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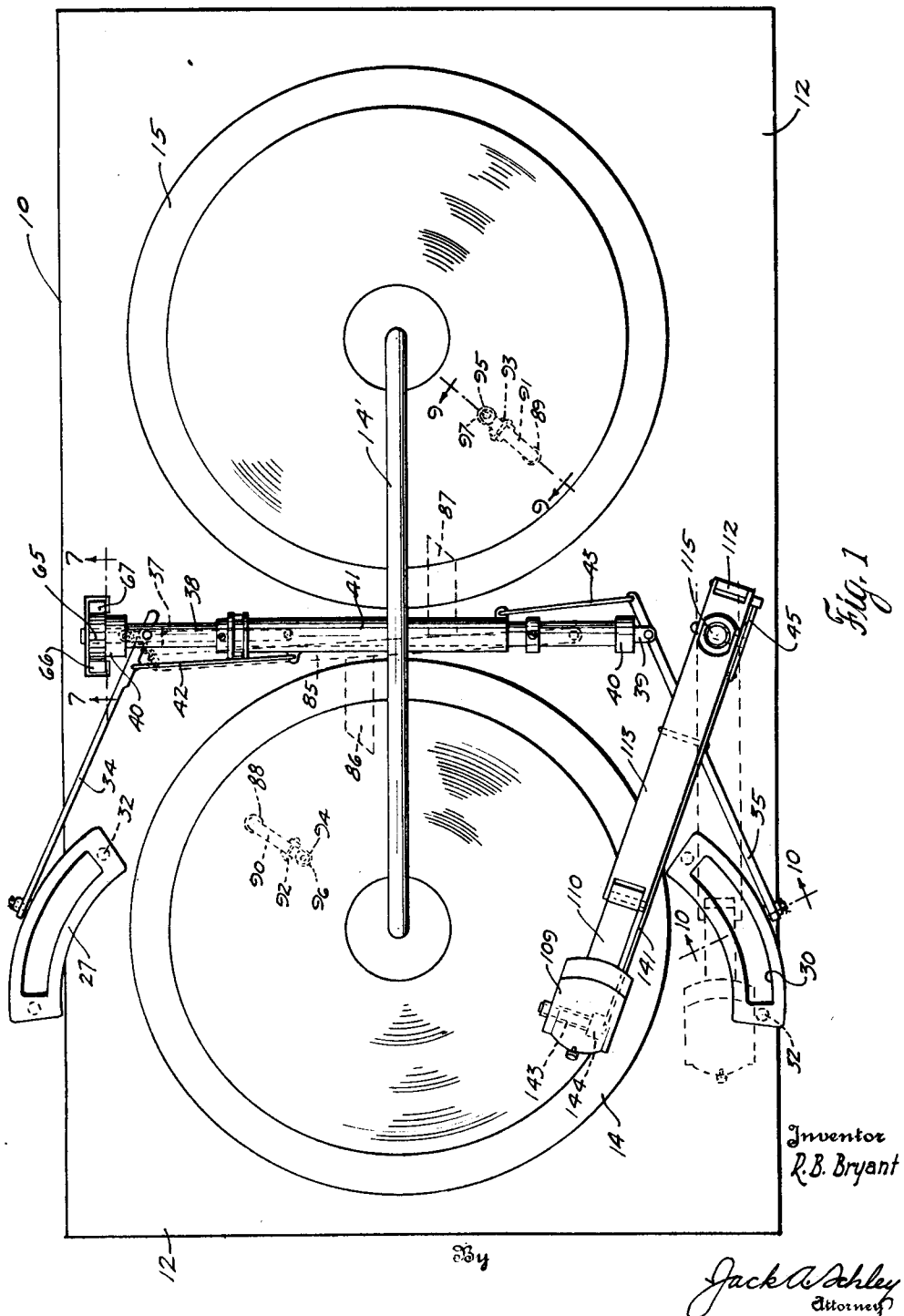
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AUTOMATIC SOUND REPRODUCING APPARATUS

Filed March 16, 1931

4 Sheets-Sheet 1



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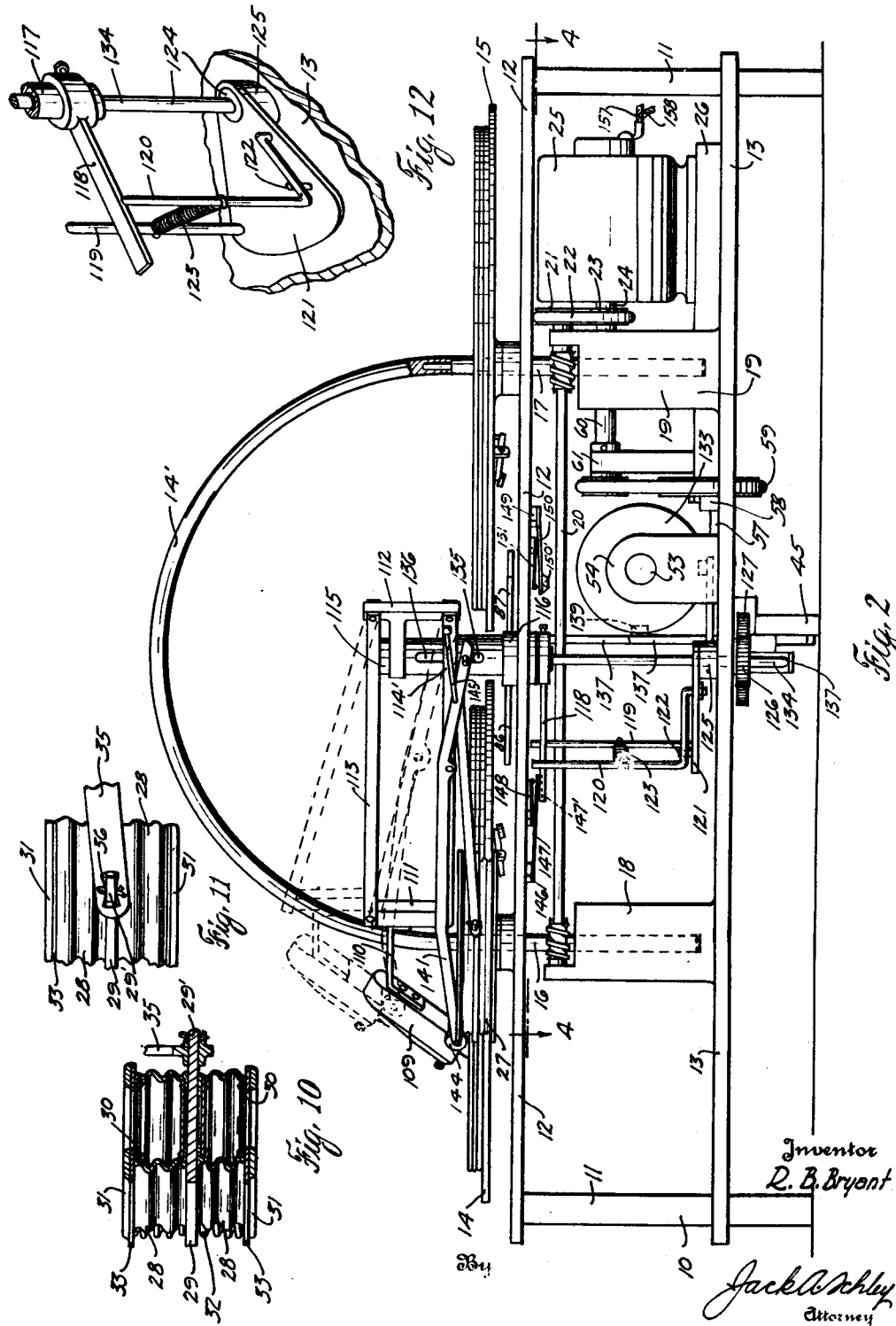
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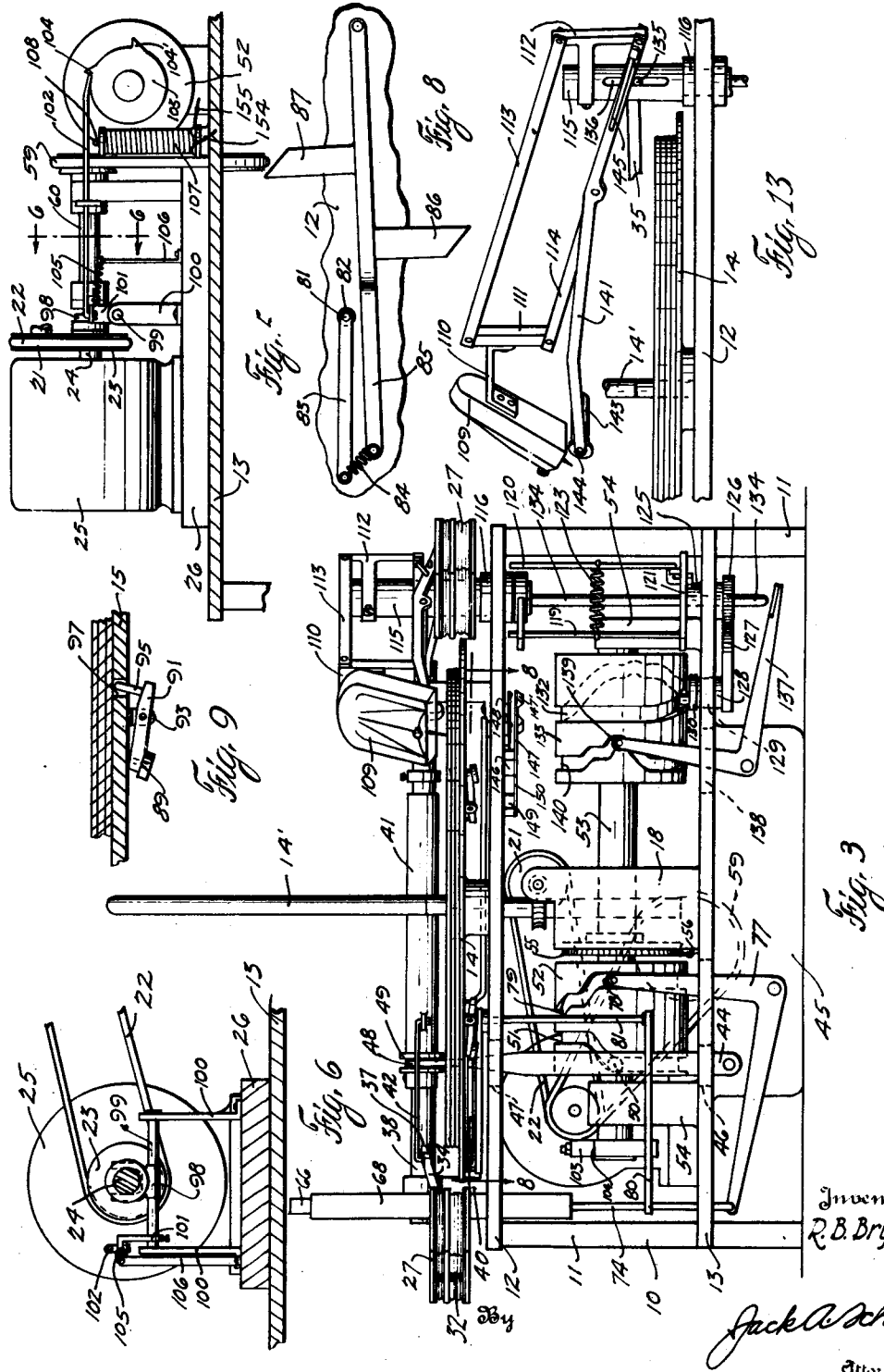
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1,918,588

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Filed March 16, 1931

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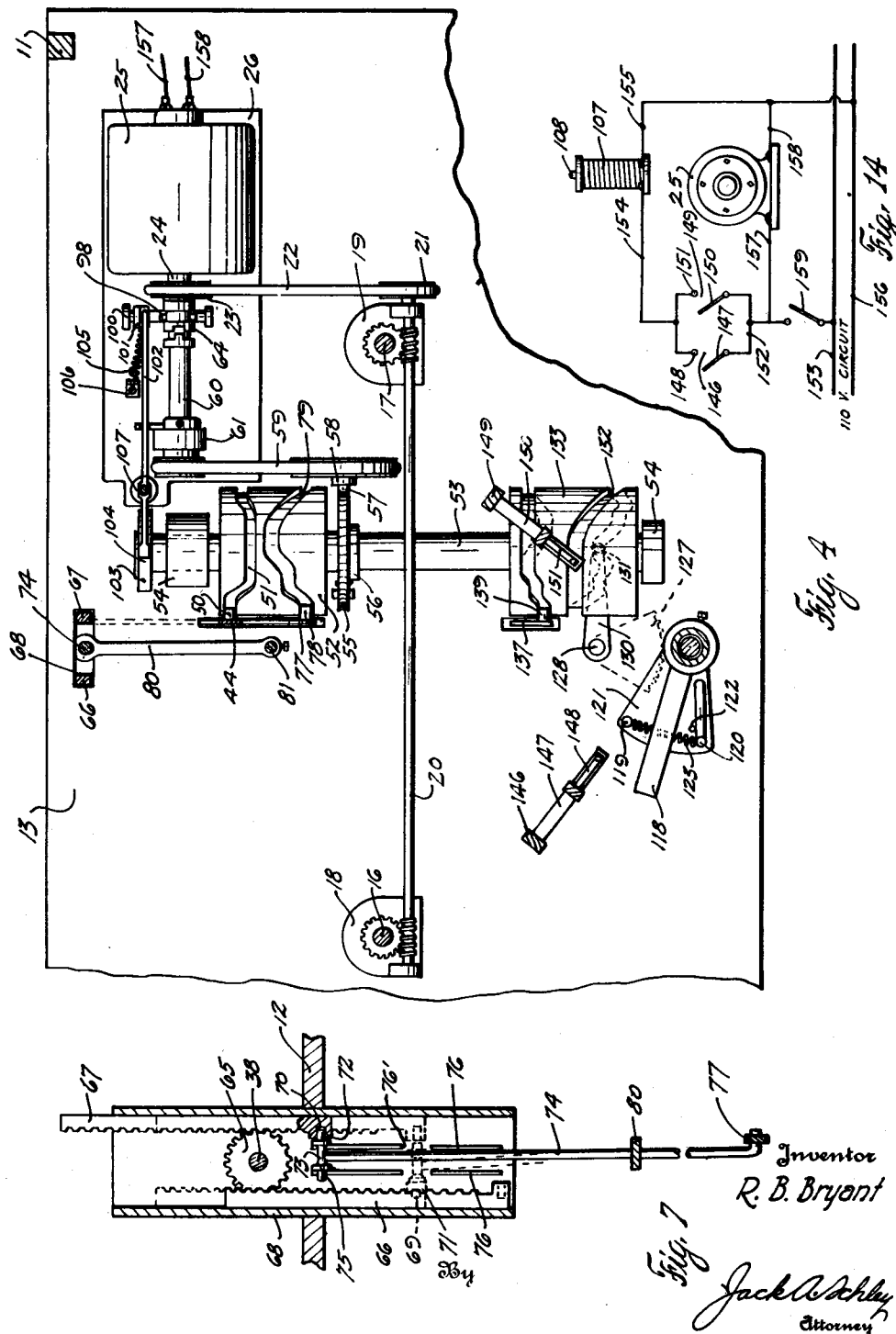
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AUTOMATIC SOUND REPRODUCING APPARATUS

Filed March 16, 1931

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UNITED STATES PATENT OFFICE

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AUTOMATIC SOUND REPRODUCING APPARATUS

Application filed March 16, 1931. Serial No. 522,926.

This invention relates to new and useful improvements in automatic sound reproducing apparatuses.

One object of the invention is to provide means for removing a record from the top of a supply stack on one turntable to another turntable, whereby both sides of a record may be successively reproduced and the records accumulated on another turntable for subsequent reproduction.

Another object of the invention is to provide means for reversing the top record after the reproduction of one side thereof and during the removal of the record to the other turntable, whereby the opposite sides of the records may be successively reproduced.

Still another object of the invention is to provide means for shifting a single reproducer to engage first one side of a record on one turntable and then the opposite side of the record on the other turntable, whereby the opposite sides of said record are successively reproduced.

A further object of the invention is to provide new and novel means for engaging the records by their scored portions, whereby records of various sizes may be easily and simply engaged for removal from one turntable to another turntable.

A still further object of the invention is to provide an improved adjustable mounting of the reproducer for engaging the same with the top record of the record stack at the best angle for reproduction, whereby the angle of engagement of the reproducer and the record to be reproduced remains constant regardless of the size of the record stack.

Another object of the invention is to provide means on the reproducer arm for positioning the reproducer with respect to variable sizes of records.

Still another object of the invention is to provide means for automatically reversing operation of the record removing and reversing means when the records have accumulated on either of the turntables, whereby the machine may operate continuously as desired.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings in which an example of the invention is shown, and wherein:

Figure 1 is a plan view of a device constructed in accordance with the invention,

Figure 2 is a side elevation of the same,

Figure 3 is an end elevation,

Figure 4 is a horizontal sectional view showing the drive and cam control taken on the line 4—4 of Figure 2,

Figure 5 is a partial side elevation taken opposite to that of Figure 2, showing the drive control means,

Figure 6 is a vertical sectional view taken on the line 6—6 of Figure 5,

Figure 7 is a vertical sectional view showing the drive of the record shifting means, taken on the line 7—7 of Figure 1,

Figure 8 is a horizontal sectional view of the record shifting control means, taken on the line 8—8 of Figure 3,

Figure 9 is a vertical sectional view showing the reverse means of the record shifting control, taken on the line 9—9 of Figure 1,

Figure 10 is an enlarged vertical sectional view of the record engaging means, taken on the line 10—10 of Figure 1,

Figure 11 is a partial elevation of the same taken at right angles to Figure 10,

Figure 12 is a partial perspective view of the reproducer shifting means,

Figure 13 is a partial elevation showing the reproducer in a raised position, and

Figure 14 is a schematic wiring diagram.

In the drawings the numeral 10 designates a frame having upright supports 11, a top panel 12 and a sub-panel 13. A pair of turntables 14 and 15 are rotatably mounted on opposite ends of the panel 12 and have drive shafts 16 and 17 extending downwardly through the panel and journaled respectively in bearings 18 and 19. The upper ends of these drive shafts are connected by a removable inverted U-shaped guide shaft 14'.

As is best shown in Figures 2 and 4, the bearings 18 and 19 are mounted on the sub-panel 13 and also have journaled therein a horizontal shaft 20 which has right angle

drive connections at its opposite ends with the shafts 16 and 17. The shaft 20 has a pulley 21 mounted on one end and driven by a belt 22 of rubber or any other suitable flexible material. The belt in turn is driven by a pulley 23 on the armature shaft 24 of an electric motor 25. The motor has a cushioned mounting 26 of rubber or the like on the sub-panel 13. This cushioned mounting of the motor, together with the flexible belt 22, serve to absorb any vibration or hum of the motor, thereby effecting a silent drive of the turntables.

As is best shown in Figures 1, 2, 3 and 10, suction members 27, each consist of a pair of arcuate shaped bellows 28, mounted on opposite sides of an arcuate disk 29. Each bellows has an opening 30 in its outer face with an annular flexible lip 31 surrounding said opening. The bellows are normally extended under tension of coiled springs 32, which are mounted between the disk 29 and outer rims 33 of said bellows.

By engaging the lower lips 31 of its suction members with a record and depressing the lower bellows a quantity of air within the bellows is expelled, the coiled springs 32 which have been compressed, by such depression will act to expand the lower bellows and thus create a suction within the bellows for holding the record to said bellows. As the lips are of arcuate shape and concentric to the grooved score of the record, the flexible lips 31 provide a positive seal between the bellows and the record except for a partial seal at the ends of said bellows where the lips cross transversely of the grooved score. This partial seal permits a slow leakage of air within the bellows, which does not break the suction between the bellows and the record until said bellows have been fully restored to their normally extended positions under tension of the springs. During the time consumed by the full expansion of the bellows the suction members are swung to transfer the record from one turntable to another, as will be hereinafter explained. The timing of the transferring means is such that as the record being transferred approaches the turntable the restoration of the bellows is completed and the record is released to fall a short distance to the turntable.

The suction members are loosely mounted on the outer ends of transfer arms 34 and 35 by fingers 29' which extend from the disks 29 through slots 36 in said arms. The arm 34 is pivoted in a slot 37 in one end of a rock shaft 38 and the arm 35 is pivoted in a yoke 39 on the other end of the rock shaft. This shaft is mounted transversely of the panel 12 intermediate the turntables in bearings 40 secured on said panels.

An elongated sleeve 41 is slidably mounted on the shaft and has link connections 42 and

43 with the arms 34 and 35 whereby the reciprocation of the sleeve will alternately swing said arms and likewise the suction members in arcs over either of the turntables for engagement with a record and away from said turntable to clear the same. For reciprocating the sleeve a lever 44 (Figures 3 and 4) is pivoted at its lower end to a flange 45 depending from the sub-panel 13. This lever extends upwardly through slots 46 and 47 respectively in the sub-panel 13 and panel 12 and has a yoke 48 at its upper end which yoke engages in a collar 49 on the sleeve. A roller 50 carried by the lever rides within a cam groove 51 in a cylindrical cam 52 of a cam shaft 53.

This shaft is journaled in bearings 54 on the sub-panel and has a gear 55 which meshes with a worm screw 56 on a counter-shaft 57 that is journaled in bearings 58 on the sub-panel. The counter-shaft has a flexible drive connection 59 similar to the drive 22, with a loose sleeve 60 journaled in a bearing 61 and encircling the armature shaft 24 of the electric motor 25. A slidable clutch 64 on the armature shaft 24 is adapted to engage clutch teeth on the sleeve to provide a driving connection for the shaft 53 and likewise the cam 52. The rotation of the cam will actuate the lever 44 to reciprocate the sleeve 41 and to swing the suction members 27.

For sliding the clutch to connect the shaft 24 and the sleeve 60, a yoke 98 (Figures 4, 5 and 6) is secured on a rock shaft 99 which is journaled in upright supports 100 mounted on the cushion 26. An arm 101 adjustably secured on the shaft has one end of a link 102 connected thereto. The other end of this link rides on the periphery of a cam 103 secured on one end of the cam shaft 53 in the path of cams 104 and 104', whereby the engagement of the link by the cams will rock the shaft 99 in a counter-clockwise direction (Figure 5) under tension of a spring 105 and disengage the clutch from the sleeve 60. The spring 105 is mounted under tension between the arm 101 and an upright brace 106. A tripping coil 107 is positioned beneath the link 102 adjacent the cam 103 and adapted so that when the coil is energized the armature 108 of said coil will lift the link from engagement with the cam 104 permitting the tension of the spring 105 to engage the clutch with the sleeve.

For rocking the shaft 38, as is best shown in Figures 1, 4 and 7, a pinion 65 secured on one end of the shaft meshes with a pair of vertical rack bars 66 and 67. These bars are mounted on opposite sides of the pinion in a vertical guide housing 68 which depends through the panel 12. Bosses 71 and 72 on the lower ends of the rack bars are provided with openings 69 and 70 for receiving the opposite ends of a stud 73 on the upper end of a link 74. This stud is adapted to be engaged

with either of the rack bars and is provided with collars 75 for engaging guides 76 of the housing 68, whereby said stud is held in engagement with the desired rack bar. Opening 76' in the guides permit the stud to be shifted into engagement with the opposite rack bar.

The lower end of the link 74 depends through the sub-panel 13 and is pivotally connected to one end of a bell crank lever 77 (Figures 3 and 4) which is pivoted to the flange 45. The other end of this lever extends upwardly through the slot 46 in the sub-panel and carries a roller 78 which rides in a cam groove 79 in the cam 52. The rotation of the cam will swing the lever and reciprocate the rack bars, thereby imparting a rocking motion to the shaft 38.

For shifting the link 74 to engage the stud with the opposite rack bar, an arm 80 (Figures 3, 4 and 7) has one end loosely connected to the link and its other end adjustably secured to the lower end of a vertical shaft 81. This shaft extends upwardly through a bearing support 82 in the panel 12 and receives on its upper end an arm 83 (Figure 8). The outer end of this arm is connected by a spring 84 with one end of an elongated lever 85 which is pivoted at its other end to the panel 12, intermediate the turntables. This lever has cam arms 86 and 87 extending from opposite sides thereof beneath the turntables and below the normal paths of cam rollers 88 and 89 which are carried by the turntables.

These cam rollers (Figure 9) are mounted on the ends of levers 90 and 91 which are pivoted in yokes 92 and 93 depending from the turntables. The other ends of the levers have pins 94 and 95 protruding upwardly through openings 96 and 97 respectively in the turntables 14 and 15, whereby the weight of any records on the turntables will depress the pins and raise the rollers out of the path of the cam arms. When the last record on either turntable is removed therefrom the respective roller will fall under its own weight in the path of the respective cam arm. As the turntable rotates the roller will engage the respective cam arm and swing the lever 85 and likewise the arm 83, through tension of the spring 84, thereby shifting the link stud into engagement with the opposite rack bar and reversing the rocking direction of the shaft 38. This reversing operation takes place when the rack bars are in a neutral position, as shown in dotted lines in Figure 7, with the collars 75 registering with the openings 76' in the guides 76. The transfer arms 34 and 35 and likewise the suction members with the engaged record are likewise in a neutral or vertical position when this reversing operation takes place, whereby the record is returned to the empty turntable and subsequent operations of the transferring

elements will again accumulate the records on said turntable.

As is best shown in Figures 1, 2, 3 and 13, a reproducer 109 is secured by a bracket 110 to a vertical link 111 of a pantograph which consists of four links 111, 112, 113 and 114 pivotally connected at their ends in the form of a parallelogram. The link 112 is rigidly secured to the upper end of a hollow shaft 115 which is journaled in a bearing 116 in the panel 12. A reduced shank 117 (Figure 12) of the shaft depends through the bearing and has an arm 118 adjustably secured thereon, which arm extends between upright pins 119 and 120 on a segmental disk 121, Figure 12. The pin 119 is rigidly secured in the disk while the pin 120 is L-shaped and pivoted in the disk. This pin is held under tension against a stop 122 by a spring 123 mounted intermediate the pins. By swinging the disk the pins will bear against the arm 118 and swing the same, whereby the reproducer is swung in an arc. The tensional mounting of the pin 120 permits a variance in the positioning of the reproducer for engaging the standard 10 and 12 inch records.

The disk 121 is mounted on the upper end of a hollow shaft 124 which extends downwardly through a bushing 125 in the sub-panel. A gear 126 secured on the lower end of the shaft meshes with a segmental gear 127 (Figures 3 and 4), which is mounted on the lower end of a stub shaft 128. This stub shaft extends upwardly through a bearing 129 in the sub-panel and has a lever 130 attached to its upper end. A roller 131 on the outer end of this lever rides in a cam groove 132 in a cylindrical cam 133 on the cam shaft 53. The rotation of the cam will swing the lever 130 and likewise the segmental gear 127, thereby imparting rotation to the gear 126 for swinging the disk 121 and the reproducer.

For positioning the reproducer to engage either a standard 10 or 12 inch record at the beginning of its score, an elongated lever 141 pivoted to the link 114 and extending longitudinally thereof has an elongated roller 143 on its forward or outer end adjacent the reproducer. The other end of the lever 141 extends adjacent the shaft 115 and is held normally depressed under tension of a leaf spring 145 mounted intermediate the lever and the link 114, as shown in Figure 2. The roller is thus normally held in a raised position disengaged from the top record.

The roller is provided with a hub or collar 144 for engaging the edge of the top record on the turntable. As the reproducer is swung inwardly the roller is lowered, as will be hereinafter explained, into engagement with the top record on the turntable so that the collar 144 will engage the edge of said record upon continued swinging of the reproducer and position the reproducer at the beginning of

the score on said record. Any continued movement of the disk 121, when the roller collar engages the edge of a 12 inch record, merely swings the pin 120 under tension of the spring 123. After the reproducer is lowered into engagement with the record the disk 121 is swung in a counter-clockwise direction (Figure 4) to free the reproducer from any tension of the spring 123.

For raising and lowering the reproducer, a plunger 134 (Figures 1, 2 and 3) extends upwardly through the hollow shafts 124 and 115 and carries a pin 135 in its upper end. This pin rides in vertical slots 136 in the shaft 115 and protrudes therefrom for engaging the rear end of the lever 141 and the yoke ends 114' of the pantograph link 114, which latter ends extend on opposite sides of said shaft. By raising the plunger the pin 135 will first engage the lever and lower the roller to a position slightly below the reproducer. Further movement of the plunger and the pin will swing the reproducer upwardly in an arc, with the reproducer maintaining its angle of inclination. By lowering the plunger the reproducer is first lowered and then the roller is raised above the bottom of the reproducer under tension of the spring 145.

For actuating the plunger a bell crank lever 137 (Figure 3) is pivoted to the flange 45 of the sub-panel and has one end engaging the plunger. The other end of said lever extends upwardly through a slot 138 in the sub-panel and carries a roller 139 which rides in a cam groove 140 in the cam 133. The rotation of the cam will swing the lever, thereby raising and lowering the plunger and likewise the roller and the reproducer.

As is best shown in Figures 2, 3, 4 and 14, a switch 146 having normally disengaged spring contacts 147 and 148 is mounted on the underside of the panel 12 beneath the turntable 14 and has a shoe 147' depending from the contact 147 in the path of the arm 118. The shoe is adapted to be engaged by the arm 118 when the reproducer reaches the end of the score on a record which is on the turntable 14, thereby engaging the switch contacts and closing an electric circuit through said switch. A similar switch 149 having contacts 150 and 151 is mounted beneath the turntable 15 and has a shoe 150' depending from the contact 150 and adapted to be engaged by the arm 118 when the reproducer reaches the end of the score on a record which is on the turntable 15, thereby closing an electric circuit through said switch.

The spring contacts 147 and 150 are connected by a common lead 152 to the positive lead 153 of a 110 volt electrical circuit while the contacts 148 and 151 have a common lead 154 to one end of the tripping coil 107.

The other end of the tripping coil is connected by a lead 155 to the negative lead 156 of the 110 volt circuit. Therefore, when either of the switches 146 and 149 is closed an electric circuit is completed to the tripping coil, whereby the clutch 64 is shifted to provide a driving connection between the motor and the cam shaft 53, as hereinbefore explained, for rotating said cam shaft. The motor has leads 157 and 158 connected in the leads 152 and 155 for supplying electrical current to said motor. A suitable control switch 159 is connected in the lead 152 (Figure 14) for starting or stopping the operation of the apparatus.

In operation with the parts in the positions illustrated in Figures 1 to 12 inclusive, the control switch 159 is closed to complete an electrical circuit to the motor 25. Upon operation of the motor the turntables 14 and 15 and the records thereon begin rotating, whereby the top record on the turntable 14 is reproduced. When the reproducer reaches the end of the score on the record the switch 147 is closed and the tripping coil is actuated to release the spring 105, whereby the clutch is engaged with the sleeve 60 to rotate the cam shaft 53. Upon the rotation of the cam shaft the lever 137 is actuated by the cam 140 to raise the reproducer from the record, then the lever 130 is swung by the cam 132 to shift the reproducer in a clockwise direction (Figure 1) into position for engaging the top record on the other turntable 15. As the reproducer reaches the turntable 15 there is a slight pause in the shifting action due to the shape of the cam 132, during which pause the reproducer is partially lowered and the roller 143 is engaged with the record, so that further shifting of the reproducer will engage the collar 144 of the roller on the edge of the record and position the reproducer at the beginning of the score on the record. The reproducer is then lowered on the record and the roller raised from said record as the cam lug 104' of the cam 103 engages the link 102 and shifts the clutch to stop the rotation of the cam shaft 53. The record on the table 15 is then reproduced.

When the reproduction of the record on the turntable 15 is completed the switch 149 is closed to actuate the tripping coil and start the rotation of the cam shaft 53. The reproducer is then lifted from the said record and shifted in a counter-clockwise direction to a position at one side of the turntable 14, as shown in dotted lines in Figure 1. During the foregoing operation of the cam 132 the roller 78 of the lever 77 has been traveling in the straight portion of cam 79, and the roller 50 of lever 44 has a similar travel in the straight portion of cam 51; thus there is no operation of the transferring means. When the roller strikes the offset of

the cam 79 the lever 77 is swung to slide the rack bar 67 downwardly whereby the shaft 38 is rotated in a clockwise direction, Figure 7, and the suction elements 27 are swung upwardly in an arc. When the suction members are in a position above the records on the turntable 14 the lever 44 is actuated by the offset of the cam 51 to slide the sleeve 41 to the right (Figure 3) whereby the suction members and supporting arms are swung inwardly over the turntable 14 and under the elevated reproducer.

The suction members are then swung in an arc to the turntable 15 to engage the top record on said turntable. The suction members in contact with the top record are then swung in a counter-clockwise direction (Figure 2) to the turntable 14 where the record is released and deposited on said turntable in a reversed position. The inverted U-shaped shaft 14' guides the records during the transferring operation and positions them when said records are released from the suction members.

When the suction members reach a vertical position in their arcuate travel there is a momentary pause caused by the cam 79 during which the link 74 is shifted into engagement with the opposite rack bar to reverse the travel of the suction elements, provided the last record has been removed from the turntable, whereby the record is returned to the turntable 15. If the reversing action does not take place the record is deposited on the opposite turntable, as stated.

As the suction members approach the turntable on which the record is being deposited, said members are spread apart to clear the turntable before reaching their neutral or stationary positions opposite the turntable 14. If for any reason the suction hold between the members and the record has not been broken by restoration of the bellows the spreading of said members will break the suction and release the record. The reproducer is then shifted inwardly of the turntable 14 with a slight pause due to the shape of cam 132 in the shifting action as the reproducer reaches the turntable.

During this pause the reproducer is partly lowered to permit the roller to engage the top record after which the continued swinging of the reproducer will cause the roller collar 144 to engage the edge of the record and position said reproducer over said record. The reproducer is then lowered on the record as the cam lug 104 of the cam 103 engages the link 102 and shifts the clutch to stop the rotation of the cam shaft. The opposite side of the record is then reproduced.

It is pointed out that when the cams 140 and 132 are actuating the reproducer, the cams 79 and 51 are presenting their straight portions to the rollers 78 and 50. Then, when the cams 79 and 51 are actuating the trans-

ferring means, the cams 140 and 132 are presenting their straight portions to the rollers 139 and 131. Thus, it can be readily seen, that while one set of cams are actuating their respective levers, the other set of cams are idling; consequently, during one half of the revolution of the cam shaft 53 one set of cams operate, and during the other half of the revolution the other set of cams function.

When the records have accumulated on the turntable 14 the travel of the suction members are reversed to transfer the records from the turntable 14 to the turntable 15 as said records are reproduced. It is obvious that the cycle of operation of the various elements is entirely synchronous and automatic to perform the function of reproducing first one side of the top record on one turntable and then transferring the record in a reversed position to a second turntable where the opposite side of said record is reproduced, after which the succeeding top record on the first turntable is reproduced. The successive reproduction of the records is repeated with the records accumulating first on one turntable and then on the other turntable until the control switch 159 is opened.

Various changes in the size and shape of the different parts, as well as modifications and alterations, may be made within the scope of the appended claims.

Having illustrated and described a preferred form of the invention, what I claim, is:

1. In an automatic sound reproducing apparatus, a pair of rotatable turntables, means for maintaining a plurality of records in playing positions on the turntables, means for alternately reproducing the uppermost records on the turntables, and means for transferring the uppermost record on one turntable to the top of the record stack on the other turntable and inverting said record during the transferring action for reproduction of its opposite side.

2. An automatic sound reproducing apparatus as set forth in claim 1, with the transferring operation occurring intermediate the successive reproduction of the uppermost records, whereby the opposite sides of a record are successively reproduced.

3. An automatic sound reproducing apparatus as set forth in claim 1 with means for engaging and disengaging the reproducing means with and from the uppermost records on the turntables, and means for shifting the reproducing means clear of the records during the transferring operation.

4. In an automatic sound reproducing apparatus, a plurality of rotatable turntables, means for rotating said turntables, a stored stack of records supported on one of the turntables, means for reproducing the uppermost record, means for engaging the uppermost record by its scored portion, means for inverting the record engaging means to invert said

record and for transferring the same to a second turntable, for reproduction of the opposite side of said record, and means for shifting the reproducing means to engage the inverted record and reproduce its opposite side.

5. In an automatic sound reproducing apparatus, a plurality of rotatable turntables, a plurality of records supported on the turntables, means for reproducing the uppermost records on the turntables, a plurality of suction members, means for alternately swinging the suction members in an arc to engage the uppermost record on one of the turntables by its scored portion, means for creating a suction within the members to secure the record thereto, whereby the alternate swinging of the suction members will invert the record, and means for releasing the record in its inverted position on the top of the record stack on a second turntable for reproduction of the opposite side of said record.

6. In an automatic sound reproducing apparatus, a pair of rotatable turntables, a record stack supported on one of the turntables, means for removing and inverting the uppermost record and transferring it to the other turntable, sound reproducing means including a stylus for engaging the record, means for engaging and disengaging the sound reproducing means with and from the uppermost records on the turntables, means for shifting the reproducing means from the end of the score of a record on one turntable to the beginning of the score of a record on the other turntable, and means for engaging the record to position the reproducing means at the beginning of the score on said record irrespective of the diameter of the record.

7. In an automatic sound reproducing apparatus, a pair of rotatable turntables, a plurality of records supported on the turntables, a rocking element intermediate the turntables, spring tensioned suction members supported by the rocking element for engaging the top records on the turntables, means for alternately rocking the rocking element to engage the suction members under pressure with the top record on one turntable for securing the record to said members and to swing the members and their engaged record in an arc to the opposite turntable where the record is released by the suction members and deposited in an inverted position on the latter turntable, a sound reproducer mounted intermediate the turntables for engaging the

top record on either turntable, and means for shifting the reproducer to engage and reproduce the top record on first one turntable and then on the other turntable.

8. An automatic sound reproducing apparatus, a pair of rotatable turntables, means for rotating said turntables, a plurality of superimposed sound reproducing records mounted on one of the turntables, reproducing means for engaging the records, means for transferring the reproduced record to the other turntable for subsequent reproduction, the transferring means inverting the record during the transferring operation, whereby the opposite side of the record will be presented for reproduction.

9. An automatic sound reproducing apparatus, a pair of rotatable turntables, means for rotating said turntables, a plurality of superimposed sound reproducing records mounted on one of the turntables, reproducing means for engaging the records, means for transferring the reproduced record to the other turntable for subsequent reproduction, and means for disengaging the reproducing means prior to the transferring operation and for engaging said reproducing means with a record subsequent to the transfer of the same.

10. In an automatic sound reproducing apparatus, a pair of rotatable turntables arranged to support a plurality of superimposed records thereon, reproducing means arranged to engage the upper sides of exposed records, means for guiding the records from one table to another, a swinging device for moving a record from one table to the other and inverting said record during such movement, and means for reversing the operation of the swinging means when all of the records have been removed from one of the tables.

11. In an automatic sound reproducing apparatus, a pair of rotatable turntables arranged to support superimposed records, an air suction transferring device for engaging a record on one of the tables, means for operating the transferring device for transferring a record from one turntable to the other turntable, and means for automatically reversing the operation of the transferring device after the last record has been transferred.

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