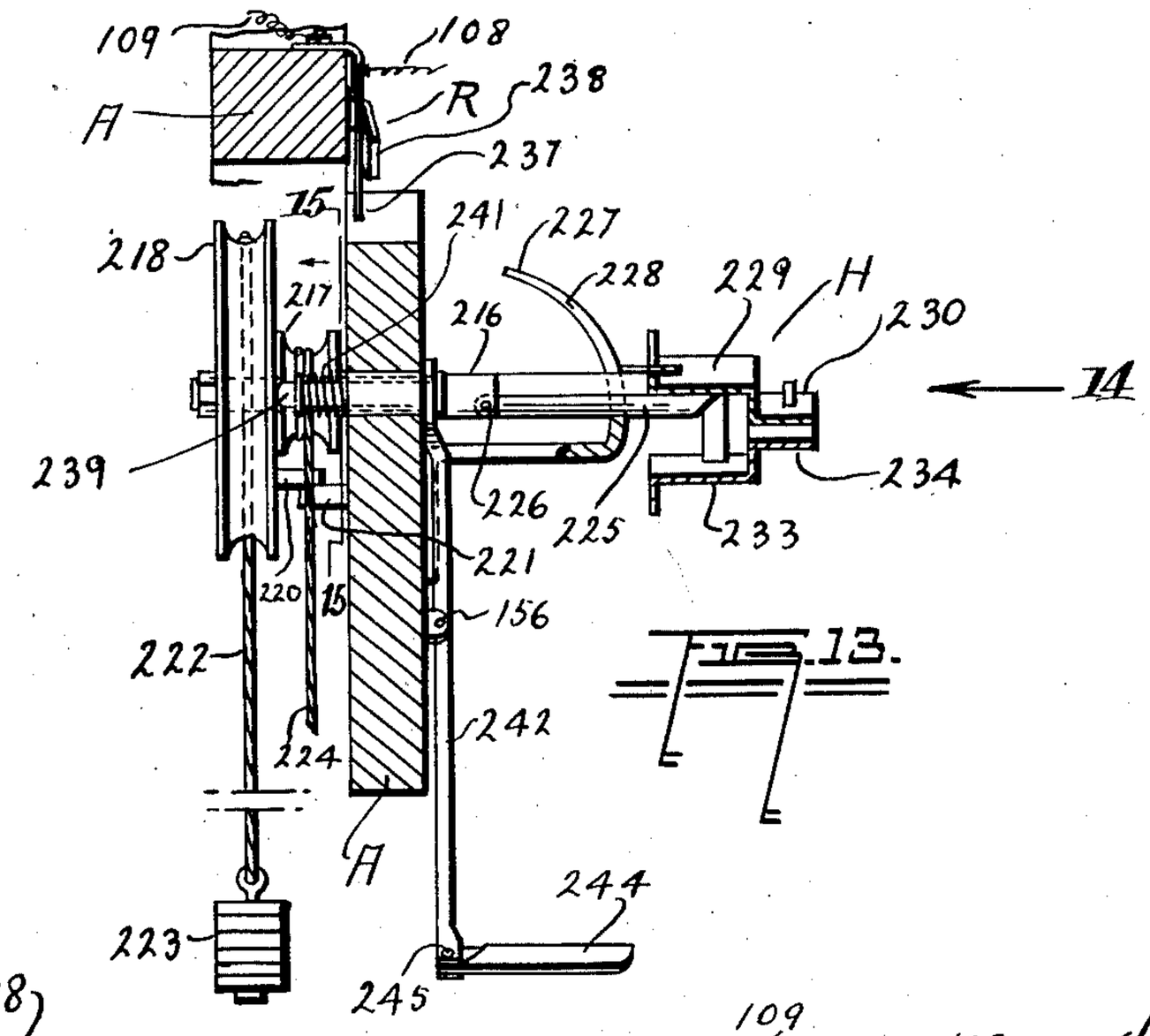

FIG. 13.

FIG. 15.

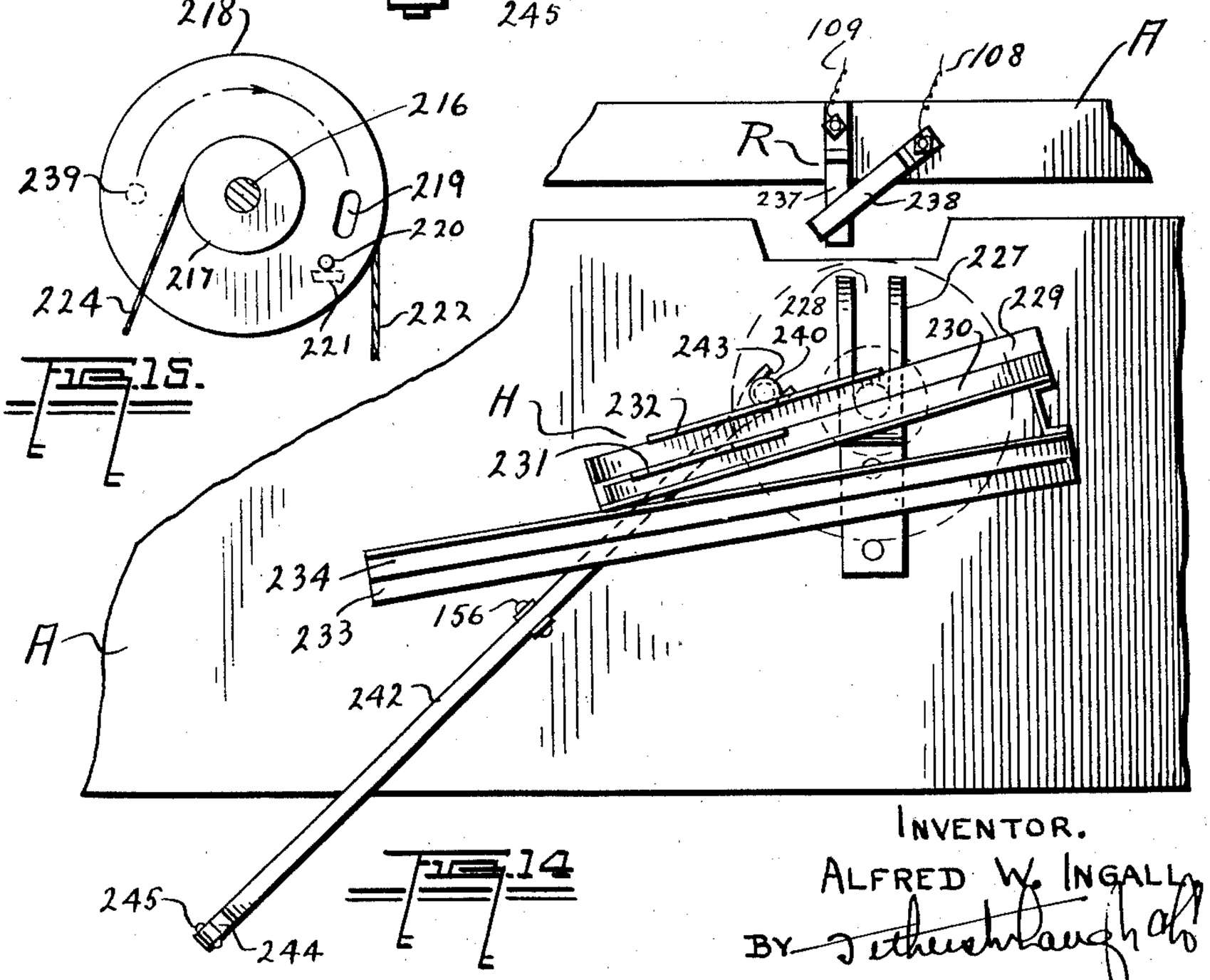

FIG. 14

INVENTOR.
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 9

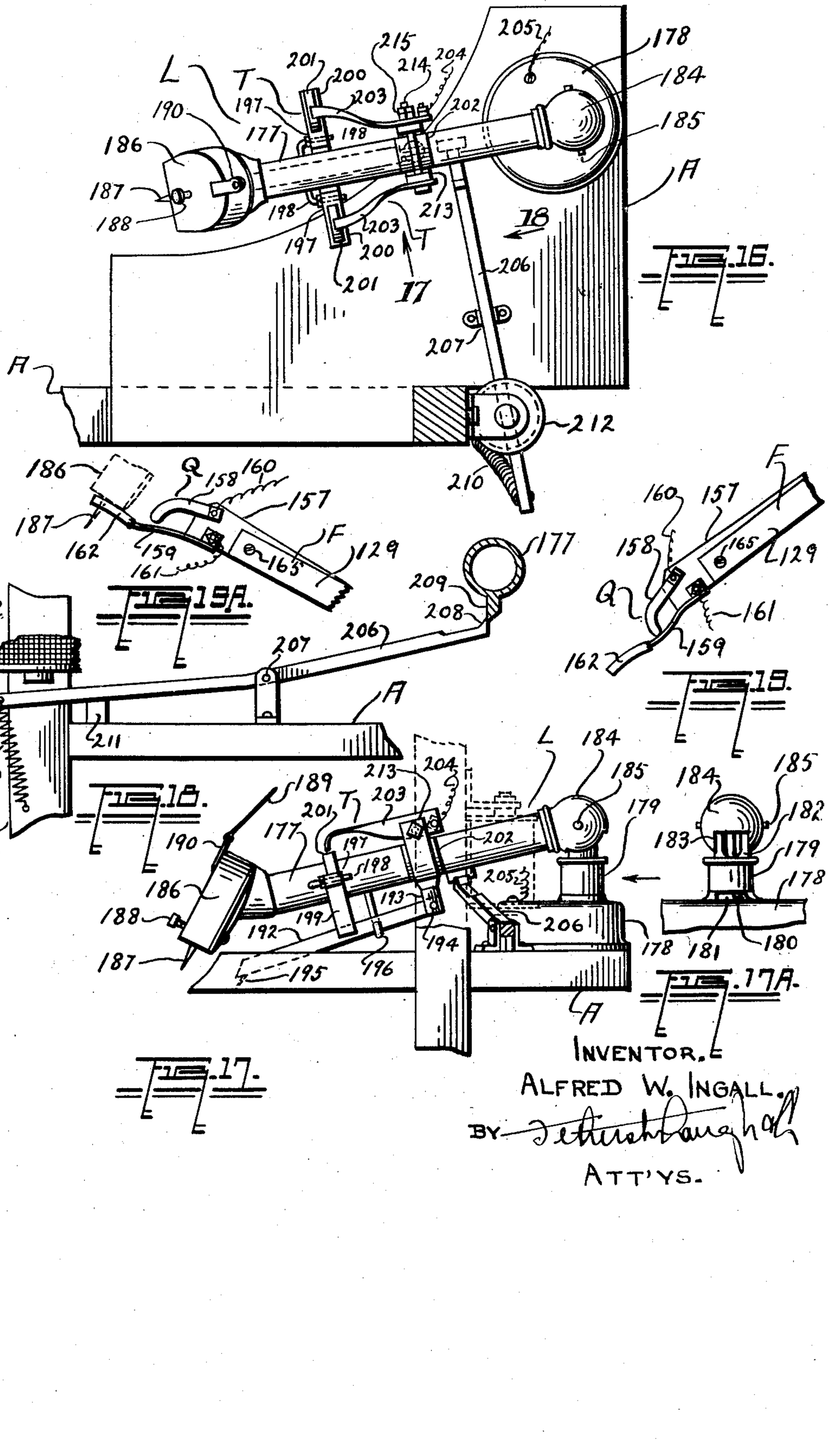

FIG. 16.

FIG. 19A.

FIG. 19.

FIG. 18.

FIG. 17A.

FIG. 17.

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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 10

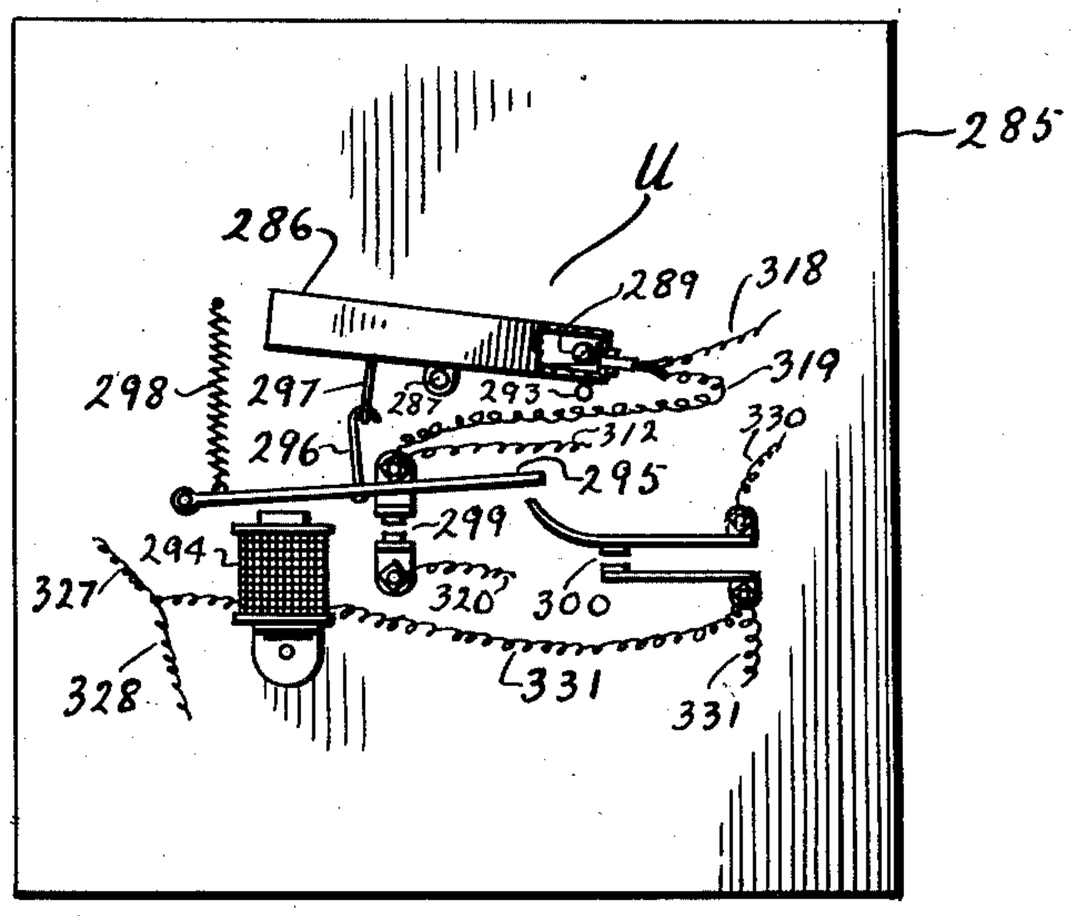

FIG. 20.

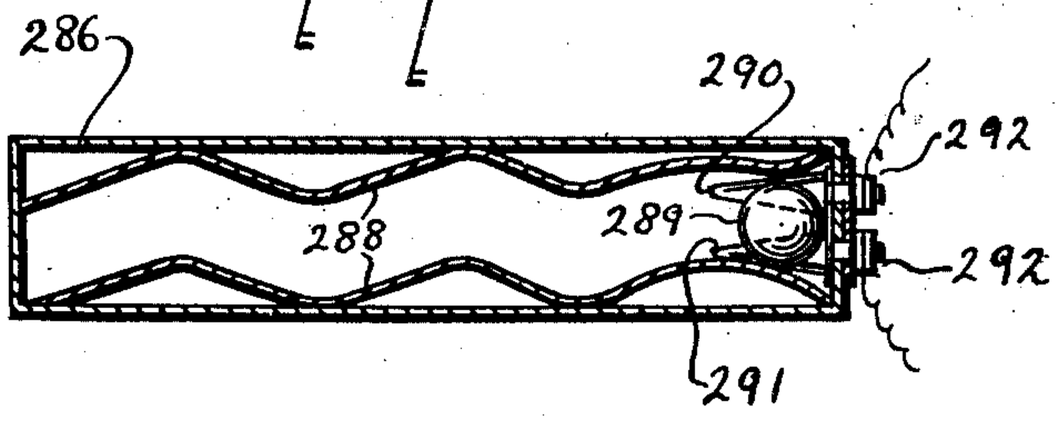

FIG. 21.

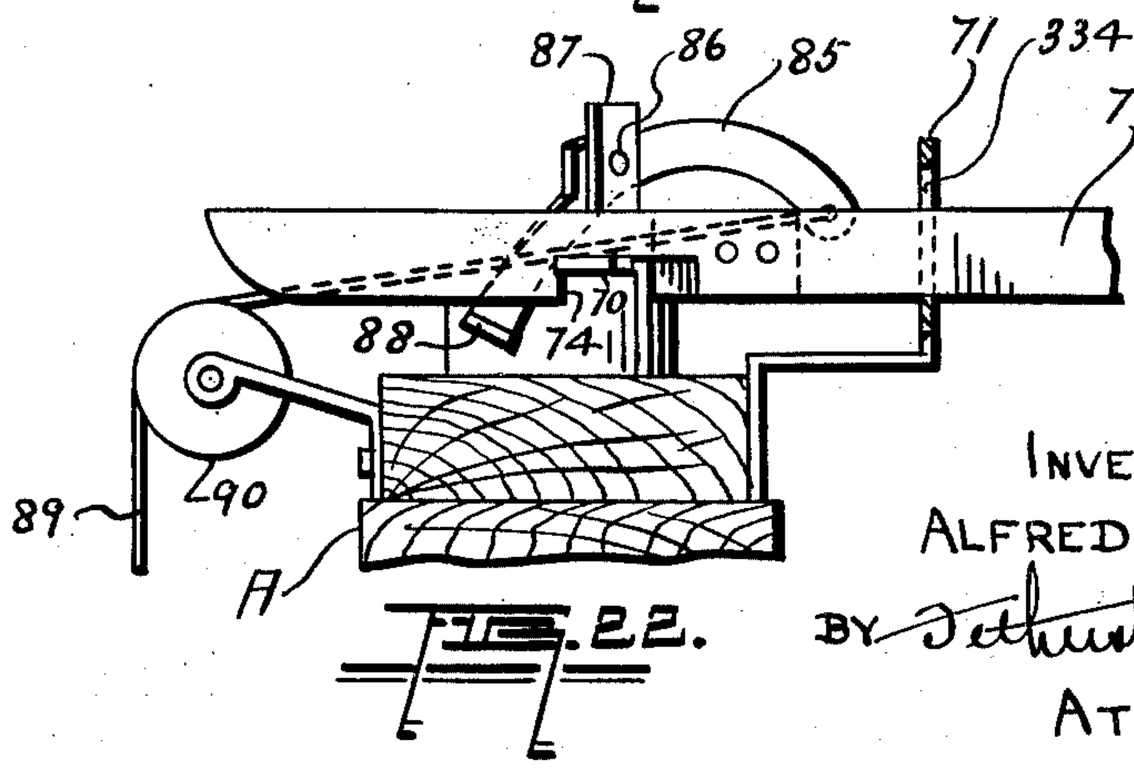

FIG. 22.

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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 11

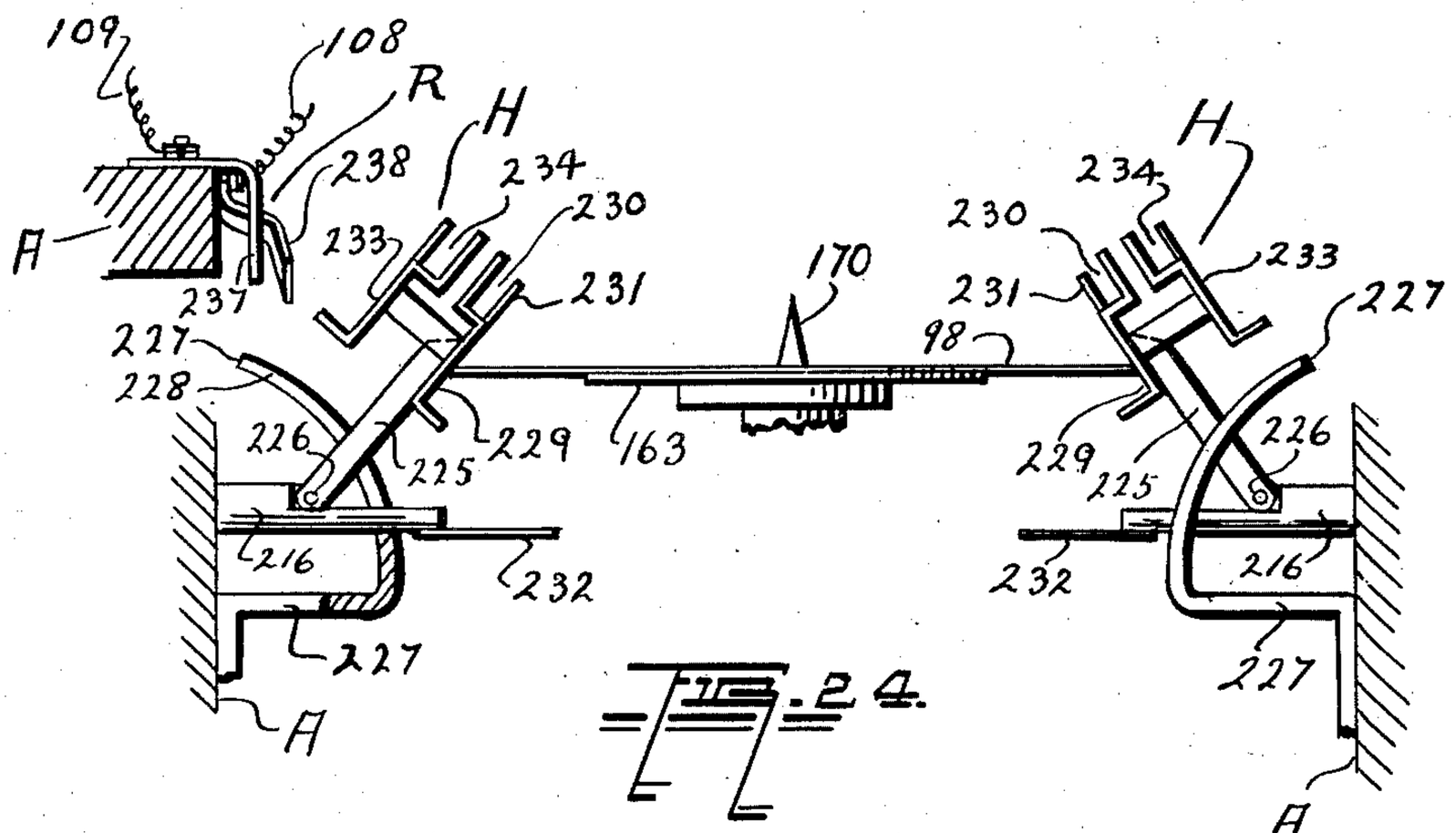

FIG. 24.

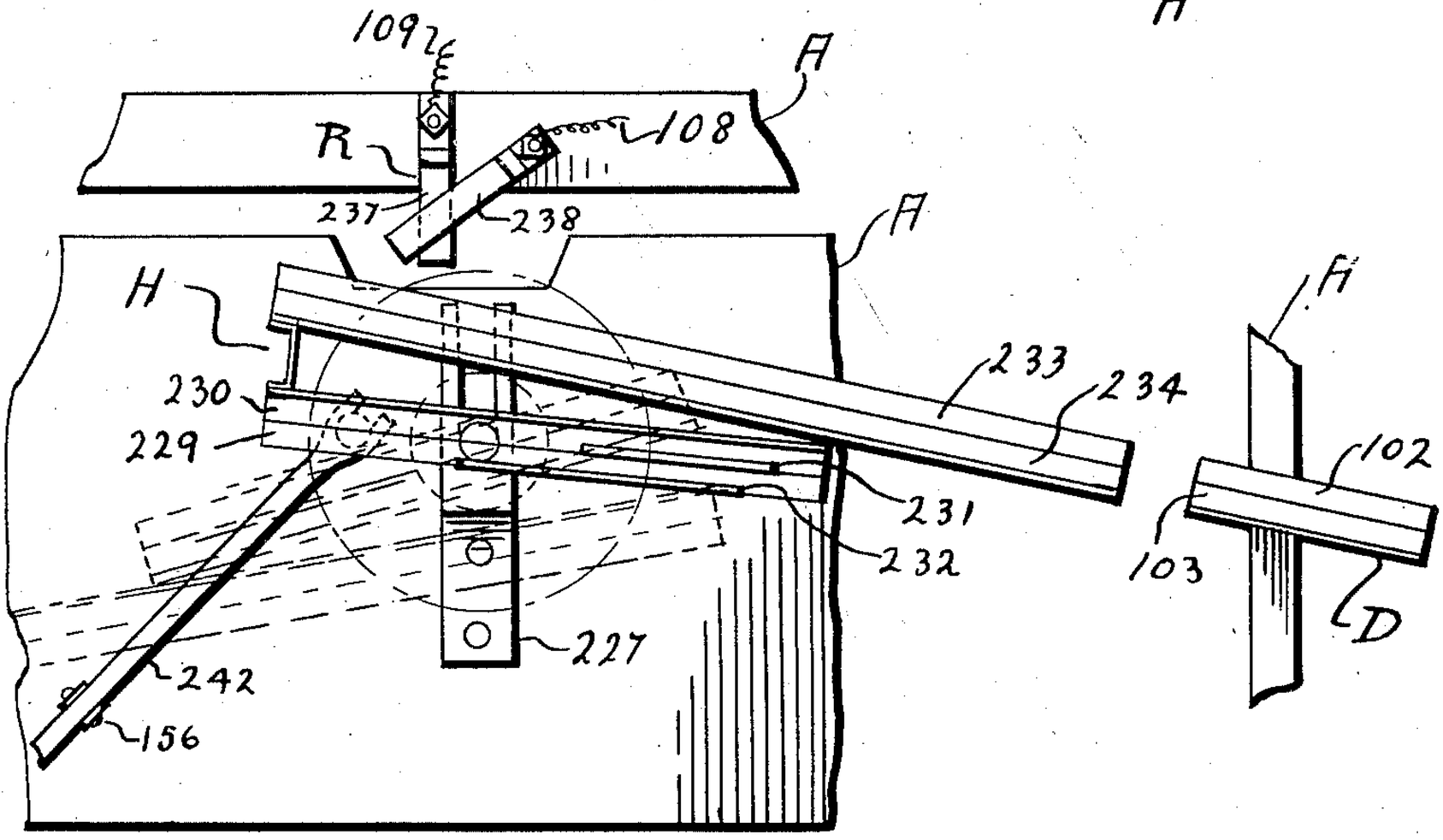

FIG. 23.

INVENTOR,
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 12

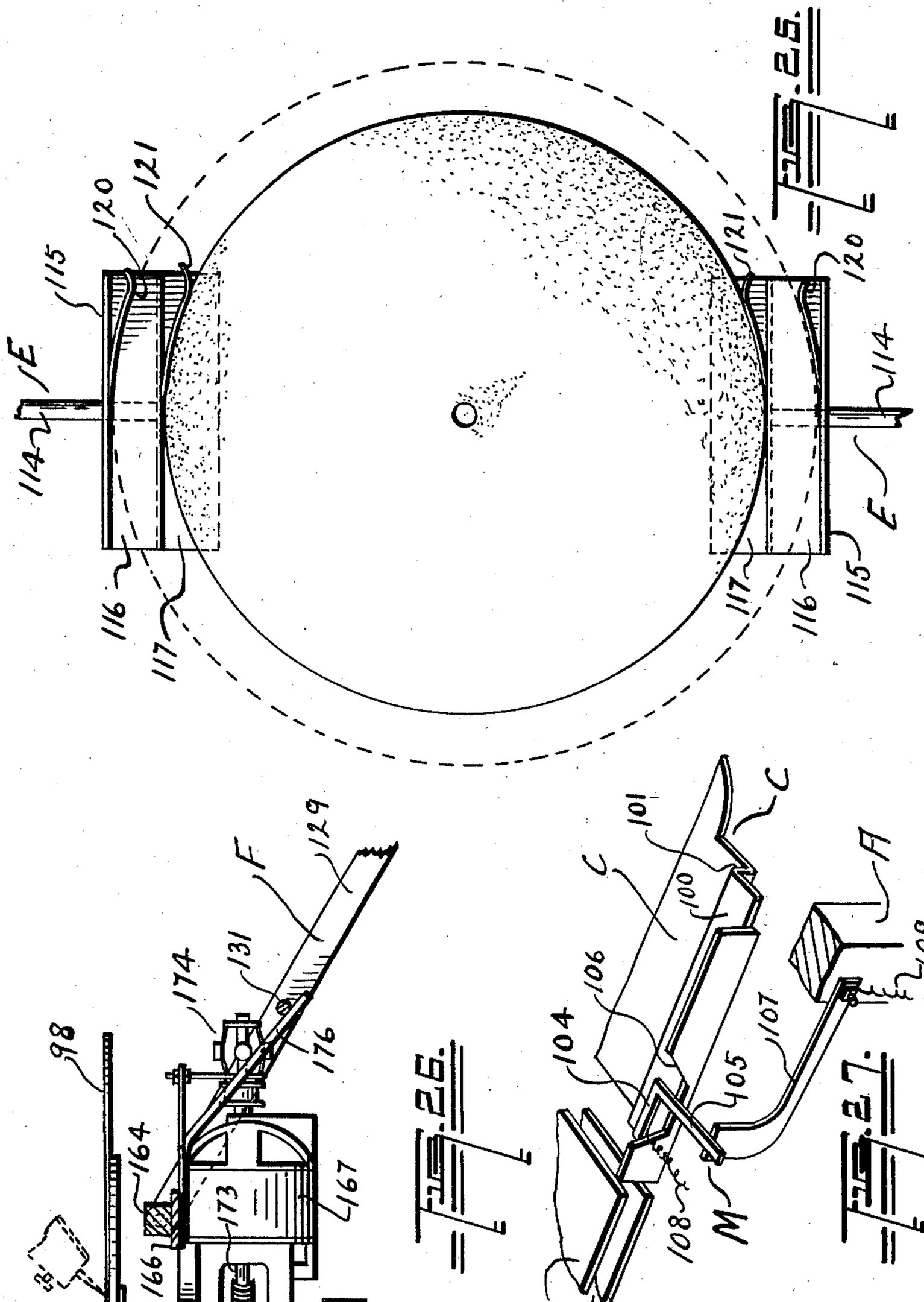

FIG. 25.

FIG. 26.

FIG. 27.

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BY Dithenthaughlo
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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 13

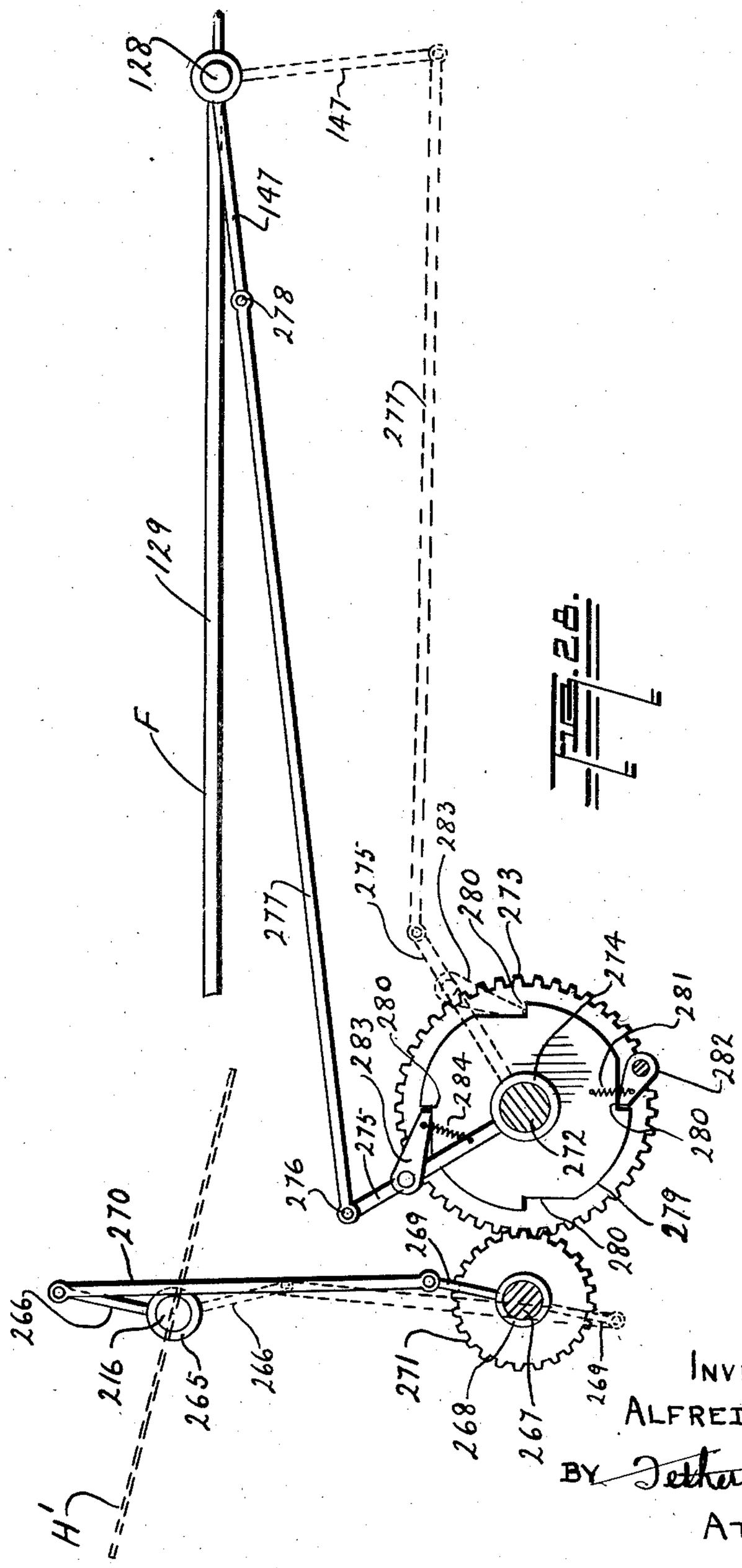

Fig. 28.

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June 5, 1934. A. W. INGALL 1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Filed Aug. 31, 1931 14 Sheets-Sheet 14

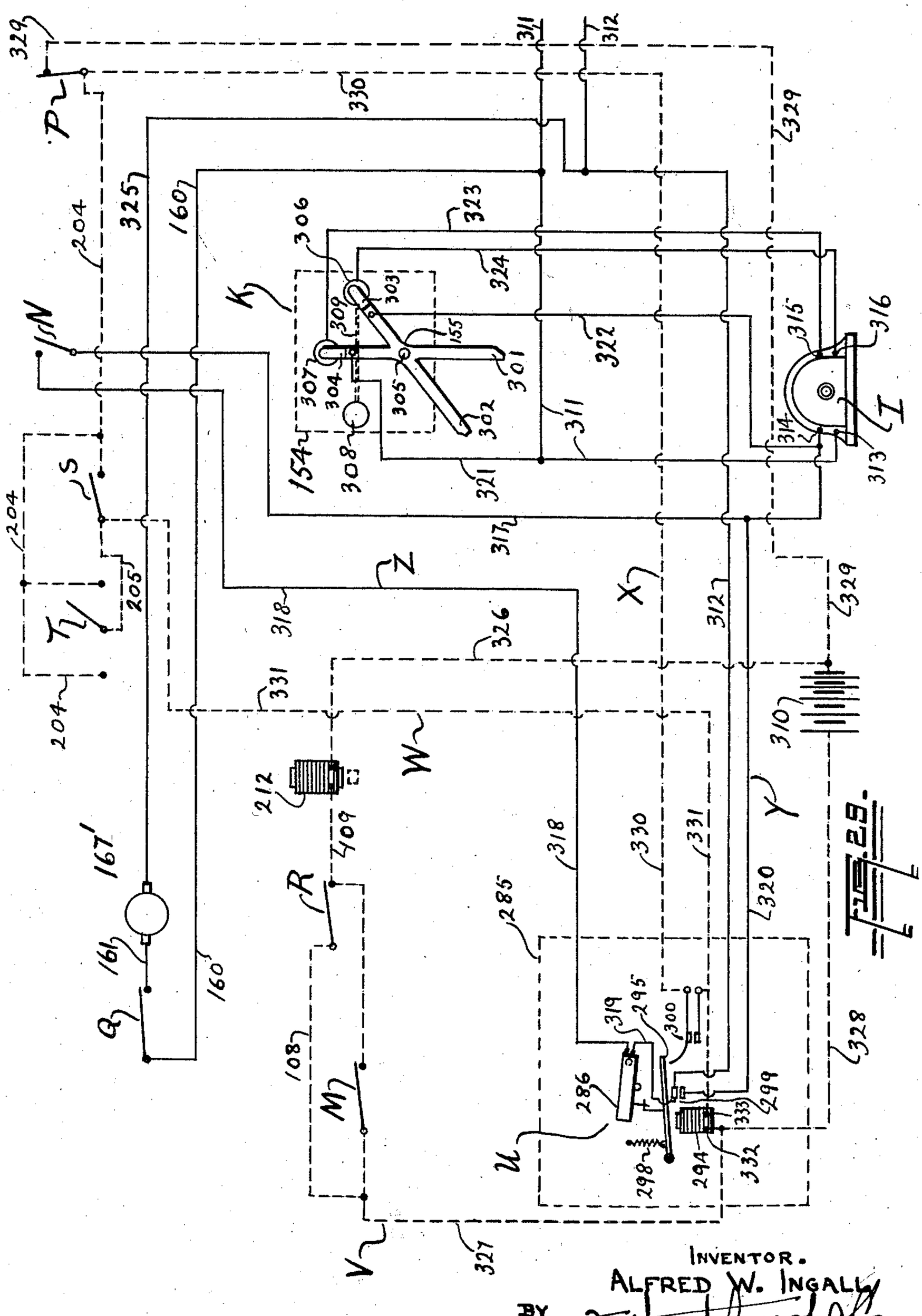

FIG. 29.

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Patented June 5, 1934

1,961,972

UNITED STATES PATENT OFFICE

1,961,972

APPARATUS FOR THE MANIPULATION AND PLAYING OF DISK RECORDS

Alfred William Ingall, Moose Jaw, Saskatchewan, Canada

Application August 31, 1931, Serial No. 560,461

23 Claims. (Cl. 274—10)

This invention relates to improvements in apparatus for the manipulation and playing of disk records with particular reference to machines adapted to successively play the records of a series placed therein and the principal object of the present invention is to provide improvements in apparatus of this character possessing important advantages over former constructions and in which many defects and disadvantages of former apparatus are overcome and eliminated, thus improving the performance of and greatly extending the useful field of application of these machines.

In this type of machine a large number of records may be placed therein and played successively in a desired order so that these machines have a wide application for use in dance halls, restaurants and such places where it is desired to have the machine continue in operation for some considerable period and with such a machine, which will operate satisfactorily, an entire opera or musical score consisting of many records may be reproduced from beginning to end without interruption and machines of this type are particularly suitable for adaptation to gramophone-radio combination sets for use in the home and other places including radio broadcasting studios.

Among other objects and features of the present invention are to provide the following:—

A machine which will be entirely automatic in operation and which will successively play all records of a series placed therein without requiring any manual attention or adjustment whatever and which will thus be particularly suited for use in a gramophone-radio combination.

A machine which will be applicable for use both with the mechanical vibratory reproduction of sound as in the ordinary gramophone or with the electrical reproduction of sound as in the radio.

A machine which will automatically handle and play records of various diameters successively without requiring any manual adjustment on account of change of record diameter but in which the record itself in its passage through the machine constitutes the medium by which such necessary adjustments are attained.

A machine which will automatically handle double-sided records so as to play both sides thereof.

A machine which will, while being primarily designed for the automatic handling and playing of both sides of double-sided records, be readily adaptable to playing and handling single-sided records.

A machine which will handle any type of record successfully so that it is immaterial to the successful automatic operation of the machine whether the records therein are or are not formed with an inner high pitch spiral at the inner end of the sound groove, thus enabling the machine to play successfully all records of various patterns or types in this respect.

A machine which will not only accommodate itself to the playing of records of various diameters, such for instance as 10 inch and 12 inch size, but in which provision is made whereby slight variations in the diameters of these regular sizes, as actually occurs in records on the market, will not interfere with the successful operation of the machine.

A machine in which the records are fed to and removed from the turntable individually so that there is only one record on the turntable at any one time, each record being automatically removed from the turntable after having been played.

As a result of the feature set forth in the preceding paragraph, making the capacity of the machine dependent only upon the number of records in the record magazine thereof and not in any way dependent upon the length of the centre pin of the turntable.

To entirely eliminate all surface rubbing or contact between records during the operation of the machine.

An electrically operated machine in which the presence of a record in proper operative position therein is a necessary and vital link in the continued operation of the machine so that, after the playing of the last of a series of records, all the electric circuits in the machine are automatically opened and the entire machine must come to rest.

A machine in which, after one side of a record has been played, the record is automatically removed from the turntable, turned over side for side, replaced upon the turntable with its second side up, which second side is then presented to the sound reproducing mechanism, played, and finally removed from the turntable.

Record handling and playing apparatus such that the record will be safeguarded to the maximum degree from any possibility of damage or injury during the operation of the machine.

An improved construction which will lend itself to incorporation in machines of a wide range of capacity.

A machine of simple and inexpensive construc-

tion and yet of exceptional efficiency and perfection of operation.

The present invention consists of record holding and manipulating apparatus co-operating with record playing mechanism and electrical circuits and apparatus, all as hereinafter more particularly described and illustrated in the accompanying drawings in which:—

Figure 1 is a side elevation of a machine constructed in accordance with the present invention showing the main frame of the machine, an outer enclosing casing being omitted with the exception of portions of the top and bottom thereof which are shown in section. In this view a beam forming part of the apparatus and mounted for oscillation vertically, which beam carries a record holding turntable, is shown at an intermediate point of its vertical movement and a record in position to be picked up thereby is shown suspended in proper position in a cradle forming part of the apparatus. For convenience of description the near side of the machine as seen in this view will be hereinafter referred to as the left side of the machine while the left and right ends as seen in this view will be referred to as the front and rear ends of the machine, the side of the machine remote from the observer in this view being referred to as the right side of the machine.

Figure 2 is a front end elevation looking in the direction of the arrow 2 in Figure 1, the parts being in the positions shown in Figure 1 and the enclosing casing of the machine being in section.

Figure 3 is a rear end elevation of the machine looking in the direction of the arrow 3 in Figure 1, the parts being in the positions shown in Figure 1 and the enclosing casing of the machine being in section.

Figure 4 is a vertical longitudinal section taken on the line 4—4 of Figure 3 looking in the direction of the arrows, a portion only of the top and bottom of the enclosing casing being shown.

Figure 5 is a top plan view of the machine, the parts being in the positions shown in Figure 1 and the enclosing casing being entirely omitted.

Figure 6 is a horizontal section through the machine taken on the line 6—6 of Figure 1 looking downwardly in the direction of the arrows and the enclosing casing again being omitted.

Figure 7 is a horizontal section to a larger scale taken on the line 7—7 of Figure 1 looking downwardly in the direction of the arrows and the enclosing casing again being omitted.

Figure 8 is a detached fragmentary perspective detail view showing portions of the main frame of the machine together with ratchet mechanism for oscillating certain record holding channels to turn the record during the operation of the machine and also a pivoted lever co-operating with a ratchet operated dog for controlling the movement of a record holding magazine in accordance with the present invention.

Figure 9 is a horizontal section to a larger scale taken on the line 9—9 of Figure 1, the enclosing casing of the machine again being omitted.

Figure 10 is a vertical sectional detail showing the manner of supporting a record holding magazine forming part of the present invention.

Figure 11 is a detached perspective view of a slotted rotatable thrust collar and mounting therefor forming part of the apparatus for controlling the movement of a record holding magazine in accordance with the present invention.

Figure 12 is a diametrical section through the thrust collar shown in Figures 10 and 11.

Figure 13 is a fragmentary sectional elevation on the line 13—13 of Figure 1 showing the left hand one of a pair of opposed record holding channels forming part of the improved machine together with the parts associated therewith for mounting and operating said channel. In this view the channel is shown in what will be hereinafter referred to throughout the specification as its receiving position in contradistinction to a second position which the channel may adopt and which will be referred to throughout as its turned over or discharging position.

Figure 14 is an elevation of Figure 13 looking towards the left in the direction of the arrow 14.

Figure 15 is a section on the line 15—15 of Figure 13 looking in the direction of the arrow. This view illustrates a pulley and cable arrangement employed for oscillating or turning the record holding channels forming part of the improved apparatus and in this view one of the pulleys is shown in the position it occupies when the record channels are in their receiving positions. There is a similar cable and pulley arrangement at each side of the machine associated with each of the pair of record holding channels and this view illustrates that at the left side of the machine as shown in Figures 13 and 14.

Figure 16 is a top plan view of a pickup arm and associated parts together with a portion of the main frame of the machine.

Figure 17 is an elevation of the pickup arm and associated parts looking in the direction of the arrow 17 in Figure 16, a pivoted lever being shown broken intermediately and a portion of the main frame and an electro-magnet carried thereby being broken away and indicated in broken lines so as not to obscure the parts therebehind.

Figure 17A is a fragmentary end elevation of the pickup arm looking in the direction of the arrow in Figure 17, showing the manner of mounting the arm and limiting the arc through which it may swing.

Figure 18 is an elevation of a pivoted stop lever operatively associated with the pickup arm, the view being taken looking in the direction of the arrow 18 in Figure 16, and the pickup arm being shown in cross-section, a portion only of an electromagnet associated with this pivoted lever being shown.

Figure 19 is a fragmentary elevational view of the free end of an oscillating beam forming part of the improved apparatus showing a switch carried thereby for controlling the circuit to a turntable motor forming part of the machine. In the position shown the beam is in a downwardly inclined position and the switch is in its normally closed position in which the circuit to the turntable motor is closed.

Figure 19A is another fragmentary elevational view of the parts shown in Figure 19 but showing in this instance the beam in its fully raised position and with a pickup forming part of the invention resting upon the switch whereby its weight opens the switch to open the circuit to the turntable motor

Figure 20 is an elevational view of a panel upon which is mounted certain circuit controlling mechanism, a portion of a metal cradle being broken away to show a metal ball carried therein.

Figure 21 is a longitudinal section through the cradle shown in Figure 20 showing the interior baffled construction thereof and the metal ball carried therein.

Figure 22 is a fragmentary elevational detail to a larger scale looking in the direction of the ar-

row 22 in Figure 9, showing trip mechanism forming part of the magazine operating mechanism of the present invention, a portion of the main frame of the machine being shown in section and a slotted bracket carried by the frame being shown partly in section.

Figure 23 is an elevational detail of the left hand one of a pair of opposed record holding channels (shown in Figures 13 and 14) the view being taken similarly to Figure 14 but the channel in this case being shown in full lines in its turned over or discharging position and a portion of a stationary discharge slide or guide apron being shown at the right. In this position a pin is spring-held in engagement with an arcuate slot in the pulleys for locking the channel in turned over position. In this view the receiving position of the record holding channel is indicated in broken lines.

Figure 24 is an end elevation looking from the rear end of the machine, of the record holding channels in their turned over discharging positions (as shown in full lines in Figure 23) showing the manner in which a record being lifted by the ascending turntable operates to swing the channels about their hinged connections to permit the record to be lifted from the channels preparatory to its being carried into its playing position in the machine.

Figure 25 is a top plan view showing the manner in which the records are held within and engage stops provided upon a channelled cradle forming part of the improved apparatus. In this view a portion only of each of the arms of the cradle is shown. A small size record held in the cradle is shown in full lines, a larger size record being shown in broken lines, there being separate channelled portions of the cradle for each size record.

Figure 26 is a side elevation of a turntable unit pivotally mounted in the free end of a beam in accordance with the present invention, the beam being in raised position in which a record carried by the turntable is in playing position in the machine, a near end of the beam being omitted and some parts being in section and also showing a stop arm carried by the turntable unit for maintaining the turntable and record carried thereon horizontal during the playing of the record.

Figure 27 is a fragmentary perspective view of a portion of an upper channelled slide or guide apron and a portion of a record magazine with which it is associated showing a spring switch associated with the outer or larger channelled guideway, said switch being normally open but adapted to be closed by the pressure of a record sliding thereover.

Figure 28 is a diagrammatic side elevation showing a modified form of apparatus for oscillating the record holding channels.

Figure 29 is a wiring diagram showing schematically the electrical circuits and connections used in the improved machine and in this diagram for the purpose of clearness the 110 volt power circuits are shown in full lines while associated low voltage battery circuits are shown in broken lines.

In the drawings like characters of reference indicate corresponding parts in the different views and, while generally reference numerals are employed to indicate the various parts, reference letters are used in some cases to indicate certain units of the apparatus, which units may comprise a number of component parts, the reference letter in any case indicating the unit collectively and the reference numerals indicating the individual component parts thereof.

The improved apparatus of the present invention comprises a complete and self-contained machine which may conveniently be mounted within and upon a main frame and enclosed within a suitable casing, the essential elements of the apparatus being certain novel record holding, manipulating and changing apparatus co-operating with suitable novel record playing mechanism together with actuating electric circuits and apparatus.

In order to facilitate a clear understanding of the nature of the device and before describing the full detailed construction and operation thereof, it is thought advisable to give a very brief statement of the broad general lines upon which the improved machine functions but it is, of course, to be fully understood that in this statement reference to many important features of the present invention has been entirely omitted and therefore the scope of the invention is not intended to be in any way limited thereby.

Stated very briefly and incompletely the improved apparatus functions somewhat as follows:—

There is provided a record holding magazine comprising two sections, one for the records about to be played and the other for the reception of records after having been played together with record handling and manipulating apparatus for properly directing the record in its passage through the machine; also an electrically rotated turntable adapted to descend and ascend during the operation of the machine and a main electric motor serving as a source of driving power for the entire machine excepting only the rotation of the turntable which is provided for by a separate turntable motor. Operatively associated with the turntable is a pickup arm adapted to operatively engage a record to be played, when the turntable is in its raised playing position and the record to be played is supported thereon and rotating therewith.

When it is desired to set the machine in operation, all the records to be played are inserted in proper order in that section of the magazine intended for the records to be played and the machine is set in operation. In due course the first record of the series to be played is fed from the magazine and placed upon the ascending turntable and raised thereon into playing position, in which position the pickup needle properly engages the record grooves and the record is played, the turntable remaining elevated in its raised playing position during the entire playing of the record.

At the conclusion of the playing of the record the turntable commences to descend in which operation the record moves away from the pickup arm which immediately swings outwardly into proper position to properly engage the next record presented thereto. As the turntable descends the played record is removed therefrom, turned over side for side so as to present its unplayed side uppermost and upon the turntable ascending this turned-over record is picked up thereby and carried upwardly into playing position in which the pickup arm operatively engages the record groove thereof. The playing of the second side of the record is then carried out, the turntable remaining once again in its raised playing position during the entire playing of the record at the end of which it again descends and

as the record descends away from the pickup arm, the latter again swings outwardly into proper position to commence playing the next record. As the turntable continues its descent the played record is removed therefrom and deposited in that section of the magazine reserved for played records and the next record is fed from the section of the magazine containing unplayed records to be, in due course, picked up by the turntable, have both sides thereof played, and finally to be deposited in that section of the magazine reserved for played records.

This operation continues until all the records have been played and deposited in the section reserved for played records at the conclusion of which the entire mechanism automatically comes to rest.

In the form illustrated the improved apparatus comprises a main frame A within and within which the entire mechanism is mounted. Mounted for vertical movement within the frame A is a record holding magazine B having an upper section and a lower section and associated with these upper and lower magazine sections respectively are upper and lower stationary channelled slides or guide aprons C and D, while mounted within the frame for oscillation about a horizontal axis and operatively associated with the upper stationary slide C is a channelled cradle E. Mounted within the frame A for oscillation about a horizontal axis is a beam F and pivotally carried at the free end of this beam F is a turntable unit G. Mounted within the frame A for oscillation about horizontal axes are a pair of opposed record holding channels H. A reversing motor I forms a drive for the machine and included in the electrical apparatus is a special form of switch K for reversing the connections to the starting coils of this motor I. Mounted within the frame A for proper co-operation with the records when in playing position in the machine is a pickup arm or tone arm L.

For convenience of description the left hand end of the machine as viewed in Figure 1, that is the end at which the magazine B is located, will be referred to throughout as the front end of the machine while the right hand end, as viewed in Figure 1, will be referred to throughout as the rear end of the machine and movement or distance measured from left to right in Figure 1 will be spoken of as movement rearwardly and distance measured rearwardly respectively. Also the near side of the machine, as viewed in Figure 1, will be referred to as the left side of the machine.

The main frame A of the machine may be suitably enclosed within any suitable casing 50 and supported upon castors 51. The record holding magazine B is mounted for movement vertically within the frame A and comprises an upper magazine section 52 and a lower magazine section 53 spaced some distance below the upper section 52.

The sections 52 and 53 are of box like form open at their front and rear faces and are rigidly secured together by strips 54 which not only accurately space the two sections 52 and 53 but form them into a rigid magazine the two sections of which are in vertical alignment.

Rigidly secured within the main frame A at the right and left sides of the magazine B and extending practically the entire height of the frame are rigid guide rods 55 which are secured to the frame at their top and bottom ends by U-bolts 56 (see Figure 6).

Secured to each of the magazine sections 52 and 53 at each side thereof and intermediately of the height of each section are two spaced apart angles 57, the laterally projecting arms of which are spaced apart sufficiently to form a guideway through which the guide rods 55 extend so that these angles 57 co-operating with the guide rods 55 constitute guide means for the magazine B whereby vertical movement of the magazine is permitted but no rotational movement thereof is possible, the angles 57 engaging the rods 55 and sliding therealong upon vertical movement of the magazine but effectively preventing any rotational movement of the magazine.

Extending centrally from the bottom of the lower magazine section 53 and engaging a foot bearing 58 therein is a magazine supporting rod 59 which serves as a support for the magazine, as will be hereinafter explained. This rod 59 is drilled with a series of axially spaced apart orifices within which are secured pins 60, both ends of each of these pins projecting beyond the circumference of the rod 59, as clearly shown in Figure 10. The rod 59 is rigidly secured with respect to the magazine so that there can be no rotation thereof relatively to the magazine and the pins 60 are all in alignment and are disposed transversely of the machine, that is in a right and left direction.

The frame A is provided with an orifice 61 (see Figure 10) through which the rod 59 extends and mounted upon the frame A concentrically with this orifice 61 is a rotatable slotted thrust collar 62 having a central orifice 63 through which the rod 59 extends. This thrust collar 62 is rotatably mounted upon the frame A by means of a flanged annular fitting 64 secured upon the frame A by means of suitable screws or nails 65 extending through orificed lugs 66 carried by the fitting 64 and also mounted within this fitting 64 and beneath the collar 62 is a roller thrust bearing 67 which rotatably supports the collar 62 and takes the downward thrust thereof. The construction is such that the fitting 64 serves as a common mounting for both the collar 62 and the roller thrust bearing 67.

The collar 62 is formed with a novel arrangement of slots comprising a pair of diametrically opposed axially disposed slots 68 and a pair of diametrically opposed obliquely disposed slots 69, the slots 68 and 69 being spaced apart circumferentially of the collar 62 and being of such dimensions as to accommodate and permit passage therethrough of the projecting ends of the pins 60 during the operation of the device, as will hereinafter be explained.

The collar 62 is so positioned with respect to the rod 59 that when the magazine is in normal supported position (as shown in Figures 9 and 10) the projecting ends of one of the pins 60 which is then operative will rest upon a solid portion of the upper face of the collar 62 intermediately between the slots 68 and 69, as clearly shown in Figure 9, in which position it will be clear that descent of the rod 59 and therefore of the magazine B is positively prevented by the engagement of the ends of this pin 60 with the solid portion of the collar 62.

The thickness of the collar 62 and the axial spacing of adjacent pins 60 is such that there is just sufficient clearance between adjacent pins 60 to accommodate the collar 62 therebetween so that, as clearly shown in Figure 10, when one of the pins 60 is engaging the top of the collar 62, the next lower pin 60 is engaging the bottom face of the collar.

Rigidly secured to the collar 62 is an arm 70 by which the collar 62 is rotated during the operation of the device, as will hereinafter be explained.

Slidably mounted within orificed brackets 71 and 72 rigidly carried by the main frame A is a bar 73 adjacent to one end of which is provided, in the bottom edge of the bar, a notch 74 into which the free end of the arm 70 is adapted to engage to operatively connect the bar 73 with the arm 70 (see Figure 22). The orifice 334 in the bracket 71 through which the bar 73 extends is elongated so as to permit lifting of this end of the bar 73 to permit disengagement of the arm 70 from the notch 74, as is necessary at a certain point in the operation of the device. The opposite end of the bar 73 is connected through a turnbuckle 75 with a cable 76, which cable passes over a pulley 77 and upwardly to be connected to one end 78 of a lever 79, which lever is pivoted intermediately of its length at 80 and the free end 81 of which is adapted to be depressed by a ratchet operated dog 82, as will hereinafter be explained.

A coil spring 83 has one end connected to the frame A and the other end to the bar 73 (see Figures 1 and 9) so that this spring operates to normally hold the free end of the bar 73 downwardly against the arm 70 and to maintain engagement between the notch 74 and the arm 70 when the parts are in proper position to permit this and also to draw the bar 73 forwardly (see Figures 1, 9 and 22) and to maintain the cable 76 taut.

There is provided for co-operation with the lever 79 a stop pin 84 for limiting the downward oscillation of the end 78 of the lever to which the cable 76 is attached (see Figure 8) and the spring 83 operates to pull the cable 76 and bar 73 forwardly and to maintain the lever 79 normally in abutment with the stop 84 except when the lever is oscillated by the depression of its free end 81 by the dog 82 at which time the lever 79 moves upwardly away from the stop 84 and the cable 76 and bar 73 are drawn rearwardly.

Pivotally mounted upon the arm 70 is a bent lever 85 which is pivoted intermediately at 86 (see Figure 22) to a lug 87 secured to the upper face of the arm 70, one end of the lever 85 being formed with an offset lug 88 overlying the bar 73 at a point measured forwardly of the notch 74 while the other end of the lever 85 has connected thereto a cable 89 which passes over a pulley 90 and has its other end connected to a foot treadle 91. A coil spring 92 (see Figures 1 and 9) has one end secured to the frame A and the other end secured to the thrust collar 62.

The function of the notched bar 73, the notch 74 of which is normally held in engagement with the arm 70, is at certain desired points in the operation of the device to cause counter-clockwise rotation of the collar 62, as viewed in Figure 9, to place the obliquely disposed slots 69 in the collar 62 in registration with the projecting ends of the pins 60.

The function of the lever 85 with the cable 89 connecting it to the foot treadle 91 is to cause clockwise rotation of the collar 62, as viewed in Figure 9, at another point in the operation of the device so as to bring the axial slots 68 in the collar 62 into registration with the projecting ends of the pins 60, which clockwise rotation is accomplished by depressing the treadle 91, as will be hereinafter explained.

The upper and lower magazine sections 52 and 53 are formed respectively with a series of uniformly spaced apart inclined shelves 93 and 94 forming therebetween a series of uniformly spaced record holding compartments 95 and 96. These shelves 93 and 94 extend forwardly and rearwardly through the front and rear faces of the box sections 52 and 53. The shelves 93 in the upper magazine section 52 are inclined downwardly and rearwardly so as to be adapted to deliver records therefrom rearwardly into the machine during the operation thereof, while the shelves 94 in the lower magazine section 53 are inclined downwardly and forwardly of the machine so as to be adapted to receive records delivered thereto during the operation of the machine, as hereinafter explained.

Spaced rearwardly from the upper magazine section 52 are two vertical rods 97 rigidly secured in the frame A and disposed respectively adjacent to the right and left hand side of the magazine section 52, which rods form stops against which records 98 placed in the upper magazine section and indicated in broken lines in Figure 1 are adapted to abut so that these rods 97 constitute stop means for holding the records 98 in the inclined compartments 95 of the upper magazine section. It will, of course, be clear that in the absence of some such stop means, since the shelves 93 are inclined downwardly, any records placed therein would otherwise simply slide rearwardly therefrom unless this sliding movement were prevented.

Spaced forwardly from the front of the lower magazine section 53 is a vertical stop bar 99 rigidly secured to the magazine, which bar 99 forms a stop means against which records deposited in the lower magazine section 53 strike to prevent these records from sliding out through the front ends of the lower magazine compartments 96.

The stop members 97 and 99 are very similar in function except for one difference which is that the lower stop bar 99 is carried rigidly by the magazine B and moves therewith while the upper stop bars 97 are carried rigidly by the frame A and therefore do not move with the magazine so that in the operation of the device the upper magazine section 52 moves relatively to these stop rods 97, which feature is of importance in the successful operation of the device, as will be hereinafter explained.

Associated with the upper magazine section 52 and spaced slightly to the rear thereof is an upper stationary downwardly and rearwardly inclined channelled slide or guide apron C, the inclination of which is the same as that of the slides 93 in this magazine section and this apron C is adapted to co-operate with the slides 93 in the operation of the device to form a slide or guide apron over which the record in passing from the upper magazine section rearwardly into the machine is supported and guided as will be hereinafter explained.

The guide apron C is of channelled construction and in the form illustrated is provided with an outer pair of channelled guideways 100 spaced sufficiently apart to constitute guides for the largest size record to be handled in the machine, say a 12 inch record, and with an inner set of channelled guideways 101 spaced sufficiently far apart to form guideways for a smaller record to be accommodated in the machine, say a 10 inch record, there being, therefore, a separate channelled guideway in this apron adapted to accom-

modate each individual size of record to be handled in the machine.

The stop rods 97 are of such length that their lower ends terminate slightly above the upper channelled guide apron C so as to permit a record being discharged from the upper magazine section to slide upon the guideway C beneath the lower ends of these guide rods when the magazine is in position for discharging such record. This feature will be explained in greater detail hereinafter.

Associated with the lower magazine section 53 and spaced slightly to the rear thereof is a lower stationary downwardly and forwardly inclined channelled slide or guide apron D the inclination of which is the same as that of the slides 94 in this lower magazine section and this apron is adapted to co-operate with the slides 94 in the operation of the device to form a slide or guide apron over which the record will pass and be delivered from the machine after having been played therein to be deposited in one of the compartments 96 of the lower magazine section 53, the passage of this record outwardly through the front end of the magazine section 53 being prevented by the stop bar 99 against which the record strikes.

The lower guide apron D is of similar channelled formation as the upper apron C, being formed with large and small or outer and inner channels 102 and 103 respectively of proper width to accommodate the different sized records to be handled in the machine.

Both the upper and lower guide aprons C and D are rigidly carried by the frame A and in connection with the outer or larger channel 100 in the upper apron C is provided a spring switch M, the purpose of which will be hereinafter explained. This switch M comprises a spring blade 104 overlying the 12 inch outer channelled guideway 100 and normally upwardly inclined with respect thereto, this blade being insulated from the channel and having an arm 105 projecting laterally therefrom through a notched portion 106 in the side of the apron C (see Figure 27). Cooperating with the spring blades 104 and 105 is a fixed switch blade 107 secured to the frame A and insulated therefrom. Circuit wires 108 and 109 are connected respectively with the switch blades 104 and 107 and the arm 105 of the blade 104 overlies, but is normally spaced upwardly from, the stationary blade 107 so that the electric circuit containing the wires 108 and 109 is normally open and is closed by the depression of the blade 104 and with it the arm 105 so that this latter makes contact with the fixed blade 107. The function of this switch M in the operation of the device will be fully explained hereinafter.

Associated with the upper guide apron C is a cradle E which cradle comprises the two side arms 110 rigidly secured at their upper ends to a cross-rod 111, which cross-rod is suitably journalled at each end thereof in the frame A and is disposed horizontally thereof so that the cradle E is journalled within the main frame A for oscillation about a horizontal axis. The side arms 110 of the cradle E are bent rearwardly intermediately of their length at 112 to form rearwardly extending portions 113 and the lower extremities of these rearwardly inclined portions 113 are bent inwardly towards each other at 114, (see Figure 3), which portions 114 are horizontal, and rigidly secured to each of the portions 114 is a channelled portion 115 formed with large and small channelled portions 116 and 117 of similar spacing and form to those of the upper channelled slide C and are adapted to accommodate and hold the different sized records during the operation of the machine.

Intermediately of the length of the arms 110 of the cradle are transverse strengthening cross-arms 118 and 119 for the purpose of stiffening and strengthening the cradle. The cradle is adapted to oscillate within the machine about the horizontal cross-rod 111 from a forward raised position, in which the channelled portions 116 and 117 of the cradle are in abutment with and in alignment with the channelled portions 100 and 101 of the upper guide apron C, to a rearward, lower position in which the channelled portions 116 and 117 of the cradle are adapted to support a record carried thereby in proper position to be picked up by the turntable during the operation of the device, as will be hereinafter more fully explained.

The channelled portions 116 and 117 of the cradle are fitted with stops 120 and 121 respectively adjacent to their rear ends which stops hold the record in position therein (see Figure 25).

Secured to arms 122 and 123 respectively, carried by the cross-rod 111 are counterweights 124 and 125 adapted to control the motion of the cradle so that when a record is delivered to the cradle it will move from its forward raised position to its lowered rearward position under the weight of the record and when the record is removed from the cradle the cradle will automatically return to its forward raised position. In other words the counterweights 124 and 125 are so positioned and adjusted that the weight of a record delivered to the cradle is sufficient to lower the cradle and when the cradle is relieved of the weight of the record it will automatically return to its forward raised position.

Associated with the cradle and secured to the frame A is a stop 126 against which one of the side arms 110 of the cradle abuts when the cradle moves into its forward raised position, thus limiting the forward movement of the cradle. Also associated with the cradle are stops 127 fixedly secured to the main frame A and so positioned that the lower rearwardly bent portions 113 of the cradle come into abutment therewith when the cradle moves into its lowered rearward position so that these stops 127 form means for limiting the rearward movement of the cradle and accurately positioning it in its descent in a proper position within the machine.

Extending transversely of the machine adjacent to the rear end thereof and journalled within the main frame A is what may be termed a main shaft 128 and rigidly carried by this shaft is the beam F, which beam comprises a pair of spaced apart parallel forwardly directed arms 129, the rear ends of which arms extend through the shaft 128 and are secured by nuts 130.

Bolted between the forward ends of the arms 129 is the turntable unit G, the construction of which will be presently explained, and extending between the arms 129 intermediately of their length is a cross tie rod 131. Secured to each of the rods 129 intermediately of the length thereof and extending laterally outward therefrom is a lug 132.

Suitably mounted upon the frame A is a main drive motor I and journalled within the main frame A at the rear end thereof are upper and lower shafts 133 and 134, the lower shaft 134 rigidly carrying a pair of cone pulleys 135 and 136. Extending rearwardly from the main shaft

128 is a rod 137 and connecting the rear end of this rod to the cone pulley 136 is a cable 138, while the cone pulley 135 is connected to one of the arms 129 of the beam F by a cable 139 and co-operating with this cable 139 is a coil spring 140 the purpose of which will be presently explained.

Rigidly carried by the upper shaft 133 are large and small pulleys 141 and 142 and rigidly carried by the lower shaft 134 is a large pulley 143, while carried by the shaft of the motor I is a small pulley 144. The pulleys 144 and 141 are connected by a belt 145 while the pulleys 142 and 143 are connected by a belt 146 so that the pulleys 144, 141, 142 and 143 and the belts 145 and 146 constitute a reduction gearing between the motor I and the shaft 134, the ratio being such that a speed reduction of approximately from 1750 revolutions per minute to 18 revolutions per minute is obtained.

The cables 138 and 139 leading from the cone pulleys 136 and 135 are wound in reverse relation upon these cone-shaped pulleys so that as the shaft 134 is rotated in the operation of the machine, while one of the cables is being wound upon its cone pulley, the other is being unwound from its cone pulley so that when the shaft 134 is rotated in one direction, for instance to wind the cable 138 upon its pulley 136, a downward pull is exerted upon the arm 137 to raise the beam F which rising movement is permitted by the simultaneous unwinding of the cable 139 from its cone pulley 135, the diameter of the cone pulleys 135 and 136 being such that the rate at which one cable is wound up exactly corresponds with that at which the other is being unwound. When the direction of rotation of the shaft 134 is reversed, the cable 139 is wound upon its pulley 135 while the cable 138 is unwound from its pulley 136 so that the beam is drawn downwardly. This operation will be explained in greater detail hereinafter but the construction and manner of mounting of the beam F in the machine is such that this beam has oscillation vertically within the machine ascending at one period followed by a descending motion at another period.

Projecting forwardly from the main shaft 128 is an arm 147, the function of which will be later explained. Rigidly carried by the main shaft 128 is a radius arm 148 provided with a rearwardly extending arm 149 and a laterally extending arm 150. Mounted upon the main frame adjacent to this radius arm 148 is a switch N, normally spring-held in closed position but having an extension 151 on one side adapted to be engaged by the rearwardly extending arm 149 of the radius arm 148 when the main shaft 128 has been rotated in a clockwise direction, as viewed in Figure 1, to a certain point. Clockwise rotation of the main shaft 128 in Figure 1, it will be apparent, corresponds to an ascending movement of the beam F so that the co-operation between the radius arm 148 and the switch N is such that when the beam F reaches its uppermost position the rearwardly extending arm 149 of the radius arm 148 makes engagement with the extension 151 of the switch N to open this switch.

Also rigidly mounted upon the frame A adjacent to the radius arm 148 is a switch P, normally spring-held in closed position and having an extending arm 152 adapted to be engaged by the laterally extending arm 150 of the radius arm 148 during counterclockwise rotation of the main shaft 128, as viewed in Figure 1, this contact taking place when the shaft 128 has turned counterclockwise to a sufficient distance to bring the beam F to its lowermost position, or in other words, to the limit of its downward oscillation at which point the switch P is automatically opened. Circuit wires are connected to opposite sides of the switch N while other circuit wires are connected to opposite sides of the switch P.

Secured to one of the arms 129 of the beam F and extending beyond the forward end thereof is a strip of insulation 157 and secured to the projecting portion thereof is a switch Q having the two switch arms 158 and 159 which are normally spring-held in closed position, as in Figure 19, and connected to these switch arms are circuit wires 160 and 161. The lower arm 159 of the switch Q extends forwardly and is covered with insulation to form an insulated pad 162 upon which a pick up forming part of the apparatus is adapted to rest at a certain point in the operation of the machine for the purpose of opening this switch Q, the construction being such, as previously explained, that this switch Q is normally closed.

As previously mentioned, there is pivotally carried at the forward end of the beam F a turntable unit G which unit comprises what may be referred to as the turntable proper 163 and the apparatus and mechanism for supporting and rotating the turntable 163.

Pivotally supported in the forward ends of the arms 129 of the beam F in suitable pivot bearings is a bar 164, the bearings for the ends of this bar being adjustably secured within the arms 129 by screws 165 (see Figures 19 and 19A), the bearings being in the nature of conical points engaging corresponding recesses in the ends of the bar 164 by which the bar is rotatably supported. Rigidly carried by the underside of the bar 164 is a plate 166 to the under side of which in turn is secured a motor casing 167 containing an electric motor 167' which will be termed the turntable motor and is of the type suitable for operating the turntable of such machines.

Secured to the forward end of the motor casing 167 is an end casing 168 in which is journalled a stub shaft 169 upon the upper end of which is rigidly mounted the turntable proper 163. This shaft 169, or a continuation thereof, extends upwardly above the turntable concentrically with the turntable and constitutes what will be referred to as the centre pin of the turntable, being designated by the numeral 170. This pin 170 is concentric with the shaft 169 and is of reasonable length, in the neighbourhood of one inch, or one inch and a quarter, and is formed with a long tapering point.

The shaft 169 rigidly carries a worm gear 171 which is operatively engaged by a worm 172 rigidly carried by the forward end of the shaft 173 of the turntable motor which shaft 173, it will be understood, is perpendicular to the shaft 169 carrying the turntable. The rear end of the turntable motor shaft 173 carries a suitable governor 174 through which the speed of the turntable motor 167' is controlled.

Carried by the casing 168 is a suitable counterbalancing weight 175 whereby the entire turntable unit G is balanced so that it normally maintains a position in which the turntable 163 is horizontal.

Secured to the plate 166 is a bar 176 inclined downwardly and rearwardly and of such length as to contact in certain positions of the mechanism with the tie rod 131 extending across the beam F between the arms 129 thereof.

In Figure 26 the relative position of the turntable unit G with respect to the beam F is shown when the beam is in its fully raised position so that a record 98 carried upon the turntable is in proper playing position within the machine, a portion of a pickup arm and needle carried thereby engaging the record being indicated in broken lines. In this position the inclined arm 176 is in engagement with the tie rod 131 and the weight of the pickup arm which engages the record upon the opposite side of the bar 164 from the tie rod 131 tends to rotate the turntable unit in a counterclockwise direction about its shaft 164, which rotation is prevented by the engagement between the arm 176 and the tie rod 131. The construction is such, therefore, that in this playing position the entire turntable unit G and with it the turntable 163 and record 98 carried thereby are firmly and rigidly supported in a proper horizontal position to permit playing of the record.

As previously stated, the turntable unit G is counterbalanced by the weight 175 so that at all points during the upward and downward oscillation of the beam F the turntable is automatically maintained in a horizontal position.

Suitably mounted upon the main frame A for proper engagement with a record 98 supported in playing position upon the turntable 163 is a pickup arm L, which arm may be in the nature of the ordinary gramophone tone arm adapted for reproduction of sound on the principle of mechanical vibration or may be of the type of pickup arm used for the electrical reproduction of sound, as in the gramophone radio combination, and in the drawings and specification a pickup arm of the latter type has been shown, although the present invention is not to be limited in any way to this particular form.

The pickup arm L comprises a rigid arm 177 pivotally mounted at one end upon a base 178 carried by the main frame A, the arm being supported on this in a manner so as to permit combined swinging of the arm about a vertical axis and also about a horizontal axis. In the form illustrated, this is provided by a pedestal 179 journalled upon the base 178 for rotation about a vertical axis, the arc of rotation being limited by a pin 180 carried by the pedestal 179, which pin is adapted to move within an arcuate notch 181 formed in the base 178 which arcuate notch is of sufficient length to permit the desired arc of oscillation of the arm 177. The foregoing provides for the swinging of the pickup arm 177 about a vertical axis.

The swinging or movement of the pickup arm 177 about a horizontal axis is provided for by a parallel-sided head 182 upstanding from the pedestal 179, which upstanding head is adapted to engage within a parallel-sided recess 183 in the rear end 184 of the pickup arm 177, this rear end of the pickup arm being pivotally connected to the head 182 by a screw pin 185.

The forward or free end of the pickup arm 177 carries the usual pickup 186 adapted to hold in the ordinary manner the pickup needle 187 which is secured in position by the thumb screw 188. The free end of the pickup arm is suspended by a cable 189 having one end secured to a lug 190 on the pickup 186 and the other end secured to a lug 191 attached at the top of the main frame A, the position of the point of attachment of the upper end of the cable being to the rear of and to the left of the pivotal mounting of the rear end 184 of the pickup arm 177, the purpose of which will later be explained.

Suspended beneath the pickup arm 177 is what will be referred to as a follower needle arm 192, the rear end of which is pivotally connected within the bifurcated lower end of a stud 193 by means of a pivot pin 194, this pivot pin depending from the pickup arm and being pivotally connected thereto for rotation about its own axis. The mounting of the follower needle arm 192, therefore, is such that it is free to oscillate upwardly and downwardly about the pivot pin 194 so that its free end may move up and down relatively to the pickup 186 and pickup arm 177, which latter oscillation takes place about the axis of the bifurcated stud 193. The follower needle carried by the free end of the follower needle arm 192 is indicated by the numeral 195.

A hook 196 adapted to form a seating for the follower needle arm 192 provides a means of limiting the downward movement of this arm, the limit of this downward movement being such that the follower needle 195 is suspended at a level lower than the pickup needle 187.

Carried by the pickup arm 177 is a pair of switches T, which will be referred to as the pickup arm switches, which switches are connected in parallel with each other and the function of which is to close the necessary circuits to cause the turntable 163 and record 98 carried thereby to descend away from the pickup arm after the playing of a record has been completed, as will be hereinafter explained, these switches T being normally open and adapted to be selectively closed at a certain point in the operation of the machine.

These switches T each comprise a bell crank lever 197 pivotally mounted upon a pin 198 at each side of the pickup arm 177 and in electrical contact therewith. Each bell crank lever 197 is formed with a depending arm 199 and a laterally extending substantially horizontal arm 200, which lateral arms 200 carry metal weights 201. The depending arms 199 of these two bell crank levers 197 extend downwardly on opposite sides of the follower needle arm 192 and are normally held in contact with the arm by the action of the weights 201 so that these bell crank levers normally operate to hold the follower needle arm 192 in a definite position measured laterally with respect to the pickup arm 177, which normal position is that in which this follower needle arm is swung a slight distance laterally to the left of a position of alignment with the pickup arm 177 so that normally when the pickup needle 187 and the follower needle 195 engage the grooves of a record to be played the follower needle lags a few grooves behind the pickup needle and as a consequence during the inward swing of the pickup arm and with it the follower needle arm in the playing of a record the follower needle arm lags slightly behind its position of alignment with the pickup arm.

Secured to the pickup arm 177 and disposed at the upper side thereof and insulated from the pickup arm by suitable insulation 202 are two stationary metallic switch blades 203 disposed one at either side of the pickup arm, the ends of which blades overlie the metal weights 201 of the bell crank levers 197, the switch blades 203 being so formed and positioned that normally they are spaced away from the weights 201 but upon the follower needle arm being swung laterally to either side of its normal position so as to move one of the depending arms

199 laterally and oscillate the bell crank lever 197 about its pivot pin 198 to raise the arm 200 and with it the weight 201, this weight will make electrical contact with the corresponding switch blade 203 so that the blades 203 and the bell crank levers 197 constitute two switches which are normally open but either one of which will be closed upon the swinging of the follower needle arm 192 laterally, one of the switches being closed when the arm is swung laterally to the left and the other when it is swung laterally to the right.

A circuit wire 204 is in electrical contact with the two switch blades 203 while another circuit wire 205 is in electrical contact with the pickup arm base 178 and therefore in electrical communication with the bell crank levers 197 through the metal pickup arm 177, the circuit being completed, as will be hereinafter explained, so as to be normally open but to be closed whenever the follower needle arm 192 swings laterally in either direction with respect to the pickup arm.

Associated with the pickup arm is a stop lever 206 pivoted intermediately of its length upon the frame A at 207 for oscillation about a horizontal axis. The right hand end of this lever is formed into an upwardly directed stop edge 208 adapted for co-operative engagement with a depending stop 209 carried by the pickup arm 177 and the left hand end of the lever is connected by a spring 210 to the frame A, the action of the spring 210 being to normally depress the left hand end of the lever and to raise the right hand end so that the stop 208 is elevated into a position to be engaged by the stop 209 of the tone arm as the tone arm swings radially outward after the playing of a record, the upward oscillation of the end 208 of the lever being limited by a stop 211 carried by the frame A against which the opposite end of the lever 206 engages after it is pulled downwardly by the spring 210.

Mounted upon the frame A is an electro-magnet 212 positioned above and adapted for operative engagement with the left hand end of the lever 206, the construction and mounting of this lever and magnet being such that normally the left hand end of the lever is depressed by the spring 210 so that the stop edge 208 at the right hand end is elevated into position to engage the stop 209 of the tone arm but when the electro-magnet 212 is energized the right hand end of the lever 206 is attracted thereby and elevated so that the stop edge 208 at the right hand end is depressed out of position to operatively engage the stop 209 of the tone arm.

The bifurcated stud 193 within which the follower needle arm 192 is pivotally mounted and the switch blades 203 may be mounted upon the pickup arm 177 in any suitable way and in the form illustrated this is accomplished by means of a clamp 213 secured upon the arm by a bolt 214 and nuts 215, suitable insulation 202 being inserted between the clamp 213 and the pickup arm 177.

Journaled in the main frame A and at opposite sides thereof are a pair of co-axial horizontal shafts 216 both ends of which project laterally through the frame A. On the outer projecting end of each of these shafts is rigidly secured a small pulley 217 and a large pulley 218. On the inner faces of each of the large pulleys 218 is formed an arcuate slot 219 and projecting from this inner face of each of these pulleys is a stop 220 adapted in a certain position of the pulley to engage a co-operating stop 221 carried by the frame A. Secured in the peripheral groove of each of the large pulleys 218 and leading downwardly and forwardly from the top of the pulley is a cable 222 to the end of which is secured a weight 223. Secured in the peripheral grooves of each of the smaller pulleys 217 and leading downwardly and rearwardly from the top of the pulley is a cable 224, which will be presently referred to.

The inwardly projecting ends of the shafts 216 are split axially and a portion 225 thereof is hingedly connected at 226 to the main portion of the shaft (see Figure 24) so that in a certain position of the machine this portion 225 and the parts carried thereby may swing upwardly with respect to the remainder of the shaft 216 about the hinged connection 226. The inner split end of each of the shafts 216 extends through and has a bearing in a U-shaped bearing 227 rigidly carried by the frame A, which bearing is in the form of a bifurcated member having the bifurcation 228 thereof directed upwardly so as to form a socket bearing for the shaft 216.

The bifurcations 228 in these bearings 227 are of such width as to just accommodate the shafts 216 and the depth of the bifurcations is such that the lower ends thereof form a bearing for the shafts 216.

Rigidly carried by the inner end of each of the hinged portions 225 of the shafts 216 is a record holding channel portion H which is in the form of a stepped channelled element comprising outer and inner stepped receiving channel portions 229 and 230 which form respectively channels adapted to receive and accommodate large and small size records, for instance 10 and 12 inch records, the outer channels 229 of the member H being of such width as to accommodate a 12 inch record and the inner channels 230 being of such width as to accommodate a 10 inch record.

These stepped receiving channels 229 and 230 are so formed and so positioned in the machine that they lie at the same distance measured laterally from the longitudinal centre plane of the machine as do the channels 100 and 101 of the upper guide apron C, the channels 102 and 103 of the lower guide apron D and the channels 116 and 117 of the cradle E.

Rigidly carried by each of the channel members H is a cover plate 231 overlying the inner channel 230 and forming a support for a record contained in this channel during certain portions of the operation of the device. Rigidly carried by the main portion of each of the shafts 216 is a somewhat similar cover plate 232 adapted to overlie the outer receiving channel 229 and to form a support for a record within this channel during a certain portion of the operation of the device.

Rigidly carried by each of the channeled portions H and forming part thereof are outer and inner stepped discharging channelled portions 233 and 234 which channels face in the opposite direction to the receiving channels 229 and 230 and, as in the case of all other stepped channels in the machine, are of proper size to accommodate large and small records. These channels 233 and 234 are inclined with respect to the receiving channels 229 and 230, as clearly shown in Figures 14 and 23, and during a certain portion of the operation of the machine these discharging channels are adapted to be positioned in alignment with the lower stationary guide apron

D (see Figure 23), in which position the discharging channels 233 and 234 are in alignment with the channels 102 and 103 of the lower guide apron.

Provided in each of the receiving channels 229 and 230 respectively is a stop 235 and 236 adapted to engage the periphery of a record deposited within either of these channels, these stops being so positioned that the record is accurately positioned within the channel to insure the correct and accurate positioning of the centre hole of the record within the machine as is required for the successful operation thereof, as will hereinafter be more fully explained.

Carried by the main frame A and insulated therefrom is a switch R (see Figures 13, 14, 23 and 24) comprising two spring blades 237 and 238 normally out of contact with each other, the blade 238 overlying the blade 237 and these blades projecting downwardly so that at a certain point in the operation of the device when the record holding channels H are being oscillated outwardly and upwardly about their hinged connections 226, one of these channels is adapted to engage the switch blade 238 and press it outwardly against the switch blade 237 to close the switch R and the electrical circuit connected therewith.

Mounted in an orifice in the main frame A at each side thereof is a pin 239 formed at its inner end with an enlarged head 240 and having its outer end pressed against the inner face of the pulley 218 by means of a spring 241, the outer end of which pin is adapted at a certain point in the operation of the machine to enter and engage within the arcuate slot 219 in the pulley 218, the pin being spring-pressed into the slot when the pulley 218 has turned to that position in which the arcuate slot 219 registers with the outer end of the pin. The position of this pin relatively to the pulley 218 in the position of the apparatus shown in Figure 15 is indicated in broken lines.

Pivotally mounted upon the frame A at each side thereof is a lever 242 which is pivotally mounted intermediately of its length at 156 upon the main frame and is formed with a bifurcated end 243 overlying the enlarged head 240 at the inner end of the corresponding pin 239. Hingedly carried by the free end of each of the levers 242 is an arm 244 which arm extends inwardly transversely of the machine and its hinge connection 245 with the lever 242 is such that the arm is free to move upwardly towards the opposite end of the lever but cannot move in the opposite direction beyond a point in which it is substantially perpendicular to the lever. These arms 244 are so positioned and of such length that during the oscillation of the main beam F in the operation of the machine, the lugs 132 projecting laterally out from the arms 129 of the beam F are adapted to engage with these arms 244.

The action of the springs 241 carried by the pins 239 is such that normally the pins are pressed outwardly so that the enlarged heads 240 thereof overlie the bifurcated ends 243 of the levers 242, draw these bifurcated ends laterally out against the frame A and move the opposite ends of the levers 242 and therewith the hinged arms 244 to their innermost positions.

Journalled within the main frame A at the left side thereof is a horizontal shaft 246 upon which is rigidly carried a double grooved pulley 247. Secured within the grooves of the pulley 247 and leading downwardly and forwardly therefrom are two cables 224 which lead over a double pulley 248 adjacent to the bottom of the frame A at the left side thereof. One of these cables leads upwardly and is connected through a turnbuckle 249 to the cable 224 leading from the left hand pulley 217 while the other cable 224 from the pulley 247 leads across the machine to the right hand side thereof where it passes upwardly over a pulley 250 to be connected through a similar turnbuckle 249 to the cable 224 leading from the right hand pulley 217.

Secured within one of the grooves of the pulley 247 and leading rearwardly and downwardly over the top thereof is a cable 251 to the end of which is suspended a weight 252. The action of this weight, it will be apparent, is to tend to rotate the pulley 247 clockwise in Figure 1 while the tendency of the weights 223 is to rotate the pulleys 218 counterclockwise in Figure 1 and therefore these weights 223 and 252 oppose each other to maintain the cables 224 taut. The length of the cables 224 may be suitably adjusted by means of the turnbuckles 249.

The inner end of the shaft 246 projects slightly beyond the frame A and rigidly secured thereto is a collar 253 carrying a radial finger 254, the shaft 246 carrying an additional retaining collar 255 rigidly secured thereto for preventing axial movement of the shaft.

Rigidly secured to the frame A is a bracket 256 in which is journalled one end of a bent lever 79 (see Figure 8), this lever 79 being of bent formation such that it is in effect pivotally mounted within the bracket 256 about a point intermediately of the length of the lever, one end 78 thereof being connected to a cable 76, as previously explained, and the free end 81 of the lever being directed forwardly, as clearly shown in Figure 8.

Journalled within the frame A is a second horizontal shaft 257 in spaced relation axially from the shaft 246 and having its axis eccentric with respect to the axis of the shaft 246, the axis of the shaft 257 being slightly lower than and to the rear of the axis of the shaft 246. The outer end of the shaft 257 projects beyond the frame A and rigidly secured to this projecting end is a collar 258 which collar carries two rigid diametrically opposed radial arms the extremities of which are bent laterally outward to form the dogs 82.

The relative disposition of the dogs 82, radial arm 254 and the free end 81 of the lever 79 is such that upon clockwise rotation (as viewed in Figure 8) of the shaft 257 and with it the collar 258 and dogs 82, these dogs 82 are adapted to engage with and disengage from the radial arm 254 and the free end 81 of the shaft 79. The engaging and disengaging of the dogs 82 with the radial arm 254 is rendered possible because the shaft 257 is eccentric with respect to the shaft 246, it being obvious that, if these shafts were concentric or co-axial, engagement between the dogs 82 and the radial arm 254 would be continuous so that there would be a continuous drive established between these parts.

The inner end of the shaft 257 also extends beyond the frame A and mounted upon this inner extension are two spaced apart collars 259 and 260 rigidly carried by the shaft, the collar 259 being provided with circumferentially spaced apart notches adapted to be operatively engaged by a finger 261 for preventing counter-clockwise rotation of the shaft 257 as viewed in Figure 8. Between the collars 259 and 260 and rigidly carried by the shaft 257 is a ratchet gear upon which is operatively mounted a ratchet collar 262 from

which projects a radial arm 263, the ratchet gear and ratchet collar 262 being such that, as viewed in Figure 8, the ratchet is operatively locked when the collar 262 is rotated clockwise but that when rotated counter-clockwise the collar 262 moves freely over the ratchet gear enclosed therein. In other words the construction is such that the ratchet is operative to establish clock-wise rotation of the shaft 257 in Figure 8 but inoperative to produce counter-clockwise rotation and as a further precaution against any possibility of counter-clockwise rotation the finger 261, which because of its engagement with the circumferentially spaced apart notches on the collar 259 positively prevents any counter-clockwise rotation of the shaft 257.

Operatively connecting the radial arm 259 and the arm 147 carried by the main shaft 128 is a link 264.

In Figure 28 is illustrated diagrammatically a modified apparatus for oscillating the record holding channels H as required in the operation of the machine which modified apparatus will replace certain of the apparatus previously described and illustrated in the other views.

Specifically this modified apparatus will replace entirely the pulleys 218, 217, 247, 248 and 250, cables 224, 222, 251, weights 223 and 252 and certain other apparatus associated with the above eliminated parts. The showing of this modified construction in Figure 28 is merely diagrammatic but it is thought will be sufficient to clearly set forth the apparatus involved.

In this modified apparatus the same main shaft 128 and the beam F with its side arms 129 is employed and also the same split axles 216 which carry the record holding channels H in exactly the same manner as that already described. In the modified construction, however, the pulleys 218 and 217 carried by the shafts 216 are replaced by a collar 265 rigidly secured to the outer projecting end of each of the shafts 216 at the location formerly occupied by the pulleys 218 and 217. From each of the collars 265 extends a radial arm 266, the angular disposition of each of the arms 266 with respect to the channel H carried by the corresponding shaft 216 being the same.

Journalled in the main frame A extending transversely of the machine and projecting on each side of the frame A is a horizontal shaft 267 and upon each projecting end thereof and vertically below the corresponding collar 265 is rigidly secured a collar 268 from each of which collars extends a radial arm 269, the collars 268 being so positioned upon the shaft 267 that the arms 269 are in alignment with each other. Each radial arm 269 is connected to the corresponding radial arm 266 by a link 270, the arms 266 being slightly longer than the arms 269. Rigidly mounted upon the shaft 267 is a sprocket 271.

While in Figure 28, which is merely diagrammatic, only the parts at one side of the machine have been illustrated, it is to be understood that the collars 216 and 268 with the arms 266 and 269 carried thereby and the links 270 connecting the free ends of the arms 266 and 269 are duplicated at each side of the machine, there being, however, only one sprocket 271.

Also journalled in the main frame A of the machine is a horizontal shaft 272 upon which is rigidly carried a sprocket 273 in operative meshing engagement with the sprocket 271, the diameter of the sprocket 273 being exactly twice that of the sprocket 271 so that one revolution of the sprocket 273 will produce two revolutions of the sprocket 271. Rotatably carried by the shaft 272 is a collar 274 from which extends a radial arm 275 to the free end of which is hingedly connected at 276 a connecting link 277, the opposite end of which is hingedly connected at 278 to the arm 147 extending from the main beam shaft 128. Rigidly mounted upon the shaft 272 is a disk 279 provided with four equally spaced apart ratchet recesses 280, and operatively held in engagement with the periphery of the disk 279 in any suitable manner, as by a spring 281, is a ratchet dog 282 which dog so engages the ratchet recesses 280 as to prevent counter-clockwise rotation of the collar 279 as viewed in Figure 28 and consequently preventing counter-clockwise rotation of the sprocket 273.

Pivotally carried by the radial arm 275 is a further ratchet dog 283 which is spring held in contact with the periphery of the disk 279 by a spring 284 so as to operatively engage any one of the various ratchet recesses 280, as will be later described in detail.

In Figure 28 the relative inclined position of the record holding channels when in their receiving position within the machine is indicated by the broken line marked H'.

The arrangement of the electrical apparatus and circuits including the associated switches is illustrated in Figure 29 by way of a schematic wiring diagram in which the relative positions of the different parts and switches are shown in the positions occupied thereby when the machine has come to rest, as after the completion of a playing period, in which the beam F has come to rest in its fully raised position with the turntable carried thereby also in its fully raised position with no record thereon, in which position all electric circuits are open and the entire mechanism is at rest.

The electrical apparatus comprises the main drive motor I which forms a source of driving power for the entire machine with the exception of the rotation of the turntable 163 which is driven by a separate motor 167'. The motor I is of reversible type in which reversal is accomplished by reversing the connections to the starting coils thereof.

In addition to the switches heretofore referred to there is a starting switch S which is shown in Figure 29.

The electric circuits of the machine comprise 110 volt circuits for driving the motor I and 167' and low voltage battery circuits for controlling apparatus for opening and closing the 110 volt circuits during the operation of the machine and in this diagram for purposes of clearness the 110 volt circuits have been shown in full lines while the low voltage or battery circuits are shown in broken lines.

Certain circuit controlling apparatus collectively indicated by the letter U may conveniently be mounted in any suitable way upon the machine and, as indicated, is shown mounted upon a wooden panel 285, which may be conveniently mounted upon any desired part of the main frame A, as indicated by the broken line panel in Figure 1. This circuit controlling mechanism U comprises a metallic cradle 286 pivotally supported intermediately of its length upon a horizontal pivot bearing 287 so that the cradle may oscillate vertically about this pivotal mounting. The interior of the cradle 286 is formed with a baffle runway 288 and mounted therein is a metal ball 289 adapted to roll from end to end of the cradle upon oscillation or tilting thereof.

Secured to the right hand end of the cradle, as viewed in Figures 20, 21 and 29, are two spaced apart metallic terminals 290 and 291 which are insulated from the cradle and each of which carry binding posts 292 extending exteriorly of the right hand end of the cradle. The construction of the cradle is such that when the left hand end is depressed the ball 289 travels to the left hand end of the cradle so that the terminal points 290 and 291 are out of contact while when the left hand end of the cradle is raised, the ball 289 travels to the right hand end thereof and bridges the terminals 290 and 291 thereby operating to close the circuit connected to these terminals. Beneath the right hand end of the cradle is a stop 293 upon which this end of the cradle rests to limit oscillation thereof.

For convenience of description the cradle when in the position shown in Figure 20, that is in which the left hand end of the cradle is raised and the ball is at the right hand end, will be referred to as the elevated or raised position of the cradle while the opposite position, in which the left hand end of the cradle is depressed and the ball 289 has travelled to the left hand end, will be referred to as the depressed or lowered position of the cradle.

Mounted upon the panel 285 at a point beneath the cradle 286 is an electro-magnet 294 and pivotally mounted upon the panel 285 and operatively associated with the electro-magnet 294 is an armature 295 connected to the cradle 286 towards the left hand end thereof by a link 296 engaging a depending lug 297 carried by the cradle. The armature 295 is adapted to be attracted by the electro-magnet 294 when this magnet is energized and is normally held in raised position away from the electro-magnet by a spring 298 operative to raise the armature.

Underlying the armature 295 are switches 299 and 300 normally maintained in open position but adapted to be closed by the armature 295 when this armature moves downwardly under the attraction of the electro-magnet 294. The construction of these parts U therefore is such that normally when the electro-magnet 294 is not energized the parts are in the position shown in Figure 20 in which the armature is raised by the spring 298, the cradle 286 is in raised position with the ball 289 at the right hand end thereof and the switches 299 and 300 are in open circuit position. When the magnet 294 becomes energized the armature 295 is attracted thereby and drawn downward against the action of the spring 298 in which depressed position the armature closes the switches 299 and 300 and oscillates the cradle 286 into depressed position to lower the left hand end thereof and cause the ball 289 to travel to the left end of the cradle to break electrical contact between the terminals 290 and 291.

The starting coil reversing switch K, previously referred to and clearly shown in mounted position upon the machine in Figure 3, comprises a movable switch member 337 of substantially X shape, the four arms of which are indicated by the numerals 301, 302, 303 and 304, the member 337 being pivotally mounted at 305. Forming part of the switch K are three insulated stationary contacts 306, 307 and 308 which three contacts are carried by an insulated base 154 and are struck about the pivotal centre 305 of the switch as center and so positioned that the switch arms 303 and 304 are adapted to engage two of these three contacts at one time. Thus in the position shown in Figure 29 the arms 303 and 304 are in engagement with the contacts 306 and 307 while by oscillating the switch K counter-clockwise the arm 303 will engage with the contact 307 and the arm 304 with the contact 308. The two outer contacts 306 and 308 are in electrical communication with each other as by the dotted bar 309. Connected in the battery circuit is a suitable storage battery 310.

The circuit connections are as follows. The 110 volt circuits for driving the motors I and 167' will first be referred to.

The main 110 volt lead-in wires are indicated by the numerals 311 and 312. The main terminals of the motor I are indicated by the numerals 313 and 314 while the starting coil terminals of this motor are indicated by the numerals 315 and 316. The motor terminal 313 is connected directly with one of the 110 volt wires 311. The motor terminal 314 is connected by a wire 317 with one side of the switch N, the other side of the switch N being connected by a wire 318 to the cradle terminal point 290, the other cradle terminal 291 being connected by a wire 319 with the upper side of the switch 299. This upper side of the switch 299 is connected directly to the other 110 volt lead-in wire 312. The lower side of the switch 299 is connected by a wire 320 to the wire 317. The switch arm 304 is connected by a wire 321 to the motor terminal 313 while the switch arm 303 is connected by a wire 322 to the motor terminal 314. The switch contact 307 is connected by a wire 323 to the starting coil terminal 315 on the motor I while the switch contact 306 is connected by a wire 324 to the starting coil terminal 316 of the motor I and, since the switch contacts 306 and 308 are electrically connected by the bar 309, it will, of course, be obvious that the contact 308 is also connected electrically with the starting coil terminal 316.

The main 110 volt lead-in wire 311 is connected by a wire 160 with one side of the turntable motor switch Q while the other 110 volt lead-in wire 312 is connected by a wire 325 with one terminal of the turntable motor 167', the other terminal of this motor being connected to the opposite side of the switch Q by a wire 161.

From the foregoing it will be noted that the 110 volt circuits to the main motor I and the turntable motor 167' are parallel circuits and quite independent of each other and as a matter of fact, while the 110 volt circuit to the main drive motor I is intermittently opened and closed during the operation of the machine, the 110 volt circuit to the turntable motor 167' is closed continuously during the operation of the machine so that this turntable motor is operating and this circuit to the turntable motor is only broken when the entire mechanism comes to rest.

The battery circuits used in the apparatus will now be described. From one terminal of the battery 310 a wire 326 leads to one terminal of the electro-magnet 212, the other terminal of this electro-magnet being connected by a wire 109 to one side of the switches R and M, the other sides of these switches being connected together by a wire 108, which wire 108 is connected by a wire 327 to one terminal 332 of the electro-magnet 294 this terminal 332 being connected by a wire 328 with the opposite terminal of the storage battery 310. It will thus be apparent that the switches M and R are connected in parallel in the battery circuit above described so that the closing of either of these switches will energize the electro-magnet 212.

One terminal of the battery 310 is also connect-

ed by a wire 329 with one side of the switch P, the other side of the switch P being connected by a wire 330 with one side of the switch 300 and by a wire 204 to one side of the starting switch S, the other side of the starting switch S being connected by a wire 331 with the other side of the switch 300 and to the opposite terminal 333 of the electro-magnet 294 to that to which the wire 327 is connected. A wire 205 connects one side of each of the parallel pickup arm switches T to that side of the starting coil switch S to which the wire 331 is connected. The other sides of these pickup arm switches T are connected by a wire 204 to that side of the starting coil switch S which is connected by the wire 204 to one side of the switch P.

It will thus be clear that the starting switch S and the pickup arm switches T are in parallel connection.

All the switches employed in the circuits are automatically operated with the exception only of the starting switch S which is manually closed.

Of these switches the switches N, P and Q are normally spring-held in closed circuit position so that these switches are only opened at certain desired points during the operation of the machine; otherwise they remain automatically closed. On the other hand the switches M, R, S, T, 299 and 300 are normally spring-held in open circuit position so that the circuits controlled by these switches are normally open and are only closed by the mechanical closing of these switches at certain points during the operation of the machine.

The construction and operation of the various parts will now be described.

The motor I, as previously explained, constitutes the main drive for the entire machine, which motor, through the medium of the pulleys 144, 141, 142 and 143 and the belts 145 and 146 mounted thereon together with the cone pulleys 135 and 136 and the cables 138 and 139, functions to oscillate the beam F vertically in the machine as required for the operation thereof, which beam is oscillated vertically between an extreme lower position and an extreme upper position in the latter of which a record supported upon the turntable 163 is in proper playing position in the machine, proper arrangements being provided for reversing this motor I during certain periods of the operation to alternately elevate and lower the beam F and to permit the motor I to remain at rest for a certain period when the beam is in its elevated position to permit it to remain stationary in this position during the playing of a record.

The operation of various parts of the apparatus is accomplished by co-operative action between the oscillating beam F and these various parts, the operation of which automatically occurs at certain desired points in the oscillation of the beam.

During each descent of the beam F at which time the main shaft 128 is rotating counter-clockwise, as shown in Figure 7, the arm 147 is also being rotated counter-clockwise and through the medium of the links 264 connecting this arm to the radial arm 263 carried by the ratchet collar 262 this collar 262 is rotated clockwise in Figure 8 in which direction of rotation, as previously explained, the ratchet collar is in operative locked engagement with the ratchet gear contained therein and rigidly carried by the shaft 257 so that through the medium of this ratchet collar 262 and ratchet gear the shaft 257 is turned in a clockwise direction through an arc and with it also turns the collar 258 rigidly carried by the outer projecting end of the shaft and the two dogs 82 carried by this collar. This clockwise turning of the shaft 257 and dogs 82 occurs only during the descent of the beam F but occurs during each descent thereof.

During each ascent of the beam, in which ascent the main shaft 128 is rotating clockwise in Figure 7 thereby causing clockwise rotation of the arm 147 carried thereby, again through the medium of the link 264 connecting the arm 147 with the arm 263, the ratchet collar 262 is rotated counter-clockwise but, as previously explained, during counter-clockwise rotation of this ratchet collar it does not operatively engage the ratchet gear therein but the collar rides freely over the ratchet gear so that there is no consequent rotation of the shaft 257 and dogs 82 so that during each ascent of the beam the shaft 257 and dogs 82 remain at rest and the ratchet collar 262 merely moves in a counter-clockwise direction freely with respect to the shaft 257 to, as it were, reset itself or wind itself up with respect to the ratchet.

In the above described clockwise rotation of the dogs 82 through an arc during each descent of the beam F at certain desired points in the operation of the device these dogs 82 engage with the radial arm 254 carried by the collar 253 on the shaft 246 so as to rotate this shaft and with it the double grooved pulley 247 carried thereby through an arc in a clockwise direction after which the engaging dog 82 disengages from the arm 254.

The function of this engagement between the dog 82 and the arm 254 with the consequent turning of the double grooved pulley 247 will be further described presently but it is sufficient for the moment to state that this clockwise rotation of the pulleys 247 takes place during the descent of the beam F by the engagement and disengagement between one of the dogs 82 and the radial arm 254.

Also during the clockwise rotation of the dogs 82, as above described, consequent upon the descent of the beam F these dogs one at a time engage with the free end 81 of the pivoted lever 79 so as to depress this free end 81 and lift the opposite end 78 to which the cable 76 is secured and after depressing the free end 81 a certain distance the dog 82 disengages therefrom to permit the lever 79 to resume its original position. During each oscillation of the lever 79, as above described, the cable 76 is pulled upwardly so as to draw the bar 73 rearwardly, which rearward movement results in the operation of the record holding magazine B, as will now be described.

Consider the magazine B to be in its fully raised position in which position it is supported by the engagement of the projecting ends of one of the pins 60 upon a solid portion of the upper face of the thrust collar 62, as clearly shown in Figures 9 and 10, and that the compartments 95 of the upper magazine section 52 each contain a record 98.

In this position the records 98 are projecting rearwardly from the compartments 95 and are held in position therein by the engagement of the records with the stop rods 97, these rods extending slightly below the lowermost record but the lower ends of the rods being spaced above the upper stationary channelled slide or guide apron C. In this position of the magazine, it is therefore evident that all the records 98 are

prevented by the stop rods 97 from moving rearwardly out of the magazine.

At a desired point in the operation of the device and during descent of the beam F, as previously explained, one of the dogs 82 during its clockwise turning movement strikes the free end 81 of the lever 79 depressing this lever and pulling upwardly upon the cable 76, thus drawing the bar 73 rearwardly. During this rearward movement of the bar 73, due to the engagement of the end of the arm 70 within the notch 74 of the bar 73, the arm 70 is drawn rearwardly as in Figures 6 and 9, thereby turning the thrust collar 62 counter-clockwise as viewed from above.

The extent to which the bar 73 is drawn rearwardly, it is evident will depend directly upon the length of the arc of oscillation of the lever 79 by the dog 82, it being clear that after engaging the end 81 of the lever 79 through a certain arc, continued turning of the dog 82 will cause this dog to disengage from and release the end 81 and the parts are so related that the arc of oscillation of the lever 79 in the above described operation is just sufficient to turn the thrust collar 62 counter-clockwise sufficiently to place the oblique slots 69 in alignment under the projecting ends of the pins 60.

When this alignment occurs it will be evident that since the slots 69 are oblique to the axis of the supporting rod 59 and since no rotation of the rod 59 is possible, this rod cannot descend through the thrust collar 62 without causing clockwise rotation of this collar, that is rotation in the reverse direction to which it was just rotated by the rearward movement of the bar 73. As above described, when the dog 82 has oscillated the lever 79 through the desired arc to bring the oblique slots 69 into alignment with the pins 60, unless the lever 79 is released, no descent of the supporting rod 59 can occur since, until this release of the lever 79 takes place, the necessary clockwise rotation of the thrust collar 62 is prevented since the end 78 of the lever 79 is elevated and the cable 76 is retaining the bar 73 in its rearwardly drawn position and by the engagement of the end of the arm 70 within the notch 74 of the bar 73 clockwise rotation of the collar 62 is positively prevented.

At this point, however, the dog 82 disengages from the lever 79 thus releasing the lever and the weight of the magazine B pressing downwardly upon the rod 59 causes this rod to descend, in which descent the pins 60 travel through the oblique slots 69 causing the aforementioned clockwise rotation of the thrust collar 62 and drawing the bar 73 forwardly into its original position so that, through the cable 76, the lever 79 is also returned to its original position in which it rests upon the stop pin 84. In this operation the spring 83 operates to draw the bar 73 downwardly and forwardly and to maintain engagement between the notch 74 and the arm 70. In this descent of the rod 59 and magazine B, the clockwise rotation of the thrust collar 62, as one set of pins 60 descends through the oblique slots 69, results in the next upper set of pins 60 striking against a solid portion of the upper face of the collar 62, this being caused by the clockwise rotation of the collar so that when the original set of pins 60 emerge from the bottom ends of these slots 69 these bottom ends of the slots are in alignment with the pins 60 so that the upper ends of the slots 69 cannot be in alignment with the next upper set of pins 60 and therefore these pins engage a solid part of the upper face of the collar 62 and further descent of the magazine B is positively prevented.

This descent of the magazine has been sufficient to lower the magazine so that the record 98 contained in the lowermost compartment 95 thereof moves downwardly clear of the lower ends of the stop rods 97 and slides by gravity rearwardly from the magazine over the upper channeled guide apron or slide C to be conducted through the machine and to be finally delivered therefrom and to slide over the lower slide or guide apron D and be deposited forwardly within one of the compartments 96 of the lower magazine section 53 in which it is retained by engagement with the stop bar 99.

At proper intervals during the operation of the machine the lever 79 is oscillated by the dogs 82 as above described and at each of such oscillations the magazine B is caused to descend a set amount so as to release the next record over the upper guide apron C into the machine.

The construction is therefore such that during the operation of the machine the magazine B is at proper intervals caused to descend by a series of steps each of which descents causes a record to be delivered from the upper magazine section 52 into the machine. In loading the upper magazine section the records would be placed therein in the desired order in which they are to be played and would be delivered one at a time in regular order from the lowermost to the uppermost until the complete series of records has been thus delivered. When the magazine has reached its fully lowered position as a result of this series of stepped descents, in order to again put the machine in operation it is necessary that the magazine be raised and the upper section 52 again supplied with records. This raising of the magazine from its lowermost to its uppermost position is accomplished as follows:—

By reference to Figure 9 it will be noted that normally the pins 60 carried by the supporting rod 59 rest upon a solid portion of the upper face of the thrust collar 62 and are disposed intermediately between the oblique slots 69 and the axial slots 68 and in the normal operation of the mechanism the collar 62, as above described, is turned in a counterclockwise direction to bring the oblique slots 69 into the alignment with the pins 60.

In the operation of raising the magazine from its lowermost to its uppermost position, rotation of the collar 62 in a clockwise direction as viewed from above is necessary to bring the axial slots 68 into alignment with the pins 60 and this is accomplished as follows. The cable 89 has one end connected to the foot treadle 91 and the other end to the rear end of the bent lever 85, which lever is pivoted intermediately of its length at 86 to the lug 87 carried by the arm 70, the lug 88 at the opposite end of this lever 85 underlying the bar 73. When, therefore, the foot treadle 91 is depressed, a forward pull is exerted upon the cable 89 which passes over the pulley 90, thus oscillating the lever 85 about its pivot point 86 so that the lug 88 presses upwardly upon the bar 73 raising this bar so that the notch 74 thereof disengages from the arm 70. Further depression of the foot treadle 91 will operate to rotate the arm 70 clockwise in Figure 9 and with it produce clockwise rotation of the thrust collar 62, it being of course apparent that such clockwise rotation is impossible until the arm 70 is disengaged from the notch 74 of the bar 73 and the function of the

pivoted lever 85 is to accomplish this disengagement.

In the above described operation of the lever 85, lifting of the bar 73 thereby is permitted by the making of the orifice 334 (see Figure 22) of sufficient depth to provide clearance so that the forward end of the bar 73 may be raised sufficiently to permit disengagement of the arm 70 from the notch 74. In the normal engaged position of these parts, as shown in Figure 22, the bar 73 rests upon the bottom of the orifice 334 in the bracket 71 and the necessary clearance is provided above the bar.

The arc through which the thrust collar 62 is turned clockwise in the above described operation is sufficient to bring the axial slots 68 into alignment with the pins 60 and when this occurs it will be evident that since the slots 68 are axial the magazine B may be freely raised manually into its uppermost position, it being of course necessary that during this last operation, the foot treadle 91 be held depressed.

When the magazine has been thus fully raised, the foot treadle 91 is released upon which release a spring 92, having one end secured to the collar 62 and the other to a lug carried by the frame A, operates to cause counter-clockwise rotation of the collar 62 and return it to its original position in which the pins 60 are disposed intermediately between the axial slots 68 and the oblique slots 69, as shown in Figure 9, so that when the magazine is released it is held in its raised position by the engagement of the pins 60 with the solid part of the upper surface of the collar 62. The spring 92, of course, also operates to return the arm 70 to its normal position and immediately this position is reached engagement is again established between the arm 70 and notch 74 of the bar 73 so that the entire magazine and associated parts are again in position to go through the previously described cycle of operations.

It might also be pointed out that in the above described operation of raising the magazine, when the bar 73 is raised by the lug 88 of the lever 85, this bar 73 is held in its normal forward position by the forward pull of the spring 83 so that this spring not only operates to pull downwardly upon the bar 73 to maintain engagement between the arm 70 and the notch 74 but also to normally urge this bar 73 into its forwardmost position.

In describing the construction of the upper and lower slides or guide aprons C and D, the cradle E and the record holding channels H these members have been referred to as being channelled to accommodate large and small sized records, an inner channel adapted for the accommodation of, say, 10 inch records and an outer channel adapted for the accommodation of, say, 12 inch records, the smaller or inner of which channels being depressed below the level of the outer or larger channel, and for convenience of description these channels will be referred to as stepped channels, the outer upper or larger channel being for the accommodation of 12 inch records while the lower inner or smaller channel is for the accommodation of 10 inch records. These stepped channels on the various channelled members are all of corresponding width and equally spaced laterally from the longitudinal vertical plane passing through the turntable pin 170 so that the centre hole of a record passing over or supported within any of these stepped channels always lies within the aforesaid longitudinal vertical plane.

The channelled cradle E, which is pivotally mounted in the main frame A for oscillation about a transverse horizontal axis, is normally maintained by the counterweights 124 and 125 in what will be referred to as its raised or forward position in which the stepped channels 116 and 117 of the cradle practically abut the lower ends of the stepped channels 100 and 101 of the upper guide apron C and are in alignment therewith so as to form practically a continuation thereof. In this position a downwardly and rearwardly extending tongue forming part of the upper guide apron C projects into the space between the cradle channels. Also in this forward position of the cradle one of the side arms 110 thereof is in abutment with the stop pin 126, which pin operates to limit the forward oscillation of the cradle.

At the desired point in the operation of the machine a record 98 is, as previously described, discharged from the lowermost filled compartment of the upper magazine section 52, which record slides over the upper guide apron C, sliding through the lower and inner stepped channel 101 if it is a 10 inch record, and over the upper or outer stepped channel 100 if it is a 12 inch record. This record slides from the upper stationary guide apron C into the proper stepped channel of the cradle E, being guided thereinto over the rearwardly extending lip of the guide apron C and being accommodated within the proper channelled portion of the cradle E.

Associated with each of the stepped channels 116 and 117 in the cradle E and adjacent to the rearward end thereof are stops 120 and 121, the stops 120 being in the cuter 12 inch channel and the stops 121 being in the inner 10 inch channel. These stops are of novel arrangement and are so positioned that as the record slides into the downwardly inclined channels of the cradle from the apron C at the proper point the periphery of the record engages the stops at opposite sides of the record to prevent further forward movement of the record into the cradle and to hold the record therein.

When the record has thus been fed into the cradle and is supported therein the weight of the record is sufficient to cause the cradle to oscillate downwardly and rearwardly into what will be referred to as its lowered or rearward position in which position the lower bent portions 113 of the side arms of the cradle come into abutment with the stops 127, which stops limit the rearward oscillation of the cradle and are so positioned that the record is properly positioned within the machine as required.

The stops 120 and 121 in the stepped channels 116 and 117 of the cradle and the stops 127 are so disposed that, when a record is supported in the cradle in its lower or rearward position, the centre hole of the record is accurately positioned so as to be engaged by the turntable pin 170 as is required in the operation of the machine and as will be hereinafter more fully explained.

In due course in the operation of the machine, as previously explained, the beam F rises carrying with it the turntable 163 which moves up under the record supported as above in the cradle E and the turntable pin 170 enters the centre hole in the record and to facilitate the entry of this pin into the centre hole and to compensate for any slight variation in the position of this centre hole, as may occur due to a slight variation from standard of the outside diameter of the record

the pin 170 is provided with a long tapering point. By the provision of this long tapering point it is only necessary that the extreme point enter the centre hole in the record and not vitally necessary that the centre hole and turntable pin be absolutely concentric as, providing the point of the pin 170 enters the record hole at all, the record will centre itself when lifted free of the cradle.

As the pin 170 enters the centre hole, upon the beam moving further upwardly, the record is lifted clear of the cradle and supported upon the turntable 163 and as soon as this occurs the cradle, being relieved of the weight of the record, immediately and automatically swings upwardly and forwardly into its raised position under the action of the counterbalancing weights 124 and 125 so as to be again placed in operative engagement with the upper stationary slide C ready to receive in due course another record delivered from the upper magazine section. The record thus lifted by the rising turntable from the cradle is now carried further upwardly into playing position in the machine.

The operation of the beam F will now be described.

The beam F is rigidly carried by the main axle 128 and during the operation of the machine this beam is oscillated upwardly and downwardly between two extreme positions by the oscillation of the main shaft 128, the oscillation of this shaft being produced from the main drive motor I through the medium of the reduction gearing comprising the pulleys 144, 141, 142 and 143 and the connecting belts 145 and 146 and the opposed cone pulleys 135 and 136 and the cables 138 and 139.

In the operation of the device the beam F has imparted to it alternate ascents and descents between an extreme upper position, in which the turntable 163 is raised into what will be referred to as its playing position within the machine, and an extreme lower position, which ascents and descents are produced by reversing the motor I, this motor being of the reversing type and the arrangement for the reversal of the motor being such as will hereinafter be fully explained and including a reversing switch K operatively associated with the beam F.

For controlling the opening and closing of certain electric circuits necessary to the operation of the machine, which circuits contain the switches N and P, the main shaft 128 carries a rigid radius arm 148 provided with extensions 149 and 150 adapted to operatively engage with the switches N and P during the operation of the device. This radius arm 148 is so formed that when the beam F is in its fully raised or playing position the extension 149 of the radius arm 148 engages an extension 151 of the switch N so as to open this switch, the switch being normally closed except when so opened by the radius arm, and when the beam F is in its fully lowered position the extension 150 of the radius arm 148 engages an extension 152 of the switch P so as to open this switch, the switch P being normally closed except when so opened by the radius arm 148.

The function of these switches N and P and the circuits controlled thereby will be later fully described in connection with the electrical equipment but for the present it is only desired to point out that the radius arm 148 opens the normally closed switch N when the beam is in its fully raised position and opens the normally closed switch P when the beam is in its fully lowered position.

It will be apparent that elevation of the beam F is caused by the winding up of the cable 138 upon the cone pulleys 136 during which operation the cable 139 unwinds from the pulley 135 and similarly during descent of the beam F the cable 138 unwinds from the cone pulley 136 and the cable 139 winds up on the pulley 135 and in order to permit successful operation of the beam the rate at which one cable winds up must be equivalent to that at which the other cable unwinds. Ordinarily these cables 138 and 139 should be secured to the beam F and the rearwardly extending arm 137 at equal distances on each side of the shaft 128 and in the form shown, since this is not the case, the cable 139 being attached to the beam F at a point nearer to the shaft 128 than the cable 138, the cable 139 has associated therewith a coil spring 140 so as to compensate for the above difference in the point of attachment of the two cables, which spring effectively serves to take up any slack in the cable 139.

Carried by each of the arms 129 of the beam F at a point intermediately of the length of the beam and projecting laterally outward therefrom, is a lug 132, which lugs are so positioned to contact during the oscillation of the beam with the hinged fingers 244 extending inwardly from the lower ends of the levers 242 so that during descent of the beam F, as the lugs 132 engage with and pass the hinged fingers 244, the wiping engagement therebetween serves to depress or force outwardly the lower ends of the levers 242 and oscillate these levers about their pivotal connection 156 to cause the upper bifurcated ends 243 of these levers to withdraw the pins 239 out from engagement within the slots 219 in the pulleys 218.

During each ascent of the beam F it will, of course, be apparent that wiping engagement will again take place between the lugs 132 and the hinged fingers 244 but in this case as the fingers 244 are hinged so as to move freely upwardly about their hinged connection 245 no action takes place as this wiping contact occurs other than that the fingers 244 hinge upwardly to permit the lugs 132 to freely pass thereby.

Operatively associated with the beam F is a starting coil reversing switch K mounted upon the frame A and so positioned that the arms 301 and 302 thereof project inwardly into the path of the right hand lug 132 so as to be selectively engaged by this lug at an intermediate point of the ascent or descent respectively of this beam.

Forming part of this switch K are the three stationary switch contacts 306, 307 and 308, which contacts are so positioned and spaced that the movable switch member 155 may be oscillated between two extreme positions in one of which the arms 303 and 304 engage respectively with the stationary contacts 306 and 307 and in the other of which the arms 303 and 304 engage respectively with the stationary contacts 307 and 308.

When the beam F is in its elevated position, the switch arms 303 and 304 are in engagement with the stationary contacts 306 and 307, as shown in the diagram in Figure 29, and the arm 301 is projecting inwardly into the path of the right hand lug 132 of the beam. In this position of the switch K the circuits controlled thereby are in position for producing rotation of the motor I in a direction to cause descent of the beam.

The actual operation of these circuits will, however, be fully explained in detail later but for the time being it is sufficient to merely state this fact.

As the beam descends and at an intermediate point in the descent, the lug 132 strikes the inwardly projecting switch arm 301 and oscillates the movable switch member 155 counter-clockwise, as viewed in Figure 29, so that the arms 303 and 304 are moved over to engage with the stationary contacts 307 and 308 respectively in which position of the switch K the circuits controlled thereby, as will later be explained, are so connected as to reverse the direction of rotation of the motor (after the motor has come to rest upon the beam reaching its lowermost position and the motor again being started) to elevate the beam.

The counter-clockwise rotation of the switch member 155, as just described, during the descent of the beam has positioned the switch arm 302 so that this arm projects inwardly into the path of the lug 132 and during the following ascent of the beam at an intermediate point therein this lug 132 strikes this inwardly projecting switch arm 302 and oscillates the switch member 155 in a clockwise direction back into its original position, as shown in Figure 29, in which the arms 303 and 304 thereof are in engagement with the stationary contacts 306 and 307 respectively, thus placing the switch K into position to again reverse the direction of rotation of the motor I (after it has come to rest with the beam in its topmost position and the motor is again started) to lower the beam. The co-operation, therefore, between the beam F and the starting coil reversing switch K is such that during each descent of the beam the position of the switch K is reversed so that when the beam reaches its lowermost position and the motor I comes to rest, upon restarting this motor, its direction of rotation is reversed so as to raise the beam and during each ascent of the beam the position of the switch K is again reversed so that when the beam reaches its uppermost position and the motor I comes to rest, upon restarting this motor, its direction of rotation is reversed so as to lower the beam, these reversals of the switch K taking place during each ascent and descent of the beam. Also, as previously explained, through the medium of the arm 147 carried by the main shaft 128 and radial arm 263 carried by the ratchet collar 262 together with the link 264 connecting these two arms during each descent of the beam the ratchet collar 262 is operative to turn the shaft 257 and with it the dogs 82 in a clockwise direction as viewed in Figure 8 through an arc of a circle, while during each ascent of the beam the ratchet collar 262 turns freely in a clockwise direction with respect to the shaft 257, any clockwise rotation of the shaft 257 being effectively prevented by the stop finger 261 engaging notches in the collar 259, which collar is rigidly carried by the shaft 257.

This clockwise turning of the dogs 82 during each descent of the beam is operative in connection with the operation of the magazine B, as already explained, and is also operative for turning the double pulley 247, as will presently be explained.

It will be observed that the cables 138 and 139 are so wound upon the cone pulleys 135 and 136 that when the beam F is adjacent to its topmost position these cables are being wound upon and unwound from the smaller diameter ends of these cone pulleys and as a matter of fact, in the form illustrated, during this extreme upper part of the travel of the beam these cables are being wound upon and unwinding from the shaft 134 so that the last few turns of these cables are upon this shaft. This feature is of considerable importance as, due to it, it will be apparent that the rate at which the beam F moves during this extreme upper part of its travel is of reduced speed so that a record carried upon the turntable 163 approaches the needles 187 and 195 at a reduced speed of elevation and therefore comes quietly and slowly into engagement with these needles and also, after the playing of a record has been completed and the beam F commences to descend, the first part of the descent of the record from engagement with the needles is at reduced speed.

The effect, therefore is that these cables are so wound that when the turntable is approaching its uppermost position, that is adjacent to its playing position, the cables either wind or unwind about a very small diameter and therefore the movement of the turntable towards and from the pickup arm and the pickup and follower needles carried thereby is very slow; that is a record carried by the turntable approaches and picks up these needles very slowly and after the playing of the record is completed it disengages from these needles very slowly, which of course is a most desirable feature if the machine is to operate most satisfactory with no risk of injuring either the needles or the records.

This slow action might be obtained by other means than the cone pulleys and cables herein shown, the important feature being the provision of some means whereby a record approaches and moves away from its playing position at slow speed.

Due to the manner in which the turntable unit G is supported at the forward ends of the arms 129 of the beam F and the manner in which this unit is counterbalanced, the turntable 163 is automatically maintained in a balanced horizontal position at all points during the oscillation of the beam.

The manner of mounting the pickup arm 177 is such that it is supported at its rear end by a universal connection so that the arm may swing laterally about a vertical axis and also has freedom of oscillation vertically about a horizontal axis; that is the arm is so mounted as to be permitted a combined horizontal and vertical swinging movement.

In the vertical oscillation, movement of the arm 177 takes place about a horizontal pin 185 pivotally or hingedly connecting the arm 177 to the head 182 of the pedestal 179 while in the lateral swinging movement the pedestal 179 turns upon the base 178, the pedestal 179 being of course properly journalled upon the base 178 for oscillation about a vertical axis. The arc through which the arm 177 may thus oscillate laterally is limited by the length of the recess 181 in the base 178 in which recess the depending pin 180 carried by the pedestal 179 moves, the position of the right hand end of this recess 181 as viewed in Figure 17A being such that when the pin 180 abuts thereagainst to limit the swinging of the arm 177 to the left the arm is positioned so that the pickup needle 187 carried thereby is in proper position to engage the sound grooves of a 12 inch record to commence the playing thereof.

The arrangement is therefore such that the maximum possible displacement of the arm 177

to the left (that is radially outward with respect to the record) corresponds to the correct position for commencing to play a 12 inch record, the length of the slot 181 being such that the arm 177 may swing to the right (that is radially inward of a record being played) to permit the pickup needle 187 to travel to the centre of the record.

The cable 189 by which the free or forward end of the pickup arm 177 is suspended is anchored to the frame A at a point 191 (see Figure 1) located to the rear of and to the left of the rear end 184 of the arm 177 and the arm is suspended thereby in such manner that when in its outwardly swung position (that is the position to commence playing the record), the elevation of the pickup 186 and the pickup needle 187 carried thereby is somewhat lower than the playing position thereof so that when the record rises into playing position, as occurs in the operation of the machine, it first makes contact with the pickup needle 187 and the follower needle 195 before it has risen to full playing position and then in rising into full playing position it lifts and carries the pickup arm 177 and the pickup 186 somewhat above its normal cable suspended position into playing position in which latter position the pickup arm is supported entirely upon the record and the cable 189 being relieved of the weight of the arm and is slack, this lifting of the pickup arm 177 being permitted due to the hinge connection of the pin 186 which hingedly connects the rear end 184 of the arm to the head 182 of the pedestal 179 and in the lifting of the pickup arm the arm swings upwardly about the horizontal pivot pin 185.

The point of attachment of the upper end of the cable 189 is so disposed that when the pickup arm 177 is in its extreme left hand swung position the lug 190 to which the lower end of this cable is attached lies to the right of the longitudinal vertical plane passing through the point of attachment 191, a feature of which is that when suspended by the cable the pickup arm will normally tend to move into this extreme left hand position.

The manner of suspending the pickup arm 177 by the cable 189 is such that when freely suspended the arm will normally swing by gravity outwardly towards the left, the limit of such swinging to the left being at the point where the pin 180 comes into abutment with the right hand end of the recess 181 when further swinging to the left is positively prevented and this position, as above stated, corresponds to the correct setting of the arm to commence playing a 12 inch record.

The reason why the arm 177 when freely suspended by the cable 189 will thus normally swing outwardly to the left to the limit of its possible movement in this direction is as follows. The cable 189 by which the pickup arm is suspended is connected to the free end of the arm and to a point upon the frame A located to the rear of and to the left of the rear end 184 of the pickup arm about which the swinging thereof takes place so that if the arm is swung to the right (still being suspended by the cable 189) the forward end of the arm must of necessity be raised and therefore immediately the arm is released it is obvious that it will by gravity swing back to the left into its original position. This will be further made clear by stating that the swinging of the arm to the right involves a raising of the forward end of the suspended arm while the return movement to the left is simply caused by the natural descent of the previously raised arm.

It is most desirable that the vertical movement of the arm in the above described swinging operation be as slight as possible so that there is the minimum difference in elevation of the pickup needle between its extreme outer or left hand and inner or right hand swung positions so as to avoid the possibility of scratching the record as the record descends from the needle after the playing of the record and this is provided for by choosing the point of attachment 191 of the upper end of the cable 189, as shown and described.

Obviously as long as the pickup arm 177 is suspended by the cable 189 this cable is taut and the natural tendency is for the pickup arm to swing outwardly to the left until it is stopped by the engagement of the pin 180 with the right hand end of the recess 181. While, as above described, the ultimate limit to which the pickup arm 177 may swing outwardly to the left corresponds to that for commencing to play a 12 inch record, to which ultimate left hand position the arm will naturally swing if permitted to do so, there is provided means for stopping the arm in its swinging movement to the left in the proper position for commencing to play a 10 inch record. This comprises the pivoted lever 206 and the electro-magnet 212 operatively associated therewith and the operation of which will now be described.

The lever 206 extends substantially transversely of the machine and is pivoted intermediately of its length upon the frame A at 207, the inner or right hand end of the lever being formed into a stop edge 208 adapted to co-operate with and engage the stop 209 depending from the pickup arm 177 and the outer or left hand end of the lever having secured thereto the spring 210, the opposite end of which spring is secured to the frame A. The normal position of this lever 206 is as illustrated in Figure 18, in which the left hand end thereof is depressed by the spring 210 so that the right hand end is raised, in which position the elevation of the stop 208 formed at the inner end of the lever is such as to lie in the path of and engage the depending stop 209 of the pickup arm 177 when this pickup arm suspended by its cable 189 swings outwardly to the left after the playing of a record.

During the playing of a record the pickup arm 177, of course, swings inwardly to the right as the pickup needle follows the record grooves and after the playing of the record when the record has descended away from the pickup arm so as to disengage from the pickup needle, the arm 177, which is freely suspended by its cable 189, will swing outwardly to the left until positively stopped, which positive stopping will be accomplished by the depending stop 209 striking the stop 208 at the raised inner end of the lever 206, thus stopping the pickup arm in the proper position to commence playing a 10 inch record.

It will therefore be seen that after the playing of any record as the pickup arm 177 swings outwardly to the left the pivoted lever 206 forms a means for positioning the pickup arm in the proper position for commencing to play a 10 inch record.

While the pickup arm is always reset after playing a record to its 10 inch position, provision is made for automatically setting it to the 12

inch position in the event that the next record to be played is a 12 inch record, which provision consists in temporarily depressing the right hand end 208 of the lever 206 so that the stop 208 will be lowered out of the path of the depending stop 209 and thus permit the pickup arm 177 to swing freely outwardly past the stop 208 into the 12 inch position in which it is stopped by the engagement of the pin 180 with the right hand end of the recess 181.

To provide for thus depressing the stop 208 there is associated with the outer or left hand end of the lever 206 and secured to the frame A above this outer end of the lever an electro-magnet 212 and when this electro-magnet 212 is energized it will attract the outer end of the lever 206 thus raising the outer end and depressing the inner end to move the stop 208 out of the path of the stop 209. The operation, therefore, is such that if, during the outward swinging movement of the pickup arm 177 after playing a record, the magnet 212 is energized, the pickup arm will swing into its 12 inch position.

In order to provide for this energizing of the magnet 212 there is provided in the outer or 12 inch stepped channel 100 of the upper stationary guide apron C the switch M which is in circuit with the magnet 212 which switch is normally in open position and comprises the spring switch blade 104 normally overlying and spaced above the switch blade 107 so that when a 12 inch record is discharged from one of the compartments 95 of the upper magazine section 52 and slides downwardly over this 12 inch channel 100 of the upper guide apron C, the weight of the record depresses the spring switch blade 104 to make contact with the blade 107 thus closing the switch M and energizing the electro-magnet 212. Immediately this record has cleared the blade 104 of the switch M, this switch automatically again assumes open circuit position to de-energize the magnet 212.

It will thus be seen that while the pickup arm is normally stopped in 10 inch position, whenever a 12 inch record is discharged from the upper magazine section, the mere fact of the passage of this 12 inch record therefrom serves to automatically set the pickup in the proper position for playing that size record.

Also provided in connection with the record holding channels, and as will be more fully described presently, is a second switch R in parallel with the above mentioned switch M, which switch R is also normally in open position but is adapted to be automatically closed to energize the magnet 212 during a certain part of the operation of these record holding channels as is required for setting the pickup arm into its 12 inch positon to play the reverse side of the 12 inch record.

The insulated follower needle arm 192 is suspended beneath the pickup arm 177 by a universal connection at its rear end so that it is free to swing both laterally and vertically with respect to the pickup arm, the arm 192 resting when freely suspended upon the hook 196 in which position the follower needle 195 carried by the forward free end thereof is at a lower elevation than the pickup needle 187, there being sufficient clearance so that when the arm 192 is raised off the supporting hook 196 (as when engaging a record in playing position) the arm may swing laterally in either direction relatively to the pickup arm, as is required in the operation of the device.

As just explained, when the follower needle arm 192 is lifted off its supporting hook 196, the arm is free to swing laterally with respect to the pickup arm 177 and this arm 192 is governed as to its normal position by the two depending arms 199 of the bell crank levers 197, which arms due to the weights 201 on the laterally extending arms 200 are pressed against opposite sides of the arm 192 and thus maintain it in a set position with respect to the pickup arm.

The arrangement of the switches T is such that both these switches are normally in open circuit position due to the fact that normally the weights 201 are out of contact with the stationary switch blades 203. When, however, the follower needle arm 192 is swung laterally in either direction relatively to the pickup arm 177 it will press laterally upon the depending arm 199 of one of the bell crank levers 197 so as to raise the laterally extending arm 200 thereof and with it the weight 201 so that this metallic weight will contact with the corresponding switch blade 203 thus closing the switch T on that side of the pickup arm. Similarly if the follower needle arm is swung laterally in the other direction there will be a similar movement of the opposite bell crank lever 197 to close the opposite switch T.

These switches T are connected in parallel in a circuit and the closing thereof closes certain electrical circuits, as is required in the operation of the machine and as will presently be more fully explained, the important point at the moment being to show that while these two switches T are normally in open circuit position either one of them will be selectively closed by the swinging of the follower needle arm 192 laterally in either direction with respect to the pickup arm 177.

Normally when the parts are freely suspended, as shown in Figure 17, and out of contact with a record, the follower needle arm is supported upon the hook 196 and the follower needle 195 is below the level of the pickup needle 187 and the pickup arm is in its outwardly swung position ready to commence playing of a record. Also in this position the follower needle arm 192 is slightly out of alignment with the pickup arm 177 so that the follower needle 195 is slightly to the left of the pickup needle 187.

If the record being played is of the type which is not provided with an inner high pitch spiral, when the pickup needle 187 has traversed the entire sound groove of the record and has entered the inner concentric groove therein, swinging of the pickup arm 177 radially inward ceases but as the follower needle 195 lags some few grooves behind the pickup needle 187 and is therefore still in the sound grooves, this follower needle 195 is still travelling radially inward in the record grooves and thus catches up upon the pickup needle 187 in which catching up the follower needle arm 192 swings to the right relatively to the pickup arm 177 and therefore presses outwardly upon the depending arm 199 of the right hand bell crank lever 197 and close the right hand switch T.

The closing of either of the switches T is necessary in connection with the proper operation of the machine and must occur at the completion of the playing of a record to actuate certain circuits and it will be apparent from the above that regardless of the type of record being played the arrangement of the pickup arm and associated parts is such that coincidently with the com-

pletion of the playing of a record one of the switches T is closed.

As the beam F rises carrying a record upon the turntable into playing position in the machine, slightly before the record reaches the playing position the inclined arm 176 rigidly carried by the turntable unit G comes into engagement with the tie rod 131 of the beam so that the entire turntable unit G and the record 98 supported upon the turntable 163 are rigidly supported firmly during the playing of the record so that no oscillation thereof can occur.

It will also be noted from an examination of Figure 26, that the pickup needle 187 engages the record at a point on the opposite side of the bar 164 from the point of engagement of the arm 176 with the tie rod 131 so that the weight of the pickup arm now supported by the record tends to more firmly press the arm 176 against the rod 131 and thus the action of the weight of the pickup arm is to more firmly prevent any rocking of the record during the playing thereof.

As the beam F commences to descend after the playing of the record, for some initial period of the descent the pickup arm remains supported upon the record 98 before the record disengages therefrom and the pickup becomes suspended upon its cable 189 and in this initial portion of the descent, since the weight of the pickup upon the record maintains the arm 176 in engagement with the rod 131, there will be a slight forward tilting of the record and therefore when finally the record disengages from the pickup needle the record is tilted slightly downwardly and forwardly so that the front edge thereof is slightly depressed and therefore when the needle swings outwardly upon its suspended cable 189 after leaving the record there will be less tendency for the needle in this outward swinging of the pickup arm 177 to strike or scratch the record as might otherwise be the case.

During the operation of the machine, as previously explained, the turntable switch Q is normally in closed circuit position, as shown in Figure 19, and therefore the turntable 163 is continually rotating. If, however, there is no record upon the turntable as it rises into playing position it is obvious that the pickup 186 cannot be lifted by and supported upon the record as is ordinarily the case in normal operation and in the absence of a record upon the turntable the beam F continues to rise until finally the projecting tongue or lip 162 of the switch Q engages the pickup 186 and the weight of this pickup is sufficient to open the switch Q and consequently the circuit to the turntable motor 167' so that the turntable comes to rest.

It will thus be seen that the presence of a record upon the turntable is a necessary and vital element in the continued operation of the machine as the engagement between such a record and the pickup needle constitutes means for continuing the operation of the turntable motor and in the absence of such a record upon the turntable in the ordinary course of operation of the machine the turntable motor automatically comes to rest.

As the beam F descends with a record upon the turntable 163 after the playing of this record, the record holding channels are each in their receiving positions as illustrated in Figure 14, in which positions the pulleys 218 have been rotated by the weights 223 so that the stops 220 carried by the inner faces of these pulleys are in engagement with the stops 221 carried by the frame A, the natural tendency of the weights 223 and the cables 222 being to rotate the pulleys 218 further in a clockwise direction as viewed in Figure 1, which rotation is prevented by the engagement of the stops 220 and 221 so that these stops provide means for accurately positioning the channels in their receiving positions.

In this receiving position of the channels the stepped channelled portions 229 and 230 are uppermost with the cover plates 231 and 232 overlying these stepped channelled portions. Also in this position the channels 229 and 230 are inclined downwardly and rearwardly in the machine and the shafts 216 are so turned that the hinged portions 225 thereof, to which the record holding channels H are secured, are directed downwardly and rest against the bottom end of the bifurcations 228 in the bearing members 227 so that these hinged portions 225 and with them the record holding channels H are firmly supported and cannot swing downwardly.

As the beam F descends the record 98 carried by the turntable 163 is deposited within the appropriate one of the stepped channels 229 or 230, as the case may be. If it is a 10 inch record it is deposited within the inner 10 inch channel 230 while if it is a 12 inch record it is deposited within the outer 12 inch chamber 229.

As the beam F further descends after thus depositing the record upon the record holding channel H, and the centre pin 170 of the turntable moves out of the centre hole of the record so that the record is entirely disengaged from the turntable and supported upon the record holding channels H, the record slides by gravity rearwardly within its channel until it comes to rest by its periphery engaging the stops 235 or 236 respectively, which stops are so positioned as to accurately position the centre hole of the record at the proper point in the machine to be engaged by the centre pin 170 of the turntable 163 in the subsequent operation, as will presently be explained. In this rearward sliding of the record upon the members H the record slides underneath the corresponding cover plate 231 or 232 respectively.

The beam F, after thus leaving the record supported within the record holding channels H, continues its descent and as the lugs 132 projecting laterally outward from the arms 129 of the beam pass the hinged arms 244 the levers 242 are oscillated so that the upper bifurcated ends 243 thereof withdraw the spring pins 239 from engagement with the pulleys 218 but this is an idle operation as at this point in the cycle these pins 239 are simply resting against the inner faces of these pulleys and have no operative connection therewith. The beam continues its descent and through the medium of the arm 147, link 264, radial arm 263, ratchet collar 262 and the ratchet gear carried therein the shaft 257 and with it the dogs 82 are turned in a clockwise direction, as viewed in Figure 8, through an arc so that one of these dogs 82 engages the radial arm 254 carried by the collar 253 and turns the shaft 246 and with it the double pulley 247 in a clockwise direction. This rotation of the double pulley 247 winds thereupon the cable 224, the other end of which cable being secured to the pulleys 217, rotates these pulleys 217 and with them the pulleys 218 in a clockwise direction as viewed in Figure 1 (counterclockwise as viewed in Figure 14) and during this rotation of these pulleys 218 the cables 222 are wound thereupon so as to elevate the weights 223 carried by these

cables. This engagement between the dog 82 and the radial arm 254 continues for a certain period after which, due to the eccentricity between the shafts 257 and 246, the dog 82 clears the arm 254 and disengages therefrom.

Since the pulleys 218 are rigidly secured to the shafts 216, the rotation of these pulleys 218 has produced a similar rotation of the shafts 216 and with them of the record holding channels H carried by these shafts and of course at the same time the record carried within the record holding channels H has been correspondingly turned.

The arc through which the shafts 216 have thus been turned has been sufficient to produce such a turning of the record holding channels H that the record carried therein has been turned over side for side so that the side which was formerly uppermost is now turned downwardly and the unplayed side of the record faces upwardly.

In order to lock the record holding channels in this turned over and what is their discharging position, as previously explained, the pulleys 218 are provided in their inner faces with arcuate slots 219 so positioned that when the record holding channels H have been turned over as above into turned over discharging positions, these slots 219 come into registration with the spring pins 239 so that at this point these pins automatically enter into the slots 219 to engage therewith and retain the pulleys 218 and the record holding channels H in their turned over positions after the dog 82 has disengaged from the radial arm 254.

The notches 219 are made arcuate in order to enable the pulleys to be rotated slightly further than their final positions to permit disengagement of the dog 82 from the radial arm 254 after which disengagement the pulleys 218 and with them the record holding channels H turn back to a very slight extent. In this turning over operation of the channels H the cables 222 were wound upon the pulleys 218 and the weights 223 carried by these cables elevated so that at the completion of the turning over operation the weights 223 would normally rotate the pulleys 218 and with them the record holding channels H back into their original positions if this were not prevented by the engagement of the pins 239 within the slots 219. In other words, if these pins 239 are disengaged from the slots 219, the pulleys 218 and the record holding channels H will automatically return to their receiving positions.

In this turning over of the record holding channels H and the record carried thereby the movement of the channels H is from the position shown in Figure 14, in which the stepped channels 229 and 230 are uppermost and are inclined downwardly and rearwardly, to the position shown in Figure 23, in which these channels are underneath and are inclined downwardly and forwardly so that during the turning over movement the record carried in these channels has been continuously pressing against the stops 235 or 236 within the channels so that there has been no possibility of the record falling therefrom.

Also in the turned over position of the record holding channels H as illustrated in Figure 23 the discharging stepped channelled portions 233 and 234 are uppermost and are inclined downwardly and forwardly to be substantially in alignment with the stepped channels 102 and 103 of the lower stationary slide or guide apron D after the completion of this turning over of the record as above described. The shafts 216 have been also turned over so that the hinged portions 225 thereof are now uppermost, as shown in Figure 24.

During the turning over of the channels H and after these have assumed their turned over positions as shown in Figure 23, the record carried therein is supported upon the appropriate cover plate 231 or 232 as the case may be.

The beam F now rises and the centre pin 170 of the turntable 163 moves up underneath the centre hole of the record, the record being accurately positioned within the machine so that this pin will properly register therewith and the pin therefore seats within this hole so that the record becomes supported upon the turntable and upon further upward movement of the beam the record is carried upwardly upon the turntable and as this upward movement continues the record holding channels H are swung outwardly about the hinged connections 226, as shown clearly in Figure 24, to permit the record to be lifted upwardly clear of these record holding channels H which, as soon as the record disengages therefrom, fall by gravity back into their turned over discharging positions as shown in Figure 23.

In the above described operation in which the upwardly moving record swings the record holding channels H outwardly about their hinged connections 226, if a 10 inch record is being manipulated, no co-operation takes place between the channels H and the switch R but, if a 12 inch record is being manipulated, due to the greater diameter of this record, the channels H are swung outwardly to a greater extent than with a 10 inch record, being outwardly swung sufficiently so that the left hand channel H strikes the blade 238 of the switch R and presses it into contact with the blade 237 of this switch so as to close the switch which, as previously described, operates to close the necessary circuit to energize the electro-magnet 212 to oscillate the lever 206 and permit the pickup arm 177 to swing outwardly to the 12 inch position.

It will therefore be seen that when a 12 inch record is being manipulated, this record itself actually provides the means for properly adjusting the pickup arm for the playing of a 12 inch record.

It will be noted clearly from an examination of Figure 24 that the entire record holding channels H with the single exception of the 12 inch cover plates 232 are carried by the hinged portion 225 of the shafts 216, these 12 inch cover plates 232 alone being rigidly carried by the main portions of the shafts 216.

A feature also of the construction is that the bifurcated portions 228 of the bearings 227 are so formed as to permit the upward swinging of the hinged portions 225 when the shafts 216 have been turned into their turned over discharging positions, as shown in Figure 24, but this upward swinging is only possible when the shafts are actually in this position as in all other positions the side edges of these bifurcated portions form a bar for preventing any swinging of the portions 225 about the hinged connections 226 and in particular when the hinged portions 225 are lowermost the bottom ends of the bifurcated portions 228 provide a positive secure bearing for these hinged portions 225.

After the record has been thus moved upwardly and disengaged from the record holding channels H, it is carried upwardly by the rising beam

F into its playing position in the machine in which it is properly engaged by the pickup arm needle 187 and the follower needle 195 and the second side of the record is played as already described in connection with the playing of the first side, in which operation the pickup arm 177 swings radially inward of the record and when the playing is completed one of the switches T is closed to set the necessary mechanism into operation to commence the lowering of the beam F and with it the turntable and record and when the record has cleared the pickup arm this arm swings outwardly to 10 inch position. The beam continues its descent and as it passes between the record holding channels H the record upon the turntable engages and rests upon the appropriate stepped discharging channel 233 or 234, depending upon whether it is a 10 or a 12 inch record, and the record is supported thereon so that as the beam descends the turntable moves away from the record and the pin 170 of the turntable disengages from the record and immediately this occurs the record slides forwardly by gravity over the discharging channels into the appropriate stepped channel 102 or 103 in the lower guide apron D and from thence into one of the compartments 96 of the lower magazine section 53, it being understood that the stepped channels 102 and 103 of the lower guide apron D are in proper alignment with the stepped discharging channels 233 and 234 of the record holding channels H.

The beam F continues its descent and at the usual point thereof the lugs 132 engage the hinged fingers 244 to oscillate the levers 242 so that the bifurcated ends 243 thereof withdraw the spring pins 239 from engagement within the slots 219 of the pulleys 218 upon which the raised weights 223 immediately descend to rotate the pulleys 218 counter-clockwise as viewed in Figure 1 (clockwise as viewed in Figure 23) and return the record holding channels H to receiving position, as illustrated in Figure 14.

During the completion of this descent of the beam one of the lugs 82 comes into engagement with and oscillates the lever 79 to cause descent of the magazine B through another step to deliver the next record to be played from the upper section 52 thereof into the machine.

In connection with the control of the magazine and reversal of the records it is notable that when it is necessary to reverse a record for playing the opposite side, one of the lugs 82, under operation of the ratchet arrangement controlled by the link 264, moves through an arc sufficiently to actuate the pin 254 to cause rotation of the record holding channels H through the pulley mechanism controlled by the shaft 246. On the other hand, when the opposite side of the record has been played and the beam is descending, the link 264, through the ratchet arrangement, causes the same lug 82 to rotate through the medium of the shaft 257 to a point where it engages the end 81 of the lever 79 which, through its associated connections, causes the descent of the magazine. In other words, the arrangement is such that one of the lugs 82, during operation, will, on one complete ascent and descent of the beam, actuate the pin 254 and on the next complete ascent and descent of the beam will actuate the lever 79. Consequently the pin 254 and the lever 79 will be alternately actuated at the appropriate times so that when the record is being reversed to play the other side the magazine will not be caused to descend but after the opposite side of the record has been played and the beam descends to drop the record the magazine will be caused to drop to feed another record.

In Figure 28 is illustrated a modified manner in which the turning over of the record holding channels H from receiving to discharging position and back again into receiving position is illustrated. The actual construction of this modification has already been described and the operation thereof will now be explained.

Consider the parts to be in the positions indicated in full lines in Figure 28 in which position the record holding channels H are in their receiving position, as indicated by the dotted portion H'. As the beam F descends and the main shaft 128 rotates counterclockwise, through the medium of the link 277 connecting the arm 147 and the end of the radial arm 275 it will be obvious that this arm 275 will be rotated clockwise and when the shaft 128 has turned through a quarter turn the arm 147 will have moved from the full line position to the broken line position and the arm 275 from the full line position to the dotted line position and in so doing the dog 283, which is in engagement with one of the ratchet recesses 280, will rotate the ratchet disc 279 through a practically similar arc in which operation the shaft 272 will be similarly rotated and with it the sprocket 273. This rotation of the sprocket 273 in a clockwise direction through 90° will cause a counter-clockwise rotation of the sprocket 271 through 180°. Due to the connecting link 270 connecting the arm 269 with the arm 266, this rotation of the sprocket 271, which will of course cause a corresponding rotation of the arm 269, will cause a clockwise rotation of the arm 266 and collar 265 and with it of the shafts 216 which carry the record holding channels H. The arm 266 is slightly longer than the arm 269 so that this 180° rotation of the arm 269 will cause slightly less than 180° rotation of the arms 266, the relative lengths of the arms being such that the arc through which the arm 266 moves is practically that indicated from the full to the broken line position. In this operation the record holding channels H are turned over from their receiving position to their turned over discharging position.

The rotation of the arms 266 thus serves to turn the record holding channels H and replaces the ratchet, pulleys, and cable mechanism previously described for this purpose.

When the beam F ascends the ratchet dog 283 is moved back to its original full line position and during the next descent of the beam F the same operation as previously described takes place except that the arm 269 moves counter-clockwise from the broken to the full line position in which operation the arm 266 moves counter-clockwise from the broken line to the full line position so that the record holding channels H turned over in the previous operation from their receiving to their turned over discharging positions are in this second operation turned back into their original receiving positions.

The above described series of operations are repeated so that during successive descents of the beam F the mechanism operates to alternately turn the record holding channels from their receiving to their turned over discharging position and back again from their turned over position to their receiving positions.

While the pulley and cable arrangement for turning over the record holding channels as previously described is quite satisfactory, the modi-

fication as illustrated in Figure 28 produces some advantages over the other construction in that there is not the same degree of flexibility or possibility of lost motion in the apparatus which is quite positive so that it is assured that the record holding channels H will always be turned and re-turned to an exact definite set position from which they cannot vary at all. Also the construction as per the modification may be incorporated in a more compact space so as to be less cumbersome. Further the modified construction operates more quietly and smoothly.

The operation of the electrical apparatus and circuits used in the improved machine will now be described.

The main drive motor I is of the reversing type in which the starting coils of the motor are connected in parallel across the main motor windings and the reversal of the motor is accomplished by reversing the connection of the starting coils with respect to the main motor windings. The starting coils of the motor are only in closed circuit when the motor is at rest and are used for starting purposes only. Immediately the motor starts to spin, due to the centrifugal force of the spinning motor, these starting coils are drawn out of circuit so that they are really only in operative connection when the motor is at rest and are inoperative all the time the motor is spinning.

The operation of this type of motor is as follows:—With the motor at rest and the starting coils connected in one manner, say to produce clockwise rotation of the motor when the power circuit to the motor is closed, the motor will, due to the manner of connection of the starting coils, immediately commence to rotate clockwise and immediately the motor commences to spin due to this centrifugal force the starting coils will be automatically thrown out of circuit. If, while the motor is thus running clockwise, the connection of the starting coils with respect to the main winding is reversed, as for example by a suitable switch, so as to reverse the connection of these coils with respect to the main motor windings and place them in the reverse position as required to produce counter-clockwise rotation of the motor, upon the motor being stopped by the opening of its power circuit and being again started by the closing of this power circuit due to the reversal of the connection of the starting coils which again are placed in operative circuit by the stopping of the motor, the motor will commence to rotate counter-clockwise; that is, by reversing the connection of the starting coils, the direction of rotation of the motor is reversed.

In the wiring diagram shown in Figure 29 the main motor terminals are indicated at 313 and 314 while the starting coil terminals are indicated at 315 and 316. As a matter of fact these starting coil terminals may be omitted and the wires connected thereto be connected direct to the terminals 313 and 314 but for purposes of clearness in the diagram and for more clearly explaining the connections it is preferable to show them as separate terminals.

In this diagram the switch for reversing the connection of the starting coils is indicated at K. The diagram illustrates the relative positions of the various parts of the electrical circuits when the machine has come to rest after the playing of a series of records with the beam F in fully raised position with no record upon the turntable 163, in which position the switch Q in the power circuit to the turntable motor 167' is open.

In this position of the apparatus the radius arm 148 has opened the 110 volt switch N while the 6 volt switch P is in its normally closed position. The starting switch S, the pickup arm switches T, the switches M and R and the switches 299 and 300 are all in open circuit position and the starting coil reversing switch K is in the position shown with the arms 303 and 304 in engagement with the contacts 306 and 307, which position of this switch is that required for rotating the motor I in a direction to lower the beam F.

While this represents the position of the various parts of the apparatus when the beam F is elevated with no record upon the table, if there is a record upon the table about to be played, when in this raised playing position, all the circuit connections will still be as shown in the diagram with the exception that the turntable motor switch Q will be closed so that the turntable and record carried thereby will be spinning and the record being played.

As previously stated, for more clearly distinguishing the battery or 6 volt circuits from the 110 volt circuits for the motors I and 167', the 6 volt circuits are shown in broken lines while the 110 volt power circuits are shown in full lines.

The function of the 6 volt circuits is to control the opening and closing of the 110 volt circuits to the main drive motor I to properly control the starting, stopping and reversal of the motor I as is required during the operation of the machine and while these circuits are shown and described as operated by a storage battery they might of course be supplied from a power line, the necessary feature being that they are low voltage circuits. These battery circuits really consist of three six volt circuits as follows:—a circuit V comprising the wire 328 leading from the battery 310 and communicating through the wire 327 with the two switches M and R connected in parallel in this circuit by the wires 108 and 109, the latter of which leads to one terminal of the electro-magnet 212, the other terminal of which magnet leads by wire 326 to the opposite side of the battery 310; a second circuit W which leads by wire 328 to one terminal 332 of the electro-magnet 294, the other terminal 333 of which magnet leads by wire 331 to one terminal of the starting switch S, which terminal is connected by wire 205 to the common terminal of the two pickup arm switches T, the other sides of these two switches T being connected by wire 204 to the other terminal of the starting switch S, a wire 204 also connecting this terminal of the starting switch S to one terminal of the switch P, the other terminal of this switch P being connected by wire 329 to the other side of the battery 310; and a circuit X which leads by battery wire 328 to the terminal 332 of the magnet 294 from the other terminal 333 of this magnet by a part of wire 331 to one terminal of the switch 300 through wire 330 to one terminal of switch P and from the other terminal of the switch P through wire 329 to the other side of the battery 310.

These three battery circuits V, W and X, it will be apparent, are parallel circuits and the switch M, R, the two switches T, switch S are all in parallel connection in the 6 volt circuits. The electro-magnet 212 is in series parallel connection in the circuit V with the switches M and R so that the closing of either of these switches will close their 6 volt circuit V through this magnet and energize the same.

The energizing of this magnet 212, as previously explained, functions to oscillate the lever 206 to

permit the pickup arm 177 to swing outwardly into 12 inch position and therefore the closing of either of the switches M or R will operate to permit the pickup arm 177 to properly position itself for commencing to play a 12 inch record.

The electro-magnet 294 and the switch P are connected in series with each other and are in both the 6 volt circuits W and X. In the circuit W this electro-magnet 294 and the switch P are in series parallel connection with the switches T and S. In the circuit X they are in series with the switch 300. The circuit W therefore is such that when the switch P is closed the closing of either of the switches S or T will close this 6 volt circuit through the magnet 294 to energize the same.

As regards the six volt circuit X, since the switch 300 is in straight series in this circuit with the switch P and the electro-magnet 294, this circuit X is only closed when both the switches P and 300 are closed.

The switch P is normally in closed position except only at the one point when the beam F is in its lowermost position, in which position the switch P is opened by the radius arm 148.

When the electro-magnet 294 is not energized the armature 295 is normally held in its raised position by the spring 298 so that the cradle 286 is in its elevated position with the ball 289 therein resting at the right hand end or depressed end of the cradle in which it bridges and places into electrical communication with each other the insulated terminals 290 and 291 of this cradle. Also in this position the switches 299 and 300 are in open circuit positions and in fact all the parts of the apparatus U are in the positions shown in Figures 20 and 29 so that this position of the apparatus corresponds to that in which the beam F has come to rest at the top of its stroke.

When the electro-magnet 294 is energized, the armature 295 is attracted thereby and moved into its lowered position and in this movement through the medium of the elements 296 and 297 connecting the armature 295 with the cradle 286 the cradle is oscillated about its pivot connection 287 and moved into its depressed position in which the left hand end is depressed and the right hand end raised so that the ball 289 travels by gravity from the right hand to the left hand end of the cradle and opens the terminals 290 and 291. Similarly the depression of the armature 295 due to the energization of the magnet 294 operates to close the switches 299 and 300.

The power circuits to the motor I will now be explained and are as follows:—There are two parallel 110 volt power circuits communicating with this motor I, which circuits will be designated as Y and Z, each of these circuits being utilized to drive the motor I at different periods in the operation of the device, as will presently be explained.

The circuit Y comprises the main 110 volt lead-in wire 311, motor terminal 313, motor windings, motor terminal 314, wire 320, switch 299 and the other 110 volt wire 312, this circuit being only closed when the switch 299 is closed, which is during the descent of the beam F, as will later be explained, so that this circuit Y is utilized to drive the motor I during the descent of the beam F.

The other 110 volt circuit Z to the motor I, which is in parallel with the circuit Y, comprises the main 110 volt lead-in wire 311, motor terminal 313, motor windings, motor terminal 314, wire 317, 110 volt switch N, wire 318, cradle terminals 290 and 291 and the bridging ball 289, wire 319 and return 110 volt lead-in 312, this circuit Z only being closed when the cradle 286 is in its elevated position, which is during the ascent of the beam F, as will later be explained, so that this circuit Z is utilized to drive the motor I during the ascent of the beam F.

The operation of the circuit connections between the starting coil reversing switch K and the motor I is as follows:—In Figure 29 the switch K is shown in the position to properly connect the starting coils of the motor I to produce counter-clockwise rotation of the motor as viewed in Figures 1 and 29 to cause the beam F to descend and the circuit connections to the starting coils of the motor I are as follows:— From the motor terminal 313 through wire 311 and wire 321 to the switch arm 304, switch contact 307, wire 323 to starting coil terminal 315, through the starting coils of the motor to starting coil terminal 316, wire 324, switch contact 306, switch arm 303, wire 322 to motor terminal 314.

The circuit connection is therefore such that in this position, motor terminal 313 is connected to the starting coil terminal 315 and motor terminal 314 to starting coil terminal 316, which connections, as stated above, are used for producing counter-clockwise rotation of the motor I. If now the position of the starting coil switch K is reversed and the movable switch member 155 oscillated so that the arm 303 engages the switch contact 307 and the arm 304 engages the switch contact 308, the circuit connections between the terminals 313 and 314 and the starting coils 315 and 316 will be as follows:— from the motor terminal 313 by wire 311 and wire 321 to switch arm 304, switch contact 308, bar 309 connecting switch contacts 308 and 306, wire 324 to starting coil terminal 316, starting coil terminal 315, wire 323, switch contact 307, switch arm 303 and wire 322 to motor terminal 314.

When, therefore, the switch K is in this latter position, the motor terminal 313 is connected to the starting coil terminal 316 and the motor terminal 314 to the starting coil terminal 315 so that these connections between the motor terminals 313 and 314 and starting coils terminals 315 and 316 are reversed and therefore in the proper position to cause clockwise rotation of the motor I to produce ascent of the beam F.

The actual manner in which the electrical circuits and apparatus function during the operation of the machine will now be explained.

When the beam F has come to rest at the top of its stroke after having completed the playing of a series of records so that in its last ascent it has risen with no record upon the turntable, the suspended pickup 186 has engaged the pad 162 of the switch Q and opened this switch, as shown in Figure 19A, and at the same time the radius arm 148 has opened the 110 volt switch N so that the entire mechanism has come to rest, the switch Q opening the circuit to the turntable motor 167' and stopping rotation of the turntable, and the opening of the switch N operating to bring the motor I to rest. In this position all the circuits and switches are in the positions illustrated in Figure 29, the starting coil reversing switch K having been placed during this last ascent of the beam F into the position for properly connecting the starting coils of the motor I to cause counter-clockwise rotation thereof as viewed in Figures 1 and 29 to produce descent of the beam F. In this position of the appa-

ratus the 6 volt switch P is, of course, in closed circuit position.

In order to place the machine in operation the starting coil switch S is closed which closes the 6 volt circuit W thus energizing the magnet 294 which attracts and depresses the armature 295 to close the switches 299 and 300 and to depress the cradle 286 and cause the ball 289 to travel to the left hand end of the cradle and open the terminal points 290 and 291 at the right hand end thereof. The closing of the 6 volt switch 300 following the closing of the starting switch S closes the 6 volt circuit X so that when the starting switch S is released and permitted to return to its normal open position the closed 6 volt circuit X maintains the magnet 294 energized and thus maintains the armature 295 and cradle 286 depressed and the 110 volt switch 299 closed. The closing of the 110 volt switch 299 completes the power circuit Y to the main drive motor I which immediately commences to rotate, thus commencing to lower the beam F and placing the entire machine in operation.

During the entire descent of the beam F the switches 299 and 300 remain closed and at an intermediate point in the descent the movable switch member 155 of the starting coil reversing switch K is moved into reverse position with the arms 303 and 304 engaging the contacts 307 and 308 to properly connect the starting coils for causing reverse rotation of the motor in a clockwise direction to cause ascent of the beam after the motor has been stopped at the bottom of the descent and started again.

At the time of the reversal of the switch K the starting coils of the motor are out of circuit being, as previously stated, only in circuit when the motor is at rest.

When the beam F reaches its lowermost position the radius arm 148 opens the 6 volt switch P, thus opening the 6 volt circuit X and deenergizing the magnet 294 permitting the armature 295 and cradle 286 to move into their elevated positions under the action of the spring 298 which permits the 110 volt switch 299 and the 6 volt switch 300 to open. Immediately the 110 volt switch 299 is opened the motor I comes to rest so that the beam F stops descending. Immediately the magnet 294 became deenergized and the cradle 286 moved into its elevated position the ball 289 therein commenced to travel to the right and when it reached the right hand end of the cradle it closed the 110 volt terminals 290 and 291, thus closing the 110 volt circuit Z to the motor I which immediately commences to rotate in a clockwise direction and cause the beam F to commence to ascend.

In order to provide the necessary interval of time to permit the motor I to come to rest before reversing its direction of rotation at the end of the descent of the beam F the baffle runway 288 for the ball 289 is provided in the cradle 286. By the provision of this baffle runway the passage of the ball from the left to the right hand end of the cradle when the cradle moves into its elevated position is retarded.

The 110 volt circuit Y to the motor I is broken immediately the cradle 286 commences to ascend and the 110 volt circuit Z to the motor I is not closed to commence rotation of the motor in the opposite direction until the ball 289 reaches the right hand end of the cradle to bridge the points 290 and 291 and the interval of time taken for the ball to travel along the baffle runway 288 is sufficient to permit the motor I to come to rest before reversing.

The beam F now ascends and at an intermediate point of the ascent the starting coil reversing switch K is again reversed and returned to the position illustrated in Figure 29 so as to reverse the direction of rotation of the motor I after the motor has been again stopped and started. The beam now completes its ascent and as the operation of the device is such that during this first descent and ascent no record has as yet been picked up by the turntable, the parts come to rest again with the circuits and connections exactly in the position shown in Figure 29.

It is now necessary to close the starting switch S a second time during which the beam descends and ascends with exactly the same electrical operations as previously described but during this second descent of the beam a record is fed from the upper magazine section 52 and is picked up by the turntable 163 during this second ascent of the beam so that it engages the pickup needle 187 and the follower needle 195, as previously described, and moves into playing position within the machine with the pickup 186 supported thereon.

When the record thus supported upon the turntable reaches playing position the radius arm 148 opens the 110 volt switch N and consequently the 110 volt circuit Z thus bringing the motor I to rest, this motor and the beam F remaining stationary during the playing period of the record.

As the turntable moved into playing position in the foregoing operation the record carried thereby engaged and lifted the pickup arm 177 so that the turntable switch Q remained closed and the turntable motor 167' thus continued to rotate. It might be here pointed out that the turntable motor 167' rotates continuously during the entire operation of the machine.

The playing of the record now proceeds in the course of which the pickup arm 177 swings inwardly of the record and at the completion of the playing period, as previously explained, one of the pickup arm switches T is closed thus closing the 6 volt circuit W and energizing the electro-magnet 294 which immediately attracts the armature 295 causing depression thereof and of the cradle 286 and closing the switches 299 and 300. Immediately the 110 volt switch 299 is closed thus closing the 110 volt circuit Y to the motor I the motor commences to rotate and the beam F and with it the record upon the turntable to descend and immediately the record disengages from the pickup arm the switch T previously closed automatically opens.

The table now continues its descent and as usual at an intermediate point thereof the starting coil reversing switch K is again reversed ready to reverse the motor I to cause the beam F to ascend.

When the beam F reaches the bottom of its descent, the radius arm 148 opens the 6 volt switch P thus opening the 6 volt circuit X and deenergizing the magnet 294 so that the armature 295 and cradle 286 immediately move into their elevated positions under the action of the spring 298 and with this elevation the switches 299 and 300 open. The opening of the 110 volt switch 299 opens the 110 volt circuit Y thus bringing the motor I to rest and after the usual interval of time, during which the ball 289 travels to the right along the baffle runway 288, the other 110 volt circuit Z to the motor I is closed by the

ball 289 bridging the terminals 290 and 291 and the motor I immediately commences clockwise rotation to cause the beam F to ascend.

At an intermediate point of this ascent the starting coil switch K is again reversed and the beam F continues to move upwardly and at a certain point in this ascent it picks up a turned over record which is supported within the record holding channels H of the machine and carries this turned over record upwardly into playing position. In the course of lifting this record from the turned over channels H, if the record is of the 12 inch size, the outwardly swinging channels close the switch R to energize the magnet 212 and permit the pickup arm to swing to 12 inch position.

The record is now carried on upwardly to engage the pickup needle 187 and follower needle 195 and carry the pickup 186 into playing position when the preceding operations are repeated, which operations continue as long as records are fed to the machine.

In the feeding of records from the upper magazine section 52 into the machine, as previously described, if a 12 inch record is being fed the 6 volt switch M is closed to energize the magnet 212 to permit the pickup arm 177 to swing outwardly to 12 inch position.

In connection with the operation of the electrical apparatus the following points may be noted:—

1. When the machine comes to rest after the playing of a series of records the electrical apparatus and circuits are as illustrated in Figure 29.

2. The machine is placed in operation by closing the starting switch S.

3. The pickup arm 177 is always normally reset to the 10 inch position except when a 12 inch record is being conducted to playing position in the machine at which time the passage of this 12 inch record itself is utilized to close either of the switches M or R to automatically energize the electro-magnet 212 and permit the pickup arm to assume 12 inch position. The electro-magnet 212 is in series parallel connection with the switches M and R in the 6 volt circuit V so that the closing of either of these switches closes this circuit V.

4. All the switches M, R, T and S are in parallel in the 6 volt circuits so that the closing of any one of these switches closes a 6 volt circuit.

5. The switches 300 and P and the electro-magnet 294 are in series connection in the 6 volt circuit X so that the opening of the normally closed switch P opens this circuit X to de-energize the electro-magnet 294 and permit the armature 295 and cradle 286 to be elevated by the spring 298 and the switches 299 and 300 to assume their normally open positions.

6. During each descent of the beam F the cradle 286 is depressed and the ball 289 at the left hand end thereof so that the 110 volt circuit Y is closed and the 110 volt circuit Z is open. Thus the circuit Y is operative to drive the motor I during each descent of the beam while the circuit Z is then inoperative.

7. During each ascent of the beam F the cradle 286 is elevated and the ball 289 at the right hand end thereof so that the 110 volt circuit Z is closed and the 110 volt circuit Y is opened. Thus the circuit Z is operative to drive the motor I during each ascent of the beam while the circuit Y is inoperative.

8. The position of the starting coil reversing switch K is reversed during each ascent and each descent of the beam F at a time when the motor I is spinning and the starting coils thereof are out of circuit.

9. Unless there is a record upon the turntable 163 when the beam F reaches the top of its ascent, the turntable switch Q is automatically open so that the presence of a record upon the turntable is necessary to the continued operation of the machine.

10. The beam F is brought to rest at the end of each descent thereof by the opening of the 110 volt circuit Y as a result of the opening of the normally closed 6 volt switch P by the radius arm 148, thus opening the 6 volt circuit X which de-energizes the electro-magnet 294 and permits the armature 295 and cradle 286 to elevate and open the 6 volt switch 300 and the 110 volt switch 299.

11. After being thus brought to rest, as above stated, at the end of each descent, the motor I commences to elevate the beam F on its next ascent after a short interval as a result of the closing of the 110 volt circuit Z by the bridging of the terminals 290 and 291 of the cradle 286 by the ball 289 travelling to the right hand end of the cradle.

12. The beam F is brought to rest at the end of each ascent thereof by the opening of the 110 volt circuit Z as a result of the opening of the normally closed 110 volt switch N by the radius arm 148.

13. The beam F remains at rest in its elevated position during the playing of a record and the subsequent descent thereof is commenced by the closing of the 110 volt circuit Y as a result of the closing of one of the pickup arm switches T, which closes the 6 volt circuit W, thus energizing the electro-magnet 294, depressing the armature 295 and cradle 286 with a consequent closing of the 6 volt switch 300 and 6 volt circuit X and the 110 volt switch 299 and 110 volt circuit Y.

The actual operation of the machine setting forth the various steps thereof in their proper chronological order of occurrence will now be given.

Consider the apparatus to be in the position it has assumed after having played a complete series of records during which the records have all been transferred from the upper to the lower magazine section and the magazine B is in its fully lowered position. During the last descent of the beam F in the previous playing period the final record was removed from the descending turntable 163 and deposited into the lower magazine section 53. The beam F then continued this last descent during which the record holding channels H were turned over into their receiving positions and upon the beam again rising into playing position, since there was no record upon the turntable to lift the pickup 186, this pickup engaged the insulated pad 162 of the turntable motor switch Q opening this switch and with it the 110 volt circuit to the turntable motor 167'. At the same time as the beam reached its fully raised position the radius arm 148 opened the 110 volt switch N and brought the main motor I to rest so that the entire mechanism came to rest with the beam in raised position and no record upon the turntable.

The procedure for putting the machine into operation anew is as follows:—

The magazine B is raised into its fully raised position in the manner hereinbefore described by the depressing of the foot treadle 91. The rec-

ords are now transferred from the lower to the upper magazine section by placing them in the compartments 95 of the upper section in the order in which it is desired that they be played, counting from the lowermost compartment upwardly and in this connection it is essential that the records be placed in consecutive compartments, no intermediate compartments being left vacant, as should such be the case the machine will come to rest after playing only those records in the compartments below the empty compartment.

The machine is placed in operation by closing the starting switch S which, as previously described, completes the necessary electrical circuits whereby the motor I is placed in operation to cause the beam F to descend.

The record holding channels H are now in their receiving positions (as shown in Figures 13 and 14) and the beam F and turntable 163 pass downwardly between these channels, it being of course essential to the operation of the machine that the channels H be spaced apart a sufficient distance to permit this passage of the beam F and turntable therebetween.

As the beam descends the lugs 132 carried thereby engage the hinged fingers 244 of the levers 242 and oscillate these levers about their pivotal connections 156 so that the upper bifurcated ends 243 of these levers withdraw the spring pins 239 from engagement with the pulleys 218 but as these pins are merely now in rubbing engagement with the inner faces of these pulleys this is an idle movement and no useful action takes place.

As the beam F further descends one of the lugs 132 reverses the position of the starting coil reversing switch K, as previously explained, and during the further descent of the beam the record holding channels H are turned over into their turned over discharging positions (as shown in Figure 23) this turning over being accomplished, as previously explained, by the turning of the pulleys 218 and shafts 216 carried thereby in a clockwise direction as viewed in Figure 1. As previously explained, the record holding channels H are locked or held in their turned over discharging positions by the engagement of the pins 239 in the arcuate slots 219 of the pulleys 218.

When the beam F reaches the bottom of this descent, the motor I is brought to rest, as previously explained, by the opening of the 6 volt switch P by the radius arm 148 which results in the opening of the necessary circuits to bring the motor I to rest. After coming to rest the necessary circuits are automatically closed to cause the motor I to rotate in the reverse direction and the beam F commences to ascend and at the usual point in the ascent thereof one of the lugs 132 again reverses the position of the starting coil reversing switch K and the lugs 132 idly engage the hinged fingers 244 causing these fingers to hinge upwardly to permit the lugs 132 to pass thereby. Also during this ascent the ratchet collar 262 moves freely with respect to the shaft 257 in a counter-clockwise direction as viewed in Figure 8 to reset the ratchet connection.

The beam F continues its ascent passing upwardly between the turned over channels H and as there is as yet no record to be picked up by the turntable the beam continues this ascent into its uppermost position in which, in the absence of a record upon the turntable, the pickup 186 again engages the turntable switch Q and opens the circuit to the turntable motor 167', thus bringing this motor to rest and at the same time as the beam reaches its uppermost position the radius arm 148 opens the 110 volt switch N, thus disconnecting the circuit to the motor I and bringing the motor to rest.

At the completion of this ascent the entire mechanism again comes to rest and the only important operation that has happened in this initial descent and ascent of the beam has been to turn the record holding channels H over into their turned over discharging positions and to move certain parts of the machine into their proper positions to deliver a record during the next descent.

It is now necessary that the starting switch S be again closed upon which the beam F immediately commences to descend. As the beam now descends, at the usual point the lugs 132 engage the hinged arms 244 of the levers 242 thus oscillating these levers and causing the upper bifurcated ends 243 thereof to withdraw the spring pins 239 from engagement with the arcuate slots 219 of the pulleys 218 and immediately this disengagement occurs the record holding channels H are turned back into their receiving positions, being properly stopped in these positions by the engagement between the stops 220 and 221, (see Figure 15). This return turning of the record holding channels H is caused by rotation of the pulleys 218 in a counter-clockwise direction as viewed in Figure 1, this rotation being caused by the descent of the weights 223 previously drawn upward by the winding of the cables 222 upon these pulleys 218.

As the beam now further descends one of the lugs 132 again reverses the starting coil reversing switch K and, during the latter part of this descent of the beam, the magazine B is lowered one step by the tripping of the lever 79 in the manner previously described upon which a record is delivered from the lowermost compartment 95 over the upper slide or guide apron C into the cradle E being carried rearwardly upon the cradle, as previously explained, and supported thereby in proper position within the machine to be subsequently picked up by the ascending turntable.

As previously explained, the pickup arm 177 is always normally stopped in its outward swinging motion after the playing of a record in the 10 inch position and if this record just delivered to the cradle E is of 10 inch size the pickup arm 177 remains in that normal position. If, however, this record is of 12 inch size, in sliding rearwardly over the 12 inch channel 100 of the upper stationary guide apron C, it closes the switch M in the six volt circuit V, thus energizing the electromagnet 212, which attracts the lever 206 and permits the pickup arm 177 to swing outwardly to 12 inch position.

At the completion of this descent, as in all descents, the radius arm 148 again opens the 6 volt switch P, thus connecting the necessary circuits to bring the motor I to rest and after a short interval reverses the direction of rotation of the motor so that the beam commences to ascend. At an intermediate point of this ascent of the beam, as in all ascents, one of the lugs 132 again reverses the position of the starting coil reversing switch K and the lugs 132 move upwardly freely past the hinged fingers 244 of the levers 242. Also the ratchet mechanism resets itself.

The turntable now moves upwardly under the record which is suspended in the cradle E and the centre pin 170 of the turntable enters the centre hole of the record. It is of vital importance that the record be so held in the cradle E that the

centre hole thereof is accurately positioned to be engaged by the centre pin 170 of the rising turntable. In order to facilitate the entry of this pin into the centre hole and to compensate for any slight displacement which might occur of the centre hole, the pin 170 is provided with a long tapered point and as long as the extreme point thereof enters the centre hole of the record the record will automatically centre itself as the record is lifted clear of the cradle and the pin will enter the hole provided the displacement in the position of the hole is not greater than the radius of the hole. In other words as long as the variation in the position of the hole does not exceed the radius of the hole the long tapered point of the pin will enter the hole and once entered will, of course, cause the record to properly centre itself.

Continued ascent of the table now lifts the record off the cradle E which, as soon as relieved of the weight of the record, automatically swings back under the action of the counter-balancing weights 124 and 125 into its original raised or forward position. The record is now entirely supported upon the turntable and is of course spinning therewith.

The record is now carried upwardly upon the turntable and as it approaches the raised playing position thereof the pickup needle 187 and the follower needle 195 register with and engage the record grooves and when the record has reached its final playing position the pickup arm is entirely supported upon the record and the suspending cable 189 thereof is relieved of the weight of the pickup arm and is slack. In moving into fully raised playing position the record elevates the pickup arm 177 to some extent above its normal suspended position. An important feature, as previously explained, is that as the record moves into playing position the turntable unit and therefore the record carried thereby is firmly supported against rocking by the engagement of the bent arm 176 with the tie rod 131 of the beam F.

Immediately the beam has reached its elevated playing position the radius arm 148 again opens a 110 volt switch N, thus bringing the motor I to rest so that the beam remains stationary during the entire playing of the record. The playing of the record now proceeds in which the pickup needle 187 and follower needle 195 travel inwardly along the record grooves the pickup needle being, as previously stated, three or four grooves ahead of the follower needle. At the completion of the playing of the record due to the displacement of the follower needle arm 192 relatively to the pickup needle 177, one of the switches T is closed, as previously fully explained, the closing of which switch T closes the six volt circuit W and actuates the necessary circuits to place the motor I in operation to cause the beam F to descend.

During the first part of the descent of the record, the pickup arm 177, which had previously been raised thereby, is carried downwardly upon the record until it reaches the point at which its supporting cable 189 becomes taut at which point, since the pickup arm can no longer follow the record in its descent, the record moves downwardly away from the pickup needle 187 and the pickup arm 177 is then freely suspended by its cable 189. After contact between the record and the pickup needle is broken the pickup arm again becomes suspended upon its cable which of course becomes taut and due to the disposition of the point of attachment of the upper end of the cable 189 with respect to the pickup arm this arm now swings outwardly under the action of gravity and comes to rest against the stop 208 of the arm 206 which holds the pickup arm in 10 inch position.

During this initial part of the descent of the record the weight of the record upon the table keeps the arm 176 in engagement with the tie rod 131 so that the record which was horizontal during the playing now tilts downwardly slightly towards its front end away from the needles so that the tendency for the needles in the outward swinging of the pickup arm 177 to scratch the record is largely overcome as it is obvious that if the record remains horizontal during this initial part of its descent its surface would be higher and more apt to be struck by the needles in the outward swinging of the pickup arm.

The beam F now continues its descent carrying therewith the record supported upon the spinning turntable and as the turntable descends between the record holding channels H, now in their receiving positions, it deposits this record upon the proper set of receiving channels thereof. If a 10 inch record is being manipulated it is deposited upon the 10 inch receiving channels 230 whereas if a 12 inch record is being manipulated it is deposited upon the 12 inch receiving channels 229 so that the record is supported upon these channels.

As the turntable further descends the pin 170 thereof disengages entirely from the centre hole of the record upon which disengagement the record slides rearwardly and downwardly upon the record holding channels H until it is stopped by the stops 235 or 236 thereof, as the case may be, and in this sliding movement the record moves underneath the cover plates 231 or 232, as the case may be, so that this record is engaged between the channels and the cover plates.

The beam now continues to move downwardly and once again the lugs 132 engage the hinged fingers 244 of the levers 242 to oscillate these levers in an idle movement. Upon further descent one of the lugs 132 again reverses the position of the starting coil reversing switch K. During the latter part of this descent the record holding channels K are again turned over into their turned over discharging positions as shown in Figure 23 and in this turning over operation the record carried by these channels is also turned over side for side so that the unplayed side thereof, previously undermost, is now turned uppermost preparatory to being played. This turning over is accomplished in the manner already described and the turned over channels H and record are held in the turned over position by the engagement of the pins 239 with the arcuate slots 219 of the pulleys 218. In this turned over position, the record now rests upon the appropriate pair of cover plates 231 or 232, depending upon whether it is a 10 or a 12 inch record. Also in this turned over position, as previously explained, the discharging channels 233 and 234 are uppermost, being inclined downwardly and forwardly and in alignment with the stepped channels 202 and 203 of the lower stationary guide apron D.

In this turning over operation an important point is that the record is turned from an initial downwardly and rearwardly inclined position, in which it presses downwardly upon the stops 235 or 236, as the case may be, of the record holding channels H, downwardly into a forwardly and downwardly inclined position so that during the entire turning operation the record rests by gravity against these stops 235 and 236 and at no

point is there any tendency for it to fall out of its proper engagement within the record holding channels H.

As the beam F reaches the bottom of the descent the radius arm 148 again opens the six volt switch P which in turn actuates the necessary electrical circuits, as previously described, to bring the motor I to rest and after the usual short interval to start it rotating in the reverse direction so as to cause the beam F to ascend.

During this ascent of the beam one of the lugs 132 again reverses the starting coil reversing switch K, the lugs move freely upwardly past the hinged fingers 244, and the ratchet mechanism resets itself. The ascending beam F now moves the turntable 163 upwardly underneath the turned over record, which record is so positioned and supported by the record holding channels H that the centre pin 170 of the turntable is adapted to register therewith and therefore, as the table moves upwardly, the record is supported thereon and is carried upwardly therewith.

As previously explained, the entire record holding channels H with the exception of the 12 inch cover plates 232, are carried by the hinged portions 225 of the axles 216, which hinged portions 225 are uppermost in this turned over discharging position of the channels H and, therefore, as the record is carried upwardly by the ascending turntable, it causes the record holding channels H to swing outwardly about the hinged connections 226, as indicated clearly in Figure 24, this outwardly swinging action being of sufficient extent to permit the record to pass upwardly between the record holding channels, and after this has occurred these channels H fall backwardly into their original positions, as shown in Figure 23. In this outward swinging action of the channels the hinged portions 225 of the shafts 216 move freely in the bifurcated portions 228 of the bearing members 227.

In the above described operation the position of the record as supported in turned over position in the channels H must be such that the centre hole thereof lies at the maximum distance measured radially from the shaft 128 so that when engagement has been established between the centre pin 170 and this hole, further ascent of the beam does not tend to move the record forwardly in the machine as, if such were the case, the apparatus would become locked due to the fact that the record would be pressed against the stops 235 or 236 of the members H and no further movement would be possible. On the contrary, by having the record thus properly suspended, as soon as the pin 170 engages within the centre hole of the record further ascent of the beam tends to draw the record rearwardly away from the stops instead of pressing it forwardly against the stops, thus permitting free and unrestricted movement of the parts.

If a 10 inch record is being manipulated the pickup arm 177, which normally resets itself in the 10 inch position after the playing of the last record, remains in this 10 inch position but if a 12 inch record is being manipulated, due to its greater diameter, in passing upwardly between the record holding channels H it causes these channels to swing outwardly to a greater extent than does a 10 inch record and in fact swings them outwardly sufficiently so that they engage the blade 238 of the switch R and close this switch thus closing the 6 volt circuit V, energizing the electro-magnet 212 and oscillating the lever 206 to permit the pickup arm to swing outwardly to 12 inch position.

This closing of the switch R by the outwardly swinging channels H occurs some time before the record has arrived at its playing position so that the pickup arm 177 has plenty of time to swing outwardly into its 12 inch position before the needles thereof engage the ascending record. The record as now supported upon the turntable has the unplayed side thereof uppermost preparatory to the playing of this second side.

The beam now completes its upward movement and in moving into playing position the record supported on the turntable picks up and supports the pickup arm 177, as previously explained. As the record moved upwardly into playing position the radius arm 148 again opened the 110 volt switch N thus stopping the motor I to again allow the beam F to remain at rest during the playing of the record.

The record is now played in which operation, as usual, the pickup arm swings radially inward of the record. It will be noticed that during the playing of the record, as the pickup arm swings radially inward, the depending stop 209 thereof can freely clear the co-operating stop 208 on the pivoted lever 206 due to the fact that the entire pickup arm 177 has been raised by the record as it moved into playing position thus allowing the stops 208 and 209 to clear each other.

Upon the completion of the playing of the record one of the pickup arm switches T is closed, as before mentioned, to close the six volt circuit W and thus actuate the necessary circuits to cause the motor I to rotate in the proper direction to lower the beam F.

It might be here pointed out in connection with the operation of the follower needle arm 192 and the closing thereby of one of the switches T at the completion of the playing of the record, that in the case of records having an inner high pitch spiral, which is the case with most modern records, the switch T is closed almost immediately the pickup needle 187 enters the inner high pitch spiral and the pickup needle does not have to travel very far into the high pitch spiral before the switch T is closed and it is therefore not necessary that the pickup needle travel to the extreme inner end of this spiral.

The beam F and with it the turntable and record thereon now descends clear of the pickup arm 177 to disengage the record from the needles thereof and, as previously explained, immediately this disengagement occurs the pickup arm again swings outwardly and is stopped in its 10 inch position by the engagement between the stops 208 and 209. As the beam and turntable pass downwardly between the record holding channels H, which are now in their turned over positions as illustrated in Figure 23, the record is deposited upon either of the discharging channels 233 or 234 thereof, depending upon whether it is a 10 inch or a 12 inch record, and the centre pin 170 of the turntable in descending disengages from the centre hole of the record and as soon as this disengagement occurs the record slides by gravity downwardly and forwardly over the discharging channels into the appropriate aligned channels 102 or 103 of the lower slide or guide apron D, sliding over this apron and being delivered into one of the compartments 96 of the lower magazine section 53.

In the operation of the machine, therefore, this record has been delivered from the upper magazine section 52 into the machine in which it

has been so manipulated that both sides thereof have been successively played after which it has been delivered to the lower magazine section 53.

The beam F now continues its descent during which the lugs 132 operatively engage the hinged fingers 244 of the levers 242, oscillating these levers to withdraw the spring pins 239 from engagement within the arcuate slots 219 of the pulleys 218, thus releasing these pulleys which are immediately rotated counter-clockwise by the weights 223 to return the record holding channels H to their receiving positions, as illustrated in Figure 14.

In further descending one of the lugs 132 again reverses the position of the starting coil reversing switch K and during the latter part of this descent the lever 79 is again oscillated through the medium of the ratchet mechanism to lower the magazine B another step and deliver a record from the next compartment onto the cradle E which in the next ascent is picked up to be played and manipulated in exactly the same manner as that of the record previously described.

If, however, the magazine B had already reached its lowermost position so that it could not further descend, this last oscillation of the lever 79 would merely be an idle step since it could not result in a further descent of the magazine. Similarly, if the next upper compartment 95 of the upper magazine section 52 contained no record, when this oscillation of the lever 79 lowered this empty magazine compartment into discharging position, no record could of course be delivered therefrom so that the effect in either case would be that this oscillation of the lever 79 would be an idle operation since it would not result in the delivery of another record from the upper magazine section 52 into the machine and therefore would not result in a record being operatively delivered to the cradle E.

If this last oscillation of the lever 79 resulted in a record being delivered to the cradle, the operation of the machine would continue exactly as already described but assuming that no record is delivered and that the last record of a series to be played has just been played and delivered to the lower magazine section 53, the operation of the machine continues as follows.

The beam F completes its descent and as it reaches its lowermost position the radius arm 148 again opens the six volt switch P thus actuating the necessary circuits for bringing the motor I to rest to stop the descent of the beam and after an interval of rest to cause this motor to operate in a reverse direction and start the beam on its next ascent.

As the beam F ascends one of the lugs 132 again reverses the position of the starting coil reversing switch K. The lugs 132 move freely past the hinged fingers 244 of the levers 242 and the ratchet mechanism resets itself preparatory to becoming operative on the next descent of the beam. The turntable passes upwardly between the record holding channels and if there were a record supported by the cradle E it would be picked up by the turntable and carried upwardly into playing position but as no record was delivered from the upper magazine section during the last descent of the beam there is no record so positioned on the cradle to be picked up so that the beam F continues to ascend and moves into playing position and there being no record upon the turntable to engage the pickup needle 187, as the beam moves into its uppermost position, the pickup 186 engages the insulated pad 162 of the turntable switch Q and this switch is opened by the weight of the pickup 186 upon the pad 162 thus bringing the turntable motor 167' to rest.

At the same time as the beam reaches its uppermost position the radius arm 148 opens the 110 volt switch N thus bringing the motor I to rest and stopping the entire mechanism.

In the operation of the machine, therefore, as long as records are available to be fed into the machine from the compartments of the upper magazine section 52, these records will be fed thereto in consecutive order counting upwardly of the compartments 95 of the upper magazine section, each record being so manipulated in the machine that both sides thereof are successively played after which it is delivered to the lower magazine section 53 and this will continue until all the records in the upper magazine section have been so played, provided there is no intermediate empty compartment in the upper magazine section. If, however, there is an empty intermediate compartment, only those records in the compartments below the empty compartment will be played, the machine then coming to rest.

Also in the operation of the machine, while the pickup arm 177 is normally set for the playing of 10 inch records, 12 inch records may also be played along with 10 inch records without requiring any manual adjustment as the passage of these 12 inch records through the machine automatically results in the proper adjustment of the pickup arm 177 to 12 inch position for playing these records.

After the completion of the playing of a series of records the entire mechanism must come to rest and all electrical circuits are automatically opened, the apparatus thus coming to rest with the beam F and turntable 163 in fully raised position, with no record upon the turntable and the record holding channels in their receiving positions, as illustrated in Figure 14.

It might also be pointed out as regards the ratchet mechanism including the ratchet collar 262 and the ratchet therein, which ratchet is rigidly carried by the shaft 257, together with the ratchet stop finger 261, that the operation is such that this mechanism is only operative during the descent of the beam F during which time the ratchet collar 262 operatively locks with the ratchet to cause clockwise rotation of the shaft 257 as viewed in Figure 8. During the ascent of the beam the ratchet collar 262 moves freely over the ratchet in a counter-clockwise direction as viewed in Figure 8 causing no rotation of the shaft 257 but merely resetting itself preparatory to operatively locking with the ratchet upon the next descent. In this counter-clockwise rotation of the ratchet collar 262, any counter-clockwise rotation of the shaft 257 as viewed in Figure 8 is positively prevented by the engagement of the finger 261 with a notch upon the collar 259, which collar is rigidly carried by the shaft 257.

It might be noted as regards the cradle E and the record holding channels H that these parts are so formed and disposed within the machine that the natural tendency in all positions thereof is always for a record carried thereby to be normally held by gravity against the record stops forming part of these elements and there is never at any time any tendency for the record to move away from these stops.

When the record holding channels H are in their receiving positions, as shown in Figures 13 and

14, the hinged portions 225 of the shafts 216, which are then lowermost, are supported upon the lower ends of the bifurcations 228 of the bearing members 227 so as to be firmly supported thereby. If this were not the case in this position, these lower hinged portions 225 and with them the channels H, which are carried thereby, would swing downwardly but due to this bearing the channels are supported in their correct position shown in Figures 13 and 14. When the channels H are turned over into their turned over discharging positions, however, in which positions the hinged portions 225 of the shafts 216 are uppermost, these hinged portions, and with them the record holding channels H carried thereby, are free to swing upwardly, as shown in Figure 24.

Commencing with the machine in the position just described when it has come to rest at the completion of the playing of a series of records the complete cycle of operations is as follows:—

1. Magazine B is fully raised and the records are transferred from the lower to the upper section thereof.

First descent of beam

2. Starting switch S is closed, thus closing six volt circuit W, energizing electro-magnet 294, depressing armature 295 and cradle 286 so that the ball 289 travels to the left hand end thereof, closing six volt switch 300 to close six volt circuit X, closing switch 299 thus closing 110 volt circuit Y and bringing motor I into operation to lower the beam.

3. The turntable motor switch Q closes as beam F descends away from pickup 186.

4. Lugs 132 oscillate levers 242 in idle motion.

5. Starting coil reversing switch K reversed.

6. Record holding channels H turned over into turned over discharging position and locked therein by spring pins 239.

7. Radius arm 148 opens 6 volt switch P thus opening 6 volt circuit X and de-energizing magnet 294. This permits elevation of armature 295 and cradle 286 under action of spring 298 and the consequent opening of the six volt switch 300 and the 110 volt switch 299, the opening of which latter switch opens the 110 volt circuit Y, thus bringing the motor I to rest and with it the beam F.

First ascent of beam

8. Closing of the 110 volt circuit Z by the ball 289 travelling to the right hand end of the cradle 286 as this cradle is elevated, this closing of the 110 volt circuit Z causing the motor I to rotate to elevate the beam F.

9. Starting coil switch K reversed.

10. Lugs 132 move freely upwardly past hinged fingers 244 of levers 242.

11. Beam F and turntable move upwardly between the turned over channels.

12. As beam reaches top of this first ascent pickup 186 opens switch Q to bring turntable motor 167 to rest.

13. Radius arm 148 opens 110 volt switch N thus opening 110 volt circuit Z and bringing motor I to rest.

Second descent of beam

14. Starting coil switch S closed a second time to set motor I in operation to cause beam to descend exactly as stated in item 2.

15. Turntable motor switch Q closed as beam descends away from pickup 186.

16. Lugs 132 engage hinged fingers 244 to oscillate levers 242 to withdraw pins 239 from slots 219 in pulleys 218 to permit the record holding channels H to return to their receiving positions in which positions they are held by stops 220 and 221.

17. Starting coil switch K reversed.

18. Lever 79 oscillated by dog 82 to lower magazine B one step and discharge lowermost record therefrom onto cradle E. If this is a 12 inch record in sliding to the cradle it closes 6 volt switch M to permit pickup arm 177 to swing to 12 inch position.

19. Cradle swings into its lowered rearward position suspending record in proper position to be picked up in due course by the ascending turntable.

20. Beam F stopped in its lowermost position by the opening of the six volt switch P, as described in item 7.

Second ascent of beam

21. After coming to rest at the end of the previous descent the beam F starts its second ascent as a result of the closing of the 110 volt circuit Z as stated in item 8.

22. Starting coil switch K reversed.

23. Lugs 132 move freely upwardly past hinged fingers 244.

24. Record lifted off cradle E and supported upon rising turntable, the centre pin 170 of the table entering the centre hole of the record.

25. Cradle E swings into its forward and upward position when record is lifted therefrom by the rising turntable.

26. Record spinning upon turntable is elevated into playing position in which pickup needle 187 and follower needle 195 properly engage the record grooves and the pickup arm 177 is elevated somewhat above its cable suspended position.

27. Beam F brought to rest in elevated playing position by the opening of the 110 volt switch N by radius arm 148.

28. Record is played in which operation radius arm swings radially inward thereof.

Third descent of beam

29. At the conclusion of the playing of the record one of the pickup arm switches T is closed, thus closing the six volt circuit W and causing motor I to commence to rotate to lower the beam as in item 2.

30. Pickup arm 177 swings outwardly into 10 inch position when record has descended out of engagement therewith.

31. Descending turntable deposits record in receiving channels of record holding channels H and as the centre pin 170 of the turntable disengages from the hole in the record the record slides rearwardly and downwardly between the receiving channels and the cover plates 231 or 232 as the case may be.

32. Lugs 132 engage hinged fingers 244 to oscillate levers 242 in an idle movement.

33. Starting coil switch K reversed.

34. Record holding channels H turned over and held in turned over discharging positions in which operation the record is turned over side for side so that the unplayed side thereof is uppermost.

35. Beam brought to rest at bottom of descent by the opening of the six volt switch P as in item 7.

Third ascent of beam

36. Beam started upon its third ascent by closing of 110 volt circuit Z as in item 8.

37. Starting coil reversing switch K reversed.

38. Lugs 132 move freely upwardly past hinged fingers 244.

39. Turntable moves upwardly underneath turned over record, centre pin 170 of the turntable entering the centre hole of the record.

40. Record carried upwardly through the channels H in which operation these channels swing outwardly about the hinged connections 226 and if a 12 inch record is being manipulated the switch R is closed to permit the pickup arm 177 to swing outwardly to 12 inch position.

41. As record rises clear of the channels H they fall back into their original turned over positions.

42. Record spinning upon turntable elevated into playing position in which pickup needle 187 and follower needle 195 properly engage the record grooves and the pickup arm is elevated somewhat above its cable suspended position.

43. Beam F brought to rest in elevated playing position by opening of 110 volt switch N by radius arm 148.

44. Record is played during which radius arm swings radially inward thereof.

Fourth descent of beam

45. At the conclusion of the playing of the record one of the pickup arm switches T is closed thus closing six volt circuit W and causing motor I to commence to rotate to lower the beam as in item 2.

46. Pickup arm 177 swings outwardly into 10 inch position when record has descended out of engagement therewith.

47. Descending turntable deposits record upon the discharging channels 233 or 234, as the case may be, of the turned over record holding channels H which are now in their discharging positions as illustrated in Figure 23.

48. As the centre pin 170 disengages from the centre hole of the record the record slides by gravity from the discharging channels of the record holding channels H over the lower slide or guide apron D and is deposited in the lower magazine section 53.

49. Lugs 132 engage levers 244 to oscillate levers 242 and permit channels H to be turned back into their receiving positions as illustrated in Figure 14.

50. Starting coil reversing switch K reversed.

51. Lever 79 oscillated to cause magazine B to descend another step and deliver the next record into the machine.

Note.—If a further record is now delivered from the upper magazine the cycle of operations continue as above described but if there are no further records to be delivered from the upper magazine, that is if the complete series has been played so that no record is delivered by this last oscillation of the lever 79, the cycle terminates as follows:—

52. At the conclusion of this descent the radius arm 148 again opens the six volt switch P to bring the motor I to rest and with it the beam F as set forth in item 7.

Fourth and final ascent of beam

53. Beam F commences to ascend due to the closing of the 110 volt circuit Z as set forth in item 8.

54. Starting coil reversing switch K reversed.

55. Lugs 132 move freely upwardly past hinged fingers 244.

56. As there is no record available to be picked up by the ascending turntable the beam F rises into its uppermost position in which position the turntable switch Q is opened by the pickup 186 thus bringing the turntable motor 167' to rest.

57. As the beam reaches its uppermost position it is brought to rest therein by the opening of the 110 volt switch N by the radius arm 148 as set forth in item 13. The entire mechanism is now brought to rest having played all the records of the series in the upper magazine section and transferred these to the lower magazine section.

While, as illustrated and described, the machine will play both sides of a double-sided record, it may readily be adapted for the playing of single-sided records as follows:—

The hinged fingers 244 of the levers 242 are rendered inoperative by securing them in their upwardly hinged positions so as to be out of the path of the lugs 132. The lever 79 is tripped to operate the magazine to discharge a record therefrom during each descent of the beam F instead of during every other descent thereof. The engagement between the dog 82 and the radial arm 254 occurs once when turning over the record holding channels H, no action the second time, the next operation being the record holding channels H assuming their normal positions and then the other dog 82 making the same connections.

In the operation of the improved machine the records are initially held each in a separate compartment of the magazine and are delivered therefrom to the machine one at a time, each record after having been so delivered being properly manipulated within the machine so as to have both sides thereof played, after which it is deposited in an individual compartment in the magazine following which the next record of the series to be played is similarly delivered and lead through the machine to be in turn delivered to its separate compartment so that there is at no time any contact between the various records and therefore there is no rubbing contact between records and furthermore since there is only one record upon the turntable at any time the capacity of the machine is not in any way limited by the length of the centre pin of the turntable.

The machine automatically adjusts itself to the playing of various size records so that records of different sizes may be indiscriminately fed to the machine without involving the necessity of any manual adjustment whatever.

Disk records of practically any type can be successfully handled by the machine whether they are provided with an inner high pitch spiral or not.

Any slight variation from standard in the overall diameter of the records will not interfere with the successful operation of the machine.

As the operation of the machine is entirely automatic in all its features it will readily lend itself for use in connection with a radio phonograph combination.

The electrical connections are such that the machine is absolutely foolproof and will automatically come to rest with all electrical circuits open at the completion of the playing of a series of records and the presence of a record within the machine is a necessary and vital element to the continued operation of the machine since as soon as records cease to be fed to the machine it must come to rest.

An important feature of the invention resides in the provision whereby in the passage of a record through the machine and in the handling of

the record therein, at no time does the playing surface of the record touch anything other than the turntable itself but only the edge of the record engages the various record supporting and handling elements, so that there is no possibility of damaging the playing surface of the record in its passage through the machine. This is provided for by slightly inclining inwardly the various stepped record engaging channels on the record supporting, holding the transferring parts of the machine including the guide aprons C and D, the cradle E and the record holding channels H. This inclination need only be very slight and is therefore hardly perceptible in the drawings.

It is, of course, to be understood that with the apparatus described it is necessary to plug in the pick-up into some radio or other suitable amplifier or sound reproducing apparatus in order to produce sound.

From the foregoing it will be evident that the present invention provides an improved apparatus for the manipulation of disk records whereby the objects set forth have been attained.

Various modifications may be made in this invention without departing from the spirit thereof or the scope of the claims, and therefore the exact forms shown are to be taken as illustrative only and not in a limiting sense, and it is desired that only such limitations shall be placed thereon as are disclosed in the prior art or are set forth in the accompanying claims.

I claim:—

1. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, mechanism for moving the turntable towards and away from the reproducer, means automatically operable from said mechanism for causing the magazine to descend by gravity through a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus after the playing thereof, means for depositing said played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

2. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine adapted to hold a series of records, record playing apparatus including the reproducer and turntable, said reproducer being normally set to suit a record of minimum size, means for feeding the records individually from the magazine, means operable by the record itself during the feeding of a large record, to automatically adjust the reproducer to suit this larger size of record, means in the form of a balanced swingable cradle for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus after the playing thereof, and means for depositing each played record into a discard section provided in the record holding magazine.

3. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine adapted to hold a series of records, means in said magazine for supporting a series of records in spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, means for causing said magazine to descend by gravity through a series of intermittent steps to feed the records intermittently individually from the magazine in succession from the bottom to the top of the series of records, means operable by the record itself, if of another size, to automatically adjust the reproducer to suit this other size of record, means for presenting to the playing apparaus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus after the playing thereof, means for depositing the played records in superimposed, spaced-apart relation into a discard section provided in the magazine, each played record being deposited in the magazine prior to the feeding of the next record therefrom, and means for automatically continuing said cycle to play all records in the series.

4. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, mechanism for moving the turntable towards and away from the reproducer, means automatically operable from said mechanism for causing the magazine to descend by gravity through a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of another size, to automatically adjust the reproducer to suit this other size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the turntable after the playing thereof, means for depositing said played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

5. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine adapted to hold a series of records, means in said magazine for supporting a series of records in spaced-apart, superimposed relation, record playing apparatus, including a reproducer and turntable, mechanism for moving the turntable towards and away from the reproducer means for feeding the records individually from the magazine in succession from the bottom to the top of the series of records, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus, means connected to the reproducer co-acting between the reproducer and the record for actuating said mechanism at the completion of the playing of the record, means for depositing the played records in superimposed, spaced-apart relation into a discard section provided in the magazine, each played record being deposited in the discard section of the magazine prior to the feeding of the

next record therefrom, and means for automatically continuing said cycle to play all records in the series.

6. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, means for moving said turntable towards and away from said reproducer, means automatically operable from said mechanism for causing the magazine to descend by a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of another size, to automatically adjust the record playing apparatus to suit this other size of record, means for presenting to the playing apparatus to effect in the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus, means connected to the reproducer co-acting between the reproducer and the record for actuating said turntable moving means at the completion of the playing of the record, means for depositing said played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

7. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, mechanism for moving said turntable towards and away from said reproducer, means automatically operable from the said mechanism for causing the magazine to descend by gravity through a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for automatically reversing each record after the playing of one side thereof, means for automatically controlling the magazine against movement when each record is reversed, means for withdrawing each record from the playing apparatus after the playing of both sides thereof, means for depositing the played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

8. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine adapted to hold a series of records, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, means for feeding the records individually and successively from the magazine, means operable by the record itself during the feeding of said record, if of another size, to automatically adjust the reproducer to suit this other size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for reversing each record after the playing of one side thereof, means for automatically controlling the magazine against movement when each record is reversed, means for withdrawing each record from the playing apparatus after the playing of both sides thereof, means for depositing each record after both sides thereof have been played into a discard section of the record holding magazine, each played record being deposited in the discard section of the magazine prior to the feeding of the next record therefrom, and means for automatically continuing said cycle to play all records of the series.

9. Apparatus for the manipuation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of minimum size, mechanism for moving the turntable towards and away from the reproducer, means automatically operable from said mechanism for causing the upper and lower magazine sections to descend in unison by a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of larger than minimum size, to automatically adjust the record playing apparatus to suit this larger size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for reversing each record after the playing of one side thereof, means for controlling the magazine against movement when each record is reversed means for withdrawing each record from the playing apparatus after the playing of both sides thereof, means for depositing the played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

10. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of minimum size, means for moving said turntable towards and away from the reproducer means automatically operable from said turntable moving means for causing the upper and lower magazine sections to descend in unison by a series of intermittent steps, means whereby at each step of the descent of of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of larger than minimum size, to automatically adjust the record playing apparatus to suit this larger size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for reversing each record after the playing of one side thereof means for withdrawing each record from the playing apparatus, means connected to the reproducer co-acting between the reproducer and the record for actuating said turntable moving means at the completion of the playing of each side of each record,

means for depositing the played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

11. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, mechanism for moving the turntable towards and away from the reproducer, means automatically operable from said mechanism for causing the magazine to descend by a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of another size, to automatically adjust the reproducer to suit this other size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for withdrawing each record from the playing apparatus after the playing of both sides thereof, means for automatically turning each record over side for side between the playing of the two sides thereof, means for automatically controlling the magazine against movement when each record is reversed, means for depositing the played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

12. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine having upper and lower magazine sections, means in said upper and lower sections for supporting a series of records in downwardly inclined, spaced-apart, superimposed relation, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of one size, means for moving said turntable towards and away from the reproducer means automatically operable from said turntable moving means for causing the magazine to descend by a series of intermittent steps, means whereby at each step of the descent of the magazine a record is fed from the upper magazine section, means operable by the record itself, if of another size, to automatically adjust the record playing apparatus to suit this other size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for reversing each record after the playing of one side thereof means for withdrawing each record from the playing apparatus after the playing of both sides thereof, means connected to the reproducer co-acting between the reproducer and the record for actuating said turntable moving means at the completion of the playing of each side of each record, means for depositing the played records in the lower magazine section, the playing of each record and its deposit in the lower section being effected between successive descents of the magazine.

13. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine adapted to hold a series of records, record playing apparatus including a reproducer and turntable, said reproducer being normally set to suit a record of a given size, means for moving the turntable towards and away from the reproducer, means for feeding the records individually and successively from the magazine, means operable by the record itself if of another size to automatically adjust the reproducer to suit that size of record, means for presenting to the playing apparatus to effect the playing thereof each record so fed from the magazine, means for reversing each record after the playing of one side thereof means for withdrawing each record from the playing apparatus, means connected to the reproducer co-acting between the reproducer and the record for actuating said turntable moving means at the completion of the playing of each side of each record, and means for depositing each record after both sides thereof have been played into a discard section of the record holding magazine.

14. In apparatus of the character described, the combination with the stationary frame thereof, of a vertically movable record holding magazine mounted therein, a rod depending from the bottom thereof, aligned, axially spaced-apart pins projecting diametrically from said rod, a collar rotatably mounted upon the frame and provided with an orifice through which said depending rod extends, the thickness of the collar being less than the axial distance between adjacent pairs of pins, the collar formed with a pair of diametrically opposed slots disposed obliquely to the axis of the rod and with a pair of diametrically opposed slots disposed axially of the rod, the collar normally positioned so that the projecting ends of a pair of pins engage a solid part of the upper surface thereof to support the magazine, means for turning the collar in one direction from its normal position to bring the upper ends of the oblique slots into alignment with the pins whereby said pins descend through said oblique slots and turn the collar back into its normal position, and means for turning the collar in the opposite direction from its normal position to bring the axial slots thereof into alignment with the projecting pins on the rod.

15. In apparatus of the character described, a cable suspended pick-up arm supported to be capable of oscillation about both a vertical and horizontal axis and to cooperate with a record receiving turntable movable towards and away from said arm by means of a motor, means normally retaining said arm in one extreme swung position, a follower arm suspended beneath said pick-up arm and capable of oscillation about both a horizontal and vertical axis, a pair of normally open switches carried by the pick-up arm and connected in a circuit adapted to control the operation of said motor, means co-acting between said switches and the follower arm whereby oscillation of the latter in either direction with respect to the pick-up arm is operative to close one of said switches to cause said motor to operate, means normally positioning the follower needle arm in a set position relatively to the pick-up arm, and a record engaging needle carried by each of the arms.

16. In apparatus of the character described, the combination with the frame of the machine of a pair of opposed record holding channels mounted for oscillation at each side thereof, each record holding channel formed with a record receiving channel and a record discharging channel, a cover plate overlying the receiving channel, a stop in the record receiving channel, means normally retaining the record holding channels

in downwardly and rearwardly inclined positions in which the receiving channels are uppermost, means for turning said record holding channels in unison into downwardly and forwardly inclined positions in which the discharging channels are uppermost, said record holding channels being mounted to swing upwardly when in their latter turned-over discharging positions.

17. In apparatus of the class described, the combination with the frame of the machine, of a transverse horizontal shaft journalled adjacent to the rear end of the frame and intermediately of the height thereof, a beam rigidly carried thereby and extending forwardly of the machine, a turntable unit pivotally mounted in the forward end of said beam, counterbalancing means for the turntable unit whereby the turntable is normally maintained in a horizontal position, means for oscillating said shaft to oscillate said beam between an extreme elevated and an extreme depressed position, means for automatically stopping and reversing the direction of oscillation of the beam at each extreme position, and means for rigidly supporting the turntable unit when the beam is in its elevated position.

18. In apparatus of the class described, the combination with the frame of the machine and a record holding magazine adapted to hold a series of records and means for discharging the records individually from the magazine of a cradle pivotally mounted in the frame for oscillation about a horizontal axis and adapted to oscillate between an extreme elevated position and an extreme lowered position, said cradle formed with record receiving channels, said cradle normally maintained by gravity in its elevated position in which it is adapted to receive a record discharged from the magazine and to move into its lowered position under the weight of said record.

19. In apparatus of the class described, a circuit closing device comprising a cradle mounted for oscillation about a horizontal axis and adapted to oscillate between an extreme elevated position and an extreme lowered position, a pair of spaced-apart insulated terminals at one end of the cradle connected in circuit with a motor, a metal ball within the cradle adapted to travel from end to end thereof as the cradle is oscillated and to bridge the insulated terminals when at that end of the cradle and close said circuit to start said motor, a baffled runway within the cradle adapted to retard the movement of the ball therealong, spring means normally operative to maintain the cradle in one extreme position, and means for moving the cradle into its other extreme position.

20. In apparatus for the manipulation and playing of disk records, the combination with the stationary frame thereof, of a vertically movable record holding magazine mounted therein, a rod depending from the bottom of the magazine, means for permitting the magazine to descend within the frame through a series of intermittent steps, said means including a plurality of spaced apart stop members on the rod, a collar rotatably mounted on the frame, having an orifice therein through which said rod extends, said stop members successively contacting with the collar to support the magazine rigidly at predetermined points during its descent, said collar being formed with at least one slot having a defining wall of cam-like character to engage with said stop members, means for rotating said collar to bring said slot into registry with the stop members to cause descent of the magazine, said stop members and cam-like wall of the slot coacting to return said collar to normal position, arresting the descent of the magazine.

21. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine, record playing apparatus including a reproducer and a turntable, means for feeding records individually from the magazine, a balanced cradle normally lying adjacent to the magazine designed to receive records fed from the magazine and swingable under weight of a record to a position presenting the record to the playing apparatus, means for moving the turntable towards a record so presented to engage and elevate the latter into playing position, means for withdrawing a record from the turntable after it has been played and means for depositing the played record into a discard section of the record holding magazine.

22. Apparatus for the manipulation and playing of disk records comprising in combination, a record holding magazine, record playing apparatus including a reproducer and turntable, means for feeding records individually from the magazine, balanced swingable means normally positioned adjacent said magazine for receiving a record so fed, said swingable means being designed to freely hold and swing the record to a second position to present it to the playing apparatus, means for moving the turntable in an arcuate path towards a record so presented, means in connection with said moving means for holding the turntable to assume a horizontal position throughout its arcuate movement to accurately engage and elevate each record, means for withdrawing each record from the playing apparatus after the playing thereof and means for depositing the record into a discard section of the record holding mechanism.

23. Apparatus for the manipulation and playing of disk records comprising in combination a record holding magazine, record playing apparatus including a reproducer and turntable, means for feeding records from the magazine, means for presenting to the turntable each record so fed from the magazine, means for moving the turntable in an arcuate path towards a record so presented, means in connection with said moving means for freely holding the turntable so that it assumes a horizontal position throughout its arcuate movement to accurately engage and elevate each record, means for rigidly holding said turntable in a horizontal plane when it reaches playing position, means for withdrawing each record from the turntable after the playing thereof.

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