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AUTOMATIC UNIVERSAL REPRODUCER AND TONE ARM.
APPLICATION FILED FEB. 9, 1920.

1,394,804.

Patented Oct. 25, 1921.

FIG. 1

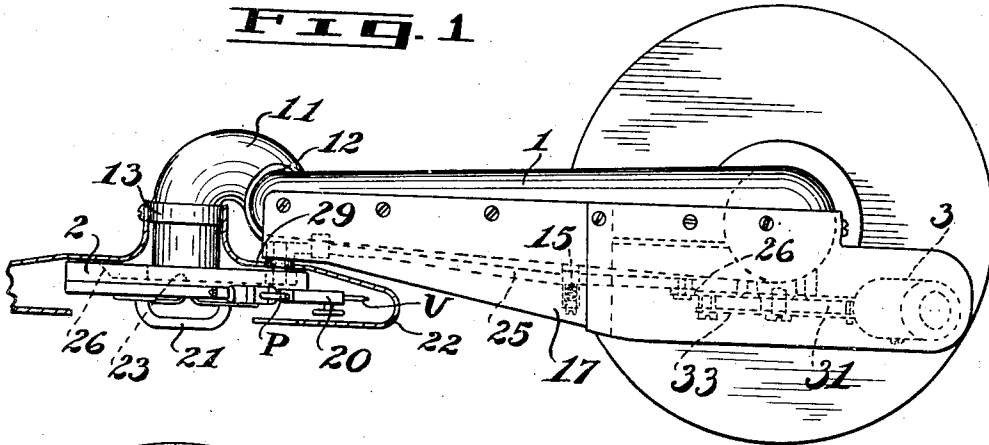


FIG. 2

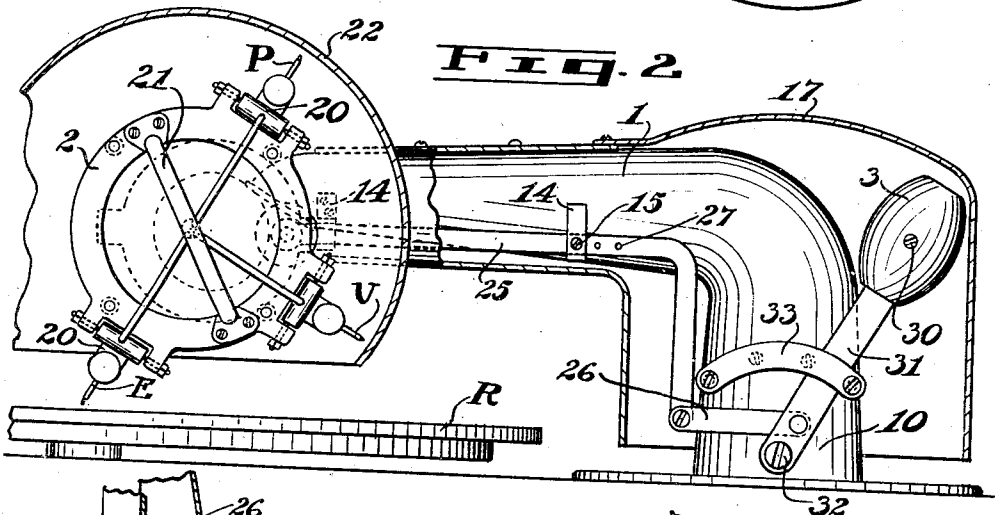


FIG. 3

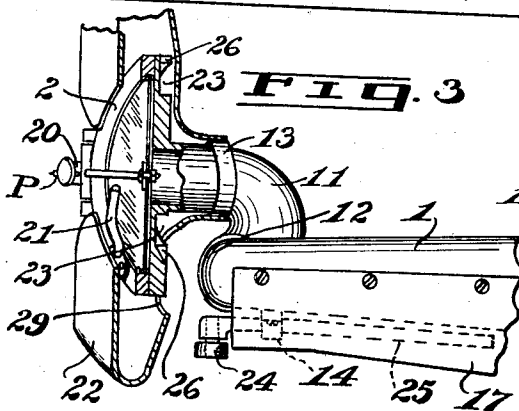
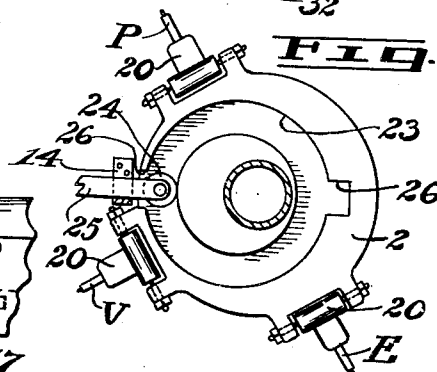


FIG. 4



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AUTOMATIC UNIVERSAL REPRODUCER AND TONE-ARM.

1,394,804.

Specification of Letters Patent.

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Application filed February 9, 1920. Serial No. 357,433.

To all whom it may concern:

Be it known that I, CHRISTIAN C. BENDER, a citizen of the United States, and resident of the city of Seattle, county of King, and State of Washington, have invented certain new and useful Improvements in Automatic Universal Reproducers and Tone-Arms, of which the following is a specification.

My invention relates to phonograph reproducers, and tone-arms, intended for playing all of the principal types of records now on the market, and may be called a universal phonograph.

It is my object to produce a phonograph which will play all of the principal types and classes of records now existent under the conditions best suited for their reproduction, especially regarding position and pressure of the needle upon the record, and without the necessity of changing needles when adapting the phonograph for a different type of record.

Two faults are common to practically all of the reproducers which attempt to play all records, and at least one of the two occurs in all of them. Either the person playing the phonograph must change needles whenever it is desired to play a different type of record, or, after changing the reproducer to present a different type of needle, they must perform a second operation—they must vary the weight of the outer end of the tone-arm, or in some other way change the pressure of the needle upon the record. If this second operation is left to be performed by the usual unskilled operator, it will in many cases be overlooked, and the record will not be reproduced under conditions necessary to bring about the best results. If the means for changing the pressure upon the record is automatically operated when the reproducer is moved to bring a new needle into playing position, so that the pressure of the needle upon the record always corresponds to the pressure required for playing with the needle then in playing position, one operation produces all of the changes required, and the possibilities of a mistake are eliminated.

It should be understood in this connection that there are two general types of records, the hill-and-dale type, and the lateral-cut type. The hill-and-dale type is further subdivided into two classes, one requiring a heavy pressure of the needle upon the record, and the other requiring a light pressure,

The Pathe record is one of the first class, and the Edison one of the second. The Victor and Columbia records are of the lateral-cut type, and require an intermediate pressure.

Associated with my object stated above is another, to keep the needle always properly "centered" upon the record; that is, upon an arc drawn from the vertical pivot of the tone-arm as a center, through the axis of the turntable and record, no matter at what playing angle it is turned to the record.

Another object is to produce an automatically operating universal reproducer which will be so constructed that it can not easily be tampered with.

Other objects will appear from an inspection of the accompanying drawings, specification, and claims.

In the accompanying drawings I have shown my invention in a form which is now preferred by me, though it will be evident that changes in construction and design may be made without departing from the scope of my invention as defined by the claims.

My invention comprises those novel features which are shown in the accompanying drawings, described in the specification, and defined by the claims terminating the same.

Figure 1 is a plan view of an embodiment of my invention, part of a guard casing being shown in section.

Fig. 2 is an elevation of my invention, parts of the guard casing being shown in section and the reproducer being shown in an intermediate position between a change from the playing position of one needle to the playing position of another.

Fig. 3 is a detail view, showing a reproducer in section and with the playing needle in its proper playing position.

Fig. 4 is an elevation of the reproducer and associated parts, taken from the side opposite that shown in Fig. 2, a portion of the tone-arm being shown in section and the guard casing being omitted.

The tone-arm 1 may be of any standard or usual construction and would be mounted, as is common in such tone-arms, for horizontal rotation about its base 10, and also for vertical movement from this point. At its outer end an elbow 11 is mounted at 12 in the end of the tone-arm 1 for rotation about an inclined axis. The reproducer 2 is pivoted in the elbow 11 at 13 for rotation about

its horizontal axis. Thus it will be seen that the reproducer 2 is mounted in the end of the tone-arm for rotation about its own axis, and also for bodily rotation about another, 5 an inclined axis.

The construction of the reproducer 2 in so far as the reproducing mechanism, the needle holders 20 and the like parts, are concerned, may be of any suitable or ordinary 10 construction. Instead of one needle holder, however, I provide a plurality of these. In the form shown in the accompanying illustration I have provided three of these needle holders. Their position relative to the re- 15 producer may be arranged as is found best suited to the proper reproduction of the record which they are designed to play.

In each of the needle holders 20 I secure a suitable playing needle, but for each needle holder I provide a different style of 20 needle. In one I may provide a needle "P" with ball point and adapted for playing a round groove, hill-and-dale type of record, as the Pathe record. In the needle holder 25 opposite the needle P I may place a needle E, which has a sharp point and is adapted for playing the fine grooved hill-and-dale record such as the Edison record. Between the positions of the needles P and E I will 30 position a needle holder for receiving the needle V. This needle is of a type suitable for playing lateral-cut records such as the Victor or Columbia records. It is obvious that more needle holders for holding other 35 types of needles may be employed if desired and also, if desired, the reproducer might be made with any one of the needles just described omitted.

The reproducer 2 being rotatable about 40 its own axis, any one of the needles P, V, or E may be presented to a record R. To properly position needles P and E for the hill-and-dale records the reproducer may be turned bodily in its pivot 12 to present the 45 needle at the proper angle to the record. The angle of the pivot axis at 12 may be so arranged that in turning the reproducer bodily about this axis the needle point will always remain at the same distance from the 50 vertical axis of the tone-arm, at 10, so that the needles will properly "center" upon the record; that is, they will always be upon an arc drawn from the vertical axis of the tone-arm as a center through the center of 55 rotation of the record R. If desired a handle 21 may be secured to the reproducer to turn it and also a suitable guard 22 may be secured upon the elbow 11, surrounding the reproducer and its needles, so that the 60 operator will not injure himself upon any of the projecting needles, and also to prevent more than one needle from projecting toward the record at any time.

As the tone-arm 1 is mounted in its base 65 10 for vertical movement, the downward

pressure at its end will depend upon the length of the tone-arm and upon the downward forces at its end, and whatever resistance may be employed counter to the downward force at its end. The pressure 70 at the outer end of the tone-arm may be varied either by lengthening the tone-arm or by varying the resistance to the downward pressure, assuming that the downward forces, due to the weight of the parts at the 75 outer end of the tone-arm, are constant. As a means of varying the resistance to the downward pressure at the outer end of the tone-arm I may employ a weight 3 which is secured to move toward and from the 80 outer end of the tone-arm. As herein shown the weight 3 is adjustably mounted by means of the set screw 30 upon the outer end of an arm 31 which is pivoted at 32 upon the base of the tone-arm for movement 85 toward and from its outer end. A quadrant or retaining bar 33 may be employed to guide the arm 31, as desired.

The movement of the weight 3 is arranged to be automatically controlled by the movement of the reproducer 2 to bring one or the other of the needles into playing position. Any suitable or desirable means may be employed to effect this automatic actuation. The means herein shown comprises 90 a groove 23 in one face of the reproducer and a cam follower 24 secured upon the outer end of an arm 25, which is actuated by said cam groove 23. The inner end of the arm 25 is connected by means of the link 26 100 with the arm 31, so that reciprocation of the arm 25 will move the weight 3 forward and backward. The cam groove 23 is eccentric of the pivot axis of the reproducer so that rotation of the latter will cause the rod 25 105 to reciprocate, thus automatically changing the position of the weight 3 with the rotation of the reproducer 2 to present a new needle to the record.

As it is necessary, in order to secure the 110 best results from the hill-and-dale type of records which are played by the needles P and E, to rotate the reproducer bodily to present the needle at the proper angle to the record, the cam follower 24 must be dis- 115 engageable from the cam groove 23, in the form of construction herein shown, in order to permit this rotation of the reproducer. The means which I have shown herein for permitting disengagement of the groove 23 120 by the follower 24 comprises a series of notches 26 so placed that when the needles P or E are presented to the record the reproducer may be rotated bodily and the fol- 125 lower 24 will pass out by the notches 26. The notches would be placed at the points where the cam groove 23 approaches nearest to and recedes farthest from the horizontal pivot axis of the reproducer.

To hold the rod 25 in fixed position it may 130

be secured in suitable guides 14 carried by the tone-arm. It is also highly desirable, if not necessary, that the position of the weight 3 be fixed for any one needle, and to secure this I may provide a spring-pressed ball catch at 15 engaging the depressions or cups 27 in the rod 25. This form of catch is old in phonographs and I have therefore not shown it in detail. Any other suitable form of catch may be employed, though this should be freely releasable with the further movement of the rod.

It is one of my objects to make the device entirely automatic so that the operator will need to adjust no parts of the device. In order that it may not be tampered with by unskilled operators I may inclose the device in a case 17 so that all of the working parts are inclosed. The casing 17 may be secured to the tone-arm 1 or in any other suitable manner. To permit the cam follower 24 to engage in the cam groove 23, a slot 29 may be cut in the guard casing 22.

In operation, when it is desired to change the reproducer to play a different style of record, it must first be rotated bodily if in the position shown in Fig. 3 to bring the cam roller 24 back into the groove 23. The reproducer may then be rotated by the handle 21 to a position where the desired needle will be presented to the record. If it is desired to change to a Victor type of record the reproducer is rotated until needle V is presented in playing position to the record.

The cam follower 24 will have been moved through its communication with the groove 23 into a position midway between its extreme inner and its extreme outer position. Thus the weight 3 will have been moved through its connection with the inner end of the rod 25 to a position midway between its extreme positions and will have no effect in varying the resistance to the downward pressure of the needle upon the record. If the normal resistance of the tone-arm is so proportioned that the pressure at the needle is normally the pressure required for Victor records, with the weight 3 in its intermediate position the pressure of the needle upon the record will be just the proper amount.

It will be noted also that with needle V in playing position the roller 24 is midway between two notches 26. In this position the roller cannot be disengaged from the groove 23 and the reproducer cannot be swung bodily into the position required for hill-and-dale records. This prevents the possibility of an error in positioning the reproducer for lateral-cut records. It will be necessary, however, for the operator always to rotate the reproducer into the position required for the hill-and-dale type.

With the weight 3 in its extreme rear position as shown in Figs. 1 and 2, it will operate through its connection with the tone-arm through the link 26 and rod 25 to increase the resistance to the downward pressure at the outer end of the tone-arm, and will, in effect, lighten the tone-arm. This causes a lighter pressure of the needle upon the record, which is the condition most favorable for playing Edison records. With the weight 3 in its extreme forward position it will operate through the same connections to increase the weight upon the outer end of the tone-arm so that the needle will press most heavily upon the record. This is the condition required for playing Pathe records to the best advantage. This position is shown in Fig. 3.

It might be found desirable to employ two needles of the type for playing lateral-cut records, one being of the style known as soft needles and the other of the style known as hard needles. This can be accomplished in the present construction with no change except the addition of a needle holder opposite the needle V. The shape of the cam groove is such that the position of the weight will be correct for playing such records either in the position of the needle holder for the needle V, as shown, or in the diametrically opposite position.

What I claim as my invention is:

1. In a phonograph, a reproducer having a single diaphragm and adapted to receive simultaneously three independent needles therein, said reproducer being movable to bring any one of said needles into operable position, and means operable through the movement of said reproducer when the latter is connected thereto for changing the pressure of said needles upon the record.

2. In a phonograph, a tone-arm pivoted for vertical movement, a reproducer adapted to receive a plurality of playing needles, and rotatably mounted upon the outer end of said tone-arm, a lever, a weight secured upon said lever outward of its pivot, said weight being movable toward and from the outer end of the tone-arm, and means adapted to be operatively connected to the reproducer, and operable by rotation of the reproducer for moving said lever and weight.

3. In a phonograph, a tone-arm pivoted for vertical movement, a reproducer adapted to receive a plurality of playing needles and rotatably mounted upon the outer end of said tone-arm, a lever pivoted upon a horizontal axis near the base of the tone-arm for movement toward and from the outer end thereof, a weight secured upon said lever outward of its pivot, and means adapted to be operatively connected to the reproducer, and operable by rotation of the reproducer for moving said lever and weight.

4. In a phonograph, a tone-arm pivoted for vertical movement, a reproducer adapted to receive a plurality of independent play-

ing needles and rotatably mounted upon the outer end of said tone-arm, a rod extending outwardly adjacent said tone-arm, a cam roller carried upon the outer end of said rod, said reproducer having a cam groove therein eccentric to its axis of rotation, and adapted to receive said cam roller, and means operated by the inner end of said rod for varying the downward pressure at the outer end of said tone-arm.

5. In a phonograph, a tone-arm pivoted for vertical movement, a reproducer adapted to receive a plurality of independent playing needles and rotatably mounted upon the outer end of said tone-arm, a lever pivoted upon the tone-arm for movement toward and from the outer end thereof, a weight secured upon said lever outward of its pivot, a rod having one end connected to said lever, and a cam roller carried upon the outer end of said rod, said reproducer having a cam groove therein eccentric of its axis of rotation, and adapted to receive said cam roller.

6. In a phonograph, a reproducer having a single diaphragm and adapted to receive simultaneously a plurality of independent playing needles differing in requiring each a different pressure upon the record, said reproducer being selectively movable to bring any one of said needles into playing position relative to a record, and means controlled by the change in position of said needles when the reproducer is connected thereto for changing the pressure of the needles upon the record.

7. In a phonograph, a tone-arm, a reproducer having a plurality of needle holders each adapted to receive a needle for playing a different type of record, said reproducer being pivoted upon the outer end of said tone-arm for rotation upon its own axis and for rotation bodily about another axis, and means controlled by the rotation of said reproducer about its own axis when the reproducer is connected thereto for changing the pressure of the needles upon the record.

8. In a phonograph, a tone-arm, a reproducer having a plurality of needle holders each adapted to receive a needle for playing a different type of record, said reproducer being pivoted upon the outer end of the tone-arm for rotation upon its own axis and

for rotation bodily about another axis, said reproducer having a cam groove eccentrically placed relative to its axis, a rod extending outwardly adjacent the outer end of the tone-arm, a cam follower upon the outer end of said rod adapted to be engaged in said cam groove, and adapted to be disengaged therefrom by bodily rotation of the reproducer about its second-mentioned axis, and means operable by the movement of said rod for changing the pressure of the needle then presented in playing position of the record.

9. In a phonograph, a tone-arm, a reproducer pivotally mounted thereon and having a plurality of needle-holders adapted to hold each a different type of needle, said reproducer being rotatable to bring a selected needle into playing position relative to a record, and a guard carried by said tone-arm and surrounding said reproducer to permit the protrusion of one needle only at one time.

10. In a phonograph, a tone-arm pivoted for vertical movement, a reproducer including a single diaphragm upon the outer end of said tone-arm adapted to receive a plurality of different needles, and movable selectively to present any one needle in playing position, means for changing the downward pressure of said needles upon the record comprising a weight movable lengthwise of said tone-arm, and means adapted to connect said reproducer and said weight to change the position of the weight automatically as the position of the reproducer is changed, as and for the purpose set forth.

11. In a phonograph, a reproducer having a single diaphragm and adapted to receive simultaneously two independent needles for playing hill-and-dale type records, said needles varying in requiring different pressures upon the record, said reproducer being movable to bring either one of said needles into operative position, and a weight movable with the rotation of the reproducer when the latter is connected thereto to change the pressure of said needles upon the record.

Signed at Seattle, King county, Washington this 31 day of January, 1920.

CHRISTIAN C. BENDER.