FIG. 3

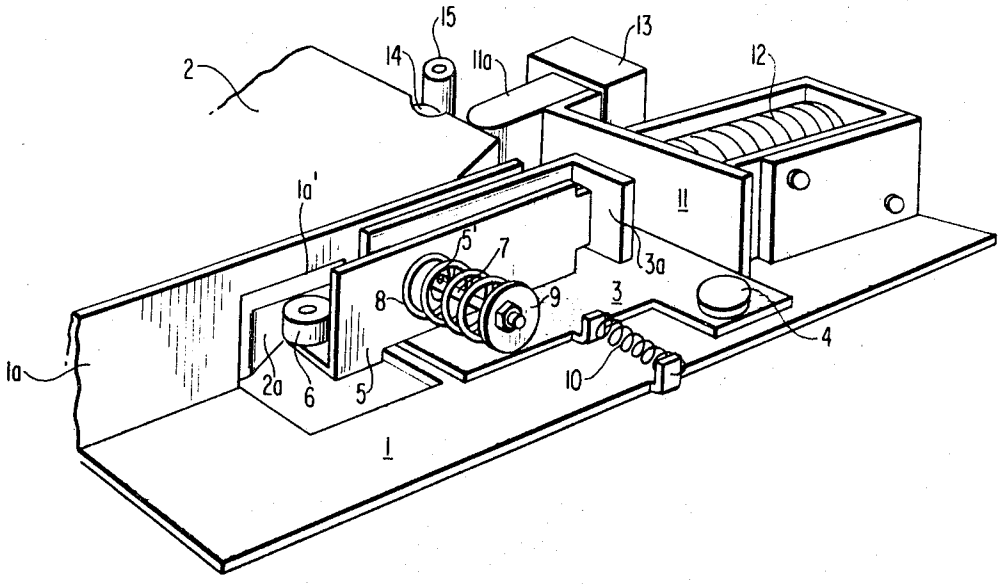


FIG. 4a

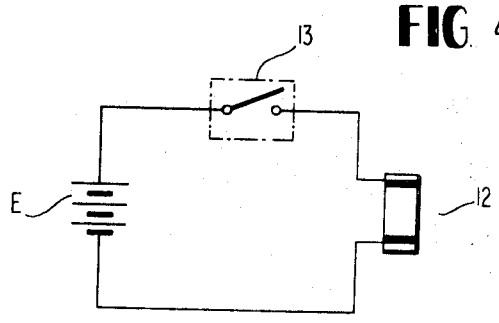
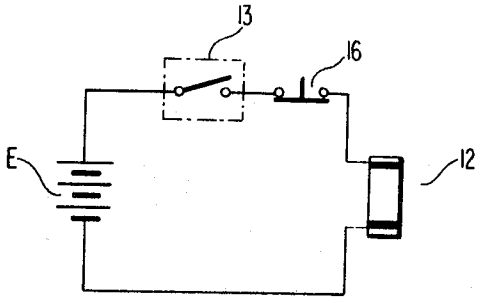


FIG. 4b



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PATENTED JAN 11 1972

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SHEET 1 OF 2

Fig. 1.

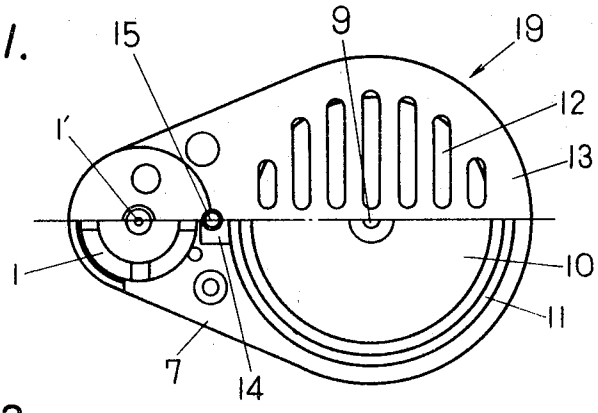


Fig. 2.

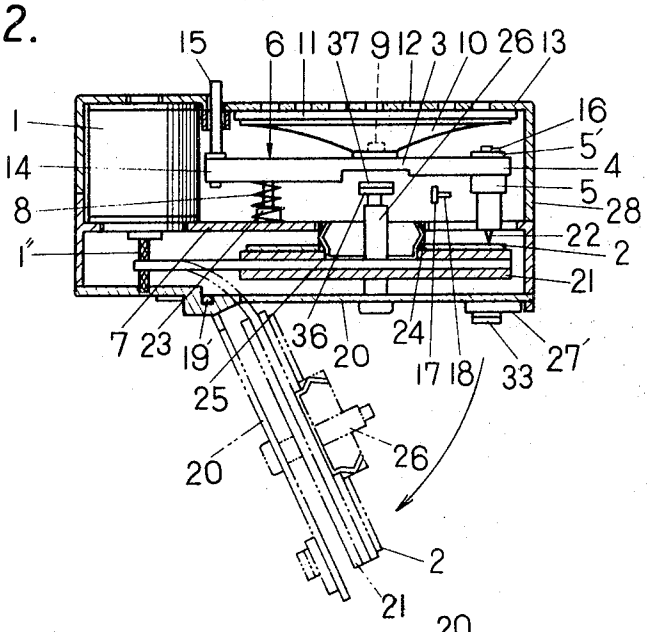
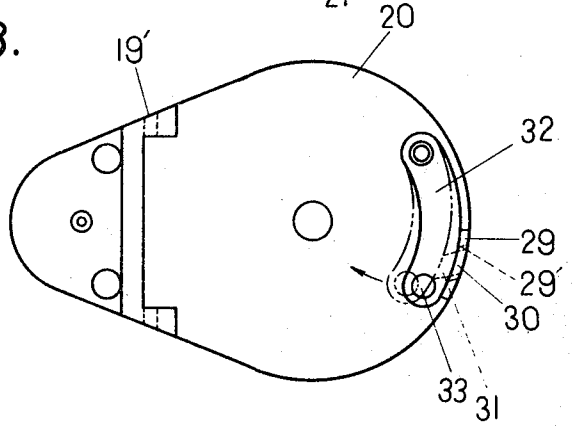


Fig. 3.



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Fig. 4.

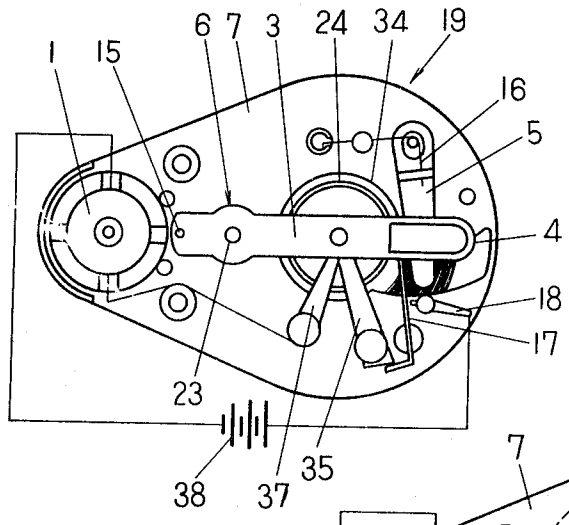


Fig. 5.

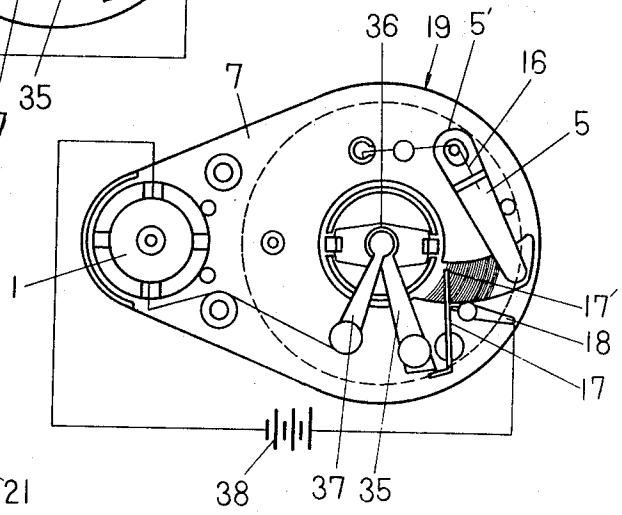


Fig. 7a.

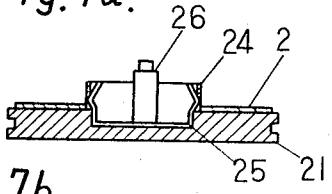


Fig. 7b.

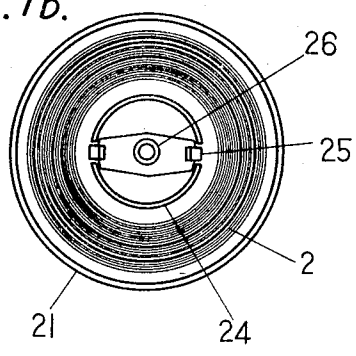


Fig. 6a.

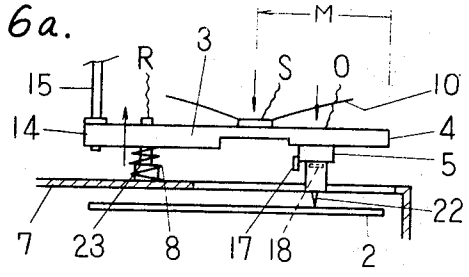
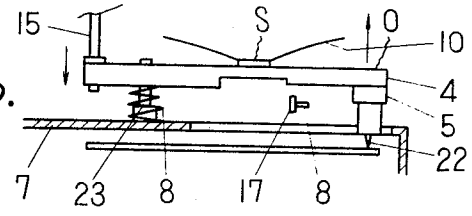


Fig. 6b.



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HANDY ACOUSTIC REPRODUCING DEVICE

The present invention relates generally to a simplified acoustic reproducing device which may be adapted in a toy phonograph or the like which is automatically operated by actuation of an electric motor. The primary object of the invention is to provide such device in which a gradually increased pressing force is applied to a pickup moving inwardly along the continuous groove on a disc and thereby pressure exerted upon the stylus is suitably regulated so as to always keep constant the rotating velocity of the disc.

Other important objects of the present invention are to maximize the baffle effect of the speaker, to prevent damage to the disc which may otherwise be caused by impact from the outside, to simplify to the utmost the construction of the mechanism, to allow easy assembly thereof, and to constitute a structure which is easy to handle and highly reliable in operation.

Now, the present invention will be described in detail by way of its example embodied in the accompanying drawings, in which:

FIG. 1 is a plan view of the present device, with the lower half of the top cover member removed;

FIG. 2 is a longitudinal sectional view of the device, in which the dotted lines illustrate a condition where the bottom plate is opened out for the purpose of exchange of the disc;

FIG. 3 is a bottom view of the device;

FIG. 4 is a plan view of the device, with the top cover member and speaker removed to show the pickup at the end of its travel;

FIG. 5 is a plan view similar to that of FIG. 4 but with the presser arm member removed and also showing the pickup located at the starting point of its travel;

FIG. 6 *a* and *b* show, respectively, a schematic operational illustration of the presser arm bar and its associated mechanism; and

FIG. 7 *a* and *b* show, in longitudinal sectional view and plan view respectively, a turntable on which a disc is placed.

In the conventional devices of this type, in order to provide required pressing force to the pickup for securing the stylus, a weight or like means the pickup placed thereupon to produce desired stylus pressure by its gravity force. In such case, however, the playback speed may become irregular since stylus pressure remains always constant with respect to variation of speed of rotation of the disc produced by inward movement of the pickup. Also, when the entire case is moved, an acceleration is given to the pickup, thus producing additional loading to the weight to invite increase of stylus pressure, which may result in inflicting damage to the disc.

The present invention is designed to eliminate all of these defects and to permit maintenance of constant rotating velocity of the disc to thereby realize stability of the melody produced by playback operation.

The present invention, in essence, comprises a structure in which a presser arm bar **3** is mounted to extend in the diametrical direction of a disc **2** adapted to be rotated on actuation of an electric motor **1**, with one end **4** of said arm bar **3** being carried on a pickup **5** arranged such as to have a constant tendency to move towards the outer periphery of the disc **2**, and with the other end **6** of said arm bar being pivoted to a baseplate **7** and arranged to always receive an elastic lifting force by a spring **8**. A speaker **10** is loosely mounted on a stem projecting from the center of said presser arm bar **3**, with the top face **11** of said speaker **10** being in and pressing against a top cover member **13** having formed therein a plurality of small perforations **12**. The rear end **14** of said presser arm **3** is coupled to an operating rod **15** which has a top end extending outside of said cover member.

A structural feature of the device comprises essentially, in combination, a pickup assembly having its one end **5'** pivotally secured to baseplate **7** and arranged to have a constant tendency to be forced towards the outer periphery of the disc **2** by a spring **16**. A resilient switch assembly comprises resilient contact **17** having its end **17'** extended to the terminal end of travel of the pickup **5** moving progressively towards the center of the disc and a fixed terminal **18** contacted with said contact **17**. A turntable assembly **21** adapted to be actuated by a motor is located on a bottom plate **20** hinged to the bottom of a case **19**. The presser arm bar assembly has its one end **4** resting on the pickup **5** and its other end **6** arranged to be normally urged upwardly by resilient spring **8** so as to gradually increase stylus pressure in proportion to movement of the pickup which moves towards the axial center of the disc. A lifting mechanism comprises the operating rod **15** coupled to the rear end **14** of said presser arm bar **3**, with the top portion thereof protruding outside of the case **19**, said operating rod being also so arranged as to be vertically moved manually as desired. These assemblies and mechanisms are disposed in their respective positions within the case **19** which includes said baseplate **7**, and are interlocked so that they may be actuated automatically in succession.

In the drawings in general, reference number **2** denotes a record disc placed on turntable **21** to which rotation is transmitted through a belt from a driving shaft **1''** of an electric motor **1**. **5** is the pickup rod adapted to securely hold a stylus **22** whose pointed end is pressed in grooves on the disc. Said pickup rod is always urged towards the periphery of the disc **2** by means of a steel wire spring **16**. **3** indicates a presser arm bar disposed to extend in the diametrical direction of the disc **2**, with one end **4** thereof being rested upon the pickup **5**, and a portion **6** adjacent the other end **14** thereof has passed therethrough a protuberance **23** erected upon the baseplate so that this portion is always pushed upwardly by the spring **8**.

Reference number **10** denotes a speaker which is closely mounted on a projection **9** provided in the center of said presser arm bar **3**, and its top face **11** is abutted against the underside of the top cover member **13**.

FIG. 6 *a* is an illustration showing by arrow the direction of the force applied to the presser arm bar **3** by the spring **8**. This structure constitutes a lever mechanism where the mounting position S of the speaker **10** loosely at the center of the presser arm **3** serves as fulcrum and the spring-pressed location R serves as dynamic point, and where the one force **0** applied on one end **4** of the presser arm bar **3** resting on the pickup **5** is continuously varied in accordance with movement of the pickup towards the center of the disc.

Since the top face **11** of the speaker **10** loosely mounted on the projection **9** abuts against the top cover member **13**, further upward movement of the assembly is inhibited and also the assembly is arranged movable without interference of lateral swinging motion of the presser arm bar **3**, so that responsive to the pressing force of the spring **8** applied the presser arm bar **3** such as to push up portion **6**, the assembly works, as a whole, to force down the pickup according to the principles of leverage with the mounting section S of the speaker **10** acting as fulcrum.

Thus, the stylus **22** retained by the pickup **5** is pressed into the groove on the disc by appropriate stylus pressure to allow playing or reproduction of the recorded sounds during rotation of the disc, while the pickup **5**, against the resilient force of the spring **16**, moves successively along the groove line in the disc towards the center thereof.

On the other hand, rotating velocity of the disc, which is under constant torque given by motor **1**, increases in proportion as the contacted position of the stylus **22** moves towards the center of the disc, but since the acting point **0** in the leverage mechanism constituted by the presser arm bar **3** is also shifted inwardly, the working distance M is correspondingly shortened to allow the pressing force to increase in proportion to increase of the force of rotation, thus achieving stability of velocity by stylus pressure.

Reference number **17** designates resilient contact element for a switch means. The end of said element is located adjacent to the end of revolving motion of the pickup **5** so that when playing is finished and the pickup **5** reaches the no-sound groove portion at the termination, said end of the resilient contact element **17** is pressed by the pickup and separated from contact with the fixed terminal **18** to break up

the electric circuit, thus automatically stopping rotation of the motor.

FIG. 6*b* illustrates an operation for returning the pickup **5**, which is at the termination of its travel, to its original or starting position. To initiate this operation, the operating rod **15** connected to the rear end **14** of the presser arm bar **3** is manually depressed, whereby the end **4** of said arm bar **3** is raised from the pickup **5** by a counter action to the above-said leverage with stem **23** serving as fulcrum, and the thereby released pickup **5** is forced outwardly or towards the outer periphery of the disc by the action of the spring **16** to bring the pickup to its starting position.

Concurrently, the resilient contact element **17**, owing to its own elasticity, returns to its original condition to contact with the fixed terminal **18** to accordingly close the switch, whereby the electric motor **1** is again actuated to initiate the playing operation.

Referring now to FIG. **7**, there is shown the turntable **21** adapted to be driven by the electric motor **1**. As will be noted, the turntable **21** is pivotally mounted on a bottom plate **20** hinged for opening to bottom portion **19'** of the case **19** and adapted to be driven by motor **1** through a belt means. Said turntable **21** also comprises a retaining link **25** engaged in a central opening **24** in the disc **2** and a switch rod **26** extending upwardly from the axial center thereof to contact with an electric contact element.

The turntable having the above-described construction is securely held in its "playing" position by a detent or clasp **27'** adapted to support an end of the bottom plate **20**, and when it is desired to exchange the disc or to turn the disc over, said detent **27'** is moved to swing the bottom plate **20** open in the manner shown by the dotted lines in FIG. **2**, whereby desired operation can be easily effected.

A detailed embodiment of such detent means attached to the bottom plate **20** is shown in FIG. **3**. As will be seen, a portion **29** of a sideplate **28** of the case **19** is projected downwardly from the underside of the bottom plate **20** to constitute a protuberance **29** having a clasping hole **29'** and so arranged as to be snugly received in a notch **30** formed at an end of the bottom plate, and a slidable bar **32** having a checking element **31** engaged in said clasping hole **29'** is mounted with its one end pivoted to a suitable end portion of the bottom plate **20**. The user may hold a grip **33** provided on the bar **32** to laterally move said bar thereby to easily open or close the bottom plate **20**, as desired.

Now, the discussion will be directed to the compressed type switch assembly adapted to be opened and closed by a projected switch rod **26** provided in the center of the turntable **21**, with particular reference to FIG. **5** where such assembly is best illustrated. As will be appreciated, the assembly comprises a movable terminal element **35** which is held in normal contact with the resilient contact element **17** by the switch rod **26** projected upwardly from the bottom plate **20** hinged to the bottom portion of the case **19**. Said movable terminal element **35** is arranged such that when said bottom plate **20** is closed, the end **36** of said movable contact is pushed up into pressed contact with a fixed terminal element **37** to thereby establish an electric circuit.

When, on the other hand, the bottom plate **20** is opened, the movable terminal element **35** is released from the switch rod **26** and also separated from the fixed terminal element **37** to cut off the electric circuit, causing the motor to stop its rotation. Also in FIG. **5**, reference number **38** denotes an electric source which is here shown as a battery for convenience of explanation but usually such electric source is supplied by connection into a wall socket. Thus, the electric circuitry in the present device comprises resilient switch assembly adapted to be opened and closed by motion of the pickup **5** and a switch assembly adapted to be opened and closed by the switch rod **26** on the openable bottom plate **20**, both assemblies being connected in series with motor **1**.

As will have been comprehended from the foregoing, it is possible according to the present invention to automatically keep constant the rotating speed of the disc by suitably adjusting the pressure exerted upon the stylus which is placed on the disc surface. Also, due to the face that the top face of the speaker abuts closely against the top cover member **13** with the perforation **12**, the reproduced sound in the case is enhanced by baffle effect. Further, the stylus assembly receives no other pressing force than the resilient force of the spring means and weight of the pressor arm bar, so that even in case the apparatus should be dropped onto the floor by accident, the resulting impact against the internal mechanism, particularly to the disc, is minimized to avoid otherwise inevitable breakdown or wrecking in such event. The present device also includes many other prominent features, such as easy and ready exchange of the disc or automatic opening and closing of switch means.

I claim:

1. In an acoustic reproducing device, a case having a baseplate and a top cover member situated over and spaced from said baseplate and formed with a plurality of perforations, a speaker situated between said cover member and baseplate in engagement with said cover member and aligned with said perforations, a turntable mounted for rotation in said case, a pickup arm having a stylus for engaging a rotary disc record on said turntable, said pickup arm being swingably mounted on said baseplate between the latter and said cover member, an elongated presser bar pressing at one end against said pickup arm for urging the latter toward said disc record, said presser bar pivotably mounting rail speaker at an intermediate portion of said presser bar and having an opposed end portion distant from said pickup arm, and a spring acting on said presser bar at said opposed end portion thereof, said bar mounting said speaker substantially in alignment with the center of said disc record, the pickup arm being mounted to swing toward said center pickup during playing of the record, whereby said spring on the one hand compresses the speaker between said presser bar and top cover member and on the other hand, with said speaker acting as a fulcrum, provides the force with which the presser bar presses against said pickup arm, which force gradually increases as the pickup arm approaches the center of a disc record.

2. The combination of claim **1** and wherein an operating rod extends through said top cover member to the exterior thereof and engages a region of said presser bar more distant from said pickup arm than said spring, and a second spring urging said pickup arm outwardly away from the center of a record, so that when said operating rod is manipulated to swing said presser bar away from said pickup arm the latter will be returned to a starting position away from the center of a disc record.

3. The combination of claim **1** and wherein an electric motor is operatively connected to said turntable for rotating the latter, and an electrical circuit for energizing said motor, said circuit including a switch assembly having a resilient contact located to be engaged by said pickup arm when the latter reaches the inner end of a recorded portion of a disc record, so that the circuit of said motor will be opened by said pickup arm to stop rotation of the turntable.

4. The combination of claim **3** and wherein said case has a swingable bottom portion carrying said turntable, a switch rod extending from said swingable bottom portion through the center of a disc record, and a second switch in series with said first-named switch and adapted to be closed by said switch rod, said second switch positioned to assume a closed position when said bottom portion closes said case and an open position when said bottom portion is swung to open said case for changing a record on the turntable.

5. The combination of claim **4** and wherein a detent assembly releasably holds the bottom portion in a closed position.

* * * * *