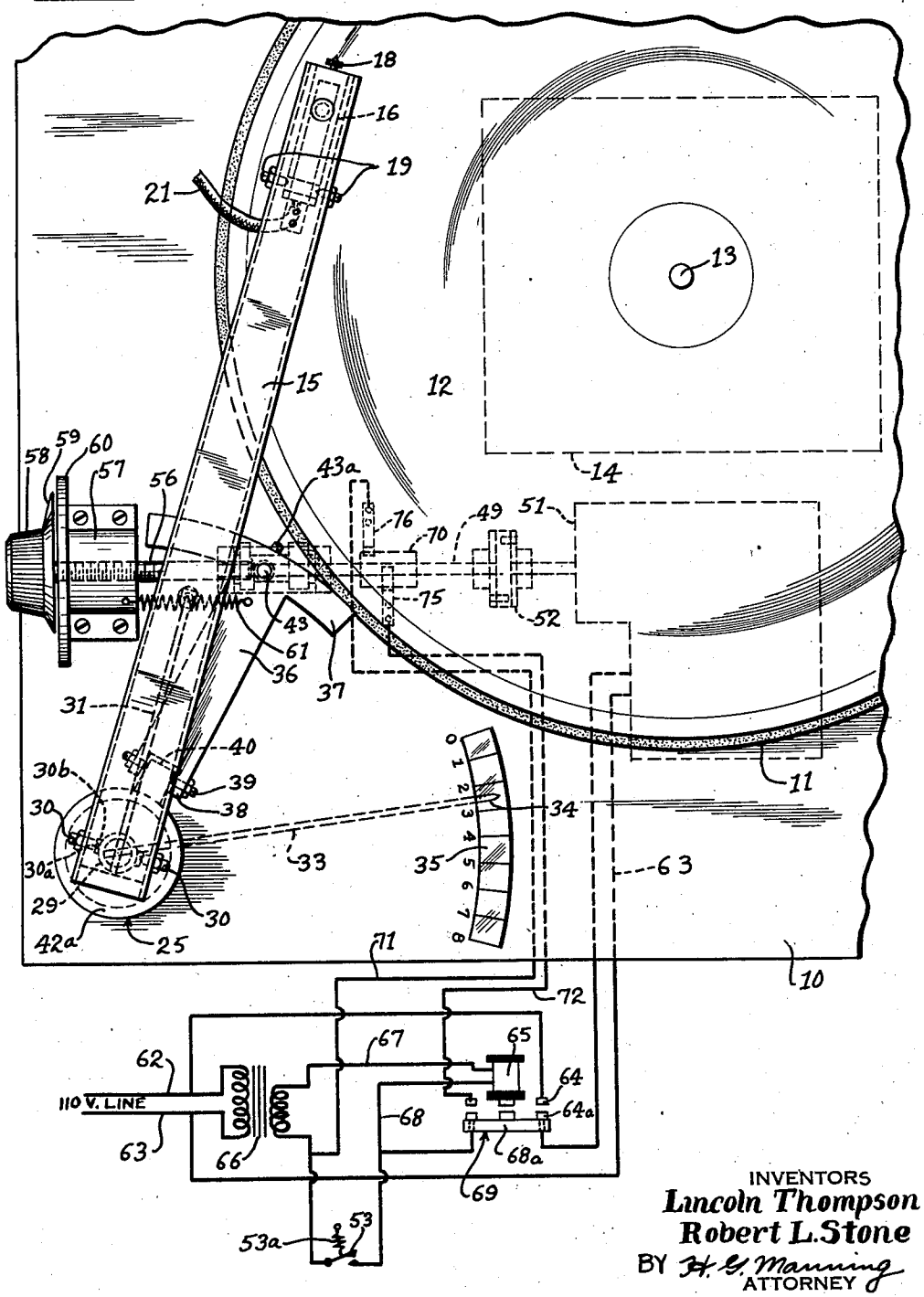
Dec. 27, 1938. L. THOMPSON ET AL 2,141,804

PHONOGRAPH REPRODUCER

Filed April 17, 1936 2 Sheets-Sheet 1

Fig. 1.



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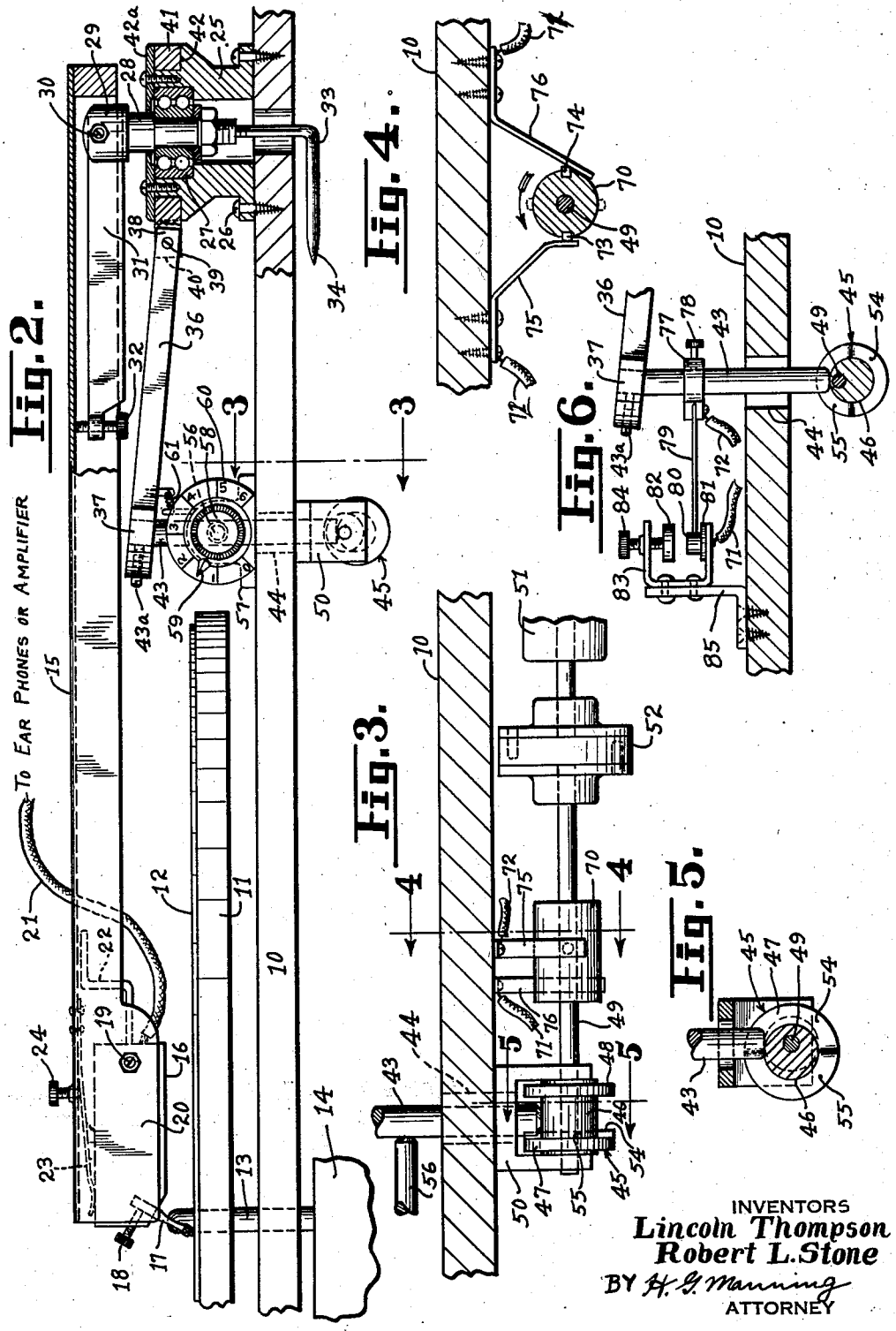


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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PHONOGRAPH REPRODUCER

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10 Claims. (Cl. 274—9)

This invention relates to phonograph reproducing devices, and more particularly to a low inertia and low pressure reproducer especially adapted for the playing of soft records, such as aluminum or wax, with "permanent" needles of sapphire, steel or other hard material.

One object of this invention is to provide a device of the above nature employing a relatively long light weight reproducer arm and a light weight pick-up, and in which said pick-up is flexibly mounted on a horizontal pivot at the end of said arm, whereby the mechanical impedance or moment of inertia of the pick-up around a horizontal axis is reduced.

A further object is to provide a device of the above nature in which the reproducer arm is mounted to swing on a vertical ball-bearing spindle so as to reduce the horizontal friction of the reproducer arm.

A further object is to provide a device of the above nature having an auxiliary stop arm located under and adapted to support the weight of the reproducer arm.

A still further object is to provide a device of the above nature in which means are provided for permitting the reproducer arm and needle-carrying pick-up supported thereby to be raised away from the record whenever desired, and also having means for automatically replacing the needle upon the record any desired number of grooves (within limits) behind the original position of said needle.

A still further object is to provide adjustable spring means mounted on the reproducer arm for engaging the pick-up to press the needle positively upon the record, and thus take up "play" or "slack", insuring proper tracking and avoiding groove-jumping, said spring means also increasing the ability of the pick-up to rapidly follow depressions in the record grooves, which occur when the record wobbles due to warping or eccentricity.

Still a further object is to provide a phonographic pick-up employing a relatively long light weight rigid stiff needle adapted to efficiently transmit the mechanical undulations received at the needle point to the electrical amplifying apparatus.

A further object is to provide an apparatus of the above nature which will be simple in construction, inexpensive to manufacture, easy to install and manipulate, compact, ornamental in appearance, and very efficient and durable in use.

With these and other objects in view, there have been illustrated on the accompanying drawings, two forms in which the invention may be conveniently embodied in practice.

In the drawings:

Fig. 1 represents a plan view of the disc record phonograph reproducer, showing a diagrammatic view of the electrical circuit connections.

Fig. 2 is a side elevation of the reproducer arm, with certain parts broken away to show the interior construction.

Fig. 3 is a side elevation, partly in section, of the cam mechanism for lifting the reproducer arm and back spacing the reproducing needle, the view being taken along the line 3—3 of Fig. 2.

Fig. 4 is a transverse sectional view of the commutator switch for automatically stopping the cam driving motor, the view taken along the line 4—4 of Fig. 3.

Fig. 5 is a transverse sectional view of the lifting cam mechanism taken along the line 5—5 of Fig. 3, the cam being at an intermediate position.

Fig. 6 is a sectional view of an alternative form of automatic motor stopping switch, and showing the cam in its normal inactive "low" position.

In the playing or reproducing of disc records of soft material, such as aluminum and wax, it was formerly necessary to employ fragile wooden or thorn needles, as otherwise, the records would wear out too rapidly on account of the abrasive and indenting action of hard needles caused by the high pressures exerted thereon by the heavy high-inertia pick-up head and reproducer arm. Such wooden and thorn needles were found objectionable as they were quite delicate, and the points would wear off quickly and often break, causing unfaithful reproduction.

By means of the present invention, the above disadvantages have been overcome, and it is now possible to reduce the pressure exerted on the record by the needle to the order of one-tenth of an ounce, which has been found to be a pressure which will not harm the surface of aluminum or other soft records now in general use. Even the lightest of the "pick-ups" previously used exerted at least two ounces pressure on the record, and many pick-ups employed pressures as high as five ounces, causing excessive wear and indentations of the record. Such high pressures, with ordinary grooves at least, would cause a sapphire or steel needle to tear aluminum or wax records very badly, and the playing would not only injure the record, but would be accompanied by great surface noise.

With the present invention, sapphire and other

hard permanent needles may be employed for reproducing from soft records without groove-jumping or harming the record surface, as by cutting. This not only permits more accurate reproduction of the quality of the sound recorded, but reduces the wear on the record so that its playing life is greatly increased.

Also, with the present improved reproducer, the moment of inertia of the pick-up is very low due to the fact that the auxiliary stop arm supports the entire weight of the main reproducer arm, and prevents it from exerting any pressure upon the record. Moreover, the pick-up member oscillates up and down on a very short axis, and hence, can rapidly follow the up and down wobbles of the turntable and record. Sudden bumps in the record will not materially increase the needle pressure, but the latter will remain practically constant under all ordinary conditions.

Referring now to the drawings in which like reference numerals denote corresponding parts throughout the several views, the numeral 10 indicates the top panel of the motor cabinet, above which is positioned a turntable 11 for supporting a disc record 12. The turntable 11 is supported by a vertical pindle 13 passing upwardly through the panel 10, said spindle being driven by a suitable electric motor 14 mounted under said panel 10.

Pivoted on both horizontal and vertical axes at one corner of the panel 10 is an elongated reproducer radial arm 15, preferably constructed of light material, such as Duralumin, in the form of a U-shaped channel.

Pick-up member

The outer free end of the reproducer arm 15 carries a pick-up member 16. The pick-up member 16 is provided with a suitable socket for detachably receiving a stylus or needle 17 having a rounded or other shaped point to fit the groove in the record and detachably held in place by a set screw 18. The needle 17 is preferably made relatively long and of light strong stiff material. It is also provided with a hard point, preferably of sapphire or steel, for contacting with the grooved surface of the record.

The pick-up member 16 is pivoted on a pair of opposed pointed screws 19 adjustably threaded into a pair of side wings 20 formed integral with the end of the reproducer arm 15. The side wings 20 enclose the greater portion of the pick-up member 16 and serve to protect it from injury. A conductor cord 21 leads from the electrical pick-up head 16 and may be connected with any suitable electrical amplifying means, not shown.

In order to limit the downward swinging of the pick-up head 16 about its horizontal axis, and also to cause it to function with a cushion effect, provision is made of a Z-shaped arm 22 projecting rearwardly from the pick-up member 16. As shown in Fig 2, the upper horizontal section of the arm 22 is located adjacent the base of the channeled reproducer arm 15, and engages the same whenever the arm 15 is lifted. The clockwise rotation of the pick-up 16 about its axis is opposed by a relatively light flat leaf-spring 23 engaging the outer end of the pick-up 16, and anchored to the base of the channel arm 15, as by rivets. The tension of the spring 23 may be varied by means of an adjustable set screw 24 threadedly engaged in the base of the arm 15.

In order to permit the reproducer arm 15 to swing on both horizontal and vertical axes, provision is made of a hollow hub 25 affixed to the top of the motor panel 10, as by screws 26. The hub supports a ball-bearing raceway 27 within which is mounted a vertical spindle 28 having an enlarged upper split head 29. A pair of opposed set screws 30 are adjustably mounted in the opposite sides of the arm 15, and have pointed inner ends 30*a* adapted to engage in pivot sockets 30*b* carried by the opposite parts of the enlarged head 29 of the spindle 28.

In order to support the reproducer arm 15 at any desired angular position, provision is made of a horizontal arm 31 rigidly secured to the enlarged split head 29, and adapted to swing with the spindle 28. The outer end of the supporting arm 31 is provided with an adjustable set screw 32 which is adapted to engage the underside of the reproducer arm 15 at an intermediate position, thus preventing the weight of the reproducer arm 15 from exerting force upon the record, permitting the height of the pick-up to be varied at will.

Attached to the lower end of the spindle 28 and rotatable therewith is an L-shaped member 33 having an indicating pointer 34 upon its outer end. The pointer 34 is adapted to register with and be visible through a transparent arcuate scale 35 located on the outer edge of the panel 10 for indicating the exact position of the needle arm with respect to the disc record 12. A suitable light source, not shown, may be positioned underneath the panel 10 to illuminate the pointer 34.

Pick-up lifting and resetting mechanism

The means for raising and lowering the needle with respect to the disc record is clearly shown in Figs. 1 and 2. It comprises a T-shaped inclined lifting arm 36 having an arcuate horizontal support member 37 which is adapted to engage the bottom of the reproducer arm 15 at a point slightly in advance of the set screw 32. The rear end 38 of the lifting arm 36 is bifurcated and carries a pair of inwardly directed pivot screws 39 which engage in a pair of sockets in an ear 40 projecting from a circular ring 41 rotatably seated in an annular groove 42 formed in the upper part of the hub 25. The ring 41 is retained in position by a cover disc 42*a*.

In order to simultaneously elevate and shift the reproducer arm and needle-carrying pick-up backwardly whenever desired, provision is made of a vertical rod 43 depending from the support 37 of the T-shaped lifting arm 36 to which it is secured by means of a set screw 43*a*. The rod 43 passes downwardly through a hole 44 in the panel 10, and the lower end of said rod engages a spool-shaped cam 45 located therebeneath, said cam 45 comprising a central body 46 and a pair of circular end flanges 47 and 48. The spool cam 45 is mounted eccentrically on a horizontal camshaft 49, which is adapted to be rotated one-half a revolution to lift the pick-up from the record, and another half rotation whenever it is desired to replace the pick-up upon the record in the predetermined back-spaced position.

The horizontal cam shaft 49 is supported at one end by means of a bifurcated hanger bracket 50 attached to the underside of the panel 10. The opposite end of the cam shaft 49 is supported and driven by a suitable electric motor 51 connected to said shaft 49 through a flexible coupling 52. The motor 51 is started by the foot-actuation of an electric switch 53 shown diagrammatically in Fig. 1, said switch being nor-

mally held open by a spring 53a. The momentary closing of the switch 53 in turn closes a relay switch 69 in the motor circuit, as will be more fully described later.

The left-hand flange 47 of the spool cam 45, as viewed in Figs. 3 and 5, is formed with semicircular high and low cam sectors 54 and 55, respectively, which are adapted to press laterally upon the lower end of the plunger rod 43.

The number of grooves of the record to be replayed is controlled by the position of a horizontal adjustable stop shaft 56 located at one side of the plunger rod 43 above the table, as shown in Fig. 3. The stop shaft 56 is threaded intermediate its ends and is screwed into a supporting bracket 57 attached, as by screws, to the top of the cabinet top 10 (see Fig. 1). The outer end of the stop shaft 56 carries a graduated knurled knob 58 having a pointer 59 which is adapted to register with a graduated stationary dial 60 attached to the bracket 57 for indicating the number of grooves to be repeated. The distance between the high and low cam surfaces 54 and 55, respectively, of the flange 47 determines the maximum number of grooves which may be replayed, and it will be understood that the device may be set to replay any desired smaller number of grooves merely by turning the knob 58 to the proper indication on the dial 60. The vertical plunger rod 43 is constantly urged in the direction of the stop member 56, or to the left, as viewed in Figs. 1 and 3, by means of a coiled tension spring 61 connected to the stationary bracket 57 and the movable lifter arm 36.

Automatic motor shut-off

The electrical hook-up for the back spacing mechanism is shown diagrammatically at the bottom of Fig. 1. Thus, the motor 51 is supplied with current by a pair of main circuit conductors 62 and 63, the conductor 63 leading directly to one terminal of the motor 51, while the conductor 62 is connected indirectly to the other motor terminal through the contacts 64 and 64a of the relay switch 69 adapted to be closed by an electromagnet 65.

The magnet 65 is electrically connected to the secondary terminals of a transformer 66 by means of a pair of conductors 67 and 68, the latter conductor having the foot-controlled switch 53 in series therewith.

When the switch 53 is momentarily closed, the magnet 65 will be energized, lifting the armature 68a, closing the relay switch 69, and starting the motor 51. Current will then continue to flow through the motor circuit regardless of the fact that the switch 53 is open until the circuit through a conductive commutator drum 70 and conductors 71 and 72 is broken by a quarter revolution of the cam shaft 49. The drum 70 is mounted to rotate with the cam shaft 49 and carries a pair of diametrically opposed insulation nubs 73 and 74 which are adapted to rotate into the path of a resilient conductive wiper strip 75 connected to the conductor 72. A second wiper strip 76 engages the surface of the drum 70 at all times. Normally, the nubs 75 and 76 are in vertical alinement, as shown in dotted outlines in Fig. 4, but when the cam shaft has made a quarter rotation carrying the nubs into the horizontal full line position, the wiper strip 75 will be pushed laterally out of contact with the commutator drum 70, thus momentarily deenergizing the magnet 65 and opening the motor circuit. The deenergized motor will, however, continue to rotate under its momentum until the nubs 73 and 74 have reached a point 180 degrees from the original dotted line positions shown in Fig. 4.

Operation

In the operation of the invention, the reproducer arm 15 will first be swung out over the constantly rotating record, and the needle 17 manually placed in the desired groove. Whenever the operator wishes to repeat any portion of the record, the needle 17 will be lifted from the record and replaced in the desired groove by the operations of twice momentarily closing the foot-operated switch 53. The first time the switch 53 is closed, the spool cam 45 will be rotated 90 degrees by the operation of the motor 51 and a further 90 degrees by momentum, causing the plunger 43 to be raised and at the same time laterally shifted backwardly by the action of the eccentric central body 46 and the high sector 54 of the side flange 47 of the spool cam. The needle will thus be automatically back-spaced the desired number of grooves, as indicated by the position of the pointer 59 with respect to the dial plate 60.

In order to replace the needle upon the record in the proper back-spaced groove, it will only be necessary to foot-actuate the switch 53 a second time. This will cause another half rotation of the cam shaft 49 in a manner similar to that described above, and the return of the cam body 46 to its "low" position will cause the needle to be deposited gently upon the record.

Modified form

Fig. 6 illustrates a modified form of automatic circuit breaker which may be used in place of the commutator 70 of the first form. In this modified form, the vertical reciprocating movement of the plunger rod 43 is utilized for interrupting the circuit through the relay magnet 65. A collar member 77, electrically connected to the relay by the conductor 72, is adjustably affixed upon the plunger rod 43 by means of a set screw 78. The collar member 77 carries a flexible metal leaf-spring 79, on the end of which is a movable switch button 80 located between a pair of stationary contacts 81 and 82 carried by an insulating U-shaped clip 83. The lower contact 81 is electrically connected to the conductor 71, while the upper contact 82 is affixed to the end of a set screw 84 having threaded engagement with the upper leg of the clip 83 for permitting said contact 82 to be adjusted relative to the contact 81. The U-shaped clip 83 is adapted to be supported in an elevated position above the table 10 by means of an angle bracket 85.

In the operation of the modified form of the invention, the position of the collar 77 with respect to the stationary contacts 81 and 82 is such that the plunger rod 43 will make its complete up stroke before the circuit will open between the contacts 80 and 81 for deenergizing the relay magnet 65. The down stroke of said plunger rod 43 will be effected by the momentum of the motor 51, as before.

While there have been disclosed in this specification two forms in which the invention may be embodied, it is to be understood that these forms are shown for the purpose of illustration only, and that the invention is not to be limited to the specific disclosures but may be modified and embodied in various other forms without departing from its spirit. In short, the invention includes all the modifications and embodi-

ments coming within the scope of the following claims.

Having thus fully described the invention, what is claimed as new and for which it is desired to secure Letters Patent, is:

1. In a device for reproducing a disc phonograph record, an elongated universally mounted reproducer arm adapted to swing across said record, a pick-up needle-carrying member flexibly mounted on said arm to swing up and down with respect thereto, means for lifting said arm and pick-up member at will from any point they have reached on said record and automatically moving said arm back a predetermined number of grooves, means for thereafter causing said needle to be replaced on said record in back-spaced position on a lateral manual operation, and means to vary the number of grooves of back-spacing.

2. In a device for reproducing a disc phonograph record, an elongated universally mounted reproducer arm adapted to swing across said record, a pick-up needle-carrying member mounted to swing up and down on the end of said arm, a cam, manually controlled means to cause said cam to lift said arm and pick-up member from any point they may have reached on said record and automatically move said pick-up back a predetermined number of grooves, manually actuated means to cause said cam to replace said needle on said record in the desired back-spaced position, and means to adjust the amount of the back-spacing.

3. In a device for reproducing a disc phonograph record, an elongated universally mounted reproducer arm adapted to swing across said record, a pick-up needle-carrying member mounted to swing up and down on the end of said arm, motor driven cam means, manually actuated means to cause said cam to lift said arm and pick-up member from said record at any desired point in their travel across it and automatically swing said pick-up back a predetermined number of grooves, means adapted to be subsequently manually actuated to cause said cam means to replace said needle on said record in the desired back-spaced groove, and means to adjust the amount of the back-spacing.

4. In a device for reproducing a disc phonograph record, an elongated universally mounted reproducer arm adapted to swing across said record, a pick-up needle-carrying member mounted to swing up and down on the end of said arm, switch-operated motor-driven cam means, manually controlled means to cause said cam to lift said arm and pick-up member from said record at any desired point in their travel across it, automatically swinging said arm back a predetermined number of grooves upon one actuation of said switch, and means to cause said cam to replace said needle on said record in the desired back spaced groove on a subsequent actuation of said switch.

5. In a device for reproducing a disc phonograph record, a base, an elongated universally swinging reproducer arm mounted on said base, a needle-carrying pick-up pivoted on a horizontal axis on the end of said arm, a manually controlled auxiliary arm pivotally connected to said base for lifting said reproducer arm and pick-up away from said record whenever desired in the course of their travel across it, said auxiliary arm having an arcuate T-shaped extremity to engage said reproducer arm at any point of its swing.

6. In a device for reproducing a disc phonograph record, a base, an elongated universally swinging reproducer arm mounted on said base, a needle-carrying pick-up pivoted on a horizontal axis on the end of said arm, manually controlled auxiliary arm pivotally connected to said base for lifting said reproducer arm and pick-up away from said record whenever desired in the course of their travel across it, said auxiliary arm being mounted to engage said reproducer arm at any point of its swing, a cam shaft under said base, said auxiliary arm having a depending rod, a cam on said cam shaft engaging said rod for alternately raising and then lowering and laterally back-spacing said reproducer arm, a motor for driving said cam shaft, and means for stopping said motor at the expiration of a definite rotation of said shaft.

7. In a device for reproducing a disc phonograph record, an elongated pick-up carrying reproducer arm mounted to swing across said record, manually controlled means for lifting said arm and pick-up from said record at any desired point they may have reached and automatically moving said pick-up back a predetermined number of grooves, means for thereafter causing said pick-up to be automatically replaced upon said record in back-spaced position, and means to adjust the amount of the back-spacing.

8. In a device for reproducing a disc phonograph record, an elongated pick-up carrying reproducer arm mounted to swing across said record, manually actuated means for lifting said arm and pick-up from said record at any desired groove they may have reached, and means operated by a subsequent actuation of said first means for thereafter automatically causing said pick-up to be replaced upon said record.

9. In a device for reproducing a disc phonograph record, an elongated universally mounted pick-up carrying reproducer arm adapted to swing across said record, a manually controlled auxiliary arm located under said reproducer arm for lifting said reproducer arm and pick-up away from said record whenever desired at the will of the operator, said auxiliary arm having a T-shaped extremity to engage said reproducer arm at any point of its swing.

10. In a device for reproducing a disc phonograph record, an elongated universally mounted pick-up carrying reproducer arm adapted to swing across said record, manually controlled motor driven rotary cam means to lift said reproducer arm and pick-up from said record whenever desired at the will of the operator, a relay switch in said motor circuit, a normally open foot-operated switch adapted when closed to energize the relay magnet to close said relay switch and start said motor, an independent switch, and means responsive to a predetermined rotation of said cam means to open said independent switch and break the motor circuit, the momentum of said motor and cam means being sufficient to cause said cam means to rotate further and close said independent switch.

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