

PATENT SPECIFICATION

814,084



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COMPLETE SPECIFICATION.

Improvements in or relating to Apparatus for Playing Gramophone Records.

I, SERGIO FAVARO, of Via Nerino 3, Milan, Italy, of Italian nationality, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for playing gramophone records and is particularly concerned with means for driving and stabilising the records.

It is already known to dispense with the customary turntable and to drive a gramophone record by means of a wheel which frictionally engages one face of the record. The present invention utilises this principle and one of the objects of the invention is to provide an extremely small and readily portable unit for playing gramophone records.

According to the present invention, there is provided apparatus for playing gramophone records, wherein a driving and stabilising system for the records is housed in a case having a hinged lid, said system including a locating member which is to project into the spindle-hole in a record in order to locate the record, a driving wheel arranged to be driven by a motor and to engage one face of the record, when the latter is located as aforesaid, so that it will drive the record by friction, and means for stabilising the record by local contact therewith, the stabilising means including an idly-running wheel which is carried by the hinged lid and which engages one face of the record.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings in which:—

Figure 1 is a plan view of a portable record-playing apparatus;

Figure 2 is a sectional elevation of the apparatus shown in Figure 1, the section being taken along the line II—II of Figure 1;

Figure 3 is an outside view, in elevation, of the apparatus; and

Figure 4 is a sectional plan view of the apparatus, the section being taken along the line IV—IV of Figure 2.

Referring to the drawings, the apparatus illustrated is housed in a rectangular case 1. The records are to be turned about the axis of a spindle 2 which is located very near one of the shorter sides of the case. In the illustrated example, the axis of the spindle is vertical and the spindle is free to rotate in a bearing formed in an inwardly-projecting rib 4 of the case. A screw 3 passing through the bearing wall has its inner end situated in an annular groove 26 in the spindle 2. The screw 3 does not normally touch the spindle but it serves to prevent the spindle from falling out of the bearing when the case is inverted. The spindle rests at its lower end on a ball 27. The spindle 2 is formed with a flange 5 upon which the lower surface of a record will lie, as shown in Figure 2. It will be apparent from this Figure that although the flange 5 affords local, central support for the record, it is not large enough to maintain the record horizontal during playing.

Commercially-available "long-playing" records, which must be driven at 33½ r.p.m., are of 10 or 12 inches diameter. The "extended-play" records, on the other hand, are to be driven at 45 r.p.m. and are of 7 inches diameter. The illustrated apparatus is designed for driving all these three types of record. A 7-inch, 45 r.p.m. record

is shown in full lines in Figure 2 and is accorded the reference 6, while 10-inch and 12-inch $33\frac{1}{3}$ r.p.m. records, designated by 7 and 8 respectively, are represented by dotted lines. Just beyond the flange 5, the spindle is of the appropriate diameter to suit the standardised spindle hole in the records.

Arranged in the case 1 are two driving wheels 9 and 10 which are mounted on a common shaft 11 so that the wheels and the shaft all rotate together. The shaft runs in bearings 12 provided in the case itself, and is so mounted that its axis, when produced, intersects the spindle axis. The driving wheels 9 and 10 have rims of rubber or other yieldable and resilient plastic material. In the illustrated example, the wheel 9 is shown as being peripherally driven by a roller 28 on the shaft of a motor 13, but other arrangements, for example having a friction, belt or gear drive onto a third wheel on the shaft 11, can be adopted to transmit motion from the motor to the shaft. A 6-volt motor will suffice and this can be powered by four 1.5-volt dry cells 14 in the case 1.

The wheel 9 will engage the under-side of a 7-inch record, 6, near the periphery thereof, while the wheel 10 will engage the under-side of a 10-inch or 12-inch record, 7 or 8, either a little more than 1 inch inward of the periphery or very close to the periphery, as the case may be. Such engagement will produce frictional drive of the record. Assuming that there is no slip between the driving wheel and the record surface, the product of the rotational speed and the distance from the rotational axis to the point of contact must be the same, both for the record and for the driving wheel. Thus the distance, d^1 , between the point of contact of the wheel 9 with a 7-inch 45 r.p.m. record and the axis of the spindle 2 is given by:—

$$d^1 = \frac{r^1 v}{45}$$

and the corresponding distance, d^{11} , for a 10-inch or 12-inch, $33\frac{1}{3}$ r.p.m. record is:—

$$d^{11} = \frac{r^{11} v}{33\frac{1}{3}}$$

where r^1 and r^{11} are the radii of the wheels 9 and 10 respectively, and v is the speed of the shaft 11 in r.p.m. The above formulae can be used to select suitable sizes and positions for the wheels 9 and 10, it being remembered that the values of d^1 and d^{11} must be less than $3\frac{1}{2}$ inches and 5 inches respectively.

The grooved portion of an "extended-

play" record is thinner than the central portion of the record, as illustrated in Figure 2, and is also thinner than a "long-playing" record. This fact must also be taken into consideration when designing the driving wheel arrangement. The top of the wheel 10 is advantageously made the same height as the top of the flange 5 but, in order that the driving wheel 9 does not engage a 10-inch or 12-inch record, the top of the latter wheel is a little lower, this being achieved either by making the wheels 9, 10 of differing diameter or by suitably inclining the shaft 11. With this arrangement, a 10-inch or 12-inch record will be maintained substantially horizontal, by means of the flange 5, the wheel 10 and two stabilising wheels, to be described, whereas a 7-inch record will be held, by the flange and stabilising wheels and the driving wheel 9, in a slightly canted position so that its right-hand side (Figure 2) will be low enough to touch the wheel 9. Naturally, the driving wheel sizes and positions could be so chosen that a 7-inch record will be truly horizontal and a 10-inch or 12-inch record will be inclined downwards from right to left, as viewed in Figure 2. Again, the 7-inch and larger records could both be slightly canted, in opposite directions, when in position.

A lid 15 is hinged at 16 to the case 1. Upon the under-side of the lid 15 there is mounted a stabilising wheel 17 which bears upon the central, non-grooved portion of the upper side of the record, applying thereto a force determined by the weight of the lid 15. A second stabilising wheel, 18, is mounted in a corner of the case 1 and engages the non-grooved central portion of the under-side of the record. The wheels 17 and 18 turn quite freely about axes which intersect the axis of the spindle 2. When considered in plan view, as in Figure 1, the angle between the axes of the wheels 17 and 18 will be about 45° , as will the angle between the axis of the wheel 17 and the axis of the shaft 11.

A conventional pick-up arm 19 is connected to the case 1 and can be swung outwardly, as indicated by chain lines in Figure 1. When not in use, the pick-up arm can be clamped to the cover 15 by a locking device which also secures the cover 15 to the case 1. The locking device consists of two links 20 and 21 pivotally connected together, the latter being pivotally mounted on the under-side of the cover 15. The free end of the link 21 is formed with a slot which can engage around a neck 22 in the spindle 2, thereby securing the cover 15 to the case. The free end of the link 20 is formed as an inverted U, the arms of which lie one on each side of the pick-up arm. When the link 20 is pushed inwardly the locking device occupies the position indicated by dashed



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lines in Figure 1, whereby the cover cannot swing upwardly from the case 1 and the pick-up arm can swing neither upwardly nor outwardly. When the link 2 is pulled out, the locking device occupies the position indicated in dash-dot lines, so that the cover 15 can be lifted, thereby freeing the pick-up arm 19. To permit a change of record, it is merely necessary to lift the cover 15, this being lowered again when the new record is in position. While this is being done, the pick-up arm is conveniently supported upon the top of the outer end of the link 20.

In the spaces marked 22A and 23 in the case 1, there will be provided a transistor amplifier and a speaker respectively. A volume-control knob 24 is indicated in Figure 4. The electric circuitry is not illustrated or explained in detail since it is of no interest here. A baffle 25 is provided above the speaker.

In the example illustrated, the stabilising pressure is exerted upon the record by the wheel 17 but it can, in principle, be exerted by any of the wheels which engage the record, provided that such wheel is vertically movable. The driving wheel could both be above the record instead of below it. In one alternative construction, the axis of the driving wheels could bisect an angle formed in a horizontal plane by the axes of the two stabilising wheels, in which case the driving wheels will be on one side of the record and both stabilising wheels will be on the other side. The flange 5 of the spindle 2 acts as a central support for the record. This function could, however, be allotted to another member, for example a sleeve, which is not integral with the spindle. It may be desirable to have the central support adjustable as regards its vertical position.

The illustrated construction permits of manufacturing to very small dimensions. For example, a prototype has been made with overall case dimensions a little greater than 8 inches by 3 inches by 1½ inches. However, the drive means for the records can be applied to larger, i.e. non portable, record-playing apparatus. It can also be applied to "record-players," i.e. units which are not equipped with amplifiers and speakers, must be coupled to separate amplifier and speaker equipment, for example in

a radio receiving set. The word "playing," as used herein, is, accordingly, to be construed as not necessarily including the actual production of sound.

The apparatus described above is also described in the Specifications of my co-pending Applications Nos. 23913 (Serial No. 814,083) and 32427/58 (Serial No. 814,085).

WHAT I CLAIM IS:—

1. Apparatus for playing gramophone records, wherein a driving and stabilising system for the records is housed in a case having a hinged lid, said system including a locating member which is to project into the spindle-hole in a record in order to locate the record, a driving wheel arranged to be driven by a motor and to engage one face of the record, when the latter is located as aforesaid, so that it will drive the record by friction, and means for stabilising the record by local contact therewith, the stabilising means including an idly-running wheel which is carried by the hinged lid and which engages one face of the record.

2. Apparatus as claimed in Claim 1, wherein the locating member is a spindle which passes through the spindle hole in a record.

3. Apparatus as claimed in Claim 1 or 2, wherein the locating member is disposed at or near one side of the case.

4. Apparatus as claimed in any preceding claim, wherein the driving wheel engages the under-side of the record and the stabilising means also includes a local, central support for the record, at about the position of the locating member, and a further idly-running stabilising wheel which makes contact with one face of the record and is turned thereby.

5. Apparatus as claimed in Claim 4, wherein the central support, the driving wheel and said further stabilising wheel are all located below the record position.

6. Apparatus as claimed in Claim 4 or 5, wherein the central support is constituted by a flange on the spindle.

HASELTINE, LAKE & CO.,
28 Southampton Buildings,
Chancery Lane, London, W.C.2,
England,
Agents for the Applicant.

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and which



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diameter and the latter 7". The driving mechanism is so arranged that the record is driven directly rather than by means of a turntable, said turntable being substituted by a spindle with a small flange. The driving of the record is effected by means of frictional contact between the record surface and one of 2 vertical driving wheels, said driving wheels so arranged that the correct wheel, depending on the size of the record, makes contact with the record itself.

According to the invention I provide a record centering device, said device formed by a vertical spindle of suitable diameter for the central hole in the record, said spindle having an enlargement or flange, large enough to support the record centre at suitable height, but not so large to prevent small inclination of the record on a vertical plane. Further I provide a driving arrangement comprising 2 plastic or rubber edged wheels, firmly fixed on a common shaft, said shaft free to rotate on a horizontal or nearly horizontal axle so orientated that its extension will meet the vertical axle of the record. The 2 driving wheels will have their upper edges at a slightly different height, by virtue of their different size or of small inclination of their supporting shaft, and said height will be very nearly the height of the flange of the centering device. The position of the 2 driving wheels will be so arranged that when a 7" record is resting on the centering device, said record will touch the edge of the wheel nearest to the record centre, but when a 10" or 12" record is resting on the centering device, said record will touch the edge of the wheel furthest from the record centre, passing clear of the other wheel, thus that the first wheel will be at not more than $3\frac{1}{2}$ " from the record centre and the second wheel at more than $3\frac{1}{2}$ " but less than 5" from the record centre. The exact distance of the 2 driving wheels from the record centre will be dictated by their speed and diameters, according to the following formulae: for the nearest wheel to the record centre driving 45 r.p.m. records:—

$$d^1 = r^1 v / 45$$

where d^1 = distance of the contact point of the record surface with the edge of said wheel from the record centre, r^1 = radius of the wheel, and v = r.p.m. of the common shaft of the driving wheels;

For the furthest wheel from the record centre driving the $33\frac{1}{3}$ r.p.m. records:—

$$d^{11} = r^{11} v / 33\frac{1}{3}$$

where d^{11} = distance of the contact point

of the record surface with the edge of said wheel from the record centre, r^{11} = radius of the wheel, and v = as before.

Said driving wheels will be powered by a roller mounted on the shaft of a motor, said roller kept in contact with one of these wheels, or alternatively said roller will be kept in contact with a third wheel fixed on the common shaft of the 2 driving wheels or, again, by means of a belt connecting the motor shaft to the third wheel. In order to give stability to the records I provide 2 wheels free to rotate on 2 separate horizontal or nearly horizontal shafts, the extensions of said shafts meeting the vertical axle of the record; said shafts having between them a horizontal angle of about 45° and forming 2 horizontal angles with the shaft of the driving wheels of about 45° and 90° respectively. The distance from the record centre of said 2 free wheels will not be greater than the radius of that part of the central record surface that is free from grooves. The vertical position of the wheel whose axle is at about 90° to the axle of the driving wheels will be such that the upper edge of said wheel will support the lower surface of the record resting on the centering device on a horizontal line passing through the record centre. The wheel whose axle is at about 45° to the axle of the driving wheels will be on the upper side of the record and its axle will be fixed to a suitable support, said support free to be raised and provided with a suitable load or spring so as to exert a downward pressure. Such support, when raised, will allow the changing of records.

The stabilizing pressure on the record surface can be applied by any one of the wheels, including the driving wheels, provided that the wheel applying the pressure is able to move vertically. If it is necessary the relative disposition of the wheels can be turned upside down, so that the driving wheels will be on the upper surface of the record. Another possible disposition can be with the axle of the driving wheels bisecting a horizontal angle of about 90° formed by the axles of the 2 other free wheels, these wheels being on the opposite side of the record in respect of the driving wheels.

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