

March 23, 1948.

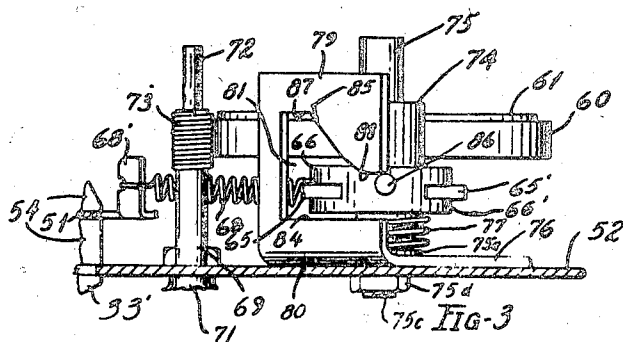
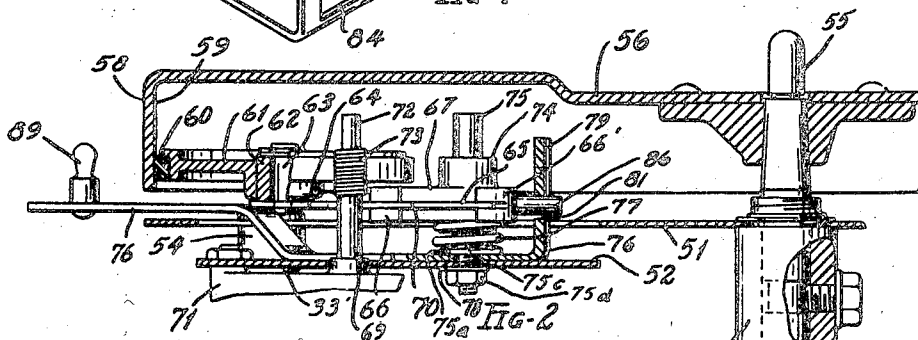
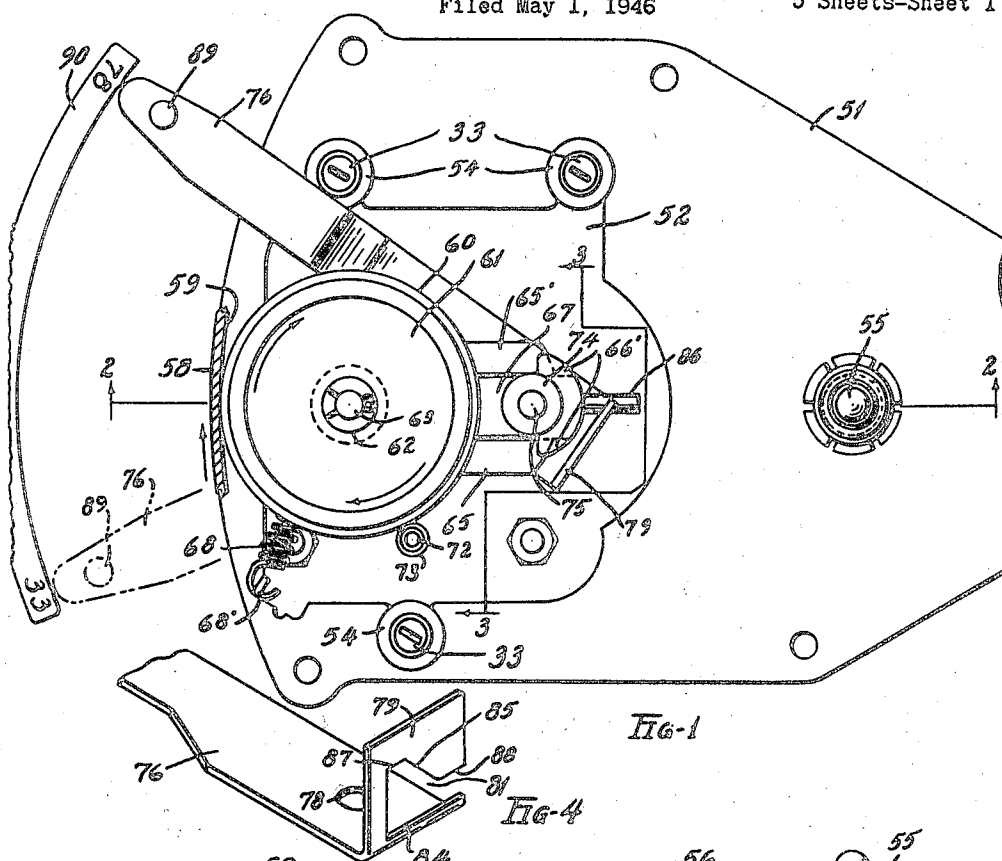
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2,438,265

TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

Filed May 1, 1946

5 Sheets-Sheet 1



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TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

Filed May 1, 1946

5 Sheets-Sheet 2

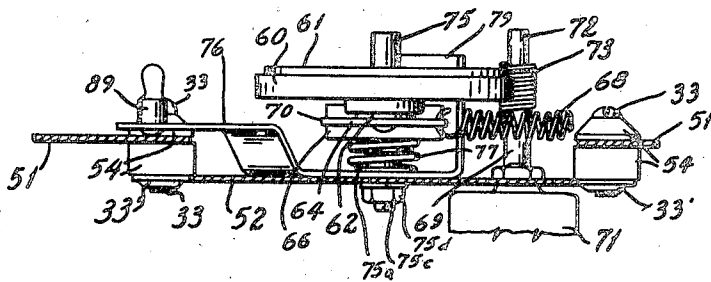
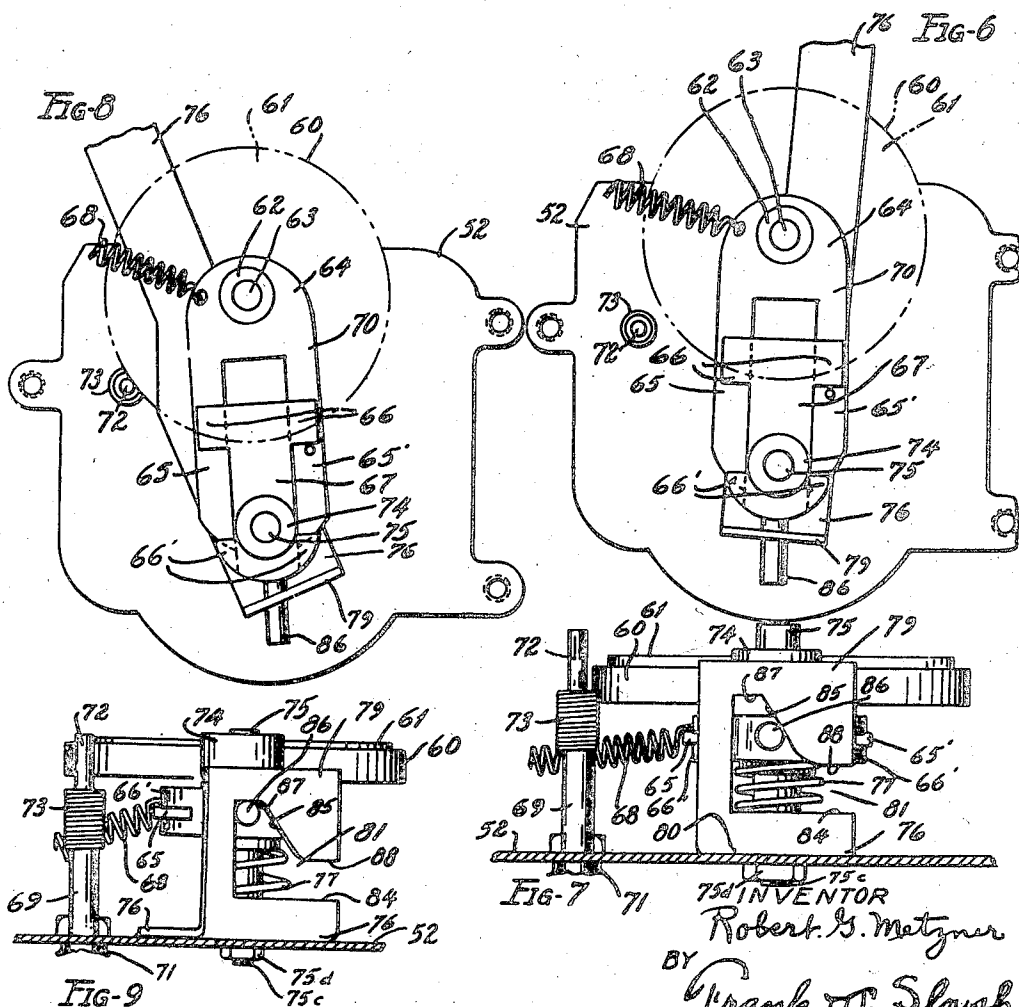


Fig-5



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TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

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5 Sheets-Sheet 3

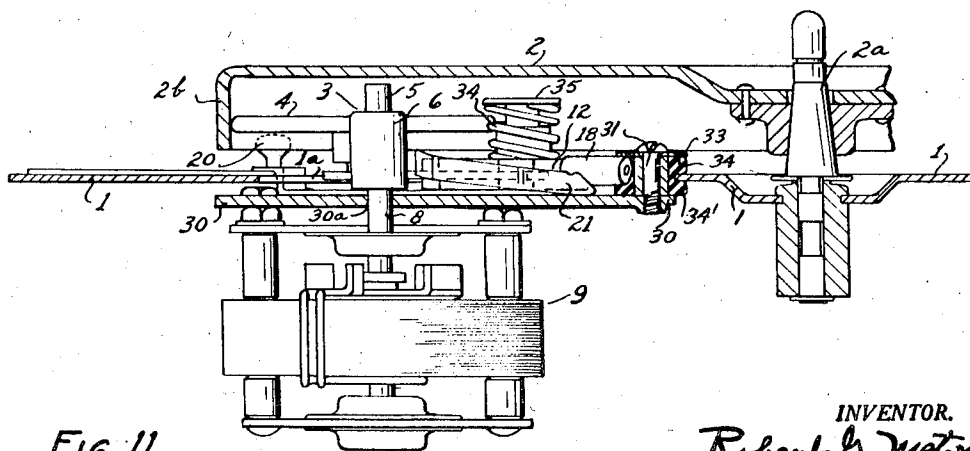
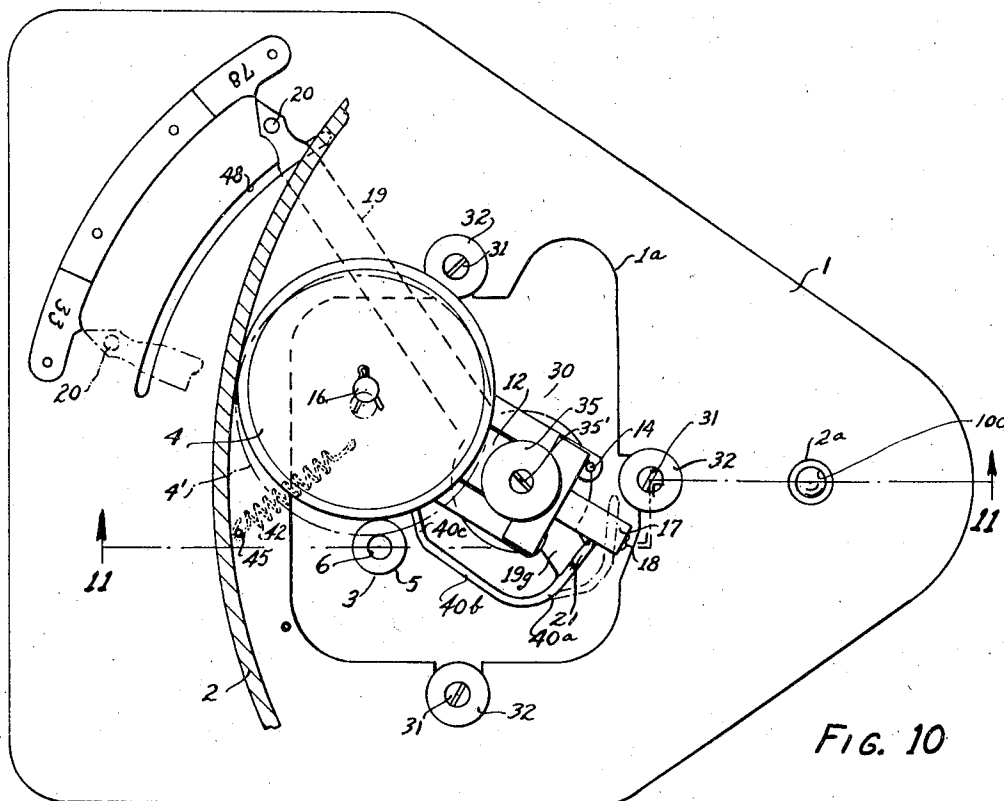


FIG. 11

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TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

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5 Sheets-Sheet 4

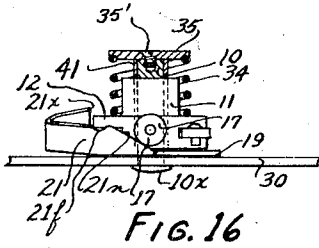


FIG. 16

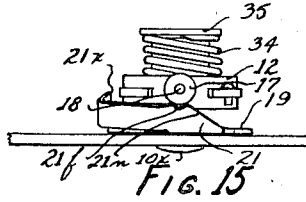


FIG. 15

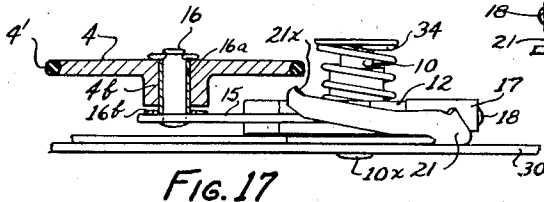


FIG. 17

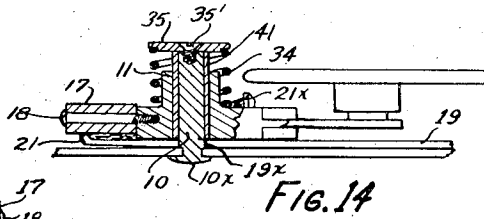


FIG. 14

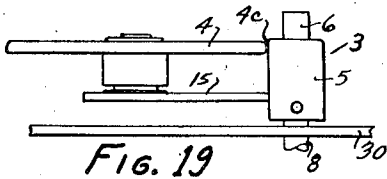


FIG. 19

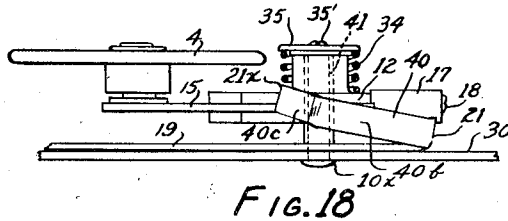


FIG. 18

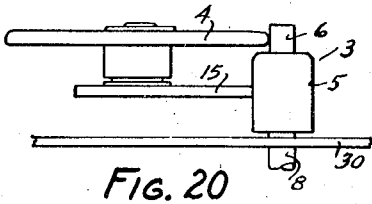


FIG. 20

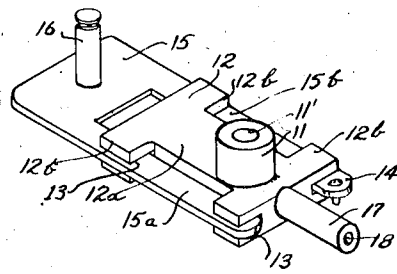


FIG. 13

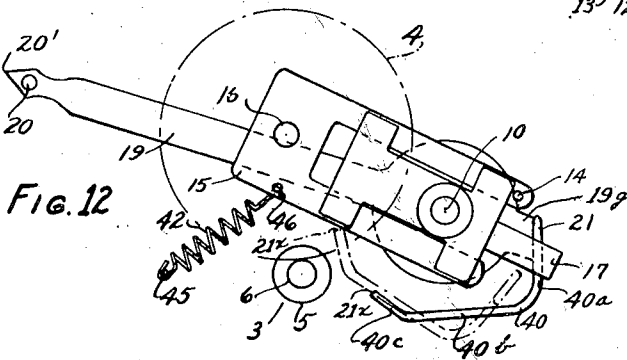


FIG. 12

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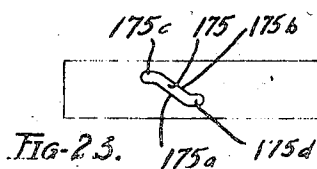
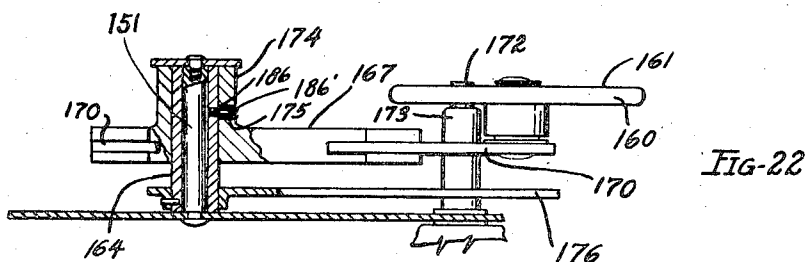
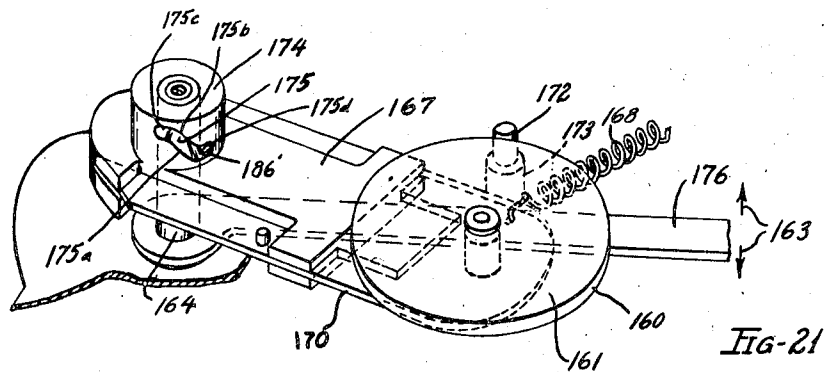
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TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

Filed May 1, 1946

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,438,265

TWO-SPEED PHONOGRAPH TURNTABLE DRIVE

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Application May 1, 1946, Serial No. 666,313

14 Claims. (Cl. 74-190)

1

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My invention relates to two-speed phonograph turntable drives and relates more particularly to an improved friction type driving mechanism employing a single idler wheel interposed between a motor driven roller and the inner surface of the turntable flange and relates more specifically to means for driving said idler wheel and thereby said turntable at a plurality of different speeds.

My present invention involves an improved form of friction-type phonograph turntable driving mechanism whereby the friction wheel, while maintaining frictional engagement with an annular surface of a pendant turntable flange, may be alternatively adjusted to alternatively engage either of two roller steps disposed at different levels, said adjustment being, in every case, achieved by movement of a manually operable controller movable in a single uniform path to cause said idler wheel to be moved in proper sequence outwardly from a pre-engaged roller step, then vertically to the level of the other roller step, and finally, horizontally to engage the alternate roller step to vary the driving ratio between said roller and turntable.

An object of my invention is to achieve a change-speed operation in a friction drive mechanism of the type referred to, which will achieve the desired purpose in a simple, reliable, expeditious and effective manner.

Another object of my invention is to provide an improved mechanism for alternately moving a single idler wheel, which is disposed intermediately of the phonograph turntable flange and the driving roller whereby said idler wheel may be frictionally engaged with said flange and, alternately, with two superposed driving roller portions which are of different diameters.

Another object of my invention is to achieve each and every of the foregoing objects in an improved manner in a mechanism which can be produced in quantities at minimum cost.

Another object of my invention is to provide an improved mechanism for adapting the floating idler carrier of the type shown in a co-pending application of Herbert L. Hartman, Ser. No. 550,995, filed August 24, 1944, for use in a two-speed frictional turntable drive mechanism wherein a two step driving roller and a single idler wheel is employed.

Another object of my invention is to provide an improved mechanism for shifting the idler wheel of a friction type driving mechanism which, while maintaining frictional engagement with the pendant flange of a phonograph turntable, may be moved from engagement with either of the two steps afforded by said roller, then displaced to the level of the alternate roller step, and subsequently engaged with said alternate roller step, and wherein all said idler wheel movements are achieved responsive to a continuous movement

of uniform nature, manually applied to a hand controller, such movement of the operating portion of said controller in either of two alternate directions being in a path of uniform nature throughout.

Other objects of my invention and the invention itself will be apparent to those skilled in the art to which my invention appertains by reference to the accompanying drawings, in which drawings:

Fig. 1 is a top plan view of an embodiment of my invention secured to a mounting plate exposed to view by assuming the cutaway of all other portions of a superposed turntable from a remaining mere fragment of its pendant flange portion, the latter being shown as engaged by the idler wheel of the said embodiment, an end portion of said mounting plate also being broken away;

Fig. 2 is a section taken on the line 2-2 of Fig. 1;

Fig. 3 is a side elevational view of certain of the apparatus illustrated in plan in Fig. 1, the view being taken on the step line of section 3-3 of Fig. 1, a showing of the turntable being omitted;

Figs. 1, 2 and 3 illustrate the idler friction wheel in a relatively lowermost adjusted position to simultaneously engage the larger step of the motor driven driving roller and the inner annular surface of the turntable flange;

Fig. 4 illustrates a perspective view of a fragmentary portion of a manually operable controller lever and a cam element thereof;

Fig. 5 is a view of the mechanism of the foregoing Figs. 1, 2 and 3 with the parts in the same adjusted position, the view being taken from another side of the apparatus, and, like Fig. 3, the showing of the turntable being omitted;

Figs. 6 and 7 are, respectively, top plan and end elevational views of the apparatus of the foregoing figures with the parts assuming the midway position occasioned by movement of the manual controlling lever of the foregoing figures, from the position indicated by the numeral 78 midway to the position shown by dotted lines in Fig. 1 designated by the numerals 33, said numerals, in each case, representing two common respectively high and low turntable speeds;

Figs. 8 and 9 are views, respectively, similar to Figs. 6 and 7, with the exception that the parts are illustrated in the positions they assume when the operating lever of Fig. 1 is swung to the position indicated by the numeral 33.

Fig. 10 is a top plan view of mechanism comprising a second embodiment of my invention as exposed to view by assuming the cutting of the planular disc portion of the turntable from its pendant flange portion;

Fig. 11 is a view partially in side elevation and

partially on a vertical plane of cross section taken on the line 11-11 of Fig. 10;

Fig. 12 is a bottom plan view of certain mechanism of Fig. 10;

Fig. 13 is a perspective view of part of the mechanism of Fig. 12;

Figs. 14, 15, 16, 17 and 18 are elevational views partially in section of an adjustment mechanism associated with the idler wheel carrier of the embodiment of Figs. 10 to 13 inclusive;

Figs. 19 and 20 are side elevational views of the idler and driving roller of said second embodiment in relatively different adjusted operative positions;

Fig. 21 is a perspective view of apparatus comprised in a third embodiment of my invention;

Fig. 22 is a side elevational view of the idler wheel, carrier, carrier adjusting means of said third embodiment in the adjusted position of Fig. 21;

Fig. 23 illustrates the form of a cam slot employed in the said third embodiment, the view assuming the slotted annular surface of a mount hub unwrapped and placed in a plane.

Referring now to the drawings, and first, more particularly to Figs. 1 to 9 inclusive, illustrating a preferred form of my invention, the main supporting plate 51 is of sheet metal and a supplemental plate 52 pendantly supported from the main plate by three machine screws 33, thereby affording a three point suspension for the plate 52; the mounting screws 33 preferably do not make metallic contact with the plate 51.

Fig. 5 indicates one of many ways of preventing such metallic contact, wherein the screw 33 is of relatively small diameter and at its lower end is provided with a clamp nut 33', and surrounded throughout most of its length by a tubular rubber sleeve 54, the plate 51 being clamped between upper and lower peripheral flanges of said rubber sleeve, and the opening through said plate 51 for the screw 33 being sufficiently large as not to make engagement with the metallic plate 51.

Such an arrangement is in accord with present day common practice to prevent tonal vibrations from passing from the supplemental plate to the main plate and thence through the turntable post 55 to the turntable 56, from which such vibrations would otherwise be transmitted through a turntable supported record disc to the reproducing stylus of the phonograph.

The turntable 56 may be carried on the post 55 in any well known manner and preferably the post 55 is journaled in a bearing tube 57 for free frictionless rotation. The turntable is preferably provided with a pendant flange 58 having a smooth cylindrical inner surface 59 with which the rubber peripheral tread 60, of the idler wheel 61, is frictionally engaged whereby rotation of the idler wheel may drive the turntable at a speed determined by the rate of rotation of said idler wheel.

The hub of the idler wheel 61 is provided with a bearing sleeve 62 drive fitted therein, said sleeve being journaled on an upright post 63 rigidly secured at its lower end to the yoke portion 64 of a U-shaped slide element, generally indicated at 70, said slide element having a pair of parallel arms 65 and 65' which make bearing fitting engagement within slideways afforded by notches laterally directed inwardly from the ends of the arms 66 and 66' of a mount element 67, in the manner disclosed in the co-pending application for patent of Herbert L. Hartman, Ser.

No. 550,995 filed August 24, 1944, now Patent No. 2,421,910.

The oppositely extending pair of mount arms 66 and the oppositely extending parallel arms 66', are relatively interspaced in the longitudinal direction of extent of the slide arms 65 and 65', and, with said slide arms disposed within the slots of said mount arms, the entire slide element 70, which, by its yoke, carries the idler wheel post 63 and idler wheel 61, may be moved longitudinally of the arms guided by the above designated slideway, subject to the restrictions imposed upon such movement by the tensile spring 68 and any engagement had by the periphery of the idler wheel 61 with the turntable flange 58 and also with the driving roller carried by the shaft 69 of the driving motor 71.

The stepped driving roller may, if desired, be formed separately from the shaft 69, but preferably said roller is afforded by providing the shaft with a reduced end 72 and a diameter increasing layer of tightly helically wound spring wire 73, said reduced end 72 affording a driving roller end portion of least diameter, which is uppermost, and the outer surface of a closed helical coil of spring wire 73 which may be soldered onto the shaft 69 at a lower level, conveniently affords a driving roller portion of relatively greater diameter than does said reduced shaft end 69. The outer surfaces of said end 72 and said coil 73, thus together provide a two-step driving roller.

The idler wheel mount 67 is provided with a hub 74, having a cylindrical bore, and is journaled upon a relatively longer upstanding post 75 by a bearing fit, to permit said mount hub to be rotationally and longitudinally reciprocated on said post 75. The lower portion of the post 75 is provided with an enlarged radial flange 75a and terminates in a reduced threaded end 75c which is extended through an aperture of the sub-plate 52, whereby the post is rigidly secured by the nut 75d to said sub-plate.

The portion of the post 75, disposed between the sub-plate 52 and the post flange 75a, is of such smaller diameter and of such length that it may loosely be projected through an aperture of the controlling lever 76, an intermediate portion of which is loosely disposed between said post flange and said sub-plate.

For adjusting the idler wheel to its various adjusted positions, the hand lever 76 is superposed on the plate 52, being telescoped by its aperture 78, over the post 75, and a helical spring 77, also telescoped over the post 65, is compressively disposed between the upper surface of said lever 76 and the portion of the underside of the mount 67 which borders said mount hub. The lever 76 is flat throughout most of its length but is rearwardly bent at 80 to afford an upstanding flange 79.

The hand lever 76 has a free end of the long arm of the lever 76 which extends outwardly below the turntable flange 58, as shown in Fig. 2, and is provided with an upstanding handle 89 adapted to be grasped by the operator for the purpose of swinging the lever 76 about the axis of the post 75 to present said free end in proximity to either of the indicia 78 or 33 placed upon a plate or other element 90 mounted upon the phonograph cabinet, not shown in the present drawings.

The shorter arm of the lever 76 terminates in an upstanding flange 79 which is so cut as to provide a notch 81 to afford three substantially

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parallel edge surfaces 84, 87 and 88, the parallel surfaces 84 and 87 being more widely interspaced than the surfaces 84 and 88, there being also a diagonal edge portion 85 interconnecting the horizontal portions 87 and 88, said diagonal portions being disposed at preferably an angle of between 30° and 35° to the planes of the said horizontally extending edges.

The angle of inclination of the edge 85 may, of course, be varied with corresponding variation in the required amount of throw of the handle portion of the lever 76.

Disposed in cooperative position to the slot edges 87, 88 and 85, the first two of which provide land surfaces for the camming surface 85, is a cam follower in the form of a preferably cylindrical stem 86 which is preferably secured to and affords a rearward extension of the idler wheel mount 67, said stem 86 affording a cam follower adapted to be cammingly moved to different lateral positions and to different levels as a result of lateral translatory movements of the camming lever flange 79.

Rotational movement of the mount 67, about the post 75 in the clockwise direction is opposed by the tension spring 68 which interconnects the free end of the slide 70 adjacent the idler wheel post 63 and a fixed portion of the main frame 51, shown at 68', in Fig. 1, said spring being so disposed as to constantly exert a pull upon the mount 67 tending to rotate it in the counterclockwise direction.

The operation of the change speed adjusted mechanism of the first embodiment of my invention, disclosed in the above described Figs. 1 to 7 inclusive will now proceed, first, by describing the operation of the turntable driving mechanism with the parts in the assumed initial position, as illustrated in Figs. 1, 2 and 5, wherein the mount stem 86 is in engagement with the lower land edge surface 88, and the lever handle 89 is at the position indicated by the indicia "78" on the plate 90 in Fig. 1, and the rubber tread periphery 60 of the idler wheel 61 is in simultaneous engagement with the inner surface of the turntable flange 58 and the outer surface of the larger step 73 of the stepped motor shaft roller, and with said wheel constrained to such engagement by the retractive effort of the spring 68.

Consequently, the motor being operated in any usual manner, the driving roller step 73, which is frictionally engaged with the tread 60 of the idler wheel, will rotate the idler wheel in the clockwise direction of the arrow, shown on said wheel in Fig. 1, and consequently, by virtue of the engagement between the idler wheel tread and the inner surface 59 of the turntable flange, the turntable 56 will also be rotated in a clockwise direction at a speed which, for instance, may be 78 R. P. M. or other relatively high speed, which is predetermined by the speed of the motor and the diameter of the larger driving roller step 73.

When the idler wheel is then adjusted, by moving the lever 76 to place its handle 89 adjacent the indicia "33," Fig. 1, by virtue of the operation of the camming elements associated with the upstanding flange of said lever, as later described, the idler wheel is positioned, as illustrated in Fig. 9, with the peripheral rubber tread 60 of the idler wheel in engagement with the smaller step 72 of the driving roller, to rotate the idler wheel and the idler-engaged turntable 58 in the same clockwise direction as before, but at a much lower speed, such as 35 R. P. M. which lower speed is in

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proportion to the smaller diameter of the roller step 72, relative to that of the larger roller 73.

The apparatus comprising the flange cam 74 and cam follower 86, with the other ancillary cooperative elements, whereby the idler wheel is adjusted from either of the above operative positions to the alternate position, will now be described.

When the parts are in the high speed driving position, as shown in Figs. 1, 2, 3 and 5, should the operator move the handle 89 of the controlling lever 76 in the counterclockwise direction, as illustrated in Fig. 1, by virtue of the upward pressure exerted by the compression spring 77 against the underside of the idler carrier mount 67, the lever flange 79 will be moved successively from the position shown in Fig. 3 through the position shown in Fig. 7, and ultimately, to the position shown in Fig. 9.

Such counterclockwise movement of the lever flange 79 about the axis of the post 75 will permit the mount stem 86 to pass from under the lower straight edge land surface 88 and by virtue of upward pressure exerted upon the mount by the spring 77, to be lifted upwardly along the diagonal camming surface 85 to engagement with the upper land surface 87, as shown in Fig. 9.

During this counterclockwise adjustment movement of the lever 76, and its cam flange 79, the idler wheel 61 and the mount stem 86 will pass through an intermediate position illustrated in Figs. 6 and 7, which show that the lateral inclination of the camming edge 85, and the upward pressure exerted upon the mount 67 by the spring 77, is effective to cause the idler wheel periphery to momentarily move laterally outwardly from engagement with the larger driving roller step 73, while said mount and wheel are rapidly ascending in Figs. 8 and 9; the lever and its cam flange 79 meanwhile is swung to the positions of Figs. 8 and 9, and such positions of the lever 76 is shown by dotted lines, in Fig. 1.

The final continuing counterclockwise adjusting movement of the lever handle portion 89 towards the indicia 33, thus causes the diagonal cam surface 85 to move towards the right, as viewed in Figs. 7 and 9, and thereby permits the mount stem 86 to continue its rising movement in a vertical direction, being guided by lateral engagement of said stem with the cam 85 until all parts of the idler wheel periphery 60 have been elevated to the level of the uppermost and smaller roller step 72.

When the cam flange 79 has moved nearly to the approximate position shown in Fig. 9, wherein the idler wheel 61 is at the level of the uppermost roller step 72, in engagement with the land surface 87, continuing movement of the lever flange 79 causes the stem 86 to be engaged by and to be moved by the end edge surface 83 of the cam notch 81, to swing the mount 67 in a counterclockwise direction whereupon the periphery of the idler wheel will be moved inwardly to engage the small step 72 of the driving roller, as shown in Fig. 8.

It is to be understood throughout the foregoing description that Figs. 6 and 7 show the same intermediate adjusted position of the parts, and that Figs. 8 and 9 alike illustrate a different further adjusted position of said parts, during the period when the lever 76 is being swung from the "78" indicated position toward the "33" indicated position.

With the parts in their final adjusted position,

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as shown in Figs. 8 and 9, the small uppermost driving roller 72 is engaged with the periphery of the idler wheel 61, and the longitudinal and lateral pulling components of the force exercised by the spring 68 will, at all times, be sufficient to maintain the periphery of the idler wheel in engagement both with the inner surface of the turntable flange, and the lateral surface of the smaller step 72.

From the foregoing description, the reverse adjustment operation will be readily understood, such adjustment being effected by moving the handle 89 of the lever 76 in the clockwise direction from the indicia "33" to the indicia "78" and, in such case, the camming flange 79 will be moved in the counterclockwise direction, as viewed in Figs. 8 and 6, and continuously proceeding to the position shown in Fig. 1.

In such adjustment, the first movement of the camming flange 79 towards the left, as viewed in Fig. 9, and counterclockwise in Fig. 8, will be to bring the diagonal camming surface 85 in engagement with the mount stem 83 and thus exert a lateral and downward thrust on the mount stem 86, and the lateral component of such thrust will swing the mount 67 sufficiently to position the peripheral tread of the idler wheel 61 laterally beyond the periphery of the larger driving roller step 73, and then, the spring 68 increasingly resisting such swinging movement of the mount, the camming surface 85 will become more responsive to the vertical component of camming effect to force the mount stem 83 downwardly until the stem can pass laterally along the curved portion of the diagonal edge surface and into sliding engagement with the continuing horizontal lower surface 88.

Thus the stem 86 will move laterally along the surface 88 under the inducing pressure of the tensile spring 68, whereupon the tread of the idler wheel having previously been lowered to the level of the larger driving roller 73, will be resiliently pressed inwardly in a horizontal direction to engagement with said larger driving roller surface.

It will thus be seen that, by the instrumentalities comprising the notched lever flange 79, the stem 86, and the springs 77 and 68, by a simple uniform movement of the lever handle 89, the idler wheel is moved from engagement with a precedently engaged roller step disposed at one level and moved vertically upwardly to the level of the alternate roller step, whereupon it is moved horizontally inwardly to engage said alternate driving roller step.

In the above description, the relationship between the restraint exerted upon the idler wheel mount 67 by the tensile spring 68, is so related to the upward pressure exerted upon the mount by the compression spring 77, and to the degree of inclination of portions of the flange camming edge 85 as to preferably cause a lateral separation of the idler wheel periphery from the lateral surface of the larger step 73 during, and responsive to, swinging adjustment movements of the lever 76.

However, the relative power of the two springs and the inclination of portions of the camming edge surface 85 may be varied to accomplish the desired adjustment of the wheel periphery from engagement with the larger driving roller step to engagement with the smaller step while maintaining said wheel periphery in light pressure engagement with the lateral surface of the larger step until it has moved to the level of the smaller step.

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Such change in operative adjustment of the springs and in inclination of camming edge portions is within the scope of the present invention and contemplated hereby; however, I prefer the described adjustment of said springs and the shown inclination of the camming surface to effect lateral separation of the idler periphery from the large roller step prior to lifting the idler wheel to the level of the smaller step.

In the second embodiment of my invention, illustrated in Figs. 10 to 20, inclusive, the operative parts comprise a main plate 1, a supplemental plate 30, a turntable post 2a, with the turntable 2 having similar pendant flange 2b, motor 9, motor shaft 8, the step driving roller 3 having relatively large and small steps 6 and 5 respectively, idler wheel 4 carried on a slide 15, said slide being longitudinally reciprocable in the mount 12 which, in turn, is journaled for reciprocatory swinging movements on a post 10, all in a manner similar to that of the previously described first embodiment, and with the supplemental plate suspended from the main plate by grommets comprising rubber cushioning elements 34, substantially as in the said first embodiment.

Figs. 10, 11, 14, 16, 17 and 19 show related parts in the position assumed for high speed driving of the turntable, wherein the idler wheel is adjusted to its lowermost position, for peripheral engagement with the lower and larger roller step 5 of the stepped roller, said roller being fixedly secured on the motor shaft 8.

Conversely, to achieve peripheral engagement between the smaller and uppermost step 6 of the driving roller and the periphery of the idler wheel 4, for driving the turntable at the lower speed, reference should be made to Figs. 12, 15, 19 and 20, wherein the illustrated parts are shown in the appropriate alternative position to effect driving of the turntable at the lower speed.

The slide arms 15a and 15b are fitted into lateral slots 13 of the side flanges 12b of the mount 12 whereby said slide may be endwise longitudinally reciprocated on the mount 15 which supports it, a pin 14 in the free end of one of the arms, such as 15b, being provided to prevent the slide from being moved outwardly from the mount beyond a predetermined range of outward movement.

The idler wheel 13, being journaled on the post 16, as best shown in Fig. 17, a cylindrical bearing sleeve 16a is preferably interposed between the hub 4b of the idler wheel and said post 16 and a thrust bearing washer 16b is preferably provided between the lower end of the wheel hub and the supporting portion of the slide 15.

In said second embodiment, a cylindrical roller 17 which affords a cam-follower for the mount 12 is preferably journaled on a pin 18 secured at one end to a rearmost end of said mount, and an outermost pin head 18 retains the roller 17 on the pin.

The roller 17 is adapted to be cammed upwardly and subsequently lowered by the effect of reciprocatory movement of a cam 21, carried by the manually operable lever arm 19 whereby the entire mount and slide assembly, together with the wheel 4, is adjusted to the desired upper or lower position.

The lever is provided with a handle 20 at its free end, and is apertured at 19x, Fig. 14, whereby said lever arm 19 is adapted to be fulcrumed on the upstanding rod 10 projecting upwardly from the plate 30 and rigidly affixed at its lower end 10x to said plate 30.

The mount 12 is provided further with a preferably integral hub 11 and said hub 11 is also telescoped over the rod 10, a cylindrical bearing sleeve 41 being interposed between said hub and rod, and the lower end of said sleeve rests upon the upper surface portion of the lever 18 which borders the aperture 19a. A centrally apertured disc 35 is secured by a screw 35' to the upper end of the rod 10, said disc being preferably provided with a peripheral pendant flange.

Between the underside of said disc 35 and the upper surface of the mount 12 bordering the hub 11, a helical spring 34 is interposed under compressive stress. The hub 11 of the carrier 12 is adapted to be moved upwardly on the bearing sleeve 41 against the pressure of the spring 34 to an uppermost position, as illustrated in Fig. 13, and, in the alternate position, is adapted to rest upon the upper surface portion of the lever 18 which borders the bearing sleeve 41.

As in the previously described embodiment, the mount and slide assembly 12-15 is constantly biased in the counterclockwise swinging direction and tends to swing the slide carried idler wheel to resiliently maintain peripheral engagement with one or the other driving roller steps 5 and 6 disposed at the level to which the tread of the idler wheel 4 is at the time.

The presently described embodiment is largely distinguished from the described first embodiment by the fact that the compression spring 34, in the present embodiment, constantly exerts a downward thrust upon the upper side of the mount 12, instead of an upwardly directed thrust and, by virtue of this fact, the cam 21 is so formed and disposed as to lift the mount against the pressure of said spring 34 when the idler wheel is to be lifted from the level of the larger and lower driving roller step 5, as viewed in Fig. 19, to the level of the uppermost roller step 6, as viewed in Fig. 20.

Although the disclosure of the first described embodiment contemplates such reversed position of and direction of pressure exerted by the compression spring, which would necessitate an inverting of the cam element 78 together with other obvious changes, I have chosen, in this second embodiment, to employ a cam element 21 of somewhat different form than that shown at 78 in the first described embodiment. Therefore, in the presently described embodiment, the cam element 21 is an extension of the rear end 19g of the hand lever 19 and is in the form of a sheet metal strip suitably bent at two intermediate portions of its length to provide the differently directed portions 40a, 40b and 40c, the portion 40a comprising the camming portion and being of the nature of an upstanding flange of said lever portion 19g.

Figs. 12, 15 and 16 best show the camming element 21, Fig. 12 showing, by dotted lines, the position of the camming element, as illustrated in side elevational view in Fig. 16, and Fig. 15 being a side elevational view of the camming element in the solid line position of Fig. 12.

With the apparatus of Figs. 10 to 20 inclusive in the initial adjusted position wherein the periphery of the idler roller 4 is resiliently pressed into lateral engagement with the lowermost larger step 5 of the motor roller 3 by the effect of the spring 42, said idler being concurrently pressed by the same spring to engagement with the inner annular surface of the pendant flange 2 of the turntable, the cooperative operation of the various parts resulting from a movement of

the lever 19 from such position, indicated by solid lines in Fig. 10, will now be described.

The handle 20 being swung in the counterclockwise direction from the solid line position to the dotted line position of Fig. 10 will swing said lever over the indicated angle of swing to move the cam extension 21 of said lever from the solid line position to the dotted line position of said figure.

The resulting movement of the camming surface 21a with reference to the cam follower roller 17 is indicated by the terminal positions of said cam follower and its supporting mount, as shown in Figs. 16 and 15.

Fig. 16 shows the initial position with the roller 17 resting upon a relatively lower portion 47 of the cam surface 21a, this view illustrating the relative positions of the cam, follower and mount when the idler wheel 4 is in engagement with the lower and larger step 5 of the roller 3, as shown in Figs. 1, 11, 14, 17 and 19.

Movement of the cam 21 in a counterclockwise direction, as viewed in Fig. 10, will cause the cam surface 21 to move towards the right, as viewed in Fig. 16, and such movement will cause the cam follower to rise until ultimately it passes over the crest of said cam surface, subsequently reaching the uppermost position illustrated in Fig. 15 wherein it is shown seated in the notch seat 21f on the upper edge portion of said cam element.

Such elevation of the cam follower 17 together with the mount 12 against the opposing pressure of the compression spring 24 elevates the idler wheel 4 from the lowermost position, as illustrated in Figs. 11, 14, 17 and 19, to its uppermost position, as illustrated in Figs. 18 and 20.

Concurrently, as the idler wheel 4 is being elevated above the level of the uppermost step surface at the end of the larger roller step 5, the spring 42 will swing the mount 12 about the post 10 and such swinging movement will permit the spring 42 to press the idler wheel inwardly of the periphery of the larger roller step 5 and into engagement with the uppermost step 6.

Meanwhile the spring 42 will resiliently maintain the slide 15 in such relatively longitudinal extended position, with respect to the mount 12, as required to maintain the periphery of the idler wheel pressed in engagement with the inner surface of the turntable flange 2.

All operative outward movements of the slide 15 will be effected without engagement of the pin 14 carried by one of the slide arms with the adjacent end surface of the mount, the purpose of said pin being to retain the slide and mount in desired assembled relationship when the turntable is removed for any reason and prior to the placement of the turntable.

The motor 9, being energized, will now frictionally drive the idler wheel by the effect of the spring pressed engagement of the wheel tread with the uppermost small step 6 during all times that the handle 20 of the controller lever 19 is in the dotted line position of Fig. 10. When the operator desires to again drive the turntable at the higher speed of 78 R. P. M., instead of the low speed of 35 R. P. M., the handle 20 of the lever 19 will then be manually swung clockwise to the indicated position "78" of Fig. 1.

Such swinging of said controller lever will, of course, move the cam 21, which has supported the mount by the cam follower 17 resting upon the uppermost notch 21f, towards the left, as viewed in Fig. 15, and such amount of movement of the lever 19 as will cause the cam follower 17 to engage the upper end portion of the cam sur-

face 21n will also be sufficient to move the extreme end surface 21x of said cam element 21 into lateral engagement with the mount and slide assembly, as illustrated in Fig. 12, where said cam end 21x is shown in engagement with the lateral surface of the adjacent slide arm and, when such engagement is effected, the slide, and therefore the wheel carrying mount, will be caused to swing about the post 10 to move the periphery of the idler wheel horizontally outwardly beyond the periphery of the larger and lowermost step 5 of the driving roller 3, while still maintaining the wheel 4 above the upper surface of the larger lower step 5.

Further movement of the lever 19 in the clockwise direction will then move the inclined cam surface 21n towards the left, as viewed in Figs. 15 and 16, so that the spring 34, surrounding the post 10, will press the mount, which carries the cam follower 17, downwardly with the cam follower roller rolling on said cam surface 21n during such descent and the end edge 21x of the cam element 21 which, during this period, remains pressed against the slide 15, having a smooth vertical surface, offers little resistance to the said downward movement of the mount.

After swinging the lever 19 in the slot 48 in the clockwise direction to the limit of said slot, the release of said handle will permit the spring 42 to retractively swing the slide, mount and idler wheel in the counterclockwise direction whereupon the idler wheel 4 will be pressed into engagement with the large step 5 of the driving roller 3, and such movement of the slide will push the lever end 21x to retractively swing the lever 21 from its previous more fully advanced position.

To facilitate upward and inward movement of the tread of the idler wheel over the upper edge corner of the large roller step 5 when shifting from a high speed adjustment to a low speed adjustment, the upper edge corners of said large step are rounded, and also the rubber tread 4' of the idler wheel is so formed as to afford rounded tread surfaces, as indicated at 4', as illustrated, and the shifting of the idler tread over such rounded edge is further facilitated by making the shift during a period when the motor is being operated.

Referring now to the third embodiment of my invention, illustrated in Figs. 21, 22, 23 and 24, in view of the complete disclosure of similar parts illustrated in the foregoing embodiments duplicated herein, no showing is made in the above figures of many of such similar parts.

The hand lever 176 corresponding to the hand levers of the preceding embodiments is adapted to be swung in either direction, as indicated by the arrows 183 in Fig. 21. In this embodiment, however, the mount 167 is not provided with any corresponding lifting or lowering spring, such as the spring 77 of the first embodiment which exerts an upward resilient effort upon the slide 170 carried by the idler wheel mount, or the spring 34 of the second embodiment, which exercises a similar but downward effort upon said mount.

A cam afforded by a sinuous slot 175 through a side wall of the mount hub 174 affords two parallel border edge camming surfaces between which a camming element in the form of an elongated circular head 186' of a cam pin or machine screw 186 is disposed, the threaded stem end of said screw being rigidly secured within a threaded recess of a tubular extension 164 of the hand lever 176 whereby said head 186'

in effect becomes a cam and the mount hub 174 becomes a cam follower.

A fragment only of the operating adjustment lever in this embodiment is shown at 176 and oscillatory swinging thereof is effective to rotatively oscillate the cylindrical post 151 together with the cam pin 186 which affords a cylindrical cam end surface portion 186'.

The shape of the arcuate slot 175 and its two opposed camming surfaces 175a and 175b is preferably the same as that afforded by the diagonal camming edge 85 and terminal lands 87 and 88 of the above described first embodiment, and the drawings are intended to so illustrate the same.

A helical tension spring 168 corresponding to the spring 68 of the first embodiment is also employed in the embodiment of Figs. 8, 9 and 10 together with a corresponding two step driving roller having a lower step 173 of larger diameter and a step 172 of smaller diameter.

The apparatus of the third embodiment will be readily understood from the foregoing description of the other embodiments, in view of the following narrative which is specific to the apparatus and mode of operation thereof.

Figs. 21 and 22 illustrate the idler wheel in one alternative adjusted operative position wherein the tread 160 of the idler wheel is resiliently maintained by the spring 168 in engagement with the uppermost smaller step 172 of the motor shaft driving roller which also is provided with a larger step 173.

Swinging of the controller arm 176 in the direction of the lowermost arm of Fig. 21 will arcuately move the cam pin 186 towards the left, as shown in Fig. 21, until said cam surface 186' engages the upwardly inclined portion of the lowermost camming edge surface 175a of the slot 175 and the lateral component of the thrust exerted by said cam against such inclined surface is at the time predominant, the spring 168 being sufficiently weak, the mount 167 journalled on the tube 151 will be swung in a horizontal plane until the resistance by the spring 168 becomes substantially more resistant to such swinging.

At such time, the swinging movement of the mount will have caused the idler wheel tread to be moved outwardly from the small roller step 172 beyond the peripheral extent of the large roller step 173. When the spring 168 has sufficiently increased its resistance, further outward lateral swinging movement of the mount and idler wheel is prevented, and the vertical component of the pressure exerted by the cam pin 186 against the cam follower surface 175a will then cause the mount hub 174 to be cammed downwardly and the wheel 161 will concurrently be moved downwardly until disposed below the uppermost edge of the larger roller step 173.

At such time, during the final swinging movement of the lever 176, the cam 186' will be at the entrance of the horizontal upper portion 175c of the cam follower slot 175 whereupon the spring 168 will become effective to retractively swing the wheel-carrying slide 170 in such direction as to cause the peripheral tread 160 of the wheel to be moved into spring pressed lateral engagement with the outer surface of the step 173 of the driving roller.

The apparatus now being operative to drive the idler wheel by the larger driving roller step and thus transmit driving torque from the wheel tread to the turntable, the opposite adjustment will now be described.

The lever 176 being horizontally moved in the

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direction of the uppermost arrow 163 of Fig. 21, the cam pin 186 carried by the tube 161, will be swung from the end portion 175c of the slot 175 to cause its cam portion 186' to engage the uppermost cam follower surface 175b of said cam slot.

When the cam surface 186' makes engagement with the downwardly inclined portion of said surface 175b, a horizontal component of the pressure exerted between said cam and inclined follower surface will tend to move the wheel more tightly against the larger step 173, but substantial swinging movement of the wheel being so prevented, the vertical component of the cam pressure will be effective to elevate the wheel until it has risen above the upper portion of the large roller 173 and is disposed at the level of the lower portion of the upper smaller step 172.

The spring 168 then assists the cam pin 186 in bringing the wheel 160 into engagement with the upper smaller step, the cam pin 186 finally coming to rest in the horizontal end portion 175d of the cam slot whereupon the parts become fully restored to the illustrated positions of Figs. 21 and 22.

The relative positioning of the turntable flange between which and the driving roller 172—173, the idler wheel 161 is interposed, is the same as in the other embodiments, and reference to the drawings thereof will convey a complete understanding thereof.

Having described my invention in three different embodiments, I am aware that numerous and extensive departures may be made from the illustrated embodiments including variously combining different features of the said different embodiments but without departing from the spirit of my invention and the scope of the appended claims.

I claim:

1. The combination with a peripherally flanged phonographic turntable and a motor disposed therebelow, said motor provided with an upwardly directed power shaft upwardly formed to provide two superposed steps of different diameters disposed within the vertical limits of said flange, an idler friction wheel adapted for horizontal floating movements and vertical adjustment movements, spring means biasing said wheel horizontally towards said shaft steps and said flange, a manually operable adjustment device comprising a movable controller adjustably movable in a non-stepped path between two extreme adjustment positions, camming mechanism comprising a cam and a cam follower, said cam movable responsive to movement of said controller from an initial to an alternate adjustment position and adapted to cammingly adjustably move said cam follower so as to cause it to successively move said wheel from engagement with a pre-engaged shaft step, and to shift it to the plane of the alternate step, including means operative responsive to a final portion of said adjustment movement of said controller adapted to free said wheel to permit movement thereof horizontally inwardly towards, and to effect peripheral frictional engagement with said alternate step, responsive to the retractive effect of said spring means.

2. The combination with a phonographic turntable and a motor disposed therebelow, said motor provided with a power shaft comprising two axially aligned adjacent driving step portions of different diameters, a friction idler wheel, said turntable affording an annular driving surface

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having a width which is at least double the width of a peripheral portion of said wheel, said shaft portions and a portion of said driving surface being interspaced a distance which is less than the diameter of said wheel, spring means to alternately adjust said wheel for simultaneous frictional peripheral engagement with said annular surface and either of said peripheral driving step portions, a manually operable adjustment device comprising a movable controller adjustably movable in a non-stepped path between two extreme adjustment positions, camming mechanism comprising a cam and a cam follower, said cam movable responsive to movement of said controller from an initial to the alternate adjustment position adapted to cammingly adjustably move said cam follower so as to cause it to successively move said wheel from engagement with a pre-engaged shaft step, and to shift it to the plane of the alternate step, including means operative responsive to a final portion of said adjustment movement of said controller adapted to free said wheel, to permit movement thereof horizontally inwardly towards, and to effect peripheral frictional engagement with said alternate step and with said annular surface of the turntable responsive to the retractive effect of said spring means.

3. In a friction drive for phonographic turntables of the type comprising a horizontally disposed idler wheel interposed between and peripherally engaged with a motor shaft driving roller and an annular surface portion of said turntable, a spring for resiliently maintaining said engagement, and a mount carrying said wheel nearest one end and being pivoted for swinging movement nearest the other end, said spring resiliently constraining the wheel carrying end of said mount toward one swinging direction, the combination with said wheel, spring, mount, roller and flange with said roller characterized by having two relatively stepped, axially aligned, friction driving roller portions of different diameters, a manually operable change speed controller comprising a handle alternately movable between limits in opposite directions in a path of substantially uniformly like nature, a pair of respectively cam and cam follower elements, one of said elements being movable in opposite directions responsive to corresponding movements of said handle and the other element adapted to be cammingly moved responsive to movement of the first element, said latter element adapted to communicate movement to said mount to displace said wheel from engagement with a pre-engaged roller step and to effect movement of said wheel to the plane of the other roller step and said camming mechanism comprising means adapted to effect release of said wheel at said plane to permit said spring to retractively effect engagement of said wheel with said other roller step.

4. The friction drive substantially as set forth in claim 3 characterized by one of the elements of said camming mechanisms being provided with a surface having an intermediate inclined portion and substantially parallel end portions, and the other element thereof comprising a part adapted to relatively traverse the said surfaces of the first element.

5. The friction drive substantially as set forth in claim 3 characterized by the provision of means resiliently biasing said mount to position said wheel towards the plane of one of said roller steps and said camming mechanism when operated by

movement imparted thereto by said controller handle moved in one direction to cammingly so displace said mount as to position said wheel in the plane of the other roller step.

6. The combination with a phonographic turntable and a motor disposed therebelow, said motor provided with a motor shaft formed to provide two relatively axially aligned steps of different diameters, an idler friction wheel adapted for disposition between an annular surface of said turntable and alternately with one or the other of said steps, spring means biasing said wheel towards said shaft steps and said annular surface, a manually operable adjustment device comprising a movable controller adjustably movable in a non-stepped path between two extreme adjustment positions, camming mechanism comprising a cam and a cam follower, said cam movable responsive to movement of said controller from an initial to an alternate adjustment position and adapted to cammingly adjustably move said cam follower so as to cause it to successively move said wheel from engagement with a pre-engaged shaft step, and to shift it to the plane of the alternate step, said mechanism including means operative responsive to a final portion of said adjustment movement of said controller adapted to free said wheel to permit movement thereof inwardly towards, and to effect peripheral frictional engagement thereof with said alternate step, responsive to the retractive effect of said spring means.

7. In a friction drive for phonograph turntables of the type provided with a motor having a stepped shaft provided with a pair of axially aligned driving steps of relatively different diameters, a friction wheel rotatable on an axis parallel to the shaft axis and in peripheral engagement with the turntable, and mounted for movement for interchangeable engagement with any one of said steps, spring means for resiliently biasing said wheel laterally towards said stepped shaft, the combination with the above recited friction drive parts of a controller of mechanism comprising a manually operable control member, relatively interengaging cam and cam follower elements movable in opposite directions in a substantially non-stepped path, said follower element associated and movable with said wheel and said cam element and movable with said member, said elements having interengaging camming surfaces being correlatively so formed as to cause said cam when moved by said member to communicate a lateral component of camming thrust upon said follower for moving said wheel in such a direction at right angles to its axis as to disengage its periphery in opposition to the pressure of said spring from a preengaged shaft step and another component of thrust effective to move said wheel axially in such direction as to shift its periphery to the plane of an alternate step, and the portion of said cam and follower surfaces which are in relative engagement at the time said wheel is shifted to said plane comprising a land of one of said elements effective to maintain said wheel in said plane and being ineffective to oppose the retractive effort of said spring whereby said wheel is moved by said spring into engagement with said alternate step.

8. The combination with a peripherally flanged phonographic turntable and a motor disposed therebelow, said motor provided with an upwardly directed power shaft upwardly formed to provide two superposed steps of different diam-

eters disposed within the vertical limits of said flange, an idler friction wheel adapted for horizontal floating movements and vertical adjusting movements, spring means biasing said wheel horizontally towards said shaft steps and said flange, a manually operable adjustment device comprising a movable controller arcuately adjustably movable between two extreme adjustment positions, camming mechanism comprising a camming element alternately movable by said controller in alternate horizontal directions and a second cam follower element interconnected with said wheel, the first recited element comprising a cam surface extending diagonally upwardly and laterally, said second element adapted for engagement with the first element and to be cammingly actuatable by the lateral component of thrust afforded by movement of said inclined cam surface of said first element against said second element to first laterally move said wheel out of engagement with a pre-engaged shaft step, and means affording an obstruction to further movement of said wheel adapted to effect elevation of said wheel to the level of the alternate step in response to the vertical component of effort afforded by engagement of said moving cam surface with said follower, and means operative responsive to a final portion of said adjustable movement of said controller adapted to free said wheel for free unrestrained movement horizontally inwardly to make peripheral frictional engagement with said alternate step responsive to the biasing effect of said spring means.

9. The combination with a peripherally flanged phonographic turntable and a motor disposed therebelow, said motor provided with an upwardly directed power shaft upwardly formed to provide two superposed steps of different diameters disposed within the vertical limits of said flange, an idler friction wheel, a carrier for said wheel adapted for horizontal floating movements and vertical adjusting movements, spring means biasing said carrier to tend to move said wheel horizontally towards said shaft steps and said flange, a manually operable adjustment device comprising a movable controller arcuately adjustably movable between two extreme adjustment positions, camming mechanism comprising an element alternately movable by said controller in alternate horizontal directions and a second element interconnected with said carrier and cammingly actuatable by said first element to successively laterally move said wheel out of engagement with a pre-engaged shaft step, and then to move said wheel to the level of the alternate step, and then to move said wheel to the level of the alternate step, and means operative responsive to a final portion of said adjustable movement of said controller adapted to free said carrier to enable said spring means to effect free unrestrained movement of said wheel horizontally inwardly to make peripheral frictional engagement with said alternate step.

10. The combination of elements substantially as set forth in claim 9 characterised by one of the elements of said cam mechanisms having an upwardly and laterally inclined cam surface disposed for interengagement with the other element thereof and by the provision of a second spring means biasing said carrier towards one of the alternate levels to which said carrier is adjustable.

11. In a phonograph turntable driving mechanism the combination with said turntable

formed to provide an annular friction surface, a motor having a driving shaft provided with superposed axially aligned steps of differing diameters, a friction wheel, a shiftable mount for said wheel adapted for movement in both of two rectilinearly different directions, spring means resiliently biasing said wheel and mount towards a normal position wherein different portions of its periphery are in simultaneous engagement with said turntable surface and that one of said shaft steps which at the time is disposed at the level of the wheel periphery, a manually adjustable lever movable in a path of uniform like nature in both directions, camming mechanism comprising interengaged cam and cam follower elements, one of said elements comprising an element of said mount and the other said element being movable by said lever, said elements being relatively so formed and interengageable as to translate a uniform swinging movement of said handle moved element into successive horizontal and vertical movements of said mount when said handle is moved in one of two alternate directions of movement, to successively swing said mount horizontally to remove the wheel periphery from engagement with a pre-engaged shaft step, and to move said mount vertically to shift said wheel periphery to the level of the alternate wheel step, and thereafter to release said mount for horizontal movement induced by said spring means to engage said wheel periphery with said alternate shaft step.

12. In a friction drive for phonographic turntables of the type comprising a horizontally disposed idler wheel interposed between and peripherally engaged with a motor shaft driving roller and a flange of said turntable, a spring for resiliently maintaining said engagement, and a horizontally and vertically movable mount carrying the wheel, the combination with said wheel, roller and flange, said roller having two relatively stepped, axially-aligned, friction driving roller portions of different diameters, a horizontally movable camming element, manually operable shift means comprising a handle, said handle alternatively movable in opposite directions in a path of uniformly like nature to shift said element from one to another of two laterally disposed positions, said element comprising a cam surface inclined laterally and upwardly from a one end portion to the other end portion and said end portions affording substantially relatively continuing horizontal land surfaces for said cam surface and said land surfaces being relatively laterally and vertically interspaced, a cam follower secured to said mount and engageable with said cam and land surfaces, said element when moved by said handle in either direction adapted to effect camming of said follower from one land surface to the other land surface to successively swing said mounted idler wheel from engagement with a pre-engaged roller step and said other land surface adapted to release said wheel at the new level to permit said spring to retractively effect engagement of said wheel with the said other roller step.

13. In a friction drive for phonograph turntables, a motor, a motor shaft provided with a pair of axially aligned driving steps of different

diameters, a friction wheel in peripheral engagement with the turntable, said turntable shaft and wheel rotatable on parallel axes, a movable mount for said wheel, spring means biasing said wheel to resiliently press the periphery of the wheel laterally towards said shaft, a hand lever adapted to be swung between a pair of spaced limits and means comprising a cam for effecting communication of motion from said lever to said wheel to effect vertical and horizontal moving efforts upon said wheel whereby swinging movement of said lever in one direction is effective to move said wheel periphery from engagement with the smaller of said steps laterally beyond the peripheral limits of the larger step and subsequently to move it vertically into, and to maintain it in, the plane of the larger step against the opposing pressure of said spring and resilient retractive means constantly resiliently biasing said wheel laterally towards said shaft for effecting peripheral engagement of said wheel with the larger step subsequent to movement of said wheel to the plane thereof.

14. In a friction drive for phonograph turntables, a motor, a motor shaft provided with a pair of axially aligned driving steps of different diameters, a friction wheel in peripheral engagement with the turntable, said turntable shaft and wheel rotatable on parallel axes, a movable mount for said wheel, a spring constantly resiliently biasing said wheel vertically towards the plane of the smaller step, a hand lever adapted to be swung between a pair of spaced limits and means comprising a cam for effecting communication of motion from said lever to said wheel to effect vertical and horizontal moving efforts upon said wheel whereby swinging movement of said lever in one direction is effective to so move said mount as to remove said wheel periphery from engagement with the smaller of said steps laterally beyond the peripheral limits of the larger step and subsequently to move it vertically into, and to maintain it in, the plane of the larger step, resilient retractive means constantly resiliently biasing said wheel laterally towards said shaft for effecting peripheral engagement of said wheel with the larger step subsequent to movement of said wheel to the plane thereof, and means comprising said spring adapted when said hand lever is swung in the opposite direction to permit said spring to retractively move said wheel in a vertical direction to restore it to the plane of the smaller step and said lever being effective for the continued movement thereof to release said wheel for movement responsive to the retractive effect of said retractive means in the lateral direction to effect peripheral engagement of said wheel with said smaller step.

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