Dec. 23, 1952 J. G. KURZEN, JR 2,622,883

SOUND-REPRODUCING APPARATUS

Filed June 16, 1945

2 SHEETS—SHEET 1

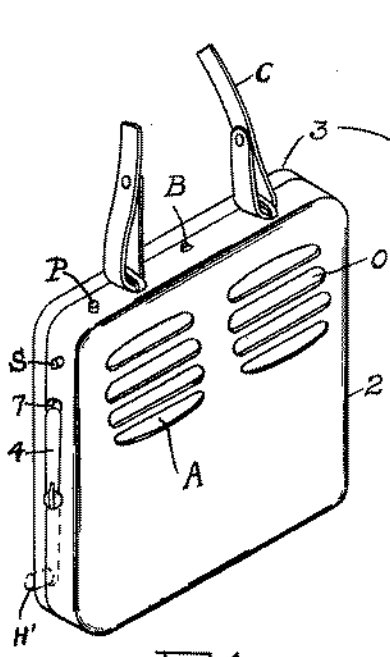

Fig. 1

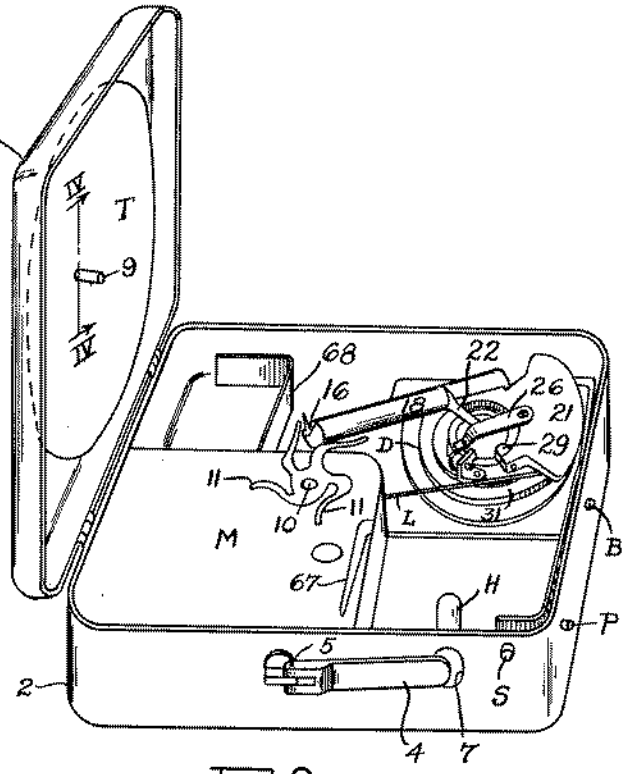

Fig. 2

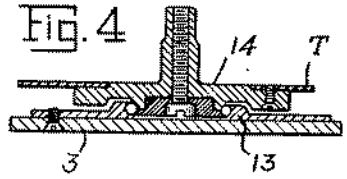

Fig. 4

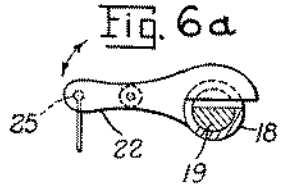

Fig. 6a

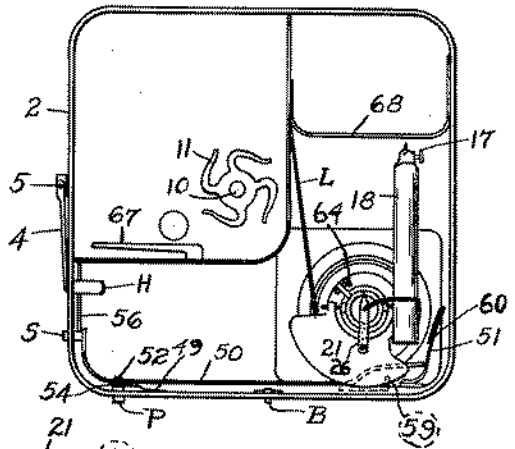

Fig. 3

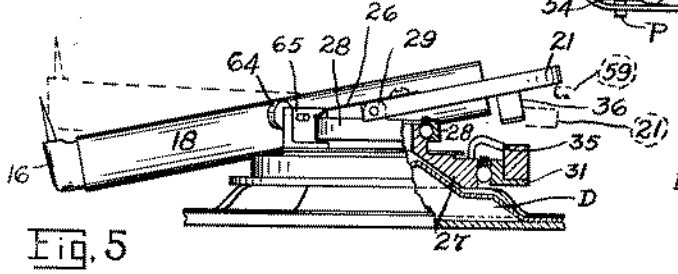

Fig. 5

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SOUND-REPRODUCING APPARATUS

Filed June 16, 1945 2 SHEETS—SHEET 2

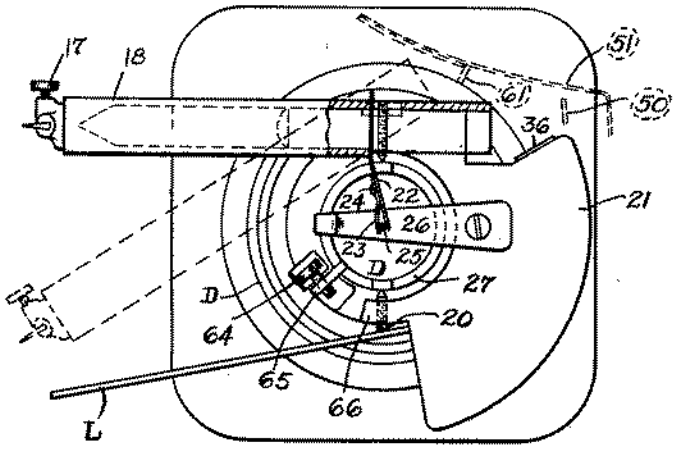

Fig. 6

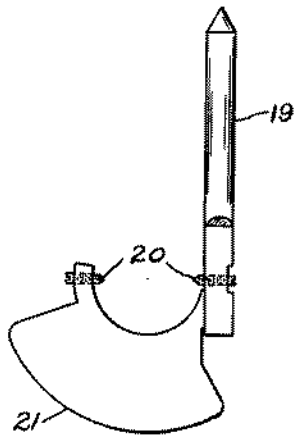

Fig. 8

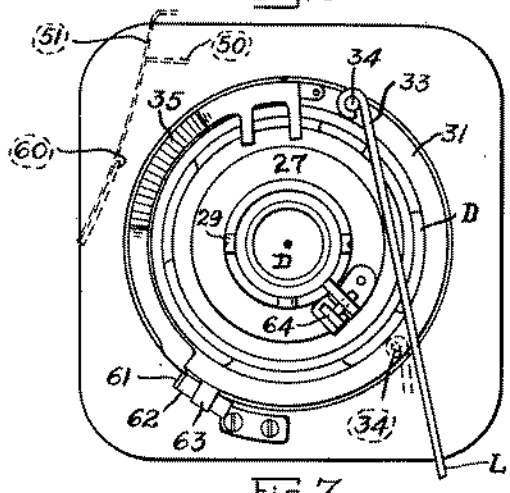

Fig. 7

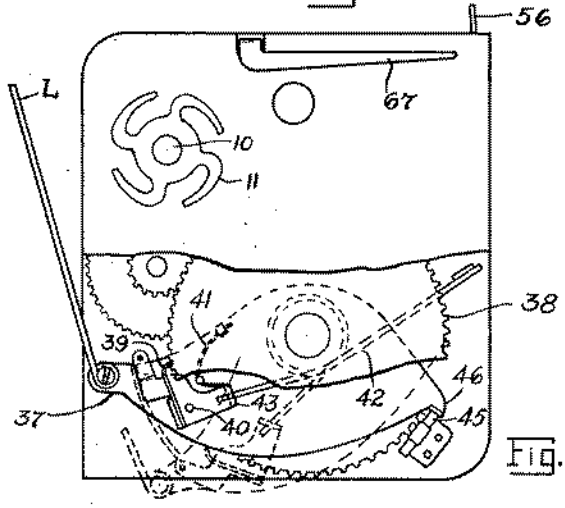

Fig. 9

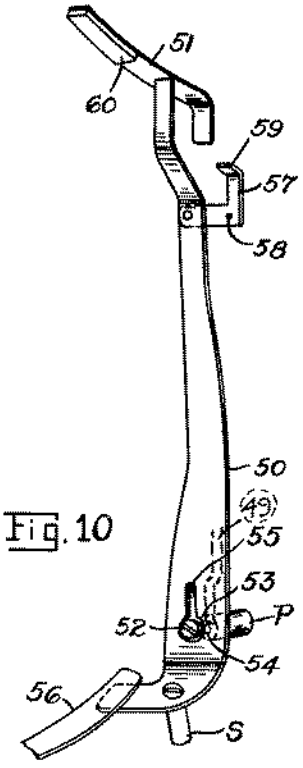

Fig. 10

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UNITED STATES PATENT OFFICE

2,622,883

SOUND-REPRODUCING APPARATUS

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Application June 16, 1945, Serial No. 599,860

17 Claims. (Cl. 274—9)

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This invention relates to sound reproducing apparatus, and it is among the objects of the invention to provide a construction which is particularly compact and light, and can be operated in any position, even upside down, and in which the motive power sets the needle into operating position at the proper time. Other objects and advantages will appear from the following description.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

Fig. 1 is a perspective view of an embodiment of the invention;

Fig. 2 is a perspective view (on slightly larger scale) showing the same with the lid open;

Fig. 3 is a plan view omitting the lid;

Fig. 4 is an enlarged sectional detail taken on a plane substantially indicated by line IV—IV, Fig. 2;

Fig. 5 is an enlarged side elevational view, partly in section, of the needle arm supporting structure;

Fig. 6 is a plan view of the same, partly in section;

Fig. 6a is a sectional detail taken transversely through the needle-carrying sleeve and arm 19, 19, with the lever arm 22 shown in elevation;

Fig. 7 is a similar view with the needle arm assembly removed;

Fig. 8 is a plan view detail of the needle arm structure, on slightly reduced scale;

Fig. 9 is a plan view, partly in section, of the motor drive and needle arm setting means; and

Fig. 10 is a perspective view of the "start" and "stop" control means.

In a suitable housing 2, having a lid 3 which may be hinged thereon and held by a suitable inner spring catch and released by a push button B, the operating mechanism is mounted, and involves means for turning a sound record, a sound diaphragm in an opening in the housing wall, means for communication between the sound record and the diaphragm, and means for starting and stopping.

Where convenient portability is particularly desirable, the housing may be provided with a carrying strap C, Fig. 1, and this may be of

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handle size or more desirably of shoulder strap length.

The sound diaphragm D, Figs. 2, 5, 6 and 7, is secured at its periphery on an opening O, Fig. 1, in the housing, this being louvred or grilled or similarly protected. For sound balancing, as is desirable for best operation of such a device, a balancing opening A, Fig. 1, is arranged alongside the diaphragm in the housing wall. Particularly natural tones are thus obtained.

The motive power may be a spring motor, and for particular convenience the winding crank 4 thereof may be of folding form, as for instance hinged at 5 so as to fold with its handle H in an out-of-the-way position in an opening 7 in the housing. And, on being unfolded back into the position H', Fig. 1, the motor may be wound by cranking as in the usual manner. Thereupon, the crank may be re-folded back into its out-of-the-way position. The drive motor M and the record turntable T are separate, and the motor may be mounted in the housing 2, while the turntable T is mounted in the lid 3. When the lid is closed, however, the spindle 9 of the turntable is in axial alignment with the spindle 10 of the motor, and by resilient engaging means, such as arms 11 on the motor spindle, such as to engage the central portion of the sound record on the table, motion is imparted. Desirably, the turntable T is mounted on ball bearings, and this may involve, for instance, an outer race member 13, Fig. 4, secured to the lid 3, and an inner race member 14 carried by the turntable T, the balls or free rolling elements being interposed.

Carried adjacent the diaphragm is the needle arm assembly, and this may include a needle chuck 16 with clamp screw 17, Fig. 6, and being carried by sleeve 18 on an arm 19, Fig. 8, which is pivotally mounted by the pivot screws 20, and which has a rear sector extension 21. The sleeve 18, while not displaceable axially of the arm 19, is mounted thereon to be freely capable of a slight oscillatory rocking or turning motion on such arm, as occasioned by the movement of the needle in the sound groove of the record; and extending laterally from anchorage on the sleeve, as for instance being soldered thereto at the end surface where the sleeve is cut away on account of the member 21 and mounting screws 20, and extending laterally as a lever connecting to the diaphragm stud as shown at Figs. 2, 3, 6 and 6a is a lever 22, Fig. 6, which connects operatively to the diaphragm, as by a two-piece bearing

clamp 23, held by a screw 24, and connecting with a ball-head 25 on a short stud extending rearwardly from the diaphragm. The movements of the needle in the sound track are thus communicated to the diaphragm. The needle arm or sound tracking arm assembly 18, 19, 21, is carried by an oscillatable or rotative mounting co-centered with the diaphragm and turning on a support which is in the form of a turret standard 27, Figs. 5, 6 and 7, which in general is a hollow truncate cone shape over the truncated conical-type diaphragm and having its annular base fastened about the periphery of the diaphragm to the casing 2. The diaphragm D with shape partially like that of the turret standard thus is protected therewithin and is clamped by it peripherally to the casing. The turret standard has several cut-outs or openings in its side wall (the diaphragm showing through these spaced openings or windows on Fig. 5). Rotatively mounted near the top of the turret standard is a ring 28 riding preferably on interposed bearing balls, and thus being co-centered with the diaphragm, and the needle arm is pivoted to lugs 29 on such ring by the pivot screws 20. A needle pressure control spring 26 of narrow finger shape (Figs. 2, 3 and 6) extending across from its point of anchorage on the rear sector 21 bears by its free end against the annular member 20, and by the lever-like arrangement of the integrally-acting assembly 18, 19, 21 and 26 on the fulcrum line of screws 29 urges the needle against a record on the turntable. With this arrangement, the needle arm assembly 18, 19, 20 is capable of rocking on its pivot screws 29, as indicated in the full line and dotted line positions in Fig. 5, and also is capable of arcuate oscillatory movement about the turret member 27, as indicated in the full line and dotted line positions in Fig. 6, and at the same time the needle-carrying sleeve 18 is capable of receiving a slight rocking or oscillating movement on its carrying arm 19, Fig. 8, as determined by the sound groove, such as to operate the diaphragm through the arm 22 and diaphragm stud 25.

With particular convenience, the needle arm may be set and unset for playing position relative to the sound record, by means in common operated by the motor. Suitable means for this may involve a link L, Figs. 2, 3, 6, 7 and 9, which extends from a connection on the needle arm assembly to an actuator means in the motor. Referring to Figs. 5 and 7 particularly, it is seen that an annular member 31 is mounted rotatably on the turret support member 27, as by interposed balls, and this carries a cam 35, Figs. 5 and 7, on which a lug 36 projecting from the sector extension 21 of the needle arm coacts. The link L is connected at one end 33 to a post 34 on the annular member 31, such that the post 34 may be turned to the positions indicated by full lines and dotted lines in Fig. 7. To thus move the needle arm assembly on its turret, the link L is connected at its other end to a swing plate 37, Fig. 9, in the motor, this plate being mounted on a shaft in the motor which carries a gear 38. On the swing plate 37 is a pawl 39 which is pivoted at 40, and which is urged into engagement in the gear 38 by a strong spring 41. A spring 42, secured at one end to the motor case, normally urges the swing plate 37 in a clockwise direction, Fig. 9, engaging in the lug 43 of the pawl, and the respective strengths are such that when the swing plate 37 is at a position such as shown in full lines in Fig. 9, the pawl 39 is in engagement with the gear 38, but when the gear has carried the pawl and plate 37 around to the other position permitted, the spring is caused to release the pawl at such point but thereupon throws the swing plate 37 back into position as indicated in full lines. The bumper 45 acts as a stop to catch the lug 46 of the swing plate 37 when in pawl-engaging position. The spring 42 in its swinging the plate 37 in counter-clockwise direction, Fig. 9, as above-noted, pulls the link L and the post 34 to which the link's other end is connected and thereby swings the annular member 31 through an arc counter-clockwise from the dotted position of post 34 in Fig. 7 to the full line position. The ring 28 which carries the needle arm assembly, being supported on the annular member 31 as seen, goes with it in this arcuate movement and the needle arm is correspondingly swung around from the dotted line position in Fig. 6 to the full line position and thereby is at starting position to play a record. As the ring 28 is not fast to the annular member 31 it can permit the general movement of the needle arm when it follows the record in playing. The spring 42 having in this manner moved the swing plate 37 and link L and accomplished the positioning of the needle, is re-stressed or re-set by the pawl 39 and gear 38 above-noted, when the motor is next started.

A thrust member 50 bears against the brake lever 56 and has an attached "stop" button S, Figs. 1, 2 and 10, riding in a guide-hole in the housing. Connected near the other end of the thrust member 50 is a bell crank lever 57, which by being pivoted to the wall of the housing at 58, gives the thrust member suitable support allowing it to have reciprocating movement and also provides a lifting finger 59 under the sector extension 21 of the needle arm assembly when the thrust member is pushed by the "stop" button S. Thus, the needle is tipped away from contact with the record as the motor is stopped. Adjacent the end of the thrust member 50 is a spring 51 secured to the housing and having a catch dog or pawl 60 which coacts with a stop lug 61 on the oscillatable annular member 31, Figs. 3 and 7. Its action is to hold the annular member 31, and through the link L the spring 42 when the latter has been re-set by the gear 38. It is released when the thrust member 50 as operated by the "stop" button S pushes the spring dog 60 away from the lug 61. On such release, the annular member 31 is swung back by the spring 42 above-noted into position against a suitable bumper 62 carried by bracket 63.

The push button P also has a control action on thrust member 50, which is normally urged in a direction toward the left as viewed in Fig. 3, by spring 51. The push button P, reciprocating in a guide hole in the housing, has an internal head 52 which is cylindrical and fits in a locking-hole 53 in the thrust member as normally held by a spring 49, Figs. 3 and 10, while a smaller diameter neck 54 between the head 52 and the push button, is of a dimension to allow sliding back and forth of the slot 55 extending back from the hole 53. With this construction, the spring 51 bears against the end of the thrust member 50 and tends to force it into release position, except when it is locked by the cylindrical head 52 in the hole 53 and thereby to hold the brake arm 56 which extends into the motor and carries a brake against a convenient rotating element in the motor, as need not be

described in full detail, and whereby the motor is held stationary. But if the "play" button P is pushed, the cylindrical head 52 is pushed out of the locking hole 53 so that the small diameter neck 54 rides in the slot 55, and the spring 51 pushes the thrust member 50 back and releases the brake lever 56 so that the motor can start.

The general operation will be clear from the foregoing. The motor being wound up by unfolding and using the winding crank 4, which is then re-folded in out-of-the-way position, and the record being placed on the turntable T and the lid being closed, the "play" button P is pushed.

To stop the motor, the button S is pushed in, and this shoves the thrust member 50 to push the brake lever 56 into braking position and the detent spring 51 to release its catch or dog 60, as shown in dotted lines in Fig. 7, whereupon the spring 42 in the motor throws the pawl plate 37 around into position where against the gudgeon of the gear 38, it and the spring 41 allow the pawl 39 to catch the gear 38, all ready for the next starting (the dotted line and full line positions of these parts being shown crowded somewhat closer together arcuately than in actual full scale, on account of space limitations).

Fine adjustment for the starting point on records is provided by an adjustment screw 64, Figs. 3, 6 and 7, which is fitted in a bracket 65 such that its end may abut the projection 66 of the needle arm sector 21. The general speed of the motor and the turning rate of the record may be adjusted by the usual speed governing lever 67 on the motor.

Small accessories, such as needle boxes, etc., may be conveniently carried in the compartment space formed by a partition 68, Figs. 2 and 3.

It will be particularly noticed that whereas mechanical sound reproducing mechanism heretofore has involved a traveling diaphragm with movement over the sound record, in the present construction the diaphragm is mounted stationarily in the wall of the housing, and as an important result it is found that a superior baffle effect is had and outstanding fullness and richness of tone. And the needle arm swings laterally across the span of the record and also vertically to and from the record, while the reproducing movements of the needle in the sound track are transmitted through an oscillatable needle support and thence an angular lever and a ball and socket joint to the center of the diaphragm.

The needle pressure being uniform and independent of gravity, the device operates in any position, and even abrupt movements of the case will not occasion jumping of the needle from the sound track. And with the automatic positioning of the needle to and from the record, as controlled by the "start" and "stop" buttons and the mechanism set in action thereby, the care which has been necessary with manually set needle arms heretofore is wholly eliminated.

Other modes of applying the principle of the invention may be employed, change being made as regards the detail described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In sound reproducing apparatus having a motor for driving a sound record, a diaphragm and connected needle arm lever with a rear sector extension, and a cam ring member, means for positioning the needle relative to a sound record, including a pawl in the motor, a connection between the needle carrier lever system and said pawl, a gear in said motor with which said pawl is engageable, an oscillatable plate to which said pawl is pivoted, a spring to swing said plate back after traveling a limited arc with the gear, a spring urging said pawl into engagement, a spring brake arm to hold the motor stopped, a thrust member with a "stop" push button at one end to move said brake arm to stop the motor, a bell crank lever connected to said member near its other end to raise under the rear sector extension of the needle arm lever and move the needle arm to its furthest position from the sound record on stopping the motor, a peripheral lug on said cam ring member, a spring dog to catch said lug and arranged to be released by the end of said thrust member, a hole and a connected narrower slot in said thrust member, and a "start" push button with a cylindrical inner end to fit said hole for normally holding the thrust member and a smaller neck to ride in said slot and allow release of the thrust member on pressure of said push button.

2. In sound reproducing apparatus having a diaphragm and connected needle arm lever with a rear sector extension, a cam ring member adjacent said extension, and a motor for turning a sound record, means for positioning the needle arm relative to a sound record, including a pawl in the motor, a connection between the cam ring and said pawl, a gear in said motor with which said pawl is engageable, an oscillatable plate to which said pawl is pivoted, a spring to swing said plate back after traveling a limited arc with the gear, a spring urging said pawl into engagement, a spring brake arm to hold the motor stopped, a thrust member with a "stop" push button at one end to move said brake arm to stop the motor, a bell crank lever connected to said member near its other end to raise under the rear sector extension of the needle arm lever and move the needle arm to its furthest position from the sound record on stopping the motor, a peripheral lug on said cam ring member, a spring dog to catch said lug and arranged to be released by the end of said thrust member, and another push button for operating said thrust member to start the motor.

3. In sound reproducing apparatus having a diaphragm and needle arm connection, and a motor, means in common for turning a record and setting the needle arm into and out of playing position, including said motor, a pawl driven by the motor, a gear with which said pawl is engageable, an oscillatable plate co-centered with the center of the diaphragm to which plate said pawl is pivoted, a spring to swing said plate back after traveling a limited arc with the gear, a spring urging said pawl into engagement, a spring brake arm to hold the motor stopped, and a thrust member to move said brake arm to stop the motor and having connections to control the needle arm position.

4. In sound reproducing apparatus having means for turning a sound record, a sound diaphragm, and needle-carrying means and means for turning a sound record, a rotatably mounted turret ring, and means to position the needle-carrying means relative to a sound record, including a needle pressure controlling spring extending from the needle-carrying means to bear on said turret ring, a cam ring rotatably mounted on said turret ring having a cam which in one position opposes said needle pressure controlling

spring and moves the needle-carrying means from the sound record, and a link connected at one end to said cam ring and at its other end having a catch and release connection with the means for turning the sound record.

5. In sound reproducing apparatus having means for turning a sound record, a sound diaphragm, and means for turning a sound record, a needle-carrying lever having a rear sector extension, a support standard, a turret ring rotatably mounted thereon, pivot means mounting said lever on said standard, a needle pressure controlling spring extending from said rear sector extension to bear on said turret ring, another ring member rotatably mounted on the base of said turret standard, and a link connected at one end to said latter member and at its other end having a catch and release connection with the means for turning the sound record.

6. In sound reproducing apparatus having means for turning a sound record, and needle-carrying means including a lever with a rear extension, a turret support standard, a ball race ring mounted on said standard and to which said needle lever is pivoted, another ball race member mounted near the base of said turret standard and supporting said ball race ring, a cam carried by said member, a lug on said needle lever extension in the path of said cam to move the needle arm, and an operating connection between said other ball race member and the means for turning the sound record.

7. In sound reproducing apparatus having means for turning a sound record, a sound diaphragm, and a needle lever having a rear extension, a turret support, a turret ring mounted on said standard and to which said needle lever is pivoted, another annular member mounted near the base of said turret standard, a cam carried by said member, a lug on said needle lever extension to co-act with said cam to move the needle lever, and a connection to oscillate said other annular member from the means for turning the sound record.

8. In sound reproducing apparatus having means for turning a sound record, a support turret standard, an annular member mounted on said turret standard for limited arcuate movement, a peripheral lug projecting from said annular member, a stationary bumper to stop said lug at one end of its arcuate movement, a spring dog to catch said lug at the other end of its arcuate movement, an operating connection between said annular member and the means for turning the sound record, and means for releasing said dog.

9. In sound reproducing apparatus having means for turning a sound record; a sound diaphragm; and means for communication between the diaphragm and a sound record, a needle lever having a rear extension means for pivotally mounting said lever; a support turret standard at the rear of said diaphragm, an annular member co-centered with the center of the diaphragm mounted on said turret standard for limited arcuate movement, a cam on said annular member movable therewith against the extension of said needle lever, and means for operating said cam.

10. In sound reproducing apparatus having a sound diaphragm and a record-tracking needle arm, driving means for a sound record and for setting the needle arm into and out of playing position, including a motor, a ratchet pawl, an oscillatable plate in relation to the motor and to which said pawl is pivoted, a gear in said motor with which said pawl is engageable, a spring to urge said pawl into engagement, control means movable in a path co-centered with the center of the diaphragm for the swinging of said plate back after travelling a limited arc with the gear, and a link connecting between the control means and said pawl.

11. In a sound-reproducing device having a record-driving motor and a diaphragm and a diaphragm-operating lever projecting laterally from a needle-carrying sleeve oscillatory on a pivoted needle arm to cooperate with a sound record, a rotary member with limited arcuate movement supporting said needle arm, a spring for turning said rotary support and needle arm to starting position, ratchet-means in the motor for resetting said spring, a detent spring to hold said rotary member at one end of its arcuate movement against the tension of said support-turning spring, a manually-actuated thrust member for stopping the motor and unseating said detent spring, and manually-actuated means for releasably holding said thrust member against the stress of said detent spring.

12. In a sound-reproducing device having a record-driving motor and a diaphragm and a diaphragm-operating lever projecting laterally from a needle-carrying sleeve oscillatory on a pivoted needle arm to cooperate with a sound record, a rotary member with limited arcuate movement supporting said needle arm, a spring for turning said rotary support and needle arm to starting position, means in the motor to re-set said spring, a detent spring to hold said rotary member at one end of its arcuate movement against the tension of said support-turning spring, a thrust member for stopping the motor and unseating said detent spring, and means for releasably holding said thrust member.

13. In a sound-reproducing device having a record-driving motor and a stationary diaphragm and a rotary support at the rear thereof for arcuate movement, a needle arm with pivotal mounting carried on said support, spring means for turning said support and needle arm to starting position, means in the motor for re-setting said spring, a spring detent for holding said rotary support at one end of its arcuate movement, a thrust member for unseating said spring detent as the motor is stopped, and a projection on said thrust member for tipping the needle arm on its pivotal mounting.

14. In a sound-reproducing device having a record-driving motor and a stationary diaphragm and a rotary support at the rear thereof for arcuate movement, a needle arm with pivotal mounting carried on said support, a spring for turning said support and needle arm to starting position, and means in conjunction with the motor to re-set said spring.

15. In a sound-reproducing device having a record-driving motor and a stationary diaphragm, a rotary support at the rear of the diaphragm, a needle arm in association with the support pivoted to move toward and away from a sound record, a spring for turning said support and needle arm to starting position, means for tipping the needle arm from the record in such turning, and means in conjunction with the motor to re-set said spring.

16. In a sound-reproducing device having a record-driving motor and diaphragm, an arcuately movable support co-centered with the diaphragm center, a needle arm carried on said sup-

port, spring means for turning said support and needle arm to starting position as the motor is stopped, means in the motor for re-setting said spring means as the motor is started, and a manually releasable means for controlling said spring means.

17. In a sound-reproducing device having a record-driving motor and diaphragm, an arcuately movable support co-centered with the diaphragm center, a needle arm carried on said support, spring means for turning said support and needle arm to starting position, and means in conjunction with the motor to re-set said spring.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
639,452	Smallwood	Dec. 19, 1899
959,238	Lindstrom	May 24, 1910
1,117,143	Abraham	Nov. 10, 1914
1,282,916	Niblack	Oct. 29, 1918
1,308,556	Shank	July 1, 1919
1,325,209	Sandell	Dec. 16, 1919
1,414,803	Burch	May 2, 1922
1,430,780	Woodhull et al.	Oct. 3, 1922
1,811,410	Watts	June 23, 1931
1,833,942	Kincannon	Oct. 25, 1932
1,984,637	Foley et al.	Dec. 18, 1934
2,219,230	Krause	Oct. 22, 1940

FOREIGN PATENTS

Number	Country	Date
588,675	Germany	Nov. 23, 1933