April 16, 1929. V. H. SEYMER 1,709,748

AUTOMATIC PHONOGRAPH

Filed March 5, 1923 5 Sheets-Sheet 1

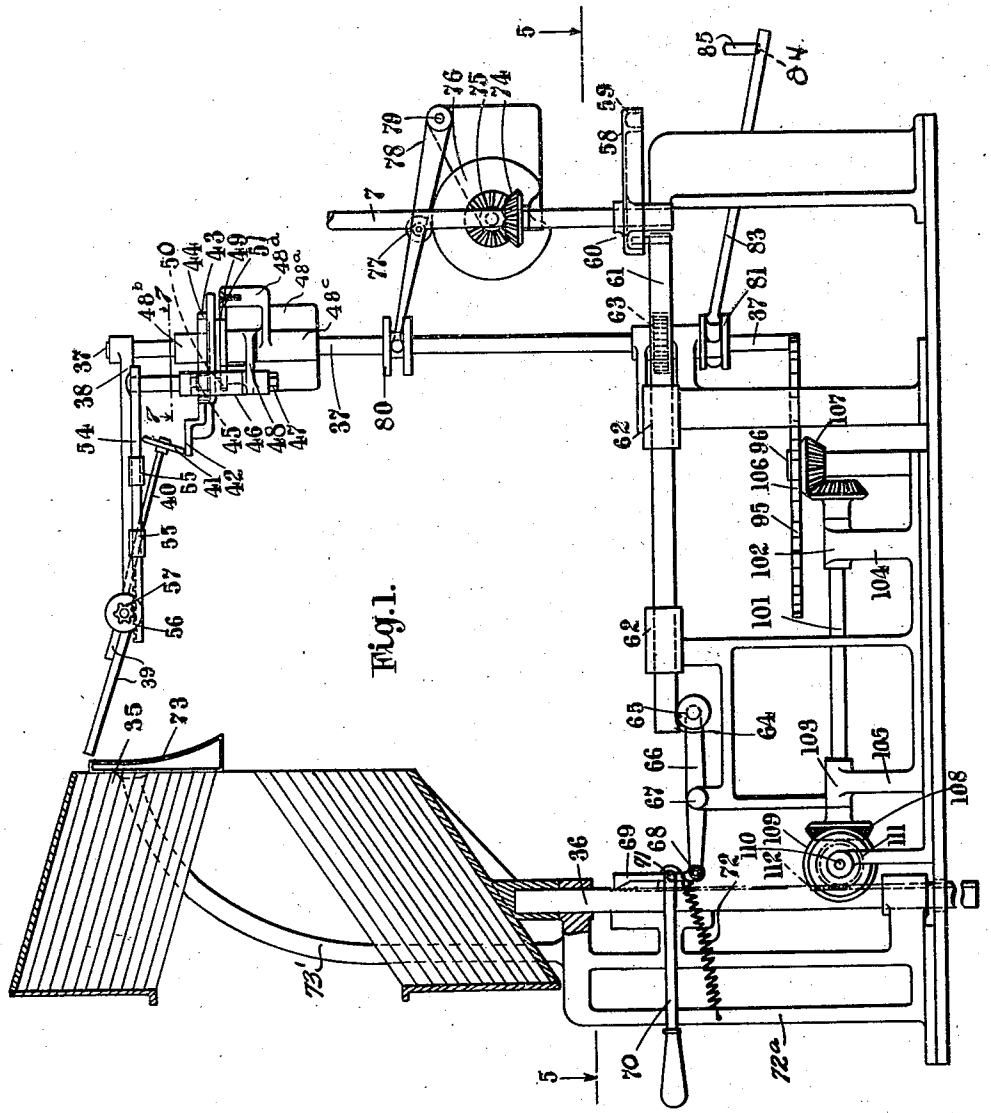


Fig. 1.

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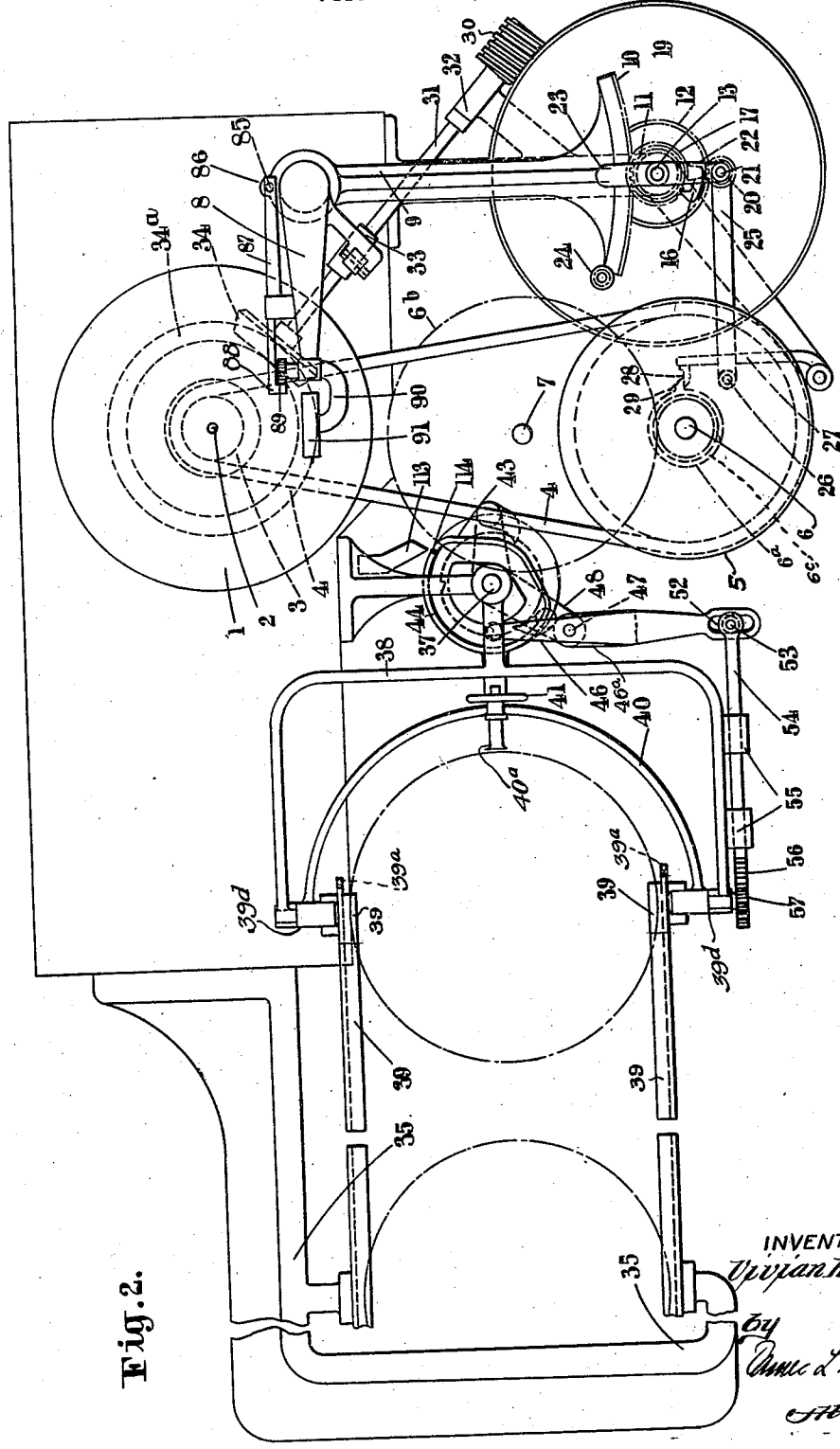


Fig. 2.

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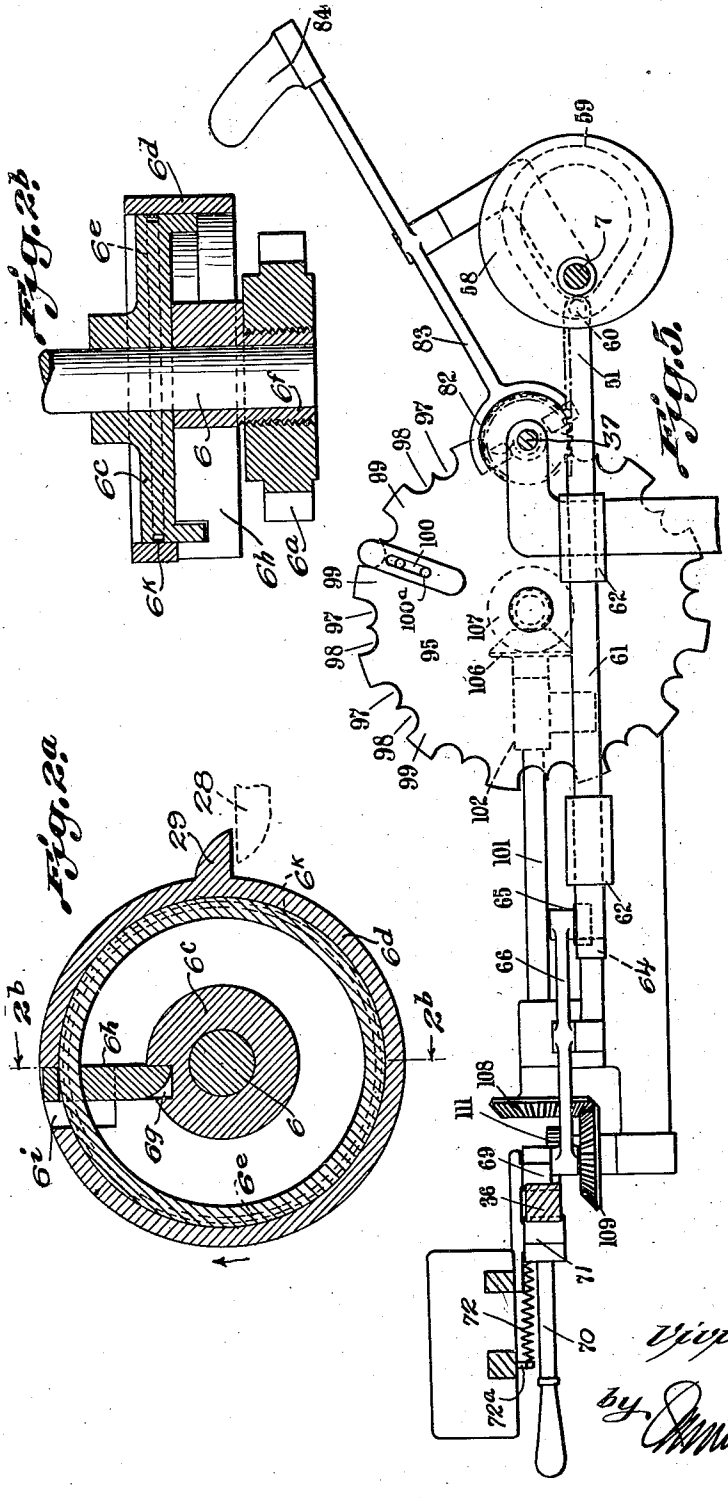


Fig. 2b

Fig. 2

Fig. 2a

Fig. 2c

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Fig. 3.

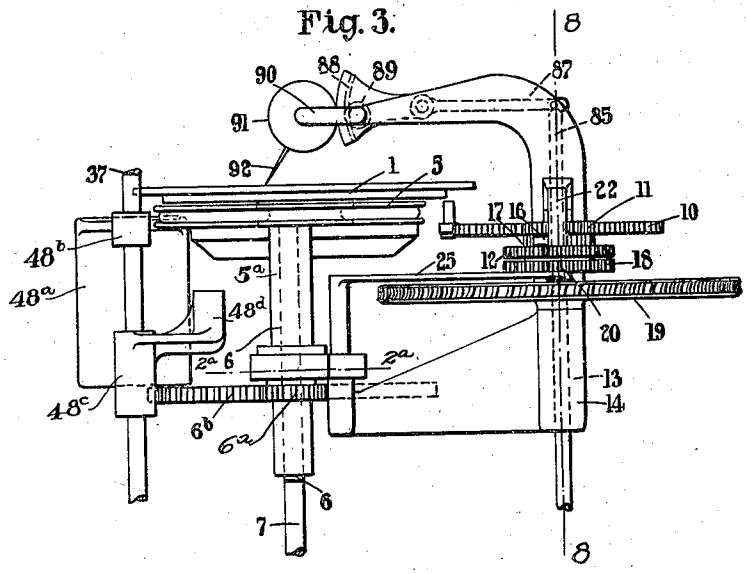
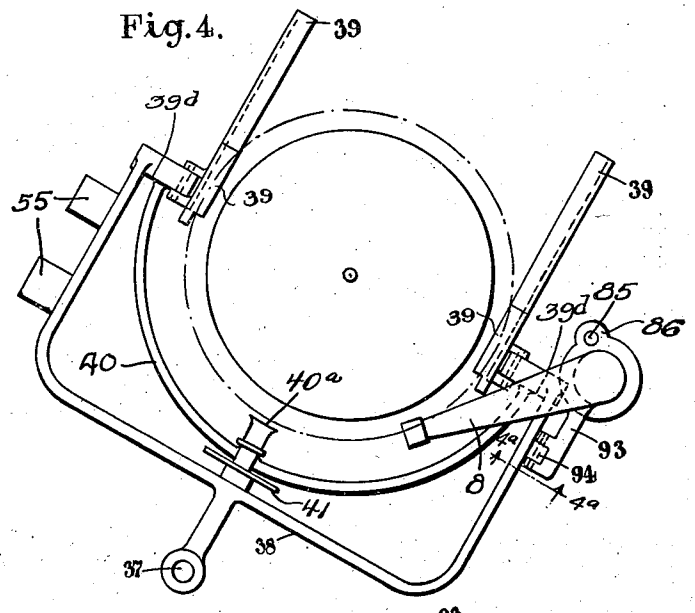
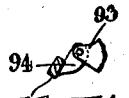


Fig. 4.





38 Fig. 4a

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Fig. 6.

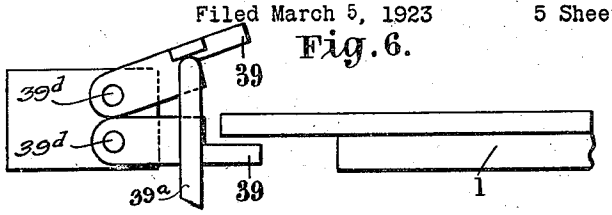


Fig. 7.

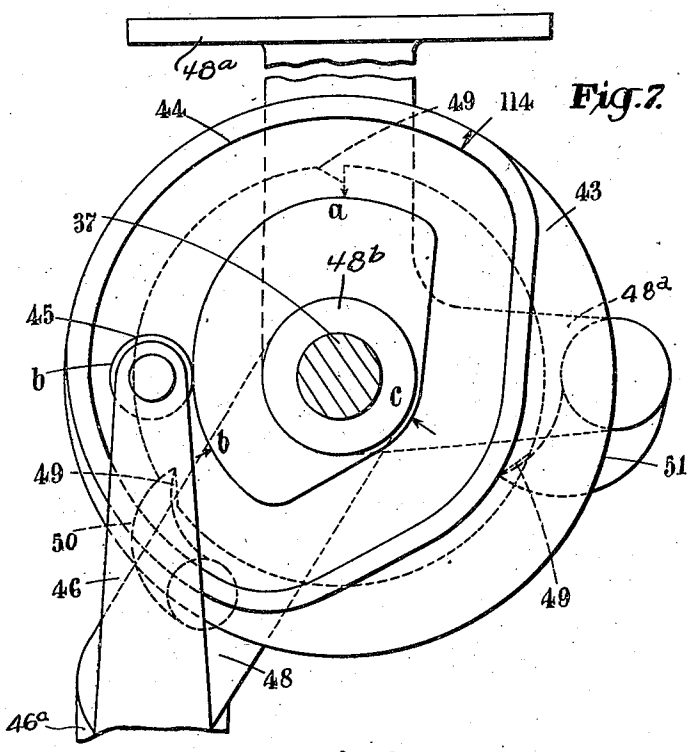
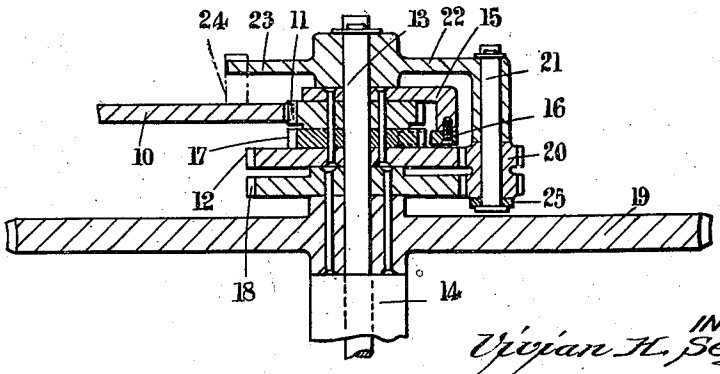


Fig. 8.



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Patented Apr. 16, 1929. 1,709,748

UNITED STATES PATENT OFFICE.

VIVIAN HOME SEYMER, OF LONDON, ENGLAND.

AUTOMATIC PHONOGRAPH.

Application filed March 5, 1923, Serial No. 622,943, and in Great Britain March 11, 1922.

This invention relates to automatic phonographs, and it has for its object to enable such machines to operate continuously for a considerable period of time, playing a series of records automatically and without requiring any attention once the mechanism has been set into motion. The recent introduction of gramophone needles capable of being used upon a considerable number of records without detriment thereto renders it possible to eliminate the necessity for frequently changing the needle.

The invention accordingly comprises means for manipulating the records and also certain elements of the playing mechanism whereby a selected number of records are deposited in succession upon a gramophone turn-table, are played by the instrument, on one side if the record is of the single-sided type and on both sides if it is of the double-sided type each record being removed after completion of its playing contents; the whole cycle of operations being performed automatically.

The control of the apparatus for carrying out this method may be effected mechanically, electrically, or pneumatically, or by any combination thereof.

The gramophone is provided with or connected to means for rotating the turn-table continuously or for as long as desired, and there is arranged, adjacent to the instrument, a container for the records to be played which container is so formed and controlled that it will deliver one record at a time to the instrument at determined periods; and co-operating both with said container and with the gramophone is a carrier device adapted to receive each record discharged from the container and then to be so operated that it will transport the record to and deposit it on the turn-table, transfer it therefrom subsequently, and, if it is a double-sided record, reverse it and replace it upon the turn-table and then transfer it to a second container for used records. If so desired, a single container for unused and used records may be employed.

This container or hopper for the records to be played may be formed with shelves or equivalent supports for the records, which supports may be inclined at such an angle that the records are capable of sliding freely therefrom in turn as the front of each support is brought to a predetermined position by convenient means to elevate the container or hopper intermittently; and other inclined shelves may be provided on to which used records also slide.

The carrier device to receive each record as discharged from the container and to manipulate it before and after it is played may be mounted adjacent to the gramophone turn-table upon a vertical spindle which is moved angularly at predetermined intervals whereby to move or oscillate the carrier device in order to effect the requsite cycle of operations, said spindle also being adjustable axially intermittently in order to position the carrier device.

The angular movement of said spindle may be produced mechanically or otherwise; and upward and downward axial displacement of said spindle and its associated parts may similarly be effected mechanically; the means for producing the required movements being synchronously connected to a common operating mechanism.

The carrier to receive the records is mounted at or near the upper end of said angularly and axially movable spindle and may consist of a curved or forked arm arranged horizontally and formed or provided with holders to support a record when delivered thereto. These holders which are adapted to receive the margins of the records may be pivoted to said curved or forked arm so that they are capable of angular movement relatively thereto in order that they may be presented at the required inclination to receive a record from or deliver it to the container or hopper and also in order that double-sided records may be reversed by means which may be provided for that purpose.

Suitable mechanism may be provided so as to co-act with these pivoted record holders in order to effect their inclination or rotation as may be required.

Provision is made for removing the needle from contact with the record at the conclusion of a piece and also for swinging the tone-arm (and with it the sound box and needle) outwardly so as to position the needle in read-

iness to commence playing the next succeeding record; and means are also provided for controlling the descent of the needle on to a record to be played.

The angular movement of the tone-arm towards the centre of the record is utilized to control the mechanisms for effecting the manipulation of the records, that is, such mechanisms are caused automatically to commence to function directly after the tone arm becomes stationary.

By way of example only, a mechanical arrangement for carrying the invention into practical effect is illustrated in the accompanying drawings which are partially diagrammatic and which omit, for the sake of clearness, to show several portions of the instrument, its casing and framing.

Figure 1 is a side view of the apparatus, omitting part of the mechanism, the casing, certain portions of the framework and other non-essential features of construction, and showing the hopper more or less diagrammatically.

Figure 2 is a plan view, non-essential features again being omitted and the record manipulating device being, for the sake of clearness, shown opposite the record hopper instead of above the turntable.

Figure 2^a is a sectional plan view on the line 2^a—2^a, Fig 3, on an enlarged scale of the preferred clutch mechanism.

Figure 2^b is a vertical section on the line 2^b—2^b, Fig. 2^a, of the same clutch mechanism.

Figure 2^c is a side view of a lever shown in plan view in Figure 2.

Figure 3 is a side elevation of the tone arm and turntable and of certain mechanism associated therewith.

Figure 4 is a detail view, in plan, of the tone arm and a portion of the record manipulating device indicating co-action therebetween for a purpose referred to hereafter.

Figure 4^a is a detail sectional elevation on line 4^a—4^a of Fig. 4 of the latch stop and the support.

Figure 5 is a sectional plan view taken on line 5—5 in Figure 1.

Figure 6 is a rear end view, drawn to an enlarged scale, of one of the pairs of jaws of the record manipulating device, showing also a portion of a record and of the turntable.

Figure 7 is a detail view on line 7—7, Fig. 1, drawn to an enlarged scale, of the cam mechanism controlling the record manipulating device.

Figure 8 is a vertical section on line 8—8, Fig. 3, also drawn to an enlarged scale, of differential gearing controlled by the tone arm.

Referring first to Figures 1, 2 and 3, 1 is the usual turntable mounted on a spindle 2 driven continuously by means not shown and having a pulley 3 mounted thereon around which a belt 4 passes to and over a pulley 5 keyed to a clutch-spindle 6 upon which is carried loosely a single reducing-gear pinion 6^a, operable by clutch mechanism to be described and which meshes with a pinion 6^b carried by the primary spindle 7.

This primary operating spindle 7 serves to impart the requisite motions to the record-manipulating mechanism, to control the positioning of the needle, and also to effect the desired adjustments of a hopper containing and receiving the records; all of which functions are accomplished by means to be hereafter described.

The entire cycle of operations governed by the spindle 7 is controlled by the movement of the tone arm 8 over the surface of the record being played, and this is effected by interposing between the spindle 7 and tone arm 8 the following mechanism.

Solid with the tone arm 8 is an arm 9 at right angles thereto and disposed in a horizontal plane, which arm 9 terminates in a toothed sector 10 engaging a pinion 11 that forms one element of a differential gear the function of which is to control the operation of the aforesaid clutch mechanism.

Referring to Figures 2^a and 2^b, the clutch spindle 6 passes through a clutch mechanism constructed as follows:

An inner clutch member 6^c is keyed to the spindle 6 and therefore rotates constantly with it, and surrounding said inner clutch member 6^c is an outer clutch member or ring 6^d fitting loosely over the member 6^c but held frictionally in contact therewith by means of a light coil spring 6^k, which is accommodated within a peripheral groove 6^e formed in the member 6^c. 6^f is a sleeve arranged loosely on the spindle 6 and terminating in a screw-threaded portion upon which the pinion 6^a is secured. The sleeve 6^f is formed with a recess or slot 6^g cut in its periphery, and in this recess or slot there rides a pawl or detent 6^h, the outer end of which enters a slot 6^i cut in the periphery of the outer clutch ring 6^d. The detent 6^h is recessed at one side so as to overlap or loosely embrace the flanged rim of the inner clutch member 6^c.

This differential gear (see also Figure 8) comprises the pinion 11 which rotates solidly in one direction with a pinion 12, both being mounted freely upon a non-rotatable spindle 13 carried by a fixed bracket 14. Above the pinion 11 is an arm 15 solid therewith and having a detent 16 pivoted at the end thereof which detent engages a ratchet wheel 17 in turn fast with the pinion 12. Below the pinion 12 and mounted freely on shaft 13 is a pinion 18 fast with a worm wheel 19 also free on shaft 13. Both the pinions 12 and 18 mesh with a floating pinion 20 carried by a pin 21 secured on an arm 22 mounted pivotally on the spindle 13 and having

an extension 23 adapted to be engaged by a peg 24 carried by the toothed sector 10 for a purpose to be described hereafter.

The arm 22 also carries a link 25 connected by a pin 26 to a projection formed integral with a latch-arm 27 whereof the nose 28 is adapted to engage a member 29 carried by the clutch ring 6^d.

The worm wheel 19 is driven constantly by means of a worm 30 carried by a shaft 31 supported by brackets 32, 33, and driven by a bevel wheel 34 engaging another bevel wheel 34^a mounted on the spindle 2 below the turntable 1.

The records are carried in a hopper 35 which is divided into two series of compartments of opposite inclination, the upper series being inclined downwardly towards the horizontal plane of the turntable and serving to contain those records which are to be played, and the lower series being inclined downwardly away from said horizontal plane and serving to receive records which have been played.

The hopper 35 is carried by a vertical rack pillar 36 capable of being shifted upwards intermittently by means to be hereafter described, and adjacent said hopper 35 there functions the means for manipulating the records.

This record manipulating means is carried by a vertical spindle 37 which is controlled as to intermittent angular and axial displacements by the movement of the primary spindle 7.

The spindle 37 bears at its upper end a carrier device in order to receive each record as discharged from the hopper 35. This carrier device comprises a forked arm 38 (Figs. 2 and 4) disposed horizontally and supporting, between its two limbs, record holders 39, 39, pivoted at the extremities of the free ends of the forked arm 38 and connected to each other by a semi-circular yoke 40 which has mounted at the middle of its length a roller 41 adapted, when the parts are in the position as shown in Figure 1, to bear upon a supporting lug 42 on a cam 44, referred to herein, and serving to aline the longer members of the record holders 39—39, with a record about to be released from the hopper 35. The buffer 40^a is also carried by the yoke upon the inside opposed to the roller 41 and acts to limit the inward sliding movement of the sound record as it is received between the holders 39.

The holders or combined record guides and clamps 39, 39, each consist of a pair of jaws adapted to grip the margins of the records, the lower member of each pair being considerably longer than the upper member in order that the records may be guided into the jaws from the hopper and such jaws being hinged on their longer sides so that the shorter upper member of each jaw may be moved away from the lower member, as shown in Figure 6 in end view; and said two pairs of jaws are mounted on trunnions 39^d—39^d (Figures 2, 4 and 6) extending horizontally inwards from the extremities of the forked arm 38 and are therefore capable of swivelling about their mountings in order to impart the requisite movements to a record carried by them.

On the spindle 37 and at a short distance below the arm 38 a plate 43 is loosely mounted, in the upper surface of which is formed a cam groove 44, in which rides a roller 45 carried by the upper member of a bifurcated lever 46, the lower member 46^a of which is pivoted at 47 to a lever 48 splined upon and rotatable with the spindle 37, which is vertically slidable through the lever 48.

A bracket 48^a, adapted to be fixed to the casing of the machine or other support not shown in the drawings, is provided and is furnished with two bosses 48^b and 48^c, through which passes the spindle 37, and the lever 48 and plate 43 are mounted between these two bosses. Thus the bracket 48^a supports these members.

The periphery of the lower part of the plate 43 is formed with three notches 49, spaced 120 degrees apart and with which a detent 50 mounted upon the lever 48 is adapted to engage. A second detent 51 mounted upon an arm 48^d projecting from the boss 48^c of the bracket 48^a is also adapted to engage the notches 49 and serves as a non-return device for the plate 43, which is intermittently rotatable in a clockwise direction only, such movement being effected by the rotation of the shaft 37 which carries with it the lever 48 and the detent 50.

The bifurcated lever 46 has a rearward extension of which the extremity is longitudinally slotted at 52 in which slot there rides a pin 53 carried at one extremity of a horizontal rod 54 sliding in brackets 55, 55, formed on or borne by the forked arm 38 and at its opposite extremity said rod 54 is formed with rack teeth 56 meshing with a pinion 57 keyed upon the trunnion carrying the adjacent pair of jaws 39.

The function of the cam groove 44 and its associated mechanism is to impart to the two pairs of record holders or clamps 39, which are interconnected by the yoke 40, angular or tilting movement.

As has already been stated, the spindle 37 is movable intermittently both angularly and axially, the angular movement being required in order to move the forked arm 38 horizontally between the hopper 35 and the turntable 1 for the purpose of manipulating the records thereto or therefrom, and the axial movement being required for moving the forked arm 38 upwardly or downwardly for the purpose of removing a record from or depositing it on the turntable.

Intermittent angular movement is transmitted to spindle 37 by means of a cam-oper-

ated rack-and-pinion mechanism consisting of a cam plate 58 keyed upon the primary spindle 7 and having formed in it at its underside a cam groove 59 in which rides a roller 60 carried on a pin at one extremity of a sliding bar 61 borne by brackets 62, 62, and being formed for a portion of its length with rack teeth (four of which are shown in full lines and the remainder in dot- and dash-lines) engaging a pinion 63 splined upon spindle 37. The bar 61 is prolonged and its other extremity is formed at its underside with a step 64 adapted to ride over a roller 65 carried at one end of a lever 66 pivoted at 67 to a suitable fixed support and whereof the other end is linked at 68 to a detent 69 engaging the rack teeth on one side of the pillar 36 whereby the hopper 35 is raised intermittently. An operating handle 70 is pivoted at 71 to detent 69, the latter being anchored by a spring 72 to a member 72^a of the machine frame to maintain it normally in engagement with the rack teeth on the pillar 36, and in order that the hopper 35 may be lowered by hand, when desired, into the bottom or starting position, said operating handle 70 is pushed toward the detent 69 to move it angularly and disengage it from the pillar 36.

Opposite the upper part of the hopper 35 and supported in a stationary position by a support 73' independently of the hopper 35, there is a fixed lip or guard plate 73 mounted on the main casing of the machine and relatively to which the hopper is moved vertically and which holds back all the records below that one which is to be delivered.

Movement in an axial direction of the spindle 37 is effected from the primary spindle 7 by means of a bevel pinion 74 keyed to spindle 7 and meshing with a second bevel pinion 75 keyed to a horizontal arbour and formed integral with a cam 76 upon which rides a roller 77 carried by a lever 78 pivoted at 79 to a fixed point and having its free end forked to engage a grooved collar 80 keyed to the spindle 37.

The cam 76 is formed peripherally with a comparatively deep indentation into which the roller 77 descends in order to enable the spindle 37 to assume its lowermost position, and the profile of the remainder of the cam is concentric with its arbour. Rotation of the cam therefore moves the lever 78 angularly and consequently raises or lowers the spindle 37 at the required times.

Near the lower end of the spindle 37 there is keyed a second grooved collar 81 with which the forked end 82 of a pivoted arm 83 engages. The opposite end of this arm 83 is formed with a curved plate 84 (Fig. 5) which serves as a footstep for a push rod 85 adapted to slide vertically in guides 86 (see Figs. 2 and 4) borne by the tone arm 8 or an extension thereon. The upper extremity of said push rod 85, is connected to the pivoted lever 87 having an internally toothed sector 88 (see Fig. 3) at its extremity engaging with a pinion 89, and serves to impart angular movement to the "swan-neck" 90 of the tone arm 8 to which neck the pinion 89 is attached. By this means, sound box 91 and with it the needle 92 may be raised from or lowered into contact with a record.

The tone arm 8 is formed with a laterally projecting bracket 93 (Fig. 4) upon which a trip catch or latch-stop 94 (Figure 4^a) is pivoted which catch or stop is adapted to be contacted with by the forked arm 38 while moving horizontally to convey a record to the turntable, the object of this contact being to move the tone arm 8 into the correct position preparatory to playing a record, so that the needle 92 is immediately above the initial groove of the next record when it is placed on the turntable.

When placing a record on the turntable, the final movement of the spindle 37 and forked arm 38 is downwards, and this carries the forked arm slightly below the horizontal plane traversed by the latch-stop 94 as the tone-arm 8 moves during the playing of the record, so that the latch-stop 94 is free to partake of the movement of the tone-arm which carries it over the forked arm 38.

When removing a played record from the turntable, the forked arm 38 rises again (the tone arm 8 having also been moved angularly upward to withdraw the needle from the record) and as it swings toward the hopper 35 contacts with the inclined end of the latch-stop 94 and raises said latch stop which then drops back into place by gravity after the arm 38 has passed it.

As has already been stated, the apparatus is designed to enable either single-sided or double-sided records to be played and manifestly the action of the parts must be controlled accordingly, that is to say the downward axial movement of the spindle 37 must be checked at certain intervals if the records are single sided whereas it is unchecked at such intervals in cases where the records are double-sided, as will be apparent hereafter.

In order therefore to obtain this control over the downward axial movement of the spindle 37 a notched selector plate or disc 95 is mounted upon a vertical arbour 96 in such a position that the edge of the disc 95 is located vertically below the foot of the spindle 37.

Notches 97, 98, are formed in pairs peripherally of the disc 95 and such pairs of notches are separated by solid portions 99 which are adapted to prevent downward axial movement of the spindle 37 at certain predetermined periods.

The pairs of notches permit downward axial movement of the spindle 37 when the disc is rotated to present such notches be-

neath the spindle; notch 97 functioning when one side of the record for the time being on the turntable is uppermost and a notch 98 functioning when the opposite side of such record is uppermost.

If the record to be played be a single sided record, the axial movement of spindle 37 permitted by a notch 98 is unnecessary and to prevent it the selector disc 95 is provided in conjunction with each notch 98 with a slotted obturator 100 (only one of which is shown). Each obturator has a longitudinal slot within which work pins 100^a carried by the disc 95, so that the obturators may be slid radially of the disc to obstruct the required notch 98.

The selector disc 95 is rotated intermittently by means of a shaft 101 mounted horizontally in bearings 102, 103, carried by pedestals 104, 105, and at one end said shaft 101 carries a mitre wheel 106 which meshes with a mitre wheel 107 keyed to the arbour 96. At its opposite end, the shaft 101 carries another mitre wheel 108 that meshes with a mitre wheel 109 carried by a horizontal arbour 110 and having rotatable therewith a pinion 111 which meshes with rack teeth 112 formed on the foot of the pillar 36. Thus the rotation of the selector disc 95 is effected by the raising of the hopper 35 containing the records.

The above described apparatus operates in the following manner:—

Assume that the hopper 35 is in its lowermost position, that it is filled with double-sided records, that no record is on the turntable, and that the turntable is at rest.

At a suitable place on the casing of the machine there is a fixed index 113 (Fig. 2) bearing the word "Start", and with this index 113 a mark 114 borne by the cam plate 43 should register before the apparatus is put into operation. If the mark and index do not register the forked arm 38 may be oscillated by hand within its full limits of travel to cause the cam plate 43 to revolve until the marks are in registration.

Although not so shown in the drawings (for purposes of clearness) the normal or starting position of the forked arm 38 is above the turntable 1.

The turntable 1 is now set in motion (by electrical or other appropriate driving means), at which moment the spindle 37 is resting on a solid portion 99 of the selector disc 95 and therefore is supporting, by means of the push rod 85, the needle 92 freely above the turntable; the tone arm 8 and consequently the sector 10 being stationary and the worm wheel 19 being driven will cause the arm 22 with its pinion 20 to move round the pinions 12 and 18 thus withdrawing the latch arm 27 from contact with the member 29 on the clutch-ring 6^d.

When the clutch mechanism is not in operation the clutch-ring 6^d is at rest and is prevented from rotating by the contact between two parts referred to hereafter; the detent 6^h occupying a position normal to the flanged edge of the inner clutch member 6^c. Thus the only revolving parts are the spindle 6 and the inner member 6^c.

It will be observed that the base of the detent 6^h is curved on one side and this is to enable the detent, when allowed to do so, to move forward.

When the nose 28 is withdrawn from contact with the member 29, the clutch-ring 6^d tends to revolve with the inner member 6^c, owing to the friction induced by the coil-spring 6^k accommodated in the groove 6^e, and the face of the slot 6^i in ring 6^d butts against the detent 6^h, forcing the outer end of said detent in the direction of rotation and locking the detent against the flanged edge of the inner member 6^c. The rotary motion of the inner member 6^c is thereby transmitted through the detent 6^h to the sleeve 6^f and therefore also to the pinion 6^a, from which the power is taken off to the spindle 7 by means of pinion 6^b thereon.

The clutch mechanism which is of the one-revolution type, thus puts the primary spindle 7 into driving engagement with the pulley 5, and the spindle 7 is thereby caused to rotate. With the rotation of the spindle 7 the cam plate 58 is set in motion and moves the bar 61 and its rack teeth cause the pinion 63 to rotate and hence also the shaft 37.

This initial angular movement of the spindle 37 carries the forked arm 38 from its position over the turntable through an angle of 120 degrees into a position in which the holders 39, 39, face the hopper 35; the holders 39, 39, being presented at the same inclination as that of the record firstly by the contour of the cam groove 44 and secondly by the weighted roller 41 tilting the yoke 40.

As the movement of the bar 61 is being completed, the hopper 35 is raised one notch by the passage of the step 64 over the roller 65 raising the mouth of the uppermost record compartment above the level of the guard plate 73 when the top record immediately commences to slide by gravity out of the hopper; the commencement of movement of the record being so timed as to take place just prior to the positioning of the holders 39, 39, in front of the hopper.

The record to be played therefore slides freely down into the jaws 39, 39, until arrested by the yoke 40.

Further movement of the cam 58 causes the bar 61 to reverse its direction of movement and thereby to move the spindle 37 so as to return the forked arm 38 into position above the turntable, and when this position is reached the indentation on the cam 76 is presented below the roller 77, the raising of the hopper 35 having already caused

the selector disc 95 to rotate until the first notch 97 is below the spindle 37, whereby the spindle 37 and with it the forked arm 38 are permitted to move axially downward and thereby the record is deposited on to the turntable 1.

The lowermost position of the spindle 37 is so adjusted that the lower members of the jaws 39, 39, are positioned below the level of the upper surface of the turntable and the upper members of the jaws 39, 39, are brought into contact with fixed stops 39^a (Fig. 6) so as to remove these members from the upper surface of the record leaving the latter free to rotate with the turntable.

It will be remembered that the forked arm 38 in assuming its place or "play" position above the turntable has already positioned the tone arm 8 with the needle above the initial groove of the record, and as the spindle 37 falls it operates the push rod 85 to cause the swan-neck 90 to be moved angularly towards the record until the needle is gently placed in contact therewith. The tone arm 8, in taking up its position with the needle above the initial groove in the record, has simultaneously moved the arm 9 until the pin 24 has contacted with the extension 23 and has pushed the link 25 and with it the nose 28 on latch arm 27 into engagement with the member on clutch-ring 6^d whereby the clutch mechanism is thrown out of action.

In addition, the angular movement into the "play" position of the forked arm 38 and consequential angular movement of the spindle 37 has caused rotation of the cam plate 43 and groove 44 through 120 degrees thus replacing the profile *a*—*b* of 120 degrees extent by a partially concentric partially inclined profile *b*—*c* of 120 degrees extent to be traversed by the roller 45 during the next succeeding angular movement of the forked arm 38 away from the turntable.

The engagement of the needle with the grooves in the record immediately causes the tone arm to commence to move radially inwards of the record and the relative movement of the differential gearing to cease, thereby rendering the clutch mechanism inoperative.

Meanwhile the record continues to rotate until completed.

On completion of the playing of the record the tone arm 8 ceases to move inwards, owing to the cessation of the grooves on the record, and the differential gearing re-commences to function causing the spindle 37 to be moved axially upwards carrying with it the forked arm 38 and thereby lifting the record off the turntable at which moment the roller 45 commences to traverse the aforesaid profile *b*—*c* of the cam groove 44. When the roller 45 reaches a point midway between *b* and *c* in groove 44 angular movement is imparted to the bifurcated lever 46 causing the rack rod 54 to be moved thereby rotating the pinion 57 and consequently also rotating the record holders 39, 39, through an angle of 180 degrees while the forked arm 38 is travelling from a position midway between the turntable 1 and its final position in front of the hopper 35. This reverses the record.

During the final stage of this turn the hopper 35 is raised by one tooth through its operating mechanism, and the selector disc 95 is advanced to present notch 98 beneath spindle 37.

Immediately thereafter the forked arm 38 carrying the reversed record holders 39, 39, is caused by the cam groove 59, the rack 61 and the pinion 63 to return to the position above the turntable and to deposit the record thereon by means of the cam 76 and its associated mechanism already described. At the same time the forked arm 38 and spindle 37 in this return movement carry with them the cam plate 43 and thereby present the profile *c*—*a* of 120 degrees extent to be traversed by the roller 45 during the next succeeding movement of the forked arm.

The second side of the record is then played and on completion the next step is to remove and eject the record into one of the inclined compartments at the lower part of the hopper 35.

The removal of the record from the turntable and the return of the forked arm 38 to a position in front of the hopper are effected in the manner and by the mechanism already referred to.

On arrival of the forked arm 38 at a position midway between the turntable and the hopper, the roller 45 enters the steeply inclined portion of the cam profile *c*—*a* which causes the bifurcated lever 46 and its associated mechanism to operate the forked arm 38 so as to rotate the record holders 39, 39, upwardly again reversing the second time played record, and then incline the holders downwardly whereupon the record slides by gravity into the hopper 35. Thus it will be apparent that the forked arm 38 only rotates in a horizontal plane, as the spindle 37 rotates, and it moves in a vertical plane when the spindle 37 is displaced longitudinally or axially.

After the record has been ejected the forked arm 38 is moved over the turntable 1 with the holders 39, 39, still at the "eject" inclination, the solid portion 99 of the selector plate 95 being now below the spindle 37 so that no mechanism is put into train by this movement, but the cam 43 has been turned through 120 degrees thus presenting the profile *a*—*b* to the roller 45 as the forked arm 38 begins to return towards the hopper. When this return of the forked arm 38 commences the cycle of operations recommences therewith and is repeated automatically until all of the records to be played are ex-

hausted when the apparatus may be stopped and the hopper re-filled if desired.

There remains to be described the means whereby single-sided records may be played. In the main the whole mechanism functions as already specified, the sole exception being that the second downward axial movement of the spindle 37 required for a double-sided record does not take place and may be prevented for all or any one of the records of the series. Thus, for example, if the third record to be played is single-sided, an obturator 100 is slid over the notch 98 appropriate to that record which will support the spindle 37 when the selector disc moves that notch beneath it.

The effect of this is that after the record has been played it is turned exactly as in a double-sided record but is not deposited on the turntable so that the tone arm remains stationary and the differential gearing continues to function causing the forked arm 38 to return to the hopper 35 and eject the record thereinto.

Various modifications may be made without departing from the spirit of the invention.

What I claim is:

1. Apparatus for playing automatically a series of gramophone records comprising a turntable, a container for records to be played, said container being located adjacent to said turntable, a carrier device to receive individual records from said container and to transport each in turn to and deposit it on and subsequently remove it from said turntable, means associated with said carrier device for reversing the record within said carrier device immediately after one side thereof has been played, means to cause said carrier device to replace a reversed record at once upon the turntable, a container for played records, means to cause said carrier device to deliver played records to the latter container, a tone arm associated with said turntable, a needle carried by said tone arm, and means for manipulating said tone arm and the needle consistently with said cycle of operations.

2. Apparatus for playing automatically a series of gramophone records comprising a continuously rotating gramophone turntable, a record container adjacent to said turntable, said container being adapted to deliver to said turntable individual records to be played, a tone arm associated with said turntable, a needle carried by said tone arm, a record carrier device, means controlled by said tone arm intermittently moving said carrier device into position to receive individual records from said container and to cause said carrier device to transport such records successively to and deposit same on and subsequently remove them from said turntable, means associated with said carrier device to reverse a record within said carrier device immediately after one side thereof has been played, means to cause said carrier device to replace a reversed record at once upon the turntable, a container for played records, means to cause said carrier device to deliver played records to the latter container, and means for actuating said tone arm and said needle consistently with said cycle of operations.

3. Apparatus for playing automatically a series of gramophone records comprising a continuously rotating gramophone turntable, a container for records adjacent to said turntable, said container being operated intermittently to deliver individual records to be played, a second container, a carrier-device also operated intermittently to receive each record and transport same to and deposit it on and subsequently remove it from said turntable, means associated with said carrier device to reverse a double-sided record within said carrier device immediately after one side thereof has been played, means to cause said carrier device to replace a reversed record at once upon the turntable, means to cause said carrier device to deliver played records to said second container, a tone arm, a needle carried by said tone arm, the intermittent operation of said container and said carrier device being controlled by the movement of said tone arm, and means for actuating said tone arm and said needle consistently with said cycle of operations.

4. In combination with a gramophone, a carrier for transporting a succession of records to and from said gramophone, a spindle supporting said carrier, means for imparting intermittent angular movement and intermittent axial movement to said carrier to position said carrier device in accordance with successive stages in the cycle of operations, and means co-operating with said carrier device to cause a double-sided gramophone record supported thereby to be reversed in order to present the opposite side thereof in playing position.

5. In combination with a gramophone, means for playing automatically a series of gramophone records, comprising, an intermittently movable container for records, an intermittently movable carrier co-operating with said container to transport a succession of records to and from said gramophone, means co-acting with said carrier device to reverse double-sided records, a tone arm, a needle carried by said tone arm, a differential mechanism controlled by the movement of said tone arm and cam-mechanisms and rack mechanisms interposed between said differential mechanism and said container and said carrier, respectively, to impart the requisite intermittent movements to said container and carrier device respectively, and means to manipulate said needle consistently

with the cycle of operations performed by the respective elements of the combination.

6. In combination with a gramophone having a tone arm, a needle carried by said tone arm, and a continuously rotating turntable, an intermittently movable container for records, an intermittently movable carrier cooperating with said container to transport a succession of records from said container to and from said turntable, said carrier device comprising pivotally mounted jaws, means to incline said jaws, and means to reverse said jaws, a cam mechanism to impart the requisite oscillations to said carrier to position same, a second cam mechanism to impart movement in a vertical plane to said carrier, clutch mechanism interconnected with said continuously rotating turntable, and differential mechanism controlled by the movement of said gramophone tone arm and serving to control said cam and clutch mechanisms and their associated parts and also to control the position of the gramophone needle.

7. In combination with a gramophone, a container for a series of records, a turntable, a carrier device movable relatively to said turntable for transferring a succession of said records from said container to and from said turntable, and means associated with said carrier device to reverse a double-sided record while supported by said carrier device immediately after one side of said record has been played in order to bring the opposite side of said record into playing position.

8. The combination with a gramophone drive shaft and a record turntable, of mechanism operably connected to the drive shaft for delivering a record to the turntable and for reversing and replacing the record on the turntable and removing the same from the turntable.

9. The combination with a gramophone drive shaft and a record turntable, and two magazines, one for unplayed and the other for played records, of mechanism for receiving an unplayed record from the magazine and delivering it to the turntable, and for reversing and replacing the record on the turntable and removing it from the turntable and delivering the played record to its magazine, said mechanism being operably connected to the drive shaft.

10. The combination with a gramophone drive shaft and a record turntable, of mechanism for delivering a record to the turntable and removing the same from the turntable operably connected to the drive shaft, and means for reversing a record after the record has first been played operated from the drive shaft, said delivering mechanism again replacing it upon the turntable.

11. The combination with a gramophone drive shaft and a record turntable, of mechanism operably connected to the drive shaft for delivering a record to the turntable and for reversing and replacing the record on the turntable and removing the same from the turntable, a tone arm carrying a stylus, and means for manipulating said tone arm and stylus consistently with said cycle of operations.

12. The combination with a gramophone drive shaft and a record turntable, and two magazines, one for unplayed and the other for played records, of mechanism for receiving an unplayed record from the magazine and delivering it to the turntable, and for reversing and replacing the record on the turntable and removing it from the turntable and delivering the played record to its magazine, said mechanism being operably connected to the drive shaft, a tone arm carrying a stylus, and means for manipulating said tone arm and stylus consistently with said cycle of operations.

In testimony whereof I have hereunto set my hand.

VIVIAN HOME SEYMER.