Jan. 19, 1937. A. R. DOWNS 2,068,449

GRAMOPHONE OR THE LIKE

Filed Oct. 26, 1934 6 Sheets-Sheet 1

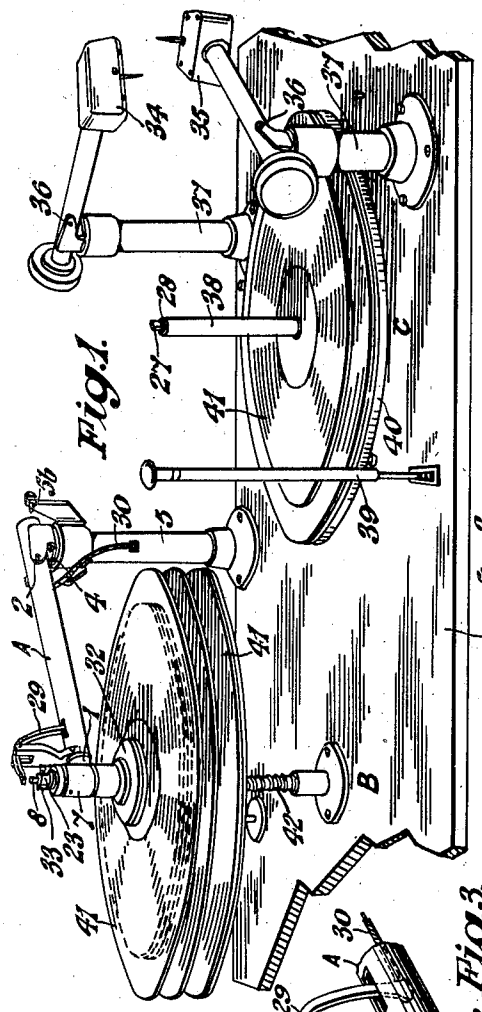


Fig. 1.

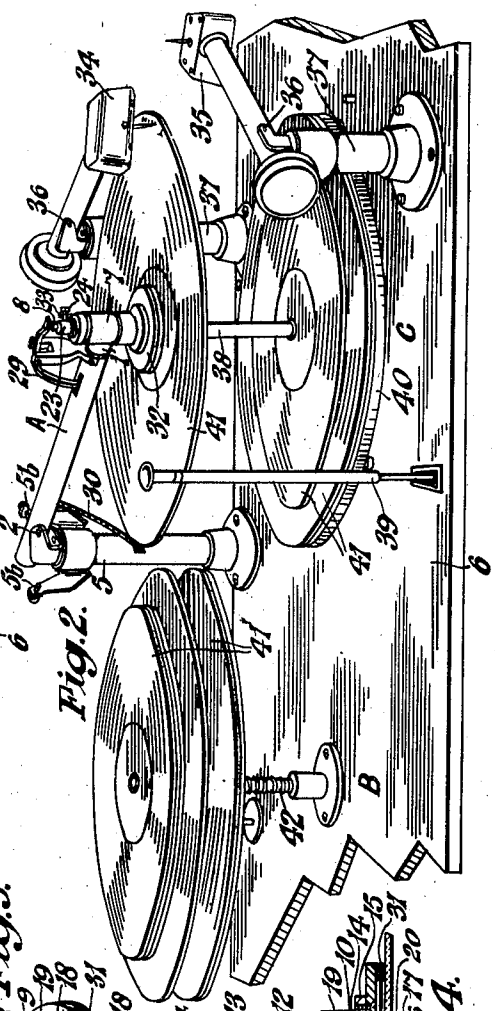


Fig. 2.

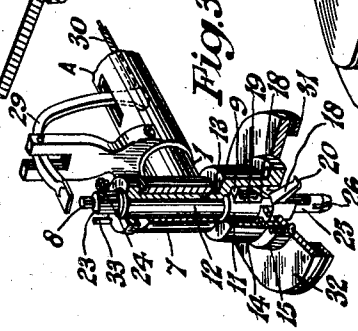


Fig. 3.

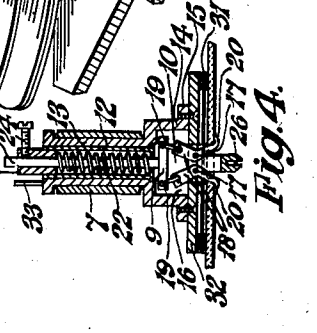


Fig. 4.

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GRAMOPHONE OR THE LIKE

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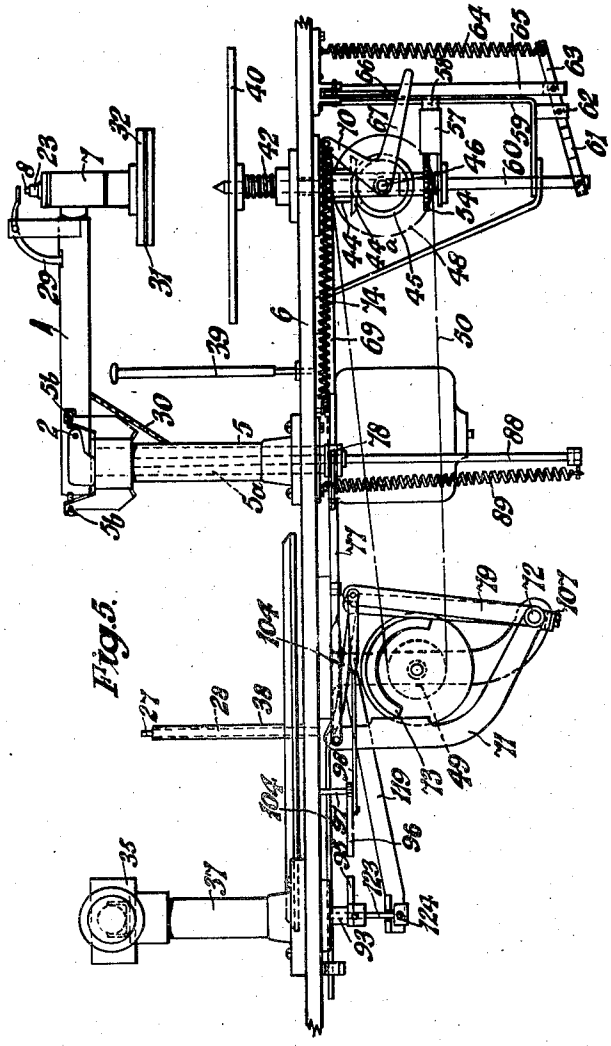


Fig.5.

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Jan. 19, 1937. A. R. DOWNS 2,068,449

GRAMOPHONE OR THE LIKE

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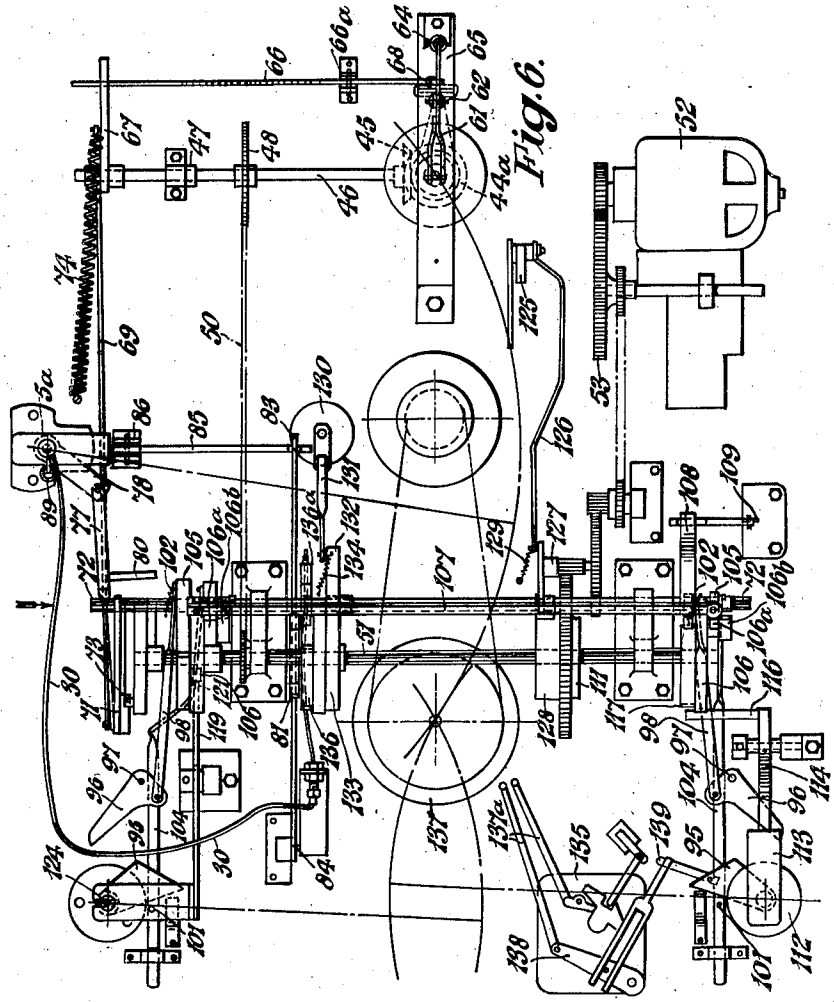


Fig. 6.

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Jan. 19, 1937. A. R. DOWNS 2,068,449

GRAMOPHONE OR THE LIKE

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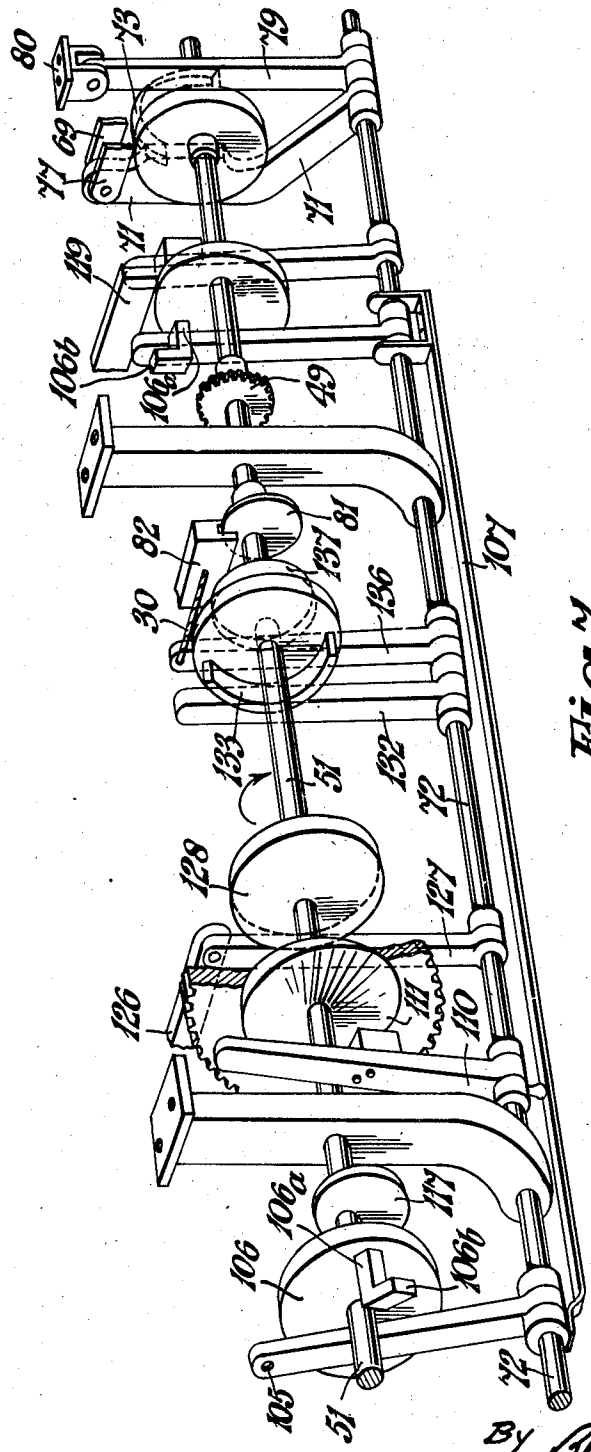


Fig. 7.

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Jan. 19, 1937. A. R. DOWNS 2,068,449

GRAMOPHONE OR THE LIKE

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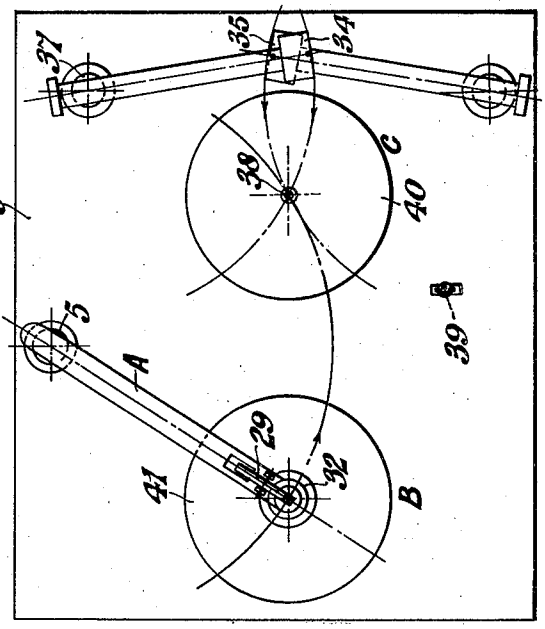


Fig.9.

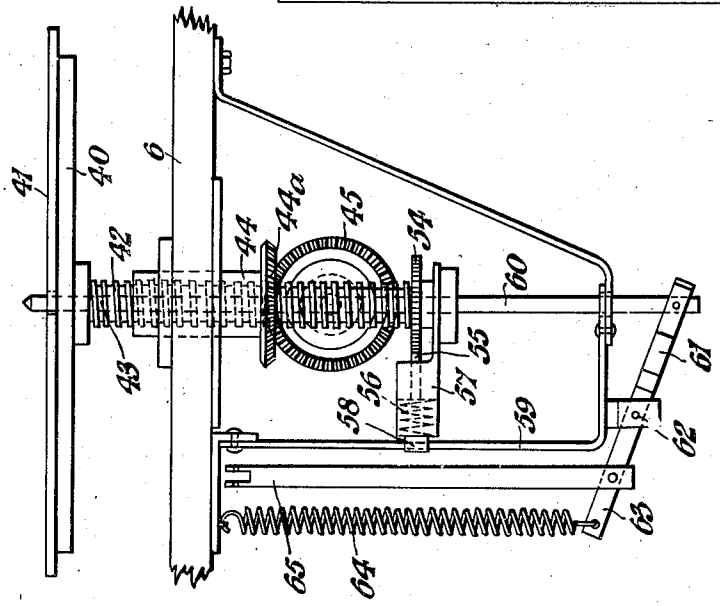


Fig.8.

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GRAMOPHONE OR THE LIKE

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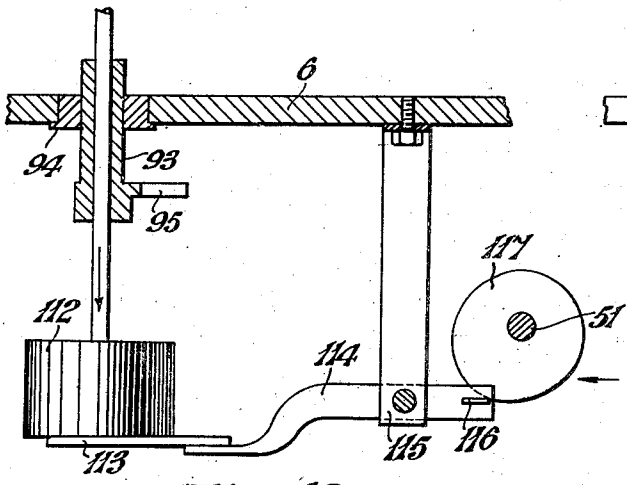


Fig. 10.

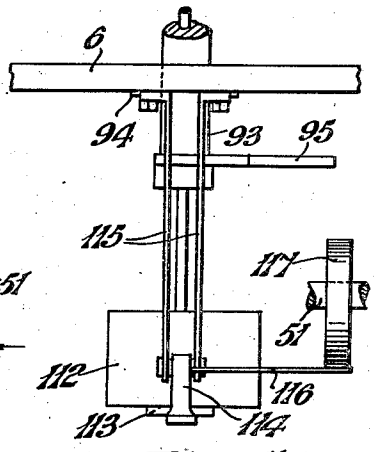


Fig. 11.

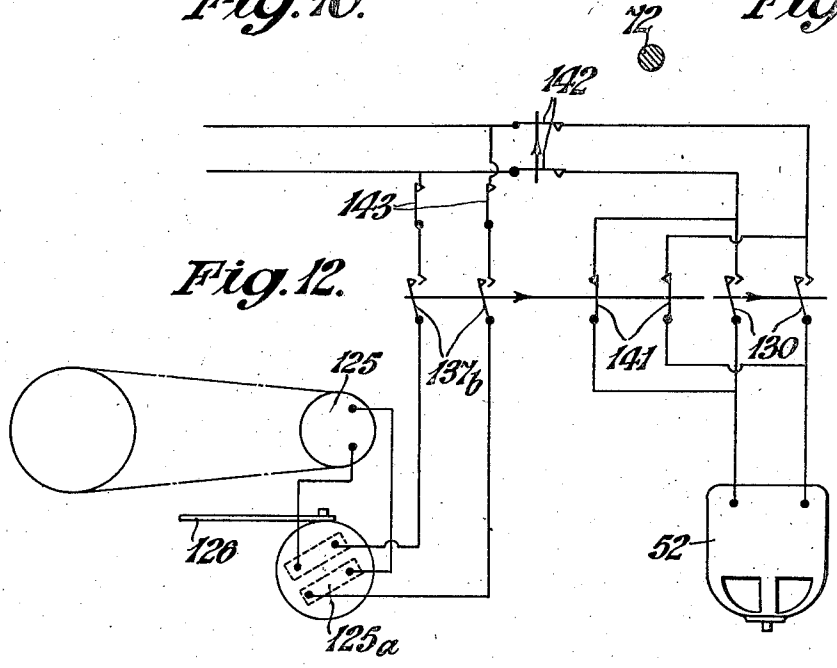


Fig. 12.

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Patented Jan. 19, 1937 2,068,449

UNITED STATES PATENT OFFICE

2,068,449

GRAMOPHONE OR THE LIKE

Arthur Robert Downs, Brighton, England

Application October 26, 1934, Serial No. 750,213
In Great Britain November 6, 1933

5 Claims. (Cl. 274—10)

This invention relates to automatic gramophones in which the records to be played are transferred one at a time from a storage position to a playing position and particularly to those automatic gramophones which reproduce both sides of each transferred record.

In automatic gramophones designed to play both sides of each transferred record it has always heretofore been necessary to invert the record. This method requires a relatively large amount of headroom and in addition it involves, as an essential, the use of a conventional turntable for supporting the record during reproduction.

The object of the present invention is to provide an automatic gramophone in which both sides of each transferred record may be played without the record being turned over and in such a manner that the conventional turntable may, if desired, be dispensed with.

Broadly the present invention consists of an automatic gramophone in which a record, transferred by automatically operating means from a storage position to the playing position is suspended or supported in said playing position so that each side thereof is playable in turn without the record being turned over.

In the preferred embodiment of the invention each record to be played is engaged by gripping means which are constricted to pass through the center hole in the record and then expanded to engage beneath the central surface of the record and pull the record against a revoluble friction pad, the record so engaged being transferred to the playing position where it is positively rotated whilst thus held, firstly in one direction for the reproduction of one side of the record and then in the opposite direction for the reproduction of the opposite side of the record.

In this embodiment the conventional turntable is dispensed with.

In order that the invention may be clearly understood and carried into effect an automatic gramophone in accordance therewith will now be described by aid of the accompanying drawings in which:—

Figs. 1 and 2 are perspective views of the upper works of an automatic gramophone according to the present invention, Fig. 1, showing the swinging arm in position above the magazine and in engagement with the upper record of a series, and Fig. 2 showing the position of the parts when the removed record is in the playing position and its upper surface about to be reproduced.

Fig. 3 is a further perspective view, partly in section of the outer or pick-up end of the swinging arm.

Fig. 4 is a vertical section through the same showing an engaged record in position.

Fig. 5 is a side elevation of the working parts of the automatic gramophone according to this invention when looking at the edge of the baseboard to both sides of which they are attached.

Fig. 6 is an underside plan view of the mechanism which is situated on the underside of the baseboard shown in Fig. 5.

Fig. 7 is a perspective view showing more or less diagrammatically the group of operating cams.

Fig. 8 is a side elevation to an enlarged scale, of the storage magazine and the means employed for lifting the records after each removal of a record.

Fig. 9 is a diagrammatic plan view taken from Fig. 1 showing the paths of movement of the swinging arm and the tone arms.

Figs. 10 and 11 are views of the mechanism to operate the arm carrying the lower sound box to move same into and out of contact with the undersurface of a positioned record.

Fig. 12 is an electrical diagram of the connection to the switches and motors.

In the embodiment illustrated in the drawings a record removed automatically from a storage position and swung into a playing position has both sides reproduced whilst the same is suspended. The apparatus illustrated for this purpose broadly comprises a swinging arm A which operates to pick up the upper record from a stack of records in a storage position B, to transfer the record thus picked up to a playing position C and to hold the same suspended in mid-air in the playing position whilst both sides are reproduced in turn.

The swinging arm A in the embodiment illustrated comprises a horizontal arm 1, which is, at its inner end, supported by pivots 2 between the arms of a bracket 4 at the upper end of a vertical column 5. This column is affixed to the upper surface of a baseboard 6 at a point equidistant between the axes of the storage position and the playing position, the bracket 4 being mounted upon the upper extremity of a vertical sleeve, hereinafter referred to and passing through the column 5, by means of which the horizontal arm 1 is given the necessary swinging movement to effect the transfer of a record from the storage position to the playing position. Further means, also to be hereinafter described, extends upwards through the vertical column 5 to turn the hori-

zontal arm 1 in a vertical plane about the pivots 2.

At the outer or free end of the horizontal arm 1 is attached a vertical sleeve 7 which serves to revolubly support mechanism for picking up a record by its center and for suspending the same during reproduction. This mechanism in the embodiment illustrated comprises a central spindle 8 on the lower end of which is formed or attached a cross bar 9 which extends through a slot 10 cut through a boss 11 carried by the lower end of a sleeve 12. This sleeve 12 is a tight fit within a further outer sleeve 13 which is a working fit in the outer stationary sleeve 7 carried by the horizontal arm 1 so as to be free to rotate therein. The lower end of the sleeve 13 is formed or provided with an enlarged boss 14 having a flange at its lower end and formed interiorly with a circular recess 16 to accommodate the cross bar 9 and the boss 11 of the sleeve 12. Pivoted at 17 within the slot 10 are a pair of grippers 18. These grippers which are bent to form, in effect, bell-crank levers are attached by their upper ends and by links 19 to opposite ends of the cross bar 9 whilst their lower extremities are turned outwards as at 20 to form fingers adapted to engage beneath a record, both of which are indicated in the engaged position in Fig. 4.

The spindle 8 with its attached cross bar 9 is adapted to have a vertical movement within the sleeve 12 and this movement is utilized to move the grippers 18 into and out of the engaging position. Normally the spindle 8 is held in the raised position by a spring 22 which at its upper end bears against a sleeve 23 which is mounted on the central spindle 8 adjacent its upper end and secured thereto by a set screw 24, and in this position the lower ends of the grippers are held in the expanded or engaging position shown. Upon depression of the spindle 8 the cross bar 9 is brought into contact with the upper edges of the grippers and in consequence of their angularity this contact effects simultaneous outward movement of the upper ends of the grippers and corresponding inward movement of the lower ends of the grippers sufficient to permit the grippers to be inserted or withdrawn from the central or spindle hole in the center of the record. Depending centrally from the boss 11, and forming an extension thereof, is a rod 25 the lower end of which is slotted as at 26 for engagement with a tongue 27 at the upper end of the main driving spindle 28, which is driven by the gramophone motor 125, see Fig. 6.

In operation, and preparatory to the picking up of the upper record from the stack of records in the storage position B, the spindle 8 is depressed by means of a lever 29, see Fig. 1, operated by a Bowden wire 30 by mechanism hereinafter to be described. This causes the lower ends of the grippers to be contracted so that when the outer end of the swinging arm A is lowered onto the center of the record to be engaged the grippers will pass through the central hole in the record. The spindle 8 is then released and under the action of the spring 22 it returns to its normal raised position thereby causing the bent extremities or fingers 20 of the grippers to move outwards and engage beneath the central portion of the record and at the same time to pull such central portion hard up against a friction surface 31 on the underside of a disc 32 fixedly attached to the underside of the flanged end of the boss 14 of the sleeve 13. The arm A is then turned upwards about the pivots 2 to lift the engaged record off the stack. The arm is then swung through an arc, see Fig. 9, until the center of the record is brought co-axially above the playing position when the arm is again lowered to effect engagement between the slot 26 and the tongue 27 of the motor spindle 28. There is thus provided a driving connection between the driving spindle and the record to be played the motion of the driving spindle being transmitted through the central spindle 8 and from thence, by means of resulting contact between the set screw 24 and a stop pin 33, to the sleeve 13 and from thence to the record by the frictional grip afforded by the friction surface 31 on the underside of the disc 32.

The record to be played, whilst thus suspended in the playing position on the outer end of the arm A, is rotated firstly in one direction during reproduction of one side of the record and then in the opposite direction during reproduction of the opposite side of the record such reversal of motion being effected by means hereinafter to be described. In the example illustrated reproduction of the two sides of a suspended record is shown as being effected by means of two sound boxes 34 and 35, the sound box 34 reproducing the upper side of the record and the sound box 35 the underside of the record. These sound boxes are supported by pivotal connections 36 upon the upper ends of vertical spindles 93 which pass up through fixed standards 37 and by mechanism hereinafter to be described are moved automatically and in turn into and out of their playing position.

When both sides of the suspended record have been reproduced the spindle 8 is again depressed automatically thus causing the record to be released and permitting the same to drop down over a stationary sleeve 38 surrounding the driving spindle 28. The arm A is then swung back automatically to the storage position to effect engagement with the next record to be played, the operations being continued until all or the required number of the assembled records have been played.

As shown, the automatic gramophone is designed to handle records of different sizes, for example, the usual 10" and 12" records. Normally the sound boxes assume a position in readiness to play a 10" record, but upon the transfer of a 12" record from the storage position to the playing position a striker arm 39 normally positioned to pass the smaller record only is engaged by the periphery of the larger record causing the striker arm to be forced backwards and this movement in turn is utilized to cause the sound boxes to take up a definite position in readiness to play the larger size of record. One suitable mechanism for this purpose is described in connection with the other figures of the drawings.

Mechanism hereinafter to be described is also provided, operable, for example, by a push button, to effect, at the will of the operator, rejection of a record before or during reproduction.

The mechanism for effecting the automatic operations of the devices shown in Figs. 1 to 4 will now be described starting with the record storage magazine.

The record storage magazine is shown in elevation in Fig. 8. It comprises the platform 40 upon which the records 41 of any diameter and in any order are assembled as previously mentioned.

This platform is adapted to be raised a distance equal to the thickness of one record each time a

record is removed from the magazine. This upward movement is accomplished, as shown in the drawings, by mounting the platform 40 on a hollow spindle 42. This hollow spindle is externally threaded with a screw thread 43 the pitch of which corresponds to the thickness of one record so that one complete revolution of the spindle will raise the platform 40 the required distance.

The mechanism to rotate the spindle comprises a nut 44 which is internally threaded with a thread corresponding to that of the spindle 42 which it engages. This nut is adapted to be rotated, imparting its rotary movement to the spindle 42 for the purpose specified and as shown the nut is made integral with a bevel gear 44a which engages with a further bevel gear which is in turn mounted on an intermittently rotating shaft 46. This shaft 46 is mounted in bearings 47 and has keyed to it a toothed wheel 48. This toothed wheel 48 is driven by a further toothed wheel 49 to which it is connected by a chain drive 50. The toothed wheel 49 is mounted on a cam shaft 51 which is driven at predetermined intervals by a motor 52 to which it is connected either directly or through gearing 53 as shown. To prevent the record platform from travelling downwards under the weight of a batch of assembled records it is provided with a ratchet device, comprising the toothed wheel 54 forming part of the hollow spindle and attached to its lower end. A ratchet finger 55 engages the teeth of the toothed wheel 54 to prevent rotation thereof in either direction when the nut is driven thereby allowing the wheel and associated spindle to be raised when the nut rotates and likewise prevents spindle 42 from rotating under the weight of the assembled records. The finger 55 is retained in the engaged position with the toothed wheel 54 by a spring 56, both the finger and its controlling spring being housed in a member 57.

To reload the magazine after a batch of records have been played the platform 40 is rotated in the appropriate direction and with a force sufficient to cause disengagement between the ratchet finger 55 and the toothed wheel 54, the nut 44 remaining stationary, the screwed spindle 42 accordingly travels downwards until the platform is in its lowest position whereupon a further batch of records may be placed thereon.

To keep the finger in step with the toothed wheel 54 during upward movement of the magazine, said member is attached to and forms a bearing for the lower end of the spindle 42 and to prevent rotation of said member it is provided with a guide piece 58 which is slidably mounted on the guide bar 59.

To ensure that the center holes of the records assembled in the magazine are kept in alignment with each other, and also in alignment with the grippers, a centering spindle is provided having a pointed extremity which is adapted to be passed up through the center holes of the batch of assembled records, each time one is removed from the magazine. This centering spindle is shown at 60, in the drawings, and passes up through the center of the aforementioned hollow spindle 42. Attached to the lower end of the centering spindle 60 is a lever 61 which is pivotally mounted in a bearing 62.

The end 63 of the lever 61 has attached to it a spring 64 which retains said lever in the normal position as shown in the drawings. Also attached to this lever 61 is a further lever 65 which receives, each time a record is removed from the magazine, a downward thrust which is imparted to the lever 61 so that said lever pivots in its bearing against the action of the restraining spring 64 and operates to raise the centering spindle 60. When the downward thrust is removed from the lever 65 the centering spindle will be returned to the normal position as shown in Fig. 8 by the aforementioned spring.

The downward thrust is applied to the lever 65 by a further lever 66. This lever 66 is carried by a bearing 66a, the end 68 of said lever 66 engaging the aforementioned lever 65 and its outer end engaging a bell crank lever 67, which is operated to raise the engaging end of lever 66 and so impart the required downward thrust to the end 68 which thrust is transformed as aforementioned into an upward thrust acting on the centering spindle. The method of applying the necessary movement to the bell-crank lever comprises mounting this lever loosely on the aforementioned shaft 46, and operating it by a connecting rod 69 connected to the arm 70 of the bell-crank lever. This connecting rod 69 is coupled to the upper end of a rocking lever 71, said rocking lever being mounted by its other or lower end on a bearing shaft 72. This rocking lever 71 is operated by a cam 73 which cam is mounted on the aforementioned cam shaft 51. When this cam is rotated by movement of said cam shaft it imparts the necessary movement to rocking lever 71, which movement is transmitted to the bell crank lever through the connecting rod 69. A spring 74 is provided which returns the bell crank lever to its normal position. This spring is attached by one end to the motor board 6 and its other end is attached to the arm 70 of the bell crank lever.

The mechanism to control the swinging movement of the swinging arm A is operated by the cam 73 mounted on the aforementioned cam shaft. Associated with this cam and operated by it is the rocking lever 71. This rocking lever as aforementioned is mounted by one end on the bearing shaft 72. The cam 73 is adapted to bear against the rocking lever 71 intermediate its length and to impart to the upper end of the same a predetermined movement. This movement in turn is transmitted to a lever 77 which is attached by one end to the upper end of the said rocking lever 71. The other end of the lever 77 is fixed to a crank 78 in such a manner that the movements of lever 71 and 77 serve to operate the crank 78. The crank 78 is rigidly attached to the lower end of a sleeve 5a which sleeve passes up through the aforementioned column 5 and is attached to the swinging arm A by the pivotal connections 2 and therefore this sleeve 5a will swing with the crank 78. The cam 73 further operates to rotate the record carrying arm from the playing position into the storage position in readiness to engage another record to be played. For this purpose a lever 79 is provided, such lever being associated with cam 73 and adapted to be operated by it. Such lever is also mounted by one end on the bearing shaft and is adapted to engage a projection 80 made integral with the aforementioned lever 77 so that after the lever 77 has been pulled in one direction by the cam 73 as above described, further operation of the cam 73 serves to return the said lever 77 to its normal position and simultaneously to rotate the crank 78 in an anti-clockwise direction to return the record carrying arm to a position over the magazine. To limit the swinging motion of the arm A stops 5b are provided on the upper end of the column 5, between which stops said arm A operates. The mechanism

to turn the horizontal arm 1 in a vertical plane about the pivots 2 comprises an edge cam 81, which is also mounted on the cam shaft 51 and operated by it. This cam on operation of the cam shaft 51 engages the lever 82 intermediate its length and raises the end 83 of the same, said lever being pivotally mounted in the bearing 84 at its other end. This upward movement of the end 83 of the lever 82 is imparted in turn to one end of a further lever 85 with which it engages. This lever 85 is mounted intermediate its length in a bearing 86 in such manner that the upward motion of the lever 82 will impart a downward movement to the end 87 of the lever 85.

This downward motion of the lever 85 is transmitted to the rear end of the horiontal arm 1 through a vertical lever 88 which passes up through the center of the vertical column 5 and as shown in the drawings is connected at one end to the lever 85, its other end being connected by pin 88a (Fig. 5) to the horizontal arm 1. A spring 89 is provided which serves to retain the vertical lever 88 in a raised position except when it is depressed by the lever 85. The horizontal arm with an engaged record is raised in the manner above described and swings over into the playing position in the manner described when it is lowered in order that the gripper mechanism may engage the driving spindle also as previously described. The lowering of the horizontal arm 1 into the playing position is effected by the cam 81 releasing the lever 82 whereupon the weight of the engaged record and gripper mechanism on the outer end of the horizontal arm 1 causes said arm to be lowered. This downward movement is aided by the aforementioned spring 89 which is connected as stated to the lever 88. After the record has been played and is released from the grippers the horizontal arm 1 is again raised in the manner previously described and returned to a position over the magazine.

The mechanism to move the sound boxes into and out of the playing position will now be described.

As shown in Fig. 5 the sound boxes 34 and 35 are mounted on arms each pivotally mounted on a vertical spindle 93 which spindle passes up through the fixed standards 37. These spindles 93 each pass through the motor board and have attached rigidly to their lower ends, a member 95. When either tone arm has travelled completely over the record surface each member 95 engages a further member 96. Each of these members 96 is adapted to pivot about a point 97 and to impart to the members 95 a turning movement which is transmitted to the vertical spindle and thus swings the sound box in the required direction clear of the playing position to allow a further record to be positioned. The members 96 receive their motion from connecting rods 98. These connecting rods are attached to the lower ends of the levers 99 and serve to return connected to the upper ends of rocking levers 99 which are pivoted at their upper ends to the bearing shaft 72. These levers 99 are moved about their pivots by cams 100 keyed to the cam shaft 72. Operation of the levers 99 by the cams imparts a pull to the rods 98 and this pull effects the turning of the members 96 about their pivots and such turning movement is in turn transmitted to the vertical spindles through the members 95 until the said members come up against stops 101. Springs 102 are attached to the lower ends of the levers 99 and serve to return provided in order that the members 96 may be returned to their original position in readiness to return the sound boxes clear of the playing position after a further record has been played.

The normal position of the stops 96a allows the tone arms to swing into a position clear of the conventional 12" diameter records. To swing the tone arms into the playing positions the stops 101 are provided which engage the members 95 and rotate same in the appropriate direction see Fig. 6. For this purpose each stop is mounted on a lever 104. Each of these levers 104 are slidable by means of associated rocking levers 105 to the upper end of which each lever 104 is connected. The rocking levers 105 are each pivotally mounted by their other ends on the bearing shaft 72, and such levers receive motion from operating members on cams 106 against the face of which each rocking lever 105 bears Fig. 7. The operating members on cams 106 comprise high and low portions 106a and 106b, the portion 106a being used to operate the levers 105 when a 12" record is to be played the other portion 106b operating the levers 105 when a 10" record is being played. In order that the operation of the stops 101 to pull in the tone arm into the correct position may be entirely automatic the position of the levers 105 over either the high and low cam portions 106a and 106b is determined by the periphery of the record to be played during its travel from the magazine to the playing position striking the striker arm 39, and for this purpose the aforementioned levers 105 are each attached to a drawbar 107. The drawbar is given a lateral sliding movement by a lever 108 which is formed integral with the drawbar 107. This lever 108 rests in a slot 108a formed in an extension 108b of the striker arm 39, said striker arm being pivotally mounted at 109, and when engaged by the periphery of a record is forced backwards and this movement is transmitted to the drawbar through the lever 108 which will therefore position the levers 105.

On completion of the playing of a 12" record the drawbar and its associated mechanism has to be returned to the normal position. To accomplish this the drawbar 107 is further provided with a rigidly attached lever 110 which is operated by a face cam 111 mounted on the cam shaft 51. Normally this lever is clear of the operating face of the cam 111 but whenever the levers 107 are positioned for playing 12" records this lever 110 is brought into such a position that when the cam 111 is operated it engages the lever 110 which is thus given a lateral sliding movement which in turn imparts to the drawbar a similar movement and returns said drawbar and the associated rocking levers 105 to their normal position over the cam portions 106a. The stops are further utilized to bring the sound boxes into the playing position, and for this purpose as soon as a record is positioned for playing continued movement of the cam shaft 51 causes either the high or low part of cam 106 to operate the associated rocking lever 105, which in turn imparts an inward movement to the lever 104, and stop 101, which bearing against the member 95 rotates it and consequently brings the sound box into the playing position.

The mechanism for raising and lowering the sound boxes to the record surfaces differs. In the case of the lower tone arm the weight of the sound box is utilized to keep the same away from the undersurface of the record, and when it is desired to play this undersurface the weight of a counterbalance weight is applied to the rear

end of the arm carrying this sound box. The counterbalance weight is shown at 112, and is supported, when the sound box is out of use, by a platform 113 forming part of a lever 114. The lever 114 is pivotally mounted in the bearing 115 on the motor board 6, and is provided with an arm portion 116. To retain the weight 112 in the raised position when the lower sound box is out of use, a cam 117 engages the arm 116 and locks it in such a position that the platform 113 is held up against the downward push of said counterbalance weight. When the sound box is to be used the cam 117 is operated and is so formed that it gradually releases the arm 116 and permits the lever 114 to move downwards under the action of the weight 112 such downward movement being transmitted to the rear end of the tone arm through rod 123a which has its lower end connected to the platform 113 and its upper end suitably connected to the rear end of the tone arm.

The upper sound box is retained in the raised position when not in use by the cam 106 which is mounted as stated, on the cam shaft 51. The cam normally retains the end 121 of the lever 119 in a raised position which results in the other end of this lever being held in the lowered position. The lowered end of the lever 119 is coupled to a vertical spindle 123 by a connection 124 in such manner that said vertical spindle is also lowered. The upper end of the vertical spindle 123 is connected to the rear end of the arm carrying the sound box which rear end will similarly be lowered, the forward or sound box end being therefore retained in a raised position. The cam 106 is so formed that when however it is required to use the upper sound box it gradually releases the lever 119 and allows the sound box to lower itself onto the record playing surface.

As previously stated the direction of rotation of the gramophone motor 125 is reversed when playing opposite sides of a record. To accomplish this the motor circuit is provided with a reversing switch 125a. This switch may be of any suitable type and is adapted to be operated as shown in the drawings by a lever 126. The lever 126 is in turn connected to the upper end of a rocking lever 127. The arrangement of switches is shown in Fig. 12. The circuit of motor 52 is controlled by a main switch of any suitable type the contacts of which are diagrammatically shown at 142. This switch is manually closed to start the mechanism driving motor 52.

Similarly the gramophone motor 125 is provided with a main switch the contacts of which are shown also diagrammatically at 143.

When the contacts 142 and 143 are closed both the motor 52 and the gramophone motor 125 are connected to the main supply.

The contacts 137b and 141 each form part of the switch 135, the operation of which is controlled by the swinging movement of the tone arm. Switches of this type are common and accordingly need no further description.

The operation of the contacts is as follows:—

Immediately upon closure of contacts 142 the motor 52 commences to operate the cam shaft 51 current being supplied thereto through the leads a contacts 130 which is closed and leads c2.

When contacts 143 are closed to connect the gramophone motor to the supply, no current can reach the motor 125 due to the fact that at the beginning of the operation of the cam shaft the reversing switch 125a is in the center position and will remain open until the cam shaft has completed part of a revolution.

As soon as the upper tone arm is brought into the playing position described and the reversing switch has closed the cam shaft has completed half a revolution and current is supplied to the gramophone motor through the leads d contacts 137b leads e reversing switch 125a and leads f and motor 125 accordingly operates. Shortly after with the closing of the reversing switch the contacts of the switch 130 are opened in a manner hereinafter described and the motor 52 ceases.

As soon as playing finishes contacts 137b are opened by operation of switch 135 and the motor 125 is stopped and similarly contacts 141 are closed whereby the motor 52 is reconnected to the supply.

The contacts 137b and 141 as stated are part of a switch which is diagrammatically shown at 135. This switch may be of any suitable type and as shown consists of a pair of arms 137a each pivotally mounted on a base as shown at 135a and 135b respectively. These arms are connected together by a cross bar not shown such bar being pivotally attached to each arm to permit relative movement between the two arms. One of the arms 137a is connected through a pin and slot connection to the member 95 and accordingly when such member is moved by movement of the tone arm the arms are accordingly moved, such movement being utilized to operate a switch block carrying the contacts 137b and 141.

The contacts are so arranged that when the tone arm is at its outer position contacts 137b are closed and contacts 141 are open. As the tone arm travels across the surface of the record during playing the arms 137a are gradually brought nearer to the rim 137 which is driven by the gramophone motor 125 such rim is provided with a projection which engages with the arms 137a when the tone arm has travelled fully across the record surface, and causes movement of the same which in turn causes movement of the switch block to open contacts 137b and close contacts 141 for the purpose specified. Upon the return of the tone arm to the outer position the switch is reset to open contacts 141 and close contacts 137b.

In the drawings the lower tone arm only is shown connected to this switch but in practice both upper and lower tone arms are connected so that the gramophone motor will cut out upon completion of playing both upper and lower surfaces of a record.

The switch 130 is operated as shown in the drawings by a lever 131. The lever 131 is connected to the upper end of a lever 132 which is pivotally mounted by its lower end to the bearing shaft 72. A cam 133 mounted on cam shaft 51 operates the lever 132 which motion is transmitted to the lever 131 and this lever being connected to the switch said switch is operated either to cut out or cut in the motor 52. A spring 134 is provided coupled to the upper end of lever 132 so that when cam 133 is clear of lever 132, said spring will pull the switch into the closed position.

What I claim is:—

1. In an automatic gramophone the combination with an arm having means thereon for engaging a record to be played by its central aperture and for holding the same in a suspended position against the underface of a revoluble surface carried by the arm, of automatically operating means for moving said arm to cause the engaged record to be thereby transferred from

the storage position to a playing position and means, in the playing position, for rotating the revoluble surface normally supporting the record whilst the same is suspended from the arm.

2. In an automatic gramophone, in combination, means for picking up a record in a storage position by engagement with its central aperture, and for suspending the same in mid-air and for transferring the suspended record to the playing position, means, in the playing position, for rotating the record whilst thus suspended for the purpose of reproduction, means for releasing the suspended record, and means for transferring the picking up means back to the storage position for the purpose of repeating the operations on a further record all said means operating automatically.

3. In an automatic gramophone, means for picking up a record to be played from a storage position and for transferring the same to a playing position comprising, in combination, a swinging arm, a plate carried thereby and gripping means for engaging the record through its central aperture and for pulling the same up against the plate.

4. In an automatic gramophone the combination with a motor driven spindle in the playing position of a swinging arm having a revoluble friction pad and means associated therewith for engaging a record to be played through its central aperture and for pulling the same up against the undersurface of the revoluble friction pad, and means for moving the swinging arm to transfer the suspended record to the playing position and to effect an engagement with said motor driven spindle for the purpose of rotating the friction pad and through it the suspended record.

5. In an automatic gramophone, in combination, a swinging arm, a friction pad on the outer end of said arm and revoluble about a vertical axis, expanding grippers extending through the friction pad and serving when contracted to pass through the central aperture in a record and when expanded to engage the undersurface of the central portion thereof and to pull the record into frictional engagement with the undersurface of the friction pad, a storage position for the records to be played, a playing position in which reproduction of each record is effected, a motor driven spindle extending vertically upwards in said playing position, and automatically operating means for lowering the swinging arm in the storage position to effect engagement with a record to be played, for raising the same with the engaged record suspended thereon, for swinging the arm with the record to a position above the motor driven spindle in the playing position, for lowering the arm to effect a driving connection between the friction pad and the motor driven spindle and finally for releasing the suspended record and for returning the swinging arm to the storage position for engaging a further record.

ARTHUR ROBERT DOWNS.