

April 30, 1929.

T. A. EDISON

1,711,265

PHONOGRAPH REPRODUCER

Filed Feb. 10, 1926

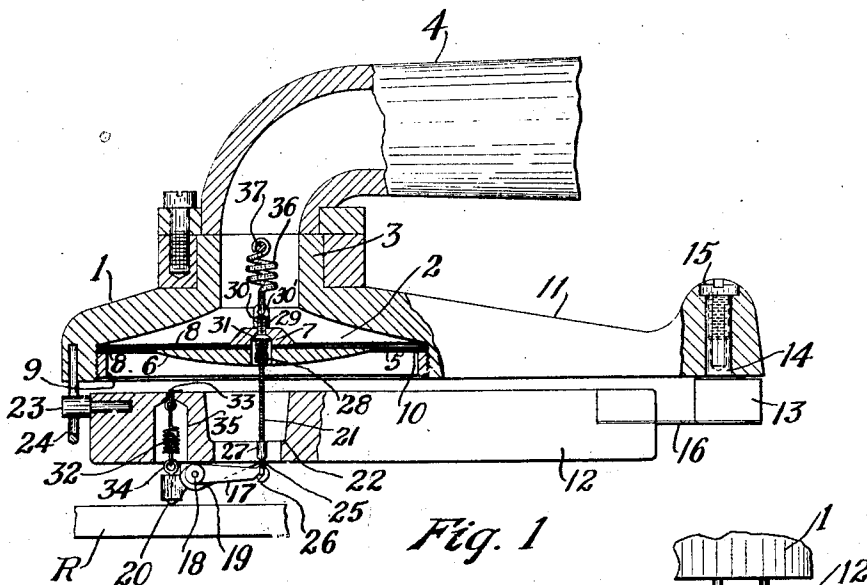


Fig. 1

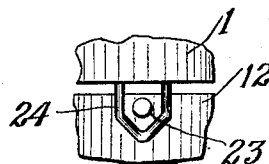


Fig. 2

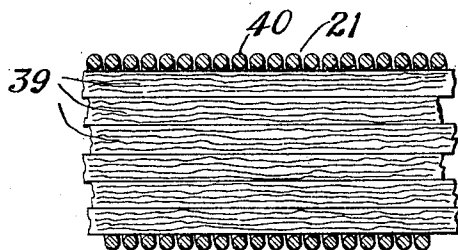


Fig. 3

INVENTOR  
Thomas A. Edison  
BY *Henry Lanahan*  
ATTORNEY

## UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, WEST ORANGE, NEW JERSEY, ASSIGNOR  
TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A COR-  
PORATION OF NEW JERSEY.

## PHONOGRAPH REPRODUCER.

Application filed February 10, 1926. Serial No. 87,200.

My invention relates to phonograph repro-  
ducers and particularly to those of the type  
adapted for use with disc records having  
vertically undulating grooves and in which  
5 the stylus is carried by a lever mounted on  
a floating weight, said lever being connected  
to a diaphragm mounted in a sound box; it  
being understood, however, that my inven-  
tion, as to certain of the features thereof, is  
10 applicable to reproducers of other types.

The principal object of my invention is to  
increase the loudness or volume of the repro-  
duction obtainable with phonograph repro-  
ducers, especially those of the type referred  
15 to, without altering or impairing the quality  
of such reproduction.

Another object of my invention is to obtain  
the desired increased volume of reproduction  
by a simple and effective construction where-  
20 by the diaphragm of the reproducer, during  
the operation of the latter, is preferably sub-  
jected to greater stress and therefore main-  
tained under more tension so that it will have  
a potentially greater amplitude of vibration,  
25 due to the resulting increased potential en-  
ergy thereof, and accordingly will cause the  
stylus in tracking the record groove, to fol-  
low and be maintained in close engagement  
with the bottoms of all the deep undulations  
30 of such groove as well as those of the shallow  
undulations.

Another object of my invention is to pro-  
vide a reproducer of the character above de-  
scribed, wherein the diaphragm is placed un-  
35 der greater tension to obtain the desired in-  
creased volume, by removing a part of the  
pressure of the stylus on the record due to  
the action of the floating weight and trans-  
ferring it to the diaphragm.

Further objects of my invention are to pro-  
vide a reproducer of the type described with  
means whereby the diaphragm will be pre-  
vented from becoming permanently set in a  
deformed shape because of the increased  
45 stress to which the same is subjected in order  
to maintain the same under a greater tension,  
and to provide an improved connection be-  
tween the stylus lever and the diaphragm  
which will not stretch in the continued use of  
50 the reproducer and which has no tendency,  
in the operation of the reproducer, to vibrate  
other than in the direction of its length.

Other objects and features of my inven-  
tion will be hereinafter more fully described  
and claimed.

In order that my invention may be more  
clearly understood, attention is directed to  
the drawing accompanying and forming a  
part of this specification, and in which:

Fig. 1 is a side elevation, partly in section, 60  
of a reproducer embodying a preferred form  
of my invention:

Fig. 2 is a front elevation showing a de-  
tail of construction of the reproducer shown  
in Fig. 1; and

Fig. 3 is a greatly enlarged fragmental sec-  
tional view of the connection employed be-  
tween the stylus lever and the diaphragm of  
the reproducer shown in Fig. 1.

Referring to the drawing; and especially to 70  
Fig. 1, the reproducer shown is of the Edison  
type and comprises the usual cup 1, having a  
sound chamber 2 which is circular in cross-  
section. The cup 1 is provided centrally  
thereof with an upstanding neck 3 to which 75  
is suitably secured at the smaller end thereof  
the usual tapering sound conducting tube 4,  
said tube 4 being adapted to be connected at  
its larger end to the small end of the usual  
horn or sound amplifier of the phonograph. 80

Reference character 5 represents the dia-  
phragm of the reproducer, this diaphragm,  
as shown, being of the form usually employed  
in Edison reproducers and consisting of a  
number of superposed layers of Japanese rice 85  
paper suitably secured together. Secured to  
the lower face of the diaphragm 5 by shel-  
lac or other suitable means, is a center piece  
6 of cork or similar material which is com-  
paratively thick at the center, tapers off to-  
wards its edge and covers a large portion of 90  
the area of the diaphragm. The curvature of  
the outer surface of the cork center piece  
6 should be such that substantially the whole  
body portion of the diaphragm flexes into a 95  
spherical shape when stresses are transmitted  
thereto through the stylus lever and the con-  
nections between the latter and the dia-  
phragm. An ivory button 7 is cemented or  
otherwise secured to the center of the upper 100  
face of the diaphragm 5. The sound cham-  
ber 2 is provided with a seat for the dia-  
phragm 5 against which the latter is held at  
its edge portion between two annular pack-

ing rings or gaskets 8, 8, by means of a clamping ring 9 screwed into the cup. A thin smooth metal ring 10 is disposed between the lower gasket 8 and the clamping ring 9 to prevent deformation of such gasket upon turning movement of the clamping ring when the latter is tightened.

The reproducer cup 1 is provided with a rearward extension 11, and a floating weight 12 is pivotally connected to this extension for movement about a vertical axis by means comprising a pivot block 13, a pivot pin 14 secured at its lower end to this block and rotatably mounted in a vertical opening in the end of the extension 11 and a screw 15 threaded into the upper end of the pin 14; the floating weight being supported from the block 13 by means of a flat spring 16, one end of which is secured to the block and the other end of which is suitably secured to the adjacent end of the floating weight. A stylus lever 17 is pivotally supported on a horizontal pin 18 which is fixedly mounted at its ends in spaced bearings 19, (only one of which is shown) projecting downwardly from the lower surface of the floating weight 12 adjacent the forward end of the latter. The stylus lever 17 has a reproducing stylus 20 secured in and extending from one end thereof and has its other end secured to the button 7 at the center of the diaphragm 5 by means comprising a link 21 extending vertically through an opening 22 in the floating weight. The usual limit pin 23 is secured to the forward end of the floating weight 12, this pin extending within a loop 24 secured to the under side of the reproducer cup 1 and co-acting with such loop to limit the vertical and lateral movements of the floating weight with respect to the reproducer cup.

The link 21 is loosely connected at its lower end to the stylus lever 17 as by means of an eye 25 loosely engaged with a notch or slot 26 in the end of the stylus lever and having a hollow extension 27 within which the said lower end of the link 21 is fixed. The upper end of the link 21 is connected to the button 7 of the diaphragm by a member having a lower recessed end portion 28 within which the upper end of the link is fixed and an upper threaded end portion 29 extending through an opening in the button 7, and a nut 30 threaded on said portion 29. The member to which the upper end of the link 21 is connected is provided intermediate the portions 28 and 29 thereof with a flange or collar 31 having an upper conical face or surface. The diaphragm 5 and the cork piece 6 are provided with central registering openings within which the upper end of the link 21 and the portion 28 of the member to which the same is secured are disposed, and the button 7 is provided on its under side with a recess registering with the said openings in the diaphragm and

cork piece 6 and having a conical end wall providing a seat for the upper conical face of the collar 31. Upon tightening the nut 30 the collar 31 is brought to a position with the conical face thereof in firm, close engagement with the said conical end wall of the recess in the button 7, and the upper end of the link 21 is thus firmly and rigidly secured to the button 7 and the diaphragm 5.

When a reproducer of substantially the same construction as that thus far described is in normal operating position with the stylus thereof engaging the groove of the record being reproduced, the floating weight is maintained by such engagement in a position with the limit pin extending from the forward end thereof occupying a substantially central position within the limit loop depending from the reproducer cup, and the diaphragm is subjected to a certain amount of stress and therefore placed under some tension by the action of the floating weight.

I have found that if the diaphragm of a reproducer is subjected to stress in addition to that to which it is ordinarily subjected when the stylus is in operative engagement with a record, so that such diaphragm is maintained under an increased tension, the potential amplitude of vibration of the diaphragm will be greatly increased and the volume of reproduction obtained greatly augmented due, in part at least, to the fact that under these conditions the elasticity of the diaphragm will act to force the stylus to the extreme low points of the deepest undulations in the record groove and thereby effect the reproduction of practically all sounds recorded. One of the principal improvements contemplated by my invention is the provision of means, whereby such additional stress is imposed on the diaphragm of a reproducer. The means which I employ for this purpose in the reproducer of the particular construction shown and described preferably attains the desired result by relieving or removing a part of the pressure of the stylus on the record due to the action of the floating weight and transferring it to the diaphragm, and this means preferably comprises a retractile spring 32, one end of which is connected as by means of an eye 33 to the floating weight 12, and the other end of which is connected as by means of an eye 34 to the stylus lever 17 at a point directly above the stylus 20. The spring 32 preferably has quite a number of turns or coils and is preferably disposed in a vertical position with the main body portion thereof disposed within a recess 35 provided in the floating weight 12 between the opening 21 therein and the forward end thereof. The construction and arrangement are such that the spring 32 will be in an extended condition when the reproducer is in playing or operative position with the stylus 20 engaging the record R, as illustrated in Fig. 1, and consequently will act to impose

additional stress on the diaphragm 5 and thereby place the latter under increased tension. This increased tension of the diaphragm, in the construction described, results from the action of the spring 32 in transferring part of the pressure of the stylus on the record, due to the action of the floating weight, to the diaphragm. It will therefore be apparent that besides imposing additional stress on the diaphragm, the spring 32 also tends to lessen or decrease the pressure with which the stylus 20 engages the record under the action of the floating weight 12, and consequently that with the use of this spring, other things being equal, the wear on the record due to the engagement of the stylus therewith is materially decreased, or that the inertia of the floating weight or other movable part or parts between the stylus and diaphragm may be materially increased, as is sometimes desirable, without any increase of the normal pressure of the stylus on the record.

In reproducers of this type as ordinarily constructed, that is, when provided with no means such as described for imposing stress on the diaphragm in addition to that due to the action of the floating weight, the stress on the diaphragm is entirely relieved when the reproducer is in inoperative position with the limit pin resting on the bottom of the limit loop. When, however, the reproducer is provided with the retractile spring 32 arranged as described, or other equivalent means, the stress on the diaphragm is continuous and, in the absence of any compensating means, is not relieved when the reproducer is in such inoperative position, but as a matter of fact is increased. This is due to the fact that when the floating weight moves to a position in which the limit pin 23 rests on the bottom of the loop 24, the spring 32 will be further extended or stretched and thereby impose still more stress on the diaphragm 5. To compensate for this extra stress when the reproducer is moved to inoperative position, I preferably provide a second spring 36; or other equivalent means, which is secured at one end to a horizontal pin 37 mounted within the neck 3 of the reproducer cup and at its other end to the diaphragm by means of a hook formed on its lower end engaging with an eye provided in an extension 30' of the nut 30 which constitutes part of the means for connecting the upper end of the link 21 to the diaphragm 5. The spring 36 which is also a retractile spring, has but very few turns or coils as compared with the spring 32 and acts in a direction contrary to the latter, the construction and arrangement preferably being such that the spring 36 is only very slightly stretched or extended when the reproducer is in operative position, as shown in Fig. 1, and then exerts but very little pull on the dia-

phragm. If made of certain materials and subjected to too great and continuous stresses, the diaphragm is likely, particularly in hot or humid climates, to dish and set in a deformed shape, especially when the reproducer is in inoperative position for a considerable period of time. The retractile spring 36 overcomes this tendency of the diaphragm to set in a dished shape, for while it is not sufficiently tensioned to exert enough force or pull to relieve the diaphragm of the additional stress which the spring 32 imposes thereon when the reproducer is in operative position, the said spring 36 will exert a much greater effective upward pull on the diaphragm when the reproducer is moved to inoperative position as the slight extension of this spring resulting from such movement of the reproducer will, because of the comparatively few turns or coils in such spring, produce an increase in the tension thereof much greater than that produced at the same time in the tension of spring 32. When the reproducer is to be used only in cold climates, or when the stresses imposed on the diaphragm are well within the limits of the elasticity of the material from which the diaphragm is formed, the use of the counteracting spring 36 is not actually necessary and this spring may, under these conditions, be omitted.

Another improvement contemplated by my invention is the provision of connecting means between the stylus lever and the diaphragm whereby the vibrations transmitted to the diaphragm will exactly correspond to those of the stylus 20 in tracking the record groove. If connecting means such as has heretofore been used are employed between the stylus lever and the diaphragm, I find that the quality of the reproduction is impaired, when the diaphragm is maintained under increased tension as described herein, due in part at least, to the fact that side vibrations are set up in such connecting means in the operation of the reproducer. I have found however that a reproduction may be obtained which is unimpaired in quality by the use of an improved connection between the stylus lever or arm and the diaphragm which is practically dead and has no tendency to vibrate. A preferred form of such a connection comprises a flexible connecting link 21 formed of a piece of fish snell, or the like, preferably consisting of a central body or core made up of a number of silk strands covered with fine copper wire closely and tightly wound thereon. A connecting link 21 composed of a piece of snell such as described is dead, it has no natural tendency to vibrate, it does not stretch under the vigorous vibrations imparted to it by the undulations of the record groove through the stylus 20 and lever 17, and it has no tendency whatever to vibrate sideways during the operation of the reproducer. Consequently, where such

a connection is employed between the stylus lever and the diaphragm, the only vibrations produced in such connection will be endwise vibrations corresponding to those imparted thereto by the stylus 20 through the lever 17, and consequently the vibrations transmitted to the diaphragm 5 will correspond exactly with those of the stylus 20 in tracking the record groove and a faithful reproduction will be obtained. Moreover a flexible link of this character enables a reproduction of unimpaired quality to be obtained, even when the diaphragm is subjected to extra stress as described, with a construction wherein the link is attached to the diaphragm and the stylus arm or lever by a rigid or fixed connection at one end and by a loose connection at its other end.

It is to be understood that the construction specifically shown and described herein is merely illustrative of my invention and that such construction is subject to various changes and modifications without departure from the spirit of my invention or the scope of the appended claims.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is as follows:

1. In a reproducer, a diaphragm, a member connected to said diaphragm and carrying a stylus, means whereby when the reproducer is in operative position the stylus is adapted to be maintained in engagement under pressure with a record, and means adapted to subject said diaphragm to stress in addition to stresses to which the same may be subjected by reason of such engagement of the stylus with the record, substantially as described.

2. In a reproducer, a diaphragm, a member connected to said diaphragm and carrying a stylus, means whereby when the reproducer is in operative position the stylus is adapted to be maintained in engagement under pressure with a record, and resilient means arranged to impose stress on said diaphragm in addition to stresses which may be imposed thereon by reason of such engagement of the stylus with the record, substantially as described.

3. In a reproducer, a diaphragm, a member connected to said diaphragm and carrying a stylus, means whereby when the reproducer is in operative position the stylus is adapted to be maintained in engagement under pressure with a record, and means adapted to relieve or remove some of said pressure and transfer the same to the diaphragm to thereby place the latter under increased tension, substantially as described.

4. In a reproducer, a diaphragm, a member connected to said diaphragm and carrying a stylus, means whereby when the reproducer is in operative position the stylus is adapted to be maintained in engagement under pres-

sure with a record, means adapted to subject said diaphragm to stress in addition to stresses to which the same may be subjected by reason of such engagement of the stylus with the record, and means for relieving the diaphragm of at least a part of such additional stress when the reproducer is in inoperative position, substantially as described.

5. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and means arranged when the stylus is in operative engagement with a record to impose stress on said diaphragm in addition to stresses imposed thereon by the action of the floating weight, substantially as described.

6. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and resilient means adapted when the stylus is in operative engagement with a record to maintain the diaphragm under a tension greater than that due to the stresses imposed thereon by the action of the floating weight, substantially as described.

7. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and means coacting directly with the stylus lever adapted when the stylus is in operative engagement with a record to impose stress on said diaphragm in addition to stresses imposed thereon by the action of the floating weight, substantially as described.

8. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, means adapted constantly to impose stress on said diaphragm in addition to any stress to which the latter is subjected by the action of the floating weight, and means for relieving the diaphragm of at least a part of such additional stress when the stylus is in inoperative position with respect to a record, substantially as described.

9. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and a retractile spring connected to said lever and so arranged as to be extended when the stylus is in operative relation to a record to thereby impose stress on said diaphragm in addition to the stress imposed thereon by the action of the floating weight, substantially as described.

10. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, means comprising a spring acting through said stylus

lever to impose stress on the diaphragm, when the stylus is in both operative and inoperative relation to a record, in addition to stresses imposed on the diaphragm by the action of the floating weight, and means for relieving the diaphragm of at least a part of such additional stress when the stylus is in inoperative relation to the record, substantially as described.

11. The combination of a sound box having a diaphragm mounted therein a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and means adapted when the stylus is in operative relation to a record to transfer a part of the pressure of the stylus on the record due to the action of the floating weight, to the diaphragm, substantially as described.

12. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and means comprising a retractile spring connected at its ends to the floating weight and the stylus lever adapted when the stylus is in operative relation to a record to transfer a part of the pressure of the stylus on the record due to the action of the floating weight, to the diaphragm, substantially as described.

13. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, means for imposing stress on the diaphragm, when the stylus is in both operative and inoperative relation to a record, in addition to stresses imposed on the diaphragm by the action of the floating weight, and means comprising a spring acting on the diaphragm to relieve the latter of at least a part of such additional stress when the stylus is in inoperative relation to the record, substantially as described.

14. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, means comprising a spring having its ends respectively connected to the floating weight and the stylus lever and adapted to impose stress on the diaphragm, when the stylus is in both operative and inoperative relation to a record, in addition to stresses imposed on the diaphragm by the action of the floating weight, and means comprising a spring acting on the diaphragm to relieve the latter of at least a part of such additional stress when the stylus is in inoperative relation to the record, substantially as described.

15. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, and a retractile spring having its ends respectively connected to the floating weight and that end

of the stylus lever opposite the end thereof connected to the diaphragm, substantially as described.

16. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, a retractile spring having its ends respectively connected to the floating weight and that end of the stylus lever opposite the end thereof connected to the diaphragm, and a second spring arranged to act on the diaphragm in a direction contrary to the action thereon of said first mentioned spring, substantially as described.

17. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight and connected to said diaphragm, a retractile coiled spring having its ends respectively connected to the floating weight and that end of the stylus lever opposite the end thereof connected to the diaphragm, and a second retractile coiled spring having its ends respectively connected to the sound box and the diaphragm, said second spring being arranged to exert stress on the diaphragm in a direction opposite to the stress imposed therein by said first mentioned spring and having fewer turns or coils than the latter, substantially as described.

18. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight, means connecting said lever and the diaphragm comprising a flexible member formed of a piece of fish snell, and means acting through said lever and connecting means adapted when the stylus is in operative relation to a record to impose stress on said diaphragm in addition to the stress imposed thereon by the action of the floating weight, substantially as described.

19. The combination of a sound box having a diaphragm mounted therein, a floating weight, a stylus lever mounted on said weight, means connecting said lever and the diaphragm comprising a flexible member which is substantially dead and has no natural tendency to vibrate, and means acting through said lever and connecting means adapted when the stylus is in operative relation to a record to impose stress on said diaphragm in addition to the stress imposed thereon by the action of the floating weight, substantially as described.

20. The combination of a sound box having a diaphragm mounted therein, a stylus carrying member, and means connecting said member to the diaphragm comprising a flexible member consisting of a wire-wound core of fibrous material, substantially as described.

21. The combination of a sound box having a diaphragm mounted therein, a stylus carry-

ing member, and means connecting said member to the diaphragm comprising a flexible member formed of a piece of fish shell, substantially as described.

5 22. The combination of a sound box having a diaphragm mounted therein, a stylus carrying member, and means connecting said member to the diaphragm comprising a flexible member consisting of a core formed  
10 of silk strands and fine wire covering said core and closely wound thereon, substantially as described.

23. The combination of a sound box having a vibratory member mounted therein, a  
15 stylus carrying member, and means connecting said members comprising a flexible element consisting of a wire-wound core of fibrous material, said element having a fixed or rigid connection at one end thereof with  
20 one of said members and a loose connection at the other end thereof with the other of said members, substantially as described.

24. The combination of a sound box having a diaphragm mounted therein, a stylus  
25 carrying member, and means connecting said member to the diaphragm comprising a flexi-

ble member consisting of a wire-wound core of fibrous material, said flexible member having a fixed connection at one end thereof with said diaphragm and a loose connection at the  
30 other end thereof with said stylus carrying member, substantially as described.

25. Means for connecting the diaphragm and stylus carrying member of a sound box structure comprising a flexible member con-  
35 sisting of a wire-wound core of fibrous material, substantially as described.

26. Means for connecting the diaphragm and stylus carrying member of a sound box structure comprising a flexible member  
40 formed of a piece of fish snell, substantially as described.

27. Means for connecting the diaphragm and stylus carrying member of a sound box structure comprising a flexible member con-  
45 sisting of a core formed of silk strands and fine wire covering said core and wound thereon, substantially as described.

This specification signed this 1st day of February, 1926.

THOS. A. EDISON.