Sept. 25, 1962 A. CURCI 3,055,664

SOUND-REPRODUCING DEVICE

Filed May 11, 1960 2 Sheets-Sheet 1

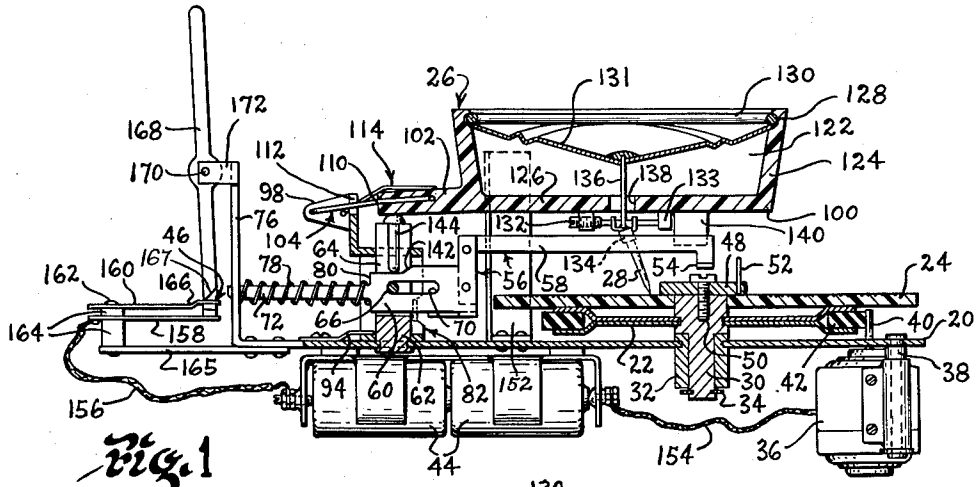


Fig. 1

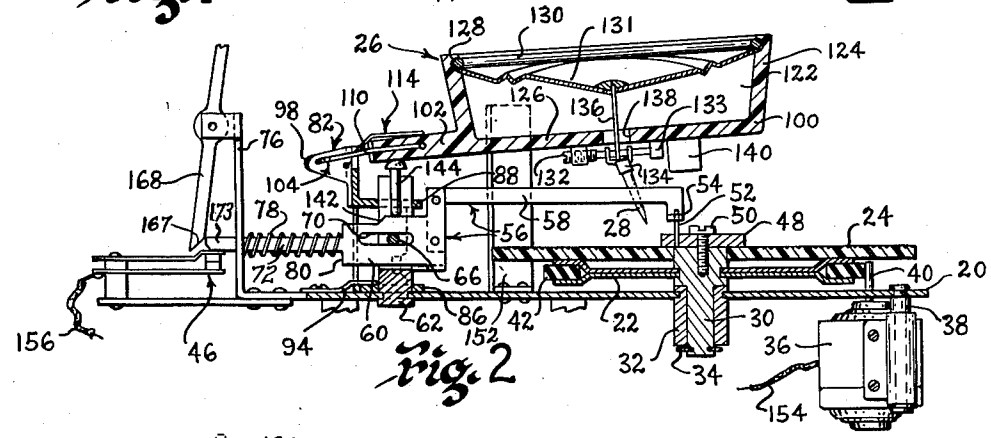


Fig. 2

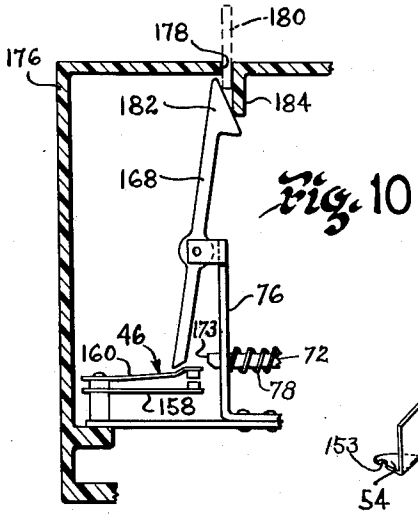


Fig. 10

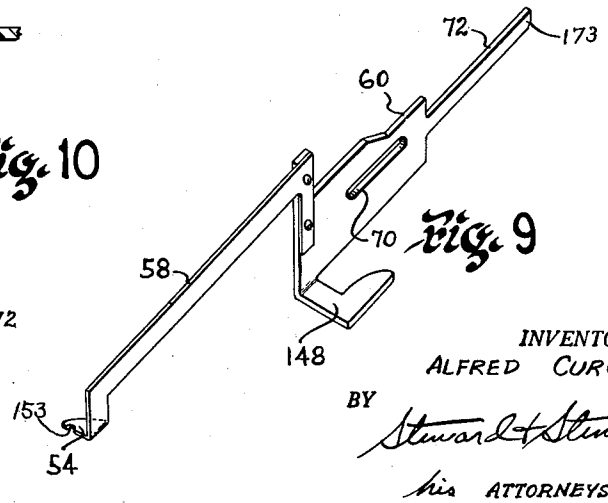


Fig. 9

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Sept. 25, 1962 A. CURCI 3,055,664

SOUND-REPRODUCING DEVICE

Filed May 11, 1960 2 Sheets-Sheet 2

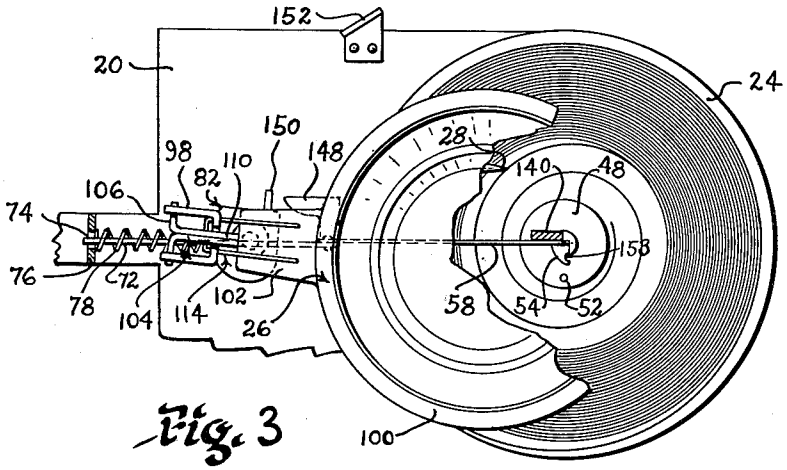


Fig. 3

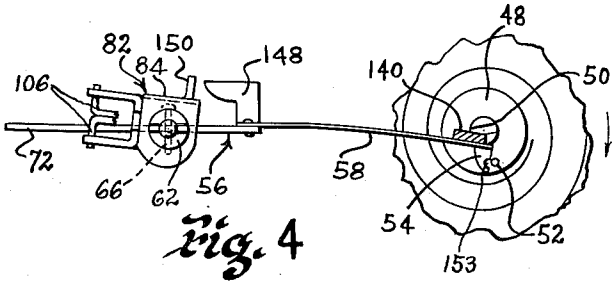


Fig. 4

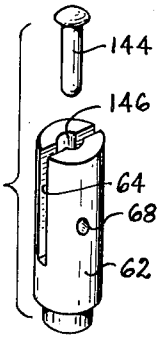


Fig. 6

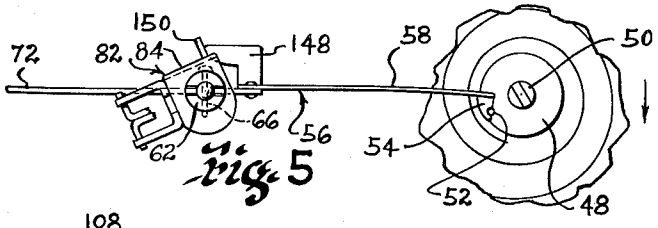


Fig. 5

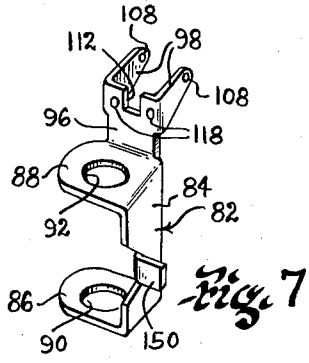


Fig. 7

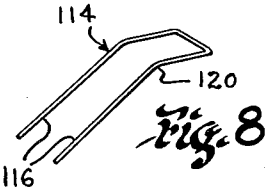


Fig. 8

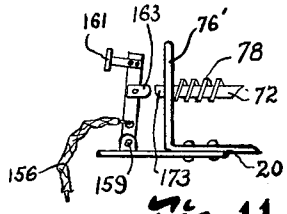


Fig. 11

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United States Patent Office 3,055,664 Patented Sept. 25, 1962

3,055,664

SOUND-REPRODUCING DEVICE

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Filed May 11, 1960, Ser. No. 28,486
21 Claims. (Cl. 274—15)

This invention relates to sound-reproducing devices, and it relates more particularly to sound-reproducing devices which automatically re-set the sound arm and can be used as toy phonographs or as components of a wide variety of different types of products, such as multiple-record players, talking dolls and the like.

A commercially successful sound-reproducing device of this type, especially if it is to be used in or as a toy, must be sturdy, yet constructed of a few, simple, inexpensive parts that are easily assembled. It must function equally well in a horizontal or vertical position and should require no manual adjustments for a reasonable period of time when properly cared for.

An object of the present invention is to provide a device of the character described that is self-adjusting, and consists of only a few inexpensive related parts having certain details of construction that allow for a wide tolerance of dimensions of the parts. Another object of the invention is to provide a device in which the parts are so constructed and arranged as to require no manual adjustment when the device is being assembled.

It is a further object of the invention to provide a device that can be rapidly and inexpensively produced on a large scale. Still another object of this invention is to provide a device which can be assembled by unskilled workmen with only simple tools.

Other objects and advantages of the present invention will be apparent from the disclosure hereinafter.

A sound-reproducing device embodying one aspect of the invention comprises a power-driven rotary element, which may for example be a part of or attached to the turntable of the sound reproducer, and a reciprocating element for transmitting movement from the rotary element in order to re-set the sound arm after a record has been played. An important feature of the invention resides in providing the reciprocating element with a laterally deflectable portion disposed in proximity to, but normally out of operative position with respect to, the rotary element such that when the record is being played, the resetting mechanism is idle. However, when the record has been played the deflectable portion of the reciprocating element is shifted laterally by means of the sound arm, for example, into an operative position within the path of the rotary element. The lateral shifting of the deflectable portion of the reciprocating element into operative relation with the rotary element causes these members to cooperatively engage each other so that movement is transmitted from the rotary element to the reciprocating element in order to re-set the sound arm of the record-playing device. Although various means can be devised for deflecting a portion of the reciprocating element from an inoperative position to an operative position, it has been found highly advantageous to simply make one end of the reciprocating element flexible so that it can be resiliently shifted to one side into the path of the rotary element when the re-setting cycle is to be initiated. Moreover, due to the flexibility of this portion of the reciprocating element, wide manufacturing tolerances can be employed without adversely affecting the proper operation of the device.

Another aspect of the present invention resides in the means whereby simple rectilinear movement of the reciprocating element first lifts the sound arm off the record and then rotates it transversely to a preceding part of the record. To this end, the sound arm is hinged to a mounting bracket so that it can be lifted off the record. The mounting bracket in turn is pivoted on the frame of the record-player in order to permit the sound arm to swing in a plane parallel to the record. Cam means are provided cooperatively interconnecting the reciprocating element and sound arm so that during the initial movement of the reciprocating element under the urge of the rotary element, the sound arm is positively lifted off the record. Further movement of the reciprocated element in the same direction causes the mounting bracket to be pivoted by a laterally extending arm on the reciprocating element, thereby swinging the sound arm toward its starting position. The sound arm is therefore always first removed from the record in a separate and distinct movement from the pivotal action during which it is swung laterally to its starting position. This ensures that the needle is never dragged across any part of the playing surfaces of the record during the re-setting operation.

This application is a continuation-in-part of my copending application Ser. No. 641,124, filed February 19, 1957.

In the accompanying drawings, in which is shown one of various possible embodiments of my invention,

FIG. 1 is a side elevation, partly in section, of the sound-reproducing device, the parts being shown in the positions which they assume while a record is being played;

FIG. 2 is a view similar to FIG. 1, but showing the relative positions of the parts after the record has been played and during the re-setting cycle;

FIG. 3 is a fragmentary plan view of the device;

FIGS. 4 and 5 are fragmentary plan views similar to FIG. 3, but showing only the principal parts of the resetting mechanism in different positions during the resetting cycle;

FIGS. 6, 7, 8 and 9 are perspective views of the mounting post and lift-rod, sound arm bracket, sound arm biasing spring, and reciprocating element, respectively;

FIG. 10 is a detail view of one of various possible coin-operated starting devices which can be used in conjunction with the re-setting mechanism of the present invention; and

FIG. 11 is a detail view of a modified starting switch.

Referring to the drawings in detail, FIGS. 1 and 2 show a sound-reproducing device intended for use with or as a toy. It will be appreciated, however, that the invention is useful in other types of sound-reproducing machines, including ordinary phonograph record players and the like. The unit consists essentially of a platform or frame 20, on which is mounted a turntable 22 that holds a conventional disk-type record 24. A sound arm or sound-reproducing element 26 is pivotally mounted on frame 20 for transverse movement across the record 24 and for movement toward and away from the record so that its needle 28 can be lifted out of engagement with the record in the usual manner and returned in a counterclockwise direction, as viewed in FIG. 3, to the starting position on the record.

Turntable 22 is provided with a central shaft 30, which is received within a bearing 32 fixed on frame 20, the turntable thus mounted being freely rotatable within bearing 32. A split-washer 34 in a circumferential groove at the lower end of shaft 30 where it projects below bearing 32 secures the turntable on the frame 20 and prevents accidental displacement of this member.

A drive motor 36 is pivotally mounted on the underside of frame 20 by means of a pivot pin 38 which is rigidly fastened to frame 20 in any suitable manner. A drive shaft 40 on motor 36 engages a rubber drive-tire 42 on the periphery of turntable 22 and rotates turntable 22 in a clockwise direction, as viewed in FIG. 3, at a desired constant speed, the motor 36 being urged by spring means (not shown) so that drive shaft 40 is

held under constant pressure against drive-tire 42. As shown in FIG. 1, motor 36 is wired to a suitable source of electrical energy, such as a pair of electric flashlight batteries 44, through a shut-off switch 46, which will be described in greater detail hereinafter.

Record 24 is in this instance secured to turntable 22 by means of a circular plate or washer 48 and a fastening screw 50 which passes through plate 48 and is threaded into the upper end of the turntable shaft 30. Plate 48, which is made of a rigid material such as a suitable metal or plastic, has integrally fixed adjacent its periphery an upwardly projecting pin or stud 52. Stud 52 which, together with its mounting plate 48, comprises in this instance the rotary element referred to hereinbefore, is adapted to coact with a finger 54 extending laterally from a reciprocating element or slide 56, which is movably supported on frame 20 and extends across the upper surface of record 24 in spaced relation thereto.

Element 56 consists of an elongated member, best shown in FIG. 9, having a laterally resilient forward section 58, on which the finger 54 is located, and a rigid section 60 rearwardly thereof. In this instance, sections 58 and 60 are fabricated from separate pieces and rigidly secured together by any suitable means such as riveting or welding. The forward section 58 is made of a resilient, flat, thin piece of steel, while the rear section 60 is fabricated from a fairly rigid piece of sheet steel. However, reciprocating element 56 could just as well be made in one piece of suitable material such as resilient sheet metal, the forward section 58 being left flexible so that it can be deflected laterally, and the rear section 60 being made rigid as, for example, by forming longitudinal ribs therein. As may be seen best in FIGS. 3 to 5, reciprocating element 56 is mounted so that in its unflexed position the forward section 58 extends substantially through the axis of rotation of turntable 22. Finger 54 at the free end of reciprocating element 56 is secured to the lower end of a depending portion of the forward section 58 so that it is at the same height as stud 52 and will be engaged thereby when the section 58 is bent to one side (FIG. 4), bringing finger 54 into the path of stud 52. As shown in FIGS. 1 and 2, most of the forward section 58 of the reciprocating element is positioned above the stud 52 so that when finger 54 is in its inoperative position (FIG. 3), stud 52 is free to revolve on turntable 22 passing under section 58 to the rear of finger 54.

Reciprocating element 56 is supported at its rigid, rear section 60 by a mounting post 62 having a slot 64 (FIG. 6) extending longitudinally through it from its upper end. Element 56 is slidably received within slot 64 and, in this instance, is retained therein against vertical movement by a pin 66, which passes through holes 68 in opposite sides of post 62 and through an elongated opening 70 in the rear section 60 of the reciprocating element. A reduced portion 72 of rear section 60 extends rearwardly through a guide hole 74 in an upright 76 fixed to the rear edge of frame 20. Reduced portion 72 is guided in upright 76 so as to prevent reciprocating element 56 from tilting about pin 66, thereby restraining this element bodily to linear movement only. A return spring 78 is mounted on the reduced portion 72 between the forward face of upright 76 and shoulders 80 on the element 56 formed by reduced portion 72. Spring 78 in this instance is a helical coil spring but could if desired be any other type of spring, such as a torsion or so-called grasshopper spring. The purpose of spring 78 is to return the reciprocating element 56 automatically to its forward position in order to complete the re-setting cycle as will be more fully brought out hereinafter. Also as will become apparent from the present disclosure, it is not essential to the invention that a return spring 78 be provided at all since, if desired, the reciprocating element 56 can be returned to its forward position manually or by some other means. In fact in some installations, such as that shown in my copending application Ser. No. 746,230 covering a multiple-record device, it may be desirable not to provide this return spring.

Pivoted on mounting post 62 is a bracket 82, by which the sound arm 26 is pivotally mounted on frame 20. Referring more particularly to FIG. 7, bracket 82 has a vertical wall 84, at the opposite ends of which and extending at right angles thereto, are a pair of apertured tabs 86 and 88. Vertically aligned apertures 90 and 92 are provided in tabs 86 and 88, respectively, through which mounting post 62 fits, so that bracket 82 is free to pivot thereon. The lower tab 86 rests in this instance on the upper surface of the frame 20 and is held down by a spring clip 94 (FIGS. 1 and 2) which is fastened to frame 20 by a screw at one end so as to overlap the edge of tab 86. Clip 94 can be swung out of overlapping relation with tab 86 in order to disassemble the unit. When clip 94 is in the position shown, bracket 82 cannot slide up on mounting post 62 but is permitted to pivot thereon within necessary limits.

Referring again to FIG. 7 more particularly, the upper tab 88 of bracket 82 has formed integrally therewith a vertical extension 96, on which a pair of rearwardly projecting ears 98, 98 are provided at opposite edges of extension 96. Vertical extension 96 and ears 98, 98 form part of the hinge connection for the sound arm 26, by which the latter can be lowered and raised onto and away from the record 24.

Sound arm 26 in this instance consists of a substantially cylindrical sound box 100 formed from some suitable material such as plastic and having extending from the bottom thereof an integrally formed extension arm 102. Embedded within extension arm 102 at the outer end thereof is one end of a hinge member 104 having outwardly and oppositely extending trunnions 106, 106, which are received within a pair of aligned holes 108, 108 at the rear ends of ears 98, 98 of bracket 82. In this instance hinge member 104 is formed of a length of stiff, relatively heavy wire or rod bent to form trunnions 106, 106 at its ends and to form a mounting shank 110 which is integrally embedded in the extension arm 102 of the sound arm. In order to permit the sound arm to be lowered into operative position, a slot 112 is formed in the upper edge of vertical extension 96, through which the shank 110 of the hinge member 104 passes.

In assembling the sound arm to bracket 82, the sound arm is held in a vertical position with the extension arm 102 and its hinge member 104 parallel to the slot 112. One of the trunnions 106, 106 is then inserted in its corresponding bearing hole 108 in bracket 82 until the opposite trunnion clears the inner side of the opposite ear 98, thereby allowing the second trunnion to be inserted in its corresponding bearing hole. The sound arm is then pivoted downwardly to its normal operating position as shown in FIGS. 1 and 2 of the drawings, so that the shank 110 of hinge member 104 is in sliding engagement with the sides of slot 112 in bracket 82. Consequently, in the normal operative position of the sound arm, shank 110 is in registration with slot 112 so that this slot has a two-fold purpose. First, it serves to accurately align the sound arm on the bracket 82 without axial side play but with freedom for vertical swinging movement, and second, it acts as a key preventing displacement of the trunnions 106, 106 from their corresponding bearing holes in the bracket ears 98.

It will be apparent that when the device is positioned horizontally as shown, the weight of the sound arm will suffice to urge it into record playing position. However, since the sound-reproducing device herein disclosed is designed to be mounted in various positions, it is desirable to have the sound arm spring-urged into playing position rather than to rely solely upon gravity. To this end, a biasing spring 114 of generally U-shape is mounted between bracket 82 and sound arm 26 and resiliently presses the latter downward onto record 24. As shown most clearly in FIG. 3, the free ends 116, 116 of spring 114 are inserted from the outer side of vertical exten-

sion 96 of bracket 82 through a pair of small holes 118, 118 in extension 96 into position on the upper surface of arm 102 of sound box 100. Ends 116, 116 are each bent at 120 so that they press downwardly on arm 102 and at the same time are prevented from becoming accidentally dislodged. Various other spring arrangements can of course be devised to serve the same purpose.

Sound box 100 is of a more or less conventional design having a hollow chamber 122 within side walls 124 and bottom 126. Formed on the inner surface of side walls 124 adjacent the upper edge thereof is a groove 128 adapted to receive a snap-lock ring 130 which secures the periphery of a resilient sound diaphragm 131 in groove 128. Located on the underside of the sound box 100 are two depending lugs 132 and 133 adapted to pivotally anchor a needle chuck 134 to the sound box for limited swinging movement. Fixed in the lower end of the needle chuck is needle 28, the needle chuck 134 having rigidly fixed thereto an elongated pin 136 which passes through a centrally located clearance hole 138 in the bottom 126 of the sound box. The upper extremity of pin 136 is secured to the center of the resilient diaphragm 131 by appropriate means. The manner in which the vibrations are transmitted from the sound grooves of the rotating record 24 through the needle 28 which is fixed to the pivoted needle chuck 134, and finally to the resilient diaphragm 131 to produce audible sound is well known. Also located on the underside of sound box 100 is a depending lug 140 adapted to engage the end of the deflectable portion 58 of reciprocating element 56 and to move the finger 54 laterally into the path of stud 52 as the needle 28 follows the spiral finish grooves on record 24 (see FIGS. 3 and 4). Lug 140 is of course properly positioned with respect to needle 28 so that it will contact the deflectable portion of element 56 at the right time in order to initiate the re-setting cycle only after the record is through. However, since the finish grooves usually cover a fairly large section of the record near the center, positioning of lug 140 is not difficult and again is allowed wide tolerances.

When reciprocating element 56 is moved rearwardly by stud 52 after the finger 54 has been deflected into operative position by the sound arm, as shown in FIG. 2, a cam surface 142 on the upper edge of the rigid section 60 of element 56 raises a lift-rod 144 mounted within a central bore 146 in the upper end of mounting post 62. The upper end of lift-rod 144 is normally in contact with, or just slightly spaced from, the underside of extension arm 102 of the sound arm so that when lift-rod 144 is forced upwardly by cam 142, the sound arm is lifted on its pivot off the record. It will be noted that cam surface 142 is positioned on reciprocating element 56 such that the sound arm 26 is raised almost immediately after the stud 52 of the rotary element starts to move the reciprocating element to the rear.

As shown best in FIGS. 3–5 and 9, reciprocating element 56 is also provided with a laterally and rearwardly projecting arm 148 spaced forwardly of bracket 82 and engageable, upon rearward movement of element 56, with an abutment 150 formed at the front edge of the vertical wall 84 of bracket 82 so as to pivot the latter counterclockwise as viewed in FIGS. 3–5 about mounting post 62 and to swing the sound arm back to its starting position on the record. From FIGS. 3 and 4 it is apparent that when the reciprocating element 56 is in its normal forward position the rearmost extremity of arm 148 is spaced forwardly of abutment 150 so that element 56 must be moved rearwardly a predetermined amount before the arm 148 starts to swing the sound arm. During this initial movement of element 56, the sound arm is raised off the record by means of cam 142 and lift-rod 144, so that the needle will not be dragged across the record when the sound arm is returned to its starting position. The distance by which arm 148 is to be spaced from the abutment 150 depends among other things on the slope and position of cam 142 and on the total distance that reciprocating element 56 travels.

It will be noted from FIG. 1 that the forward movement of element 56 is limited by engagement of pin 66 with the rear end of slot 70 in the reciprocating element. At the forward position of the reciprocating element, the finger 54 on deflectable portion 58 is most desirably located approximately abreast of the center of rotary plate 48 on the turntable, so that when it is deflected into the path of stud 52, the latter will engage finger 54 while traveling substantially parallel to the longitudinal axis of reciprocating element 56. At this point stud 52 will exert its maximum force in order to raise the sound arm off the record. A notch 153 is provided in the front edge of finger 54 in order to receive and retain stud 52 during the re-setting cycle. When the sound arm 26 is lifted off the record and then swung back to its starting position, it engages a stop 152 on frame 20 which indexes the sound arm so that the needle will be lowered into the starting groove at the beginning of the record.

It will be seen from FIG. 5 in which the bracket 82 is shown rotated by arm 148 to the position at which the side wall of sound box 100 contacts stop 152 that the stud 52 on the turntable has not yet crossed the centerline between the center of rotary plate 48 and rearmost part of the resilient section 58 of reciprocating element 56. Consequently, stud 52 is at this point still traveling somewhat rearwardly with respect to reciprocating element 56 which, however, cannot travel any further in that direction due to the fact that bracket 82 is restrained from swinging further in a counterclockwise direction, as viewed in FIG. 5, because of engagement of the sound arm with stop 152. The resilient portion 58 of reciprocating element 56, therefore, flexes to allow stud 52 to travel over-center to the opposite side of the longitudinal axis of reciprocating element 56, still carrying finger 54 with it.

Stud 52, having passed over-center continues to the far side of its circular path where it moves out of engagement with finger 54, permitting resilient portion 58 of the reciprocating element to escape from stud 52 and to spring back to its inoperative position (FIG. 3). It will be noted that return spring 78 moves reciprocating element 56 forwardly with stud 52 after the latter has traveled over-center, until reciprocating element 56 reaches its forwardmost position, substantially abreast screw 50, as determined by pin 66 in slot 70 (FIG. 1). When the forward movement of element 56 is thus arrested, stud 52 continues in a forwardly direction releasing finger 54. In the meantime, with the forward movement of reciprocating element 56, the lift-rod 144 is lowered on cam 142 permitting sound arm 26 to pivot downward, placing its needle 28 in the starting groove of the record, ready to play the record again.

From the foregoing description of the re-setting cycle, it will be apparent that close manufacturing tolerances of the parts are not necessary. For example, since resilient portion 58 of the reciprocating element simply flexes after the rearward movement of this element is arrested and before the stud 52 reaches dead-center, precise dimensions for positioning finger 54 are not required. The parts are therefore readily manufactured and easily assembled, lending the device well to large-scale production.

Coming now to the starting mechanism for operating the sound-reproducing device, it has been mentioned hereinbefore that starting switch 46 controls an electrical circuit between batteries 44 and drive motor 36. One terminal of motor 36 is grounded to frame 20 through mounting pin 38, while the other is connected to batteries 44 by a wire 154. Another wire 156 connects the opposite side of batteries 44 to the lower contact 158 of switch 46, and the upper contact 160 of switch 46 is grounded to frame 20 through a rivet 162 mounted at the rear end of a bar 165 fastened below upright 76 and ex-

tending rearwardly therefrom. The contact **158** is suitably insulated from rivet **162** and from the blade portion of contact **160** by means of insulating washers **164**.

It is to be understood that the switch **46** may if desired, be a simple "off-on" manually controlled switch, in which case the record would of course repeat itself over and over again until the power is turned off. However, since it is contemplated that children would play with toys embodying this invention, it is desirable in such cases to have means for automatically opening the switch **46** at the end of each cycle, thereby conserving the energy of the batteries.

When the sound-reproducing device is employed in a toy pay telephone, a coin savings bank or other coin-operated device, automatic means for opening the switch **46** at the completion of each cycle is necessary, so that only one cycle is operated for each deposit of a coin or coin-like object. Switch **46** is therefore shown as a self-opening, single pole switch, contacts **158** and **160** being in this instance electrically conductive, resilient, metal blades, which are spring biased to the open position. The upper blade **160** of switch **46** is formed just rearwardly of its contact point with an upwardly sloping cam surface **166** adapted to coact with a similarly formed cam surface **167** on the lower edge of a starting lever **168**, which is pivotally mounted to the upper end of upright **76** by means of a pivot pin **170** extending between a pair of spaced ears **172** projecting rearwardly from upright **76**. In order to close switch **46**, starting lever **168** is rotated is a counterclockwise direction, as viewed in FIGS. 1 and 2, on its pivot pin **170** bringing cam **167** at the lower end of lever **168** into camming engagement with the cam surface **166** on the upper switch blade **160** and pressing it down into contact with the contact point on the lower blade **158**.

Assuming that the sound arm is in a starting position with needle **28** resting on record **24**, play of the record is started when switch **46** is closed, thereby energizing motor **36** to rotate turntable **22**. On completion of the record, the re-setting mechanism is trippd in the manner already described, as lug **140** on the sound arm deflects the resilient portion **58** of reciprocating element **56** into the path of stud **52**. The resulting rearward movement of the reciprocating element during the re-setting cycle causes the pilot end **173** of reduced rear portion **72** to engage the lower front edge of the starting lever **168**, rotating said lever in a clockwise direction, as viewed in the drawings, out of registration with the upper switch blade **160** (FIG. 2). At this point, the resilient blades of switch **46** would spring to their normal open position if it were not for the fact that when the pilot end **173** of the reciprocating elements moves starting lever **168** out of engagement with blade **160**, it at the same times moves over the top of blade **160** preventing the latter from breaking contact with lower blade **158**. Switch **46** is therefore held closed in order to prevent premature stopping of motor **36** and turntable **22**.

It will be noted that if switch **46** opens as soon as lever **168** is moved out of registry with blade **160**, the turntable **22** and rotary element **48—52** will stop turning immediately, interrupting the re-setting cycle before stud **52** crosses dead-center. In that event, the re-setting cycle could not be continued by re-energizing motor **36** because the motor by itself is not powerful enough to overcome the inertia of the re-setting mechanism at this point. It would therefore be necessary to rotate turntable **22** manually in order to complete the re-setting cycle. It is essential therefore in cases where the drive motor is very light, as in toy sound-reproducing devices, that the motor not be deenergized until after the rotary element has nearly reached dead-center. While it is possible to time the opening of switch **46** so that the motor shuts off just as stud **52** travels over-center, this is not ordinarily practical in an inexpensive toy mechanism, and it is accordingly desirable to keep the drive motor energized at least until the rotary element of the present invention passes the dead-center position during a re-setting cycle. As long as the turntable is rotating at its normal speed, the power of motor **36**, with the aid of the momentum of turntable **22**, is entirely adequate to complete a re-setting cycle. In the embodiment of the invention here disclosed, starting switch **46** is permitted to open when the pilot end **173** of reciprocating element **56** moves forward again to the position shown in FIG. 10 under the urge of return spring **78**.

FIG. 11 shows a modified form of starting switch for accomplishing the same purpose as switch **46** described above. One side of the drive motor is grounded to frame **20** as before, but in this case wire **156** from the batteries is connected to a blade **157** pivoted to and insulated from frame **20** at **159**. Blade **157** is disposed vertically so that it can be pivoted into engagement with the reciprocating element, contacting the pilot end **173** which projects through upright **76'**, thus completing the circuit and energizing the drive motor. A push button **161** made of an insulating material may be secured to the upper end of blade **157**, by which to move said blade into contact with pilot end **173**.

It will be apparent that when blade **157** is in contact with the pilot end **173**, turntable **22** will rotate to play a record and, upon completion of the record, move the reciprocating element **56** rearwardly during the first part of the re-setting cycle. While the reciprocating element moves rearwardly it remains in contact with blade **157** and pivots the latter back about its pivot **159**. The drive motor therefore is not de-energized so long as the reciprocating element moves to the rear. However, when the rotary element **48—52** passes over dead-center, reciprocating element **56** is moved forward to its normal position by return spring **78**, drawing the pilot end **173** out of electrical contact with blade **157** and de-energizing the drive motor. At this point the re-setting cycle is, for all intends and purposes, complete because, even though the reciprocating element and other related parts may not have reached their starting positions at the instant that the drive motor is de-energized, the momentum of turntable **22** and the pressure of return spring **78** work together, rather than against each other, during the return stroke of the reciprocating element, and the parts therefore return to their starting positions of their own accord. In order to ensure good electrical contact between blade **157** and the end **173** of the reciprocating element, a spring clip **163** may be provided on blade **157**, which presses laterally against the side of element **72** when the switch is closed. Clip **163** may also function to delay breaking electrical contact to ensure that rotary element **48—52** passes dead-center.

As disclosed in my above-mentioned copending application Ser. No. 746,230, in cases where the reciprocating element is not to be returned to its forward position until the next playing cycle is initiated (e.g. when return spring **78** is omitted), a starting switch (not shown) operated by the lowering of the sound arm at its starting position can be substituted for either of the starting switches herein described. In that event, the sound-reproducing device is started by moving the reciprocating arm forward, manually for example, from the rearward position which it would then assume at the end of the re-setting cycle.

As mentioned before, it is important for many toys, in which the present sound-reproducing device can be used, to be operated by a coin (real or simulated). In addition the sound-reproducing device should in such cases operate only one cycle for each deposit of a coin. This can be readily accomplished by a simple modification of the starting controls described hereinbefore. Referring to FIG. 10, substantially the same starting switch **46** and lever **168** illustrated in FIGS. 1 and 2 are adapted to be operated by means of a coin. In this case the sound-reproducing device is housed in a casing **176** of a toy,

such as a coin savings bank or toy telephone. A coin slot 178 is formed in casing 176, through which a coin 180 may be dropped. A triangular-head 182 provided at the upper end of starting lever 168 is positioned below coin slot 178 with the forward sloping edge of head 182 resting against a depending flange 184 adjacent the opposite edge of slot 178 on the inner surface of casing 176. In this position of lever 168, its lower end is out of registry with switch 46, and the reciprocating element has been moved forward at the end of the previous re-setting cycle by return spring 78, so that its pilot end 173 is withdrawn. Starting switch 46 is therefore in its open position.

It will be apparent that as coin 180 is dropped or pressed downwardly through coin slot 178, one face of the coin bears against the depending flange 184, while the lower, opposite edge of the coin bears against the sloping forward edge of head 82 on the starting lever 168. This moves lever 168 in a counterclockwise direction as viewed in FIG. 10 bringing its lower end into registration with switch 46 to close it, as previously described. When coin 180 is fully inserted, lever 168 retains switch 46 closed and coin 180 falls into a coin box (not shown).

The operation of the sound-reproducer and its re-setting mechanism is believed to be clear from the foregoing detailed description. Further explanation of the operation is unnecessary except to point out that after the rotary element has passed the dead-center position during a re-setting cycle and the return spring 78 is propelling the reciprocating element back to its normal forward position, several things occur almost simultaneously. The pilot end 173 of reciprocating element 56 is disengaged from the switch 46, which thereupon opens de-energizing motor 36. The sound arm 26 is lowered under the urge of biasing spring 114 as lift-rod 144 is lowered by cam 142 on the reciprocating element. This correctly indexes needle 28 in the start grooves of record 24 for the next time when the record is to be played. Finally, just before the turntable comes to a stop due to the de-energizing of motor 36, the finger 54 on the resilient portion 58 of the reciprocating element escapes stud 52 and returns to its normal inoperative position near the center of the turntable.

In assembling the present sound-reproducing device, sound arm 26 is hinged to bracket 82 and the biasing spring 114 is inserted in place, as hereinabove described. With lift-rod 144 positioned in the bore 146 in the top of mounting post 62, bracket 82 and sound arm 26 are mounted on mounting post 62 by slipping the bearing holes 90 and 92 of bracket 82 over the upper end of post 62 and letting bracket 82 slide down until its lower tab 86 seats on the upper surface of frame 20. Clip 94 is then moved into place over tab 86 in order to hold bracket 82 down, while permitting it limited pivotal movement about mounting post 62. Reciprocating element 56 is then inserted from front to rear through vertical slot 64 in the mounting post, and return spring 78 slipped over the reduced rear section 72, whose pilot end 173 is then fitted through guide hole 74 in upright 76.

In order to retain the reciprocating element in place, pin 66 is finally inserted in place transversely through mounting post 62 and slot 70 in reciprocating element 56. As may be seen in FIGS. 4 and 5, pin 66 is provided at one end with a head in order to prevent it from passing completely through post 62. In assembling pin 66 so that it cannot accidentally become dislodged, yet can be readily removed for disassembling the device, bracket 82 is pivoted beyond its normal operating limit in a counterclockwise direction (FIGS. 4 and 5) by raising sound arm 26 above stop 152. Upon swinging bracket 82 far enough passed stop 152, the edge of vertical wall 84 of bracket 82 will expose the hole 68 in mounting post 62 sufficiently to permit pin 66 to be inserted through post 62 from that side. The sound arm is then swung back into its normal position on the turntable side of stop 152, in which position, as will be seen from FIGS. 4 and 5, the vertical wall 84 of bracket 82 at all times covers the head of pin 66 and blocks displacement of said pin.

It will be noted that none of the assembly operations above described require any tools and can be accomplished quickly without skilled workmen. Furthermore, all of the other assembly operations are equally as readily performed, requiring only simple tools and little mechanic skill. The flexible action of the reciprocating element, moreover, compensates for wide tolerances in the dimensions of the related parts. In addition, the number of parts employed are few and easy to manufacture. For example, the bracket 82 can be made very inexpensively from a single piece of sheet metal.

While the terms "forward," "rearward," "vertical" and the like are used in the specification and appended claims for purposes of clarity, these terms are of course relative only and are not to be construed as limiting the scope of the invention.

What is claimed is:

1. In a sound-reproducing device having a sound arm, the combination comprising a rotary element, a reciprocating element supported for reciprocal movement with respect to said rotary element, means operative upon reciprocal movement of said reciprocating element for re-setting said sound arm, said reciprocating element having a laterally deflectable portion in proximity to, but normally out of operative position with respect to said rotary element, said deflectable portion being movable laterally of the reciprocal movement of said reciprocating element into operative position for engagement by said rotary element whereby motion is transmitted from one element to the other, and means for moving said deflectable portion into said operative position.

2. The combination defined in claim 1, wherein said deflectable portion has a finger rigid therewith for engagement with said rotary element upon lateral movement of said deflectable portion from its inoperative position into the path of said rotary element, the reciprocal movement of said reciprocating element being directed substantially toward or away from the axis of rotation of said rotary element, said finger being located on said deflectable portion such that when said reciprocating element is at one limit of its reciprocal movement, said finger is substantially abreast the axis of rotation of said rotary element whereby, upon being deflected laterally into the path of said rotary element, said finger is carried thereby over-center from one side of said rotary element to the other.

3. The combination defined in claim 2, wherein the other limit of reciprocal movement of said reciprocating element is reached before said finger passes over-center, said deflectable portion being flexible so that it can resiliently bend in order to permit said finger to be carried over-center.

4. The combination defined in claim 2, which further includes spring means for urging said reciprocating element to its said one limit of reciprocal movement when said finger passes over-center.

5. The combination defined in claim 2, which further includes shut-off means for stopping said sound-reproducing device substantially as said finger passes over-center.

6. The combination defined in claim 1, wherein said reciprocating element is movable in one direction by said rotary element, and which further includes spring means for effecting movement of said reciprocating element in the opposite direction.

7. The combination defined in claim 6, which further includes means for positively limiting the movement of said reciprocating element in said one direction.

8. In a sound-reproducing device comprising a turntable and a sound arm mounted for movement toward and away from said turntable and also for movement transversely thereof between start and finish positions, the combination comprising a rotary element mounted on

said turntable, a reciprocating element supported for reciprocal movement relative to said rotary element and having a deflectable portion disposed in proximity to, but normally out of operative position for engagement by said rotary element, said reciprocating element having means for moving said sound arm away from said turntable and then transversely toward its starting position upon movement of said reciprocating element in one direction, and means for moving said deflectable portion transversely of the direction of reciprocal movement of said reciprocating element into operative position such that said rotary element engages said reciprocating element moving it in said one direction.

9. The combination defined in claim 8, wherein said means for transversely moving the deflectable portion of said reciprocating element comprises a part of said sound arm in position to laterally engage said deflectable portion when said sound arm reaches its finish position, and finish grooves in a record positioned on said turntable for rapidly moving said sound arm across said turntable at the end of the record.

10. The combination defined in claim 8, wherein the reciprocal movement of said reciprocating element is substantially rectilinear, said deflectable portion comprising a fixed part of said reciprocating element disposed with one end free and having capacity for resiliently bending along its length, the free end of said deflectable portion having provision for engagement with said rotary element, stop means fixed with respect to said turntable for locating the start position of said sound arm and positively limiting the movement of said reciprocating element in said one direction, and spring means carried by said reciprocating element continuously urging it in the opposite direction.

11. The combination defined in claim 8, which includes means for slidably mounting said reciprocating element on said frame, said mounting means comprising a fixed pin extending through said reciprocating element, said reciprocating element having a stop surface engageable with said pin for limiting the movement of said reciprocating element in the opposite direction, and a spring urging said reciprocating element in said opposite direction.

12. The combination defined in claim 8, which includes a mounting post rigidly secured to said frame for mounting said reciprocating element, said mounting post having a longitudinal slot in which said reciprocating element is slidably received, and a pin extending transversely through said mounting post and reciprocating element for limiting the reciprocal movement of said reciprocating element.

13. In a sound-reproducing device comprising a turntable and a sound arm, the combination comprising a bracket pivotally mounted on said frame to which said sound arm is hinged for movement toward and away from said turntable, said sound arm being also movable by the pivotal mounting of said bracket on said frame transversely of said turntable between start and stop positions, a rotary element mounted on said turntable, a reciprocating element supported for reciprocal movement relative to said rotary element and having a deflectable portion disposed in proximity to, but normally out of operative position for engagement by said rotary element, said reciprocating element having cam means for moving said sound arm away from said turntable during an initial part of the reciprocal movement of said reciprocating element in one direction and further means engaging said bracket during a subsequent part of the reciprocal movement of said element in said one direction for pivoting said bracket and sound arm transversely towards starting position, and means for moving said deflectable portion of said reciprocating element laterally of the direction of reciprocal movement of said reciprocating element into operative position such that said rotary element engages said reciprocating element moving it in said one direction.

14. In a sound-reproducing device having a frame, a mounting post fixed on said frame, a sound arm pivotally supported on said post, a lift-rod carried by said frame for raising said sound arm off a record positioned on said sound-reproducing device, a rotary element supported by said frame, and a self-adjusting reciprocating element guided by said mounting post and disposed in proximity to, but normally out of operative position with respect to said rotary element, a portion of said sound arm being disposed so as to position said reciprocating element for engagement by said rotary element, thereby imparting a substantially rectilinear rearward movement to said reciprocating element, a cam surface formed on the upper edge of said reciprocating element cooperatively associated with said lift-rod whereby the rearward movement of said reciprocating element brings said cam surface into engagement with said lift-rod transferring the rearward movement of said reciprocating element into relative vertical movement of said lift-rod, said lift-rod being positioned with respect to said sound arm in order to pivot said sound arm off the record upon such relative vertical movement of said lift-rod.

15. The combination defined in claim 14, which further includes a biasing spring continuously urging said sound arm into record playing position.

16. The combination defined in claim 14, which further includes a bracket by which said sound arm is pivotally mounted on said mounting post concentric with said lift-rod, and a laterally projecting arm on said reciprocating element in position to engage said bracket during the rearward movement of said reciprocating element in order to pivot said bracket together with said sound arm about said lift-rod, a stop-element mounted on said frame in position to limit the pivotal movement of said bracket in order to index the sound arm at its starting position.

17. In a sound-reproducing device having a frame and a sound arm supported on said frame, a reciprocating element mounted on said frame for reciprocal movement thereon, means operatively interconnecting said reciprocating element and sound arm for resetting said sound arm upon reciprocal movement of said reciprocating element, a normally open switch, means for closing said switch for turning said sound-reproducing device on and off, and means cooperatively associated with said reciprocating element upon movement thereof in one direction to dislodge said switch closing means while simultaneously deferring opening of said switch until said reciprocating element moves in the opposite direction, thereby turning off said sound-reproducing device upon the resetting of said sound arm.

18. The combination defined in claim 17, which is further provided with a coin slot in said frame, said switch closing means including a cam surface positioned for engagement by a coin-like object as it is guided through said slot for moving said switch closing means into switch closing position.

19. The combination defined in claim 17, wherein a first contact of said switch is carried by said reciprocating element and said switch closing means comprises a member pivoted on said frame in a plane parallel to said reciprocating element into and out of engagement with said first contact, a second contact of said switch being carried by said pivoted member; said switch being opened after movement of said reciprocating element in said one direction against said pivoted member and substantially upon movement of said reciprocating element in the opposite direction.

20. In a sound-reciprocating device having a frame and a sound arm supported on said frame, a normally open switch for controlling the operation of said sound-reproducing device, a reciprocating element slidably mounted on said frame, means operatively interconnecting said reciprocating element and sound arm for resetting said sound arm, a rotary element carried by said frame and disposed for engagement with said reciprocating element whereby rearward rectilinear movement is imparted to said reciprocating element in order to reset said sound

arm, a starting lever pivotally mounted on said frame having one end disposed for cooperative engagement with said switch whereby said switch is closed upon pivoting said starting lever in one direction, said switch and starting lever being so positioned wtih respect to said reciprocating element that upon rearward movement of said reciprocating element a portion thereof engages said starting lever moving it out of registration with said switch while simultaneously moving into switch closing engageemnt with said switch, said reciprocating element being movable forwardly out of engagement with said switch thereby allowing said switch to open.

21. The combination defined in claim 20, which further includes a coin slot in said frame, said starting lever being provided with a cam surface positioned for engagement by a coin-like object as it is guided through said slot for pivoting said starting lever in said one direction.

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