Aug. 14, 1934. L. J. GRUBMAN 1,970,452

PHONOGRAPH

Filed Dec. 19, 1932

Fig. 1.

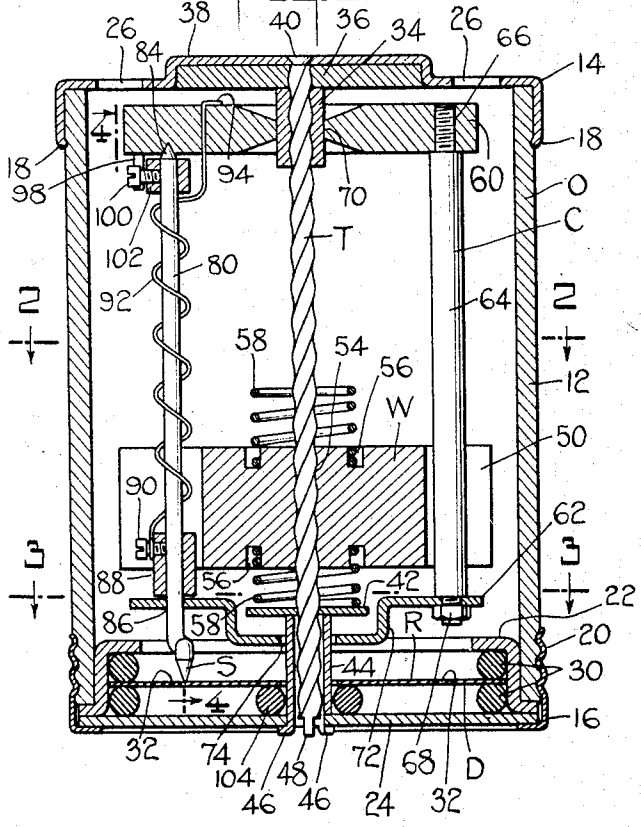


Fig. 4.

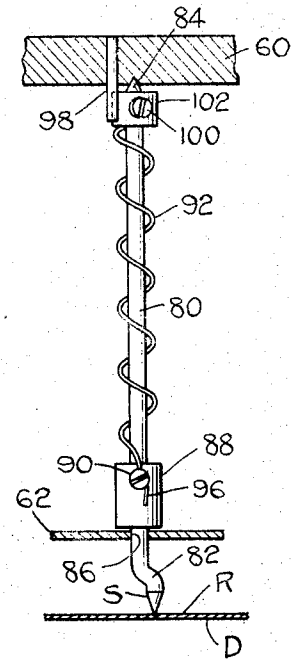


Fig. 2.

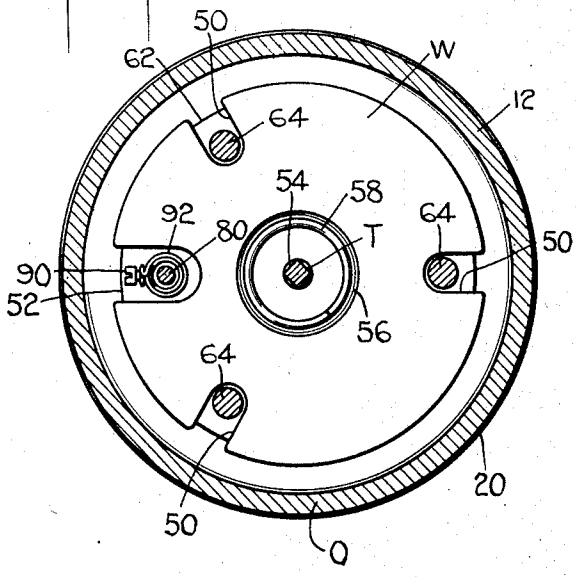
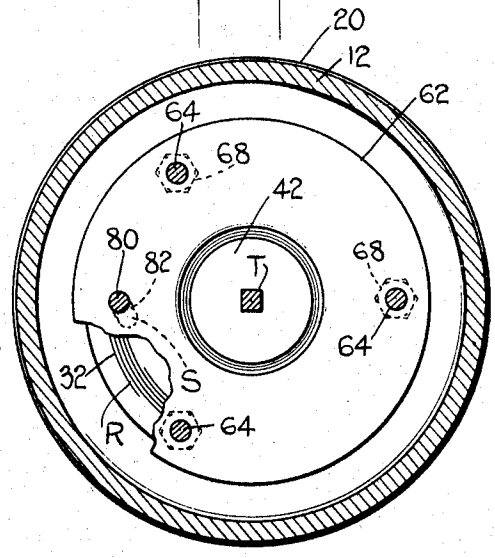


Fig. 3.



INVENTOR
Leo J. Grubman
BY
James & Franchin
ATTORNEYS

Patented Aug. 14, 1934

1,970,452

UNITED STATES PATENT OFFICE

1,970,452

PHONOGRAPH

Leo J. Grubman, Belle Harbor, N. Y., assignor to Voices, Incorporated, Newark, N. J., a corporation of Delaware

Application December 19, 1932, Serial No. 647,923

23 Claims. (Cl. 274—9)

This invention relates to phonographs, and more particularly to a miniature phonograph for use in dolls or other toys.

The primary and general object of the present invention resides in the provision of a miniature phonograph suitable to be embodied in a doll or other toy, although the phonograph may itself be employed as an attractive plaything for children. Such a phonograph, if placed in a doll, may be used, for example, to reproduce appropriate child-like words of endearment, or complaint, or the like, and, if installed in a toy animal, may reproduce sounds appropriate to that animal. The kinds of speech, music, or noise which may be recorded are without limit, making the field of use of the present toy phonograph correspondingly wide.

Further and more particular objects of my invention are to provide such a phonograph which will require no outside control means such as levers, push-buttons, and the like, and, more specifically, which will have a record and a stylus which are brought into engagement or disengaged simply by changing the position of the phonograph; which will have driving means for relatively rotating the record and stylus adapted to store up energy for driving the phonograph simply by a change in position of the phonograph; and, finally, the entire operation of which may be initiated or terminated simply by a change in position of the phonograph.

A further object of my invention resides in the provision of a gravity operated phonograph, thereby dispensing with spring motors, winding keys, and the like, although in modified form the gravity means may be used to store up energy in an intermediate spring motor. Still another object of the present invention resides in the provision of a phonograph in which the stylus revolves about the record, instead of vice versa. A further object of the invention resides in the provision of a phonograph in which the stylus causes vibration of the record, instead of vice versa. This vibration of the record is transferred directly to a sound producing diaphragm, and, in accordance with still another feature of my invention, the phonograph mechanism is very greatly simplified by combining the sound record and the sound producing diaphragm into a single structural member, resulting in a vibratile diaphragm having impressed directly on its surface a preferably hill and dale sound groove.

A further and more particular object of my invention resides in the provision of simple, trouble-free, and fool-proof means for bringing the stylus into engagement with the record and for moving the stylus away from the record to disengage the same. Another object of the invention is to insure the beginning of relative rotation of the stylus and record before bringing the same into engagement, and to cause the ultimate engagement to take place gradually and gently, these factors combining to prevent undue friction, wear, stopping, or even slowing up of the phonograph at the start of the reproducing action. Other objects of the invention are to provide a phonograph which is housed in a simple enclosed compact casing, the mechanism being energized by merely inverting the casing, and the record being self-started and completely played by merely restoring the casing to playing position, whereby no external control buttons, levers, and the like are required. Still another object of the invention resides in the provision of a recessed but externally accessible adjusting means for varying the initial point of contact between the stylus and the record, so that the phonograph may be made and assembled with large tolerances, and accurate starting of the record controlled after the phonograph has been assembled.

Still another object of my invention resides in the provision of a phonograph all of the working parts of which are housed within a simple protective casing and the parts of which are so disposed within the casing that the casing is itself made to act as a sound chamber for resonating and amplifying the sound produced by the phonograph. More generalized objects of my invention reside in the provision of a toy phonograph which will be simple, durable, trouble-free, compact if not actually tiny in size, and made of relatively few parts which themselves may be readily made under machine production conditions, resulting in a phonograph which may be sold to toy manufacturers at slight cost.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the phonograph elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing in which:

Fig. 1 is a vertical section through a phonograph embodying features of my invention, the phonograph being shown in playing condition at the end of the record;

Fig. 2 is a horizontal section taken in the plane of the line 2—2 in Fig. 1;

Fig. 3 is a horizontal section taken in the plane of the line 3—3 in Fig. 1; and

Fig. 4 is a profile of the stylus mechanism, looking in the direction of the arrows 4—4 in Fig. 1.

Referring to the drawing, the main elements of the phonograph are a sound record R, a sound producing diaphragm D which may be separate from but in the present case is shown as formed integrally with the sound record R, a stylus S for engaging the record R, an operating weight W which is reciprocable along and caused to rotate by a threaded shaft T, and a squirrel cage C which

is rotatable about the shaft T and is caused to rotate by the operating weight W. The cage C carries the stylus S and revolves the same, with the stylus tracking in the sound groove of the record. The cage C is preferably weighted and is slightly axially reciprocable along threaded shaft T so as to provide a means for causing engagement or disengagement of the stylus and the record. The entire phonograph mechanism is housed within a simple cylindrical outer casing O which is itself made to act as a horn or sound chamber, the sound produced by vibration of diaphragm D flowing through the casing O and out of discharge openings 26 in the upper end of the same. The phonograph as shown in Fig. 1 is in its playing position near the end of a record. Upon inverting the phonograph, the stylus and record are disengaged, and operating weight W moves to the opposite end of the device. Upon thereafter restoring the phonograph to its upright or playing position, the weight W causes the cage C and stylus S to rotate, while the stylus is brought into engagement with the sound record, the continued rotation of the stylus causing the record to be played.

Considering the phonograph construction in greater detail, the casing O is preferably generally cylindrical in configuration and comprises an open-ended tube 12 which may, for example, be made of card-board or the like, the ends of which receive upper and lower caps 14 and 16. These caps may be secured to the body of the container in any desired manner, the cap 14 in the present case having its edges flanged or burnished inwardly, as shown at 18, while the cap 16 is screwed onto the lower end of the tube by mating threads indicated at 20. The advantage of having at least one of the caps threaded is to facilitate opening and disassembly of the phonograph, and, if only one end is threaded, it is preferably the lower end because this facilitates assembly of the parts of the phonograph, and facilitates changing of the phonograph record, should that be desired.

The threaded cap 16 holds in place a stepped supporting ring 22 and an outer closure disc 24 between which the combined record diaphragm R, D is supported. It should be noted that the lower end of the casing, at which the sound is produced, is closed, whereas the upper end of the casing, covered by the cap 14, is provided with sound discharge openings 26. The casing O is thus made to act as a horn or amplifying chamber for the sound produced by the phonograph. Of course, even the closure disc 24 may be provided with sound discharge openings, if desired, but the main sound discharge takes place through the peripheral ring of openings 26.

The combined sound record and diaphragm R, D consists of a disc of yieldable material the outer peripheral edge of which is preferably supported between packing or spacer members 30 which are best made of yieldable material such as rubber, and the cross-section of which is desirably made circular, as shown, in order to most readily permit yielding of the diaphragm. The diaphragm may be made of any appropriate material which will combine the desirable qualities of a sound record and a diaphragm, the former requiring that it may readily be impressed with an appropriate sound track, and that it will retain the sound track in good condition after long use; and the latter requiring that the material be yieldable so as to accurately and faithfully follow the vibrations caused by cooperation of the stylus and sound groove. A material which I have found satisfactory and superior to a number of metal alloys with which I have experimented, is fibre or paper impregnated with a synthetic resin, for example, a condensation product of phenol or urea. This material is both hard enough to retain the sound groove detail, and yieldable enough to act as a satisfactory diaphragm, and, pending the possible discovery of more satisfactory material, I recommend its use. The upper surface of the diaphragm is provided with a spiral sound groove or track 32 which is of the hill and dale type, that is, the undulations corresponding to the desired sound wave are cut by differences in depth. The diaphragm should be light, and is operable even if not flexible, because the preferably rubber spacer members permit reciprocation of the diaphragm even if stiff. The spacer members may be tubular to increase their yieldability.

The threaded shaft T may be formed in any desired manner, but, for the sake of economy, it is in the present case formed by twisting a square rod of suitable material such as cold rolled steel. The rod may be, for example, one-eighth of an inch square and is preferably twisted to the left-hand so that the rotation of the weight W which it produces will be right-handed. The pitch of twist is selected so as to insure free operation of the weight and at the same time to impede its movement sufficiently to limit the rate of phonograph reproduction to a desired value without necessitating any additional or special damping means.

The shaft T extends coaxially through the cylindrical casing O and is supported at opposite ends of the casing. Specifically, the upper end of shaft T has forced thereon a cylindrical bearing collar 34 and a relatively heavy supporting and friction disc 36, the latter being frictionally received in a stepped or dished portion 38 of cap 14. The parts may be held in assembled relation by securing means 40 which may consist of a reduced portion on the end of shaft T riveted outwardly, or, if desired, a separate screw passing through cap 14 and threaded into the end of shaft T. The lower end of the shaft has forced thereon a washer 42, the remainder of the shaft passing through a guide sleeve 44 with a frictional fit. The guide sleeve 44 is itself secured to the cover plate 24, the ends of sleeve 44 being castellated to form tenons 46 which pass through mating slots or splines in disc 24 and which are then bent outwardly, as shown, to hold the sleeve 44 affixed to the disc 24. The tip of shaft T is cut away to form an end 48 adapted to receive and mate with an adjusting key, thereby permitting rotation of shaft T to effect an adjustment, later described in detail. For the present, it will be understood that because of the frictional relation between disc 36 and cap 14 at the upper end of the casing, and the frictional relation between shaft T and sleeve 44 at the lower end of the casing, the position of adjustment remains fixed, and, for all practical purposes, it should be understood that the shaft T is both axially and rotatively fixed in the outer casing O.

The weight W is generally in the form of a flat cylinder or biscuit, its periphery being slotted by a number, say, three, symmetrically spaced slots 50 and an additional and relatively large clearance slot 52. The weight is provided with means engaging the threaded shaft T so that axial movement of one relative to the other causes a relative rotation. In the present case the desired result is obtained by providing the weight

with a square central hole 54 mating with the twisted rod T. Because of the thickness of the weight, the hole must itself be spiraled to mate with the shaft, and consequently is best formed by broaching an appropriate spiraled square hole through the weight. It is, of course, also possible to form the weight with a round hole clearing the shaft for most of the thickness of the weight and providing the thin remaining portion with a simple square hole. The upper and lower faces of the weight are provided with circular grooves 56 in which bumper springs 58 are fastened. The springs move with the weight and serve to cushion the stopping of the weight at either end of its travel, the lower spring 58 bearing against the washer 42, and the upper spring bearing against the upper end of the cage C.

The cage C is generally in the form of a squirrel cage rotor except that only three spacer rods are provided. The rotor comprises an upper head 60 which is preferably made of thick material so as to weight the cage, a lower head 62, and three rods or posts 64 extending therebetween, the posts being symmetrically distributed around the heads 60 and 62 and thereby adapted to fit in the slots 50 of weight W. The posts and heads are secured together in any appropriate manner, as by threading the upper ends of the posts and screwing the same into threaded holes 66 in the upper plate 60, the lower ends of the posts also being threaded and receiving nuts 68 which lock the head 62 onto the lower ends of the posts 64. The upper plate 60 is provided with a central bearing hole 70 which rotates freely on the outer surface of the cylindrical bushing 34. The lower plate 62 is preferably stepped or dished downwardly, as shown at 72, and is provided with a central bearing hole 74 which rotates freely about the outer surface of sleeve 44. It will thus be evident that the cage C is arranged for free rotation (and a small amount of free axial movement or reciprocation). However, housed within the cage is the weight W, and this is rotatably related to stationary shaft T, as has already been explained. The mating relation between the posts 64 and the slots 50 of weight W cause the cage to rotate with the weight. Consequently, upon inversion of the phonograph as a whole, the resulting displacement of the weight W causes the same to be rotated, and its rotation is imparted to the cage C.

Cage C carries the stylus mechanism which in turn comprises a stylus S formed at the end of an elongated stylus rod 80 which is oscillatable in but axially fixed relative to the cage C. In order to permit the stylus to follow the spiral sound track 32 of the record, the stylus rod 80 is bent at its lower end into crank shape so that the stylus S is itself radially displaced from the axis of stylus rod 80, this bending or displacement being clearly evident at 82 in Fig. 4. The amount of displacement is made sufficient to permit the stylus to readily follow or track in the sound groove, and where, as in the present case, only a few sound grooves are provided, the necessary movement is small and consequently the displacement 82 may be made small, as is evident from an inspection of either Fig. 3 or Fig. 4 of the drawing. The upper end of stylus rod 80 is formed into a tapered or conical bearing 84 which is seated in a mating recess in the upper plate 60 of the cage. The lower portion of stylus rod 80 passes through a bearing hole 86 in the lower plate 62 of the cage. A collar 88, secured to the stylus rod by a set screw 90, rests against lower plate 62 and holds the conical bearing 84 in place. It will be evident that no axial movement of the stylus rod relative to the cage is permitted. A light spiral spring 92 is fastened at one end 94 in the upper head 60 and bears at its lower end 96 against the set screw 90, thereby tending always to oscillate the stylus to its initial playing position. This position is determined by a stop the stationary portion of which is a pin 98 driven into the upper head 60, and the movable portion of which is the set screw 100 of a collar 102 surrounding the stylus rod 80 at the upper end thereof. The starting position of the stylus may be adjusted by adjustment of the position of collar 102 and set screw 100 relative to stylus rod 80. The stylus mechanism is preferably located symmetrically between two of the posts 64 of the cage, as is readily apparent from an inspection of Fig. 2, and weight W is cut away to form a relatively large recess 52 which clears all of the stylus mechanism by an ample margin, even allowing for a slight play between rod 64 and slots 50. Such unbalance of the rotatable mechanism as is caused by the addition of the stylus mechanism to the cage, is offset by the coresponding removal of metal at recess 52 from weight W, thus establishing uniform rotation of the weight and cage as a whole.

It should be noted that an appreciable clearance is provided between the upper surface of the cage C and cap 14 when the stylus rests on the record, as shown in Fig. 1. With this arrangement it will be understood that upon inverting the phonograph, the cage and with it the stylus descends until the cage rests upon head 14, thereby disengaging the stylus from the record during the rewinding or storage of energy in the phonograph mechanism. Upon again restoring the phonograph to its normal position, the downward or gravitational pull on the cage causes the stylus to again be brought into engagement with the record. However, it should be noted that immediate downward movement of the cage is prevented by the weight W which then is at the upper end of its travel. As weight W begins to descend, the cage also descends and causes stylus contact. However, the initial downward movement of weight W brings the cage into rotation, so that the stylus is already revolving when it touches the record. This fact, together with the gradual engagement enforced by the slow descent of the weight, prevents forceful contact of the stylus against the record, with consequent damage; prevents the stylus from becoming stuck in the record and thereby stopping rotation; avoids unnecessary dulling of the stylus and damage to the sound groove; and minimizes any change of tone caused by gradual building up of the speed of the phonograph. The weight of the cage C may, if desired, be partially supported by the provision of a small resilient ring 104 surrounding the sleeve 44 and positioned between the diaphragm D and the disc 24.

It has already been pointed out that a rough adjustment of the initial stylus position may be obtained at the set screw 100. To permit of manufacturing tolerance, a fine adjustment is provided which may be made after the phonograph has been completely assembled, and this fine adjustment makes it immaterial to note the rotative relation between the parts at each end of the phonograph when assembling the same; or, specifically, the precise rotative relation between the record and the remainder of the phonograph is of little significance. For the purpose in question, an appropriate key or even a pair of

pliers may be applied to the end 48 of shaft T, thus making it possible to rotate shaft T and with it the weight W and cage C. Inasmuch as the sound track 32 is a spiral, whereas the movement of stylus S in outermost position is a circle, the precise point of intersection of the stylus and sound groove may be varied by this external adjustment.

In assembling the phonograph, the posts 64 are screwed into the plate 60. The weight W, with its springs, is then slid between the posts, and end plate 72 is added to complete the cage C. The stylus may be added to the cage, as desired. The shaft T is secured to the upper head 14, and the latter is secured to the cylindrical casing 12. The cage is then passed over the threaded shaft T, washer 42 meanwhile being held in place. Stepped support ring 22, resilient rings 30, and the record diaphragm R, D, are added, after which the closure disc 24, having attached thereto sleeve 44, is added, the assembly then being completed by screwing cap 16 in place. This sequence may be modified as desired.

The operation of the phonograph and the many advantages thereof will, it is believed, be apparent from the foregoing detailed description. By simply changing the physical position or inverting the phonograph, energy is stored up in the driving motor because the weight W moves to the upper end of the phonograph. At the same time, the stylus is disengaged from the record during this reverse rotation because the cage C, and with it the stylus, moves away from the record. Spring 92 moves the stylus outwardly to its initial playing position. Upon restoring the phonograph to its original or playing condition, the stylus is brought into rotation by the weight, and while rotating is gradually lowered into contact with the record sound groove. The relatively large mass of the cage C prevents appreciable vibration of the stylus and cage, and instead the flexible diaphragm is itself vibrated and generates the desired sound. This sound is cast upwardly through the phonograph mechanism and casing which acts as an amplifying horn, the sound finally being discharged through openings 26.

No external control means are provided or needed to control the engagement or disengagement of the stylus and record, or to control the operation of the drive mechanism, and instead these operations are all automatically taken care of simply by a change in the over-all position of the phonograph as a whole. The phonograph may be used as an independent toy, and the record may be provided with some joke or statement for the amusement of adults as well as children. The phonograph may also be placed in other toys to enhance the realism and value of the same. For example, the phonograph may be placed in a doll, so that the doll will be a talking doll. In such case it may be arranged axially, and therefore the doll will have to be inverted when energizing the phonograph; but, more preferably, the phonograph is disposed transversely of the doll so that by simply rolling the doll from one side to the other, it may be caused to speak, as though just awakening. The phonograph may also be placed in animal toys and caused to simulate the sounds of such animals.

While I have shown the record and diaphragm combined into a single disc, it is evident that a rigid record may be used, connected to a yieldable diaphragm by a central collar or bushing, thus separating the same structurally in accordance with their separate functions. It will also be apparent that the several features of the phonograph may be employed individually as well as collectively, it being possible, for example, to use the gravity stylus engagement mechanism in conjunction with different forms of drive mechanism and starting and stopping mechanism; and, conversely, the gravity drive mechanism here shown may be employed with phonograph mechanism using a different record mechanism, and different kinds of stylus engaging mechanism. It will therefore be apparent that while I have shown and described my invention in preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

I claim:

1. A miniature phonograph comprising a record provided with a sound groove, a stylus for engaging said groove, and gravity operated means for causing relative rotation of said stylus and record, said means including a weight reciprocable on a threaded shaft in order to cause relative rotation therebetween.

2. In a phonograph, a combined sound record and diaphragm comprising a thin light flexible disc-shaped vibratile sound producing diaphragm secured at its periphery in a sound amplifying chamber, said diaphragm having impressed thereon, at a radius substantially smaller than the radius of the diaphragm, a hill and dale sound track for engagement by a stylus.

3. A photograph comprising a vibratile sound record and a vibratile diaphragm movable therewith, means fixedly mounting the same but permitting vibration thereof, a stylus for engaging the sound track on said record in order to vibrate the diaphragm, and means causing the stylus to revolve relative to the stationary record.

4. A miniature phonograph comprising a combined sound record and diaphragm, means fixedly mounting the same but permitting vibration thereof, a stylus for engaging the sound track on said record in order to vibrate the diaphragm, and means causing the stylus to revolve relative to the stationary record.

5. A miniature phonograph comprising a disc-shaped combined sound record and diaphragm, means fixedly mounting the same but permitting vibration thereof, a stylus for engaging the sound groove on said diaphragm in order to vibrate the diaphragm, and means causing the stylus to rotate relative to the stationary record so that the stylus tracks in the stationary sound groove.

6. A miniature phonograph comprising a vibratile sound record and a vibratile diaphragm movable with said record, a stylus for engaging the sound track on said record in order to vibrate the diaphragm, and gravity operated means for causing the stylus to rotate relative to the record.

7. A miniature phonograph comprising a sound record and diaphragm, means fixedly mounting the same but permitting vibration thereof, a stylus for engaging the sound track on said record in order to vibrate the diaphragm, and means for causing the stylus to rotate relative to the stationary record, said means including a reciprocable weight, and means causing rotation of the stylus in response to reciprocation of the weight.

8. A phonograph comprising a record, a stylus for engaging said record, and means responsive to a change in the physical position of the phonograph as a whole for causing engagement or disengagement of the stylus and record.

9. A miniature phonograph especially adapted for use in dolls and other toys, said phonograph comprising a record, a stylus for engaging said record, and means responsive to inversion of the physical position of the phonograph as a whole for causing engagement or disengagement of the stylus and record.

10. A phonograph comprising a record, a stylus, drive means for causing relative movement of the record and stylus, and means responsive to a change in position of the phonograph as a whole for storing up energy in said drive means.

11. A miniature phonograph for use in dolls or other toys, said phonograph comprising a record, a stylus, means for causing relative rotation tation of the record and stylus, and means responsive to inversion of the position of the phonograph as a whole for storing up energy in said drive means.

12. A phonograph comprising a record, a stylus, means for causing relative rotation of the same, and means for causing engagement or disengagement of the same, both of said means being controlled by a change in the physical position of the phonograph as a whole.

13. A miniature phonograph for use in dolls or other toys, said phonograph comprising a record, a stylus, drive means for causing relative rotation of the same, and means for causing engagement or disengagement of the same, both of said means being controlled by inversion of the physical position of the phonograph as a whole.

14. A miniature phonograph for use in dolls or other toys, said phonograph comprising an enclosed outer casing for the phonograph, a record, a stylus, means for causing relative rotation of the same, means for causing engagement or disengagement of the same, both of said means being controlled by a change in the physical position of the phonograph as a whole without the aid of external control means, and an externally accessible adjustment for varying the initial point of contact between the stylus and the record.

15. A miniature gravity operated phonograph comprising a protective casing, a diaphragm mounted near one end of said casing, a cap closing said end of the casing, phonograph mechanism in said casing for causing vibration of the diaphragm, and a cap provided with sound discharge openings closing the opposite end of the casing, whereby the casing for the phonograph mechanism itself acts as a sound chamber for resonating and amplifying the sound produced by the diaphragm.

16. A miniature phonograph comprising a disc-shaped combined sound record and diaphragm, means fixedly mounting the same but permitting vibration thereof, a stylus for engaging the sound track on said record in order to vibrate the diaphragm, and gravity operated means for causing the stylus to rotate relative to the stationary record, said means including a fixed threaded shaft, a weight reciprocable along said shaft and rotated thereby, and means interconnecting the weight and stylus so that rotation of the weight causes the stylus to revolve.

17. A miniature gravity operated phonograph comprising a casing, a record and diaphragm mounted at one end of said casing, a threaded shaft fixed in said casing, a weight reciprocable along and rotated by engagement with said shaft, a squirrel cage rotatable about said shaft by said weight, and a stylus carried by said squirrel cage for rotation about the record.

18. A miniature gravity operated phonograph comprising an invertible casing containing a record, a stylus, gravity means for relatively rotating said stylus and record, and gravity means for relatively reciprocating said stylus and record, said stylus being disengaged from the record when the phonograph casing is inverted, and being engaged with the record when the phonograph casing is restored to playing position.

19. A miniature gravity operated phonograph comprising a casing, a record and diaphragm mounted at one end of said casing, a threaded shaft fixed in said casing, a weight reciprocable along and rotated by engagement with said shaft, a squirrel cage rotatable about said shaft by said weight, said squirrel cage being slightly axially movable within the casing, a stylus carried by said squirrel cage, said stylus being disengaged from and engaged with the record respectively by movement of the squirrel cage when the phonograph is inverted and restored to playing position.

20. A miniature gravity operated phonograph comprising a generally cylindrical casing, a record and diaphragm mounted at one end of said casing, a threaded shaft fixed axially in said casing, a weight reciprocable along and rotated by engagement with said shaft, a weighted squirrel cage rotatable about said shaft by said weight, said squirrel cage being sligthly axially movable within the casing, a stylus carried by said squirrel cage, said stylus being disengaged from the record by movement of the squirrel cage when the phonograph is inverted, and being rotated and brought gently into engagement with the record when the phonograph is restored to playing position.

21. A miniature phonograph comprising a casing, a record, a stylus, means to cause relative rotation therebetween including a threaded shaft and a weight reciprocable therealong, and means to adjust the starting position of the stylus on the record including an end of said shaft projecting from the casing for fixedly adjustable rotation.

22. A miniature gravity operated phonograph comprising a casing, a record and diaphragm mounted therein, a threaded shaft fixed axially in said casing, a weight reciprocable along and rotated by engagement with said shaft, and a stylus rotated about the record by the weight, said shaft being frictionally rotatable for adjustment of the rotative relation between stylus and weight and the record.

23. A miniature gravity operated phonograph comprising a generally cylindrical casing, a combined record and diaphragm mounted at one end of said casing, a threaded shaft fixed axially in said casing, a weight reciprocable along and rotated by engagement with said shaft, a squirrel cage rotatable about said shaft by said weight, a stylus carried by said squirrel cage for rotation about the record, means to determine the starting position of the sylus, said shaft being frictionally rotatable for adjustment of the rotative relation between stylus and weight and the record, one end of said shaft projecting out of the casing in order to permit said adjustment to be made externally of the phonograph.

LEO J. GRUBMAN.