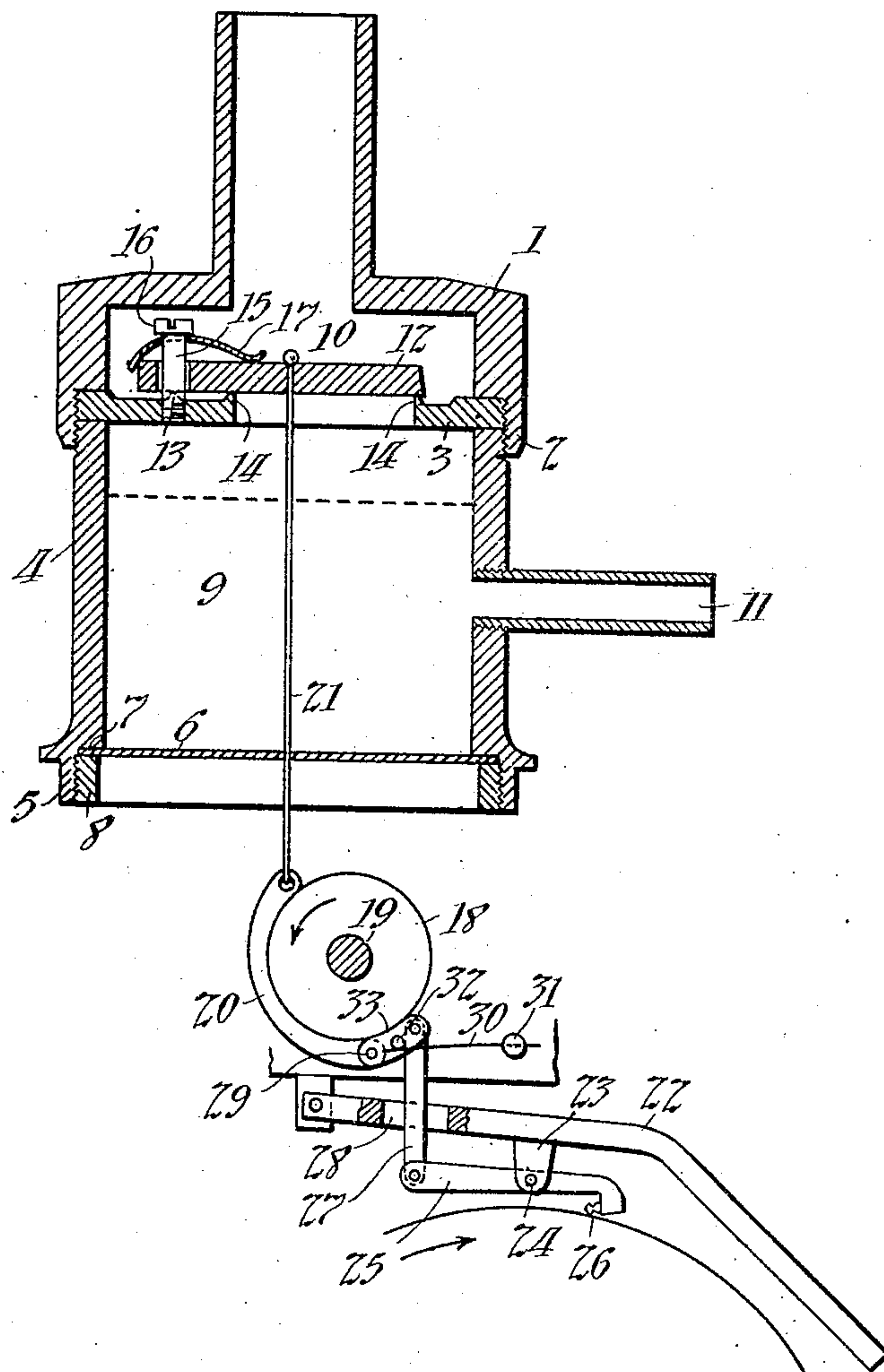


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SOUND REPRODUCER.  
APPLICATION FILED MAR. 20, 1909.

940,051.

Patented Nov. 16, 1909.



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# UNITED STATES PATENT OFFICE.

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## SOUND-REPRODUCER.

940,051.

Specification of Letters Patent.

Patented Nov. 16, 1909.

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*To all whom it may concern:*

Be it known that I, ALEXANDER N. PIERMAN, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have made a certain new and useful Improvement in Sound-Repducers, of which the following is a specification.

My invention relates to sound reproducers of the type wherein the rate of flow of elastic fluid through the ports of a valve situated between chambers in a sound box is varied in accordance with the movements of the reproducing stylus tracking a sound record, whereby the current of the fluid is thrown into vibrations corresponding in form to those which were originally caused by the production of sound in the formation of the original record, but which are of greater amplitude than the original vibrations causing an amplified reproduction of the said sounds.

The object of my invention is to provide a device of this character in which an even greater amplification of the sounds in the reproduction thereof is attained by the combination with the above described means for varying the rate of flow of the elastic fluid through the valve, of co-acting friction means and lever means.

In my Patent No. 891,367, granted June 23, 1908 for improvements in sound reproducers, I have disclosed an apparatus wherein the principle of the variation of rate of flow of air or other elastic fluid through the ports of a valve is made use of to amplify the reproduced sounds. Also, in my Patents Nos. 829,123, granted August 21, 1906, for frictional reproducing attachments for phonographs, 847,686, granted March 19, 1907 for phonic apparatus, and 867,597, granted October 8, 1907 for friction reproducing attachment for phonographs, I have disclosed various apparatus of the type wherein a rotating friction wheel is used in combination with a friction shoe placed against the same, the pressure between the friction shoe and the friction wheel being varied by suitable means representative of sound vibrations, thus producing variations in the amount of friction, which by suitable mechanical connections may operate a diaphragm or other phonic apparatus.

In my present invention, the variations in the amount of friction between the co-acting

friction members are caused by suitable means to regulate the amount of opening of the valve seated on a port or a series of ports through which a steady current of air or other elastic fluid is progressed, whereby the reproduction of sound with considerable amplification is attained.

Attention is hereby directed to the accompanying drawing embodying a preferred form of my invention and consisting in a diagrammatic side elevation of the device partly in section.

Referring to the drawing, 1 represents a sound box provided with the threaded depending annulus 2. In this the circular plate 3, constituting the valve seat and formed on its periphery with screw thread, is secured. The cylinder 4 carrying screw thread on the upper portion of its periphery is screwed within the ring 2, so that its upper edge is brought into contact with the lower surface of the ring 3, whereby the sound box 1, the valve seat ring 3 and the cylindrical member 4 are rigidly secured together. The cylinder 4 is formed at its lower end with the depending annular flange 5, which is screw threaded on its bore. The circular plate 6 is placed in position under the shoulder 7, formed by the meeting of the flange 5 with the body portion of the cylinder 4, and is rigidly secured in such position by the ring 8, which is threaded within the flange 5 to secure the plate 6 in position rigidly against the shoulder 7. The plate 6 thus constitutes a closure, whereby a pressure chamber 9 is formed, the sound box 1 forming a resonating chamber 10 of less dimensions than the pressure chamber 9 and separated therefrom by the valve seat 3 and valve to be described. Air or other elastic fluid is conducted to the pressure chamber 9 by means of the connection 11, which is threaded or otherwise secured within the wall of the chamber 9 to form an opening therein. The valve 12 is seated upon the ports formed in the plate 3 in any suitable manner. As shown in the drawing, the valve 12 is mounted to have pivotal movement upon the knife edge 13, the valve also, when in its closed position, resting upon the edges of the ports 14-14. The bolt 15 is threaded in the plate 3 and projects through a vertical opening in the valve 12. The bolt 15 is provided with a head 16 against which rests the flat spring 17, the two ends



of which bear upon the top valve plate 12, the pressure of said spring thereby being exerted to maintain the valve plate 12 upon its seat.

5 The friction wheel indicated diagrammatically at 18 is mounted upon the spindle 19 and is adapted to be constantly rotated by any suitable means not here shown. Suitable means for causing this rotation are  
10 described in several of my patents above referred to. Brake shoe 20 partly surrounds friction wheel 19 and is connected at one end thereof by link 21 with the valve plate 12. This link 21 passes through a suitable opening in closure 6 and the link is conveniently  
15 secured to the valve plate 12 by passing the link through a central vertical recess in the valve plate, upsetting the end of the link 21 above the valve plate, or forming a ball thereon of sufficient size to prevent the same  
20 passing through the passageway in the plate. This connection between the brake shoe and the valve plate is sufficient, since the pressure of the fluid entering chamber 9 through pipe 11 tends to hold the valve in  
25 its open position at all times, it therefore being only necessary for the friction element 20 to draw the valve toward its seat in accordance with the variations of pressure  
30 between the friction elements 18 and 20.

The floating weight of the reproducer is indicated at 22, and from this depend lugs 23 in which is mounted the horizontal stud 24, which forms the axis on which stylus  
35 lever 25 bearing stylus 26 is pivotally mounted. Stylus lever 25 is connected as by link 27 with one end of the brake shoe 20. Link 27 passes through the vertical recess 28 in the floating weight. Brake shoe 20 is  
40 mounted on pin 29 and a flat spring 30 secured at 31 to some stationary part of the structure bears on a pin 32 situated on the shorter arm 33 of the brake shoe to maintain the shoe with a certain amount of pres-  
45 sure in contact with the rotating wheel 18.

Vertical movement given stylus 26 in tracking the record groove is transmitted with amplification by stylus lever 25 to the  
50 arm 33 of brake shoe 20, since the arm of lever 25 to the left of the pivot 24, as shown in the drawings, is longer than the arm of said lever to the right of the pivot. The amount of friction between the rotating  
55 member 18 and the shoe 20 is varied in accordance with the movement thus transferred to it from the stylus and the link 21 is caused to repeat the movements of the stylus in its rise and fall with amplification in a manner that is well known. Down-  
60 ward movements of link 21 so caused restrict the amount of opening of the ports covered by the valve 12, pressure of elastic fluid on the lower side of valve 12 always holding valve 12 in the position of greatest opening  
65 of the ports allowed by the link 21. The

column of air or other elastic fluid in resonating chamber 10 is thereby thrown into vibrations corresponding to those which originally caused the formation of the sound groove on the record tracked by stylus 26, 70 these vibrations, however, being greatly amplified, and causing the reproduction of the record with great amplification.

It is, of course, obvious that various changes can be made in the construction of 75 the apparatus shown without departing from the spirit of the invention. Thus, it is not essential that friction members of the type specified be used, nor is it essential that the design of the valve and ports indicated be followed. Instead of using air 80 under pressure in the chamber 9, the use of a vacuum might be substituted and the relative proportions of the chambers 9 and 10 interchanged. 85

Having now described my invention, what I claim and desire to secure by Letters Patent of the United States is as follows:

1. In a phonograph, the combination with a stylus lever and reproducer stylus carried 90 thereby, and means supporting said lever so that the stylus may track the record, of frictional means for amplifying the movement of said stylus, means for varying the flow of a fluid under pressure through an 95 orifice, and means for transmitting the amplified movements caused by said frictional means to said varying means, substantially as described.

2. In a phonograph, the combination with 100 a reproducer stylus mounted to track the record, of an air reproducer and frictional and lever connections between said stylus and the movable member of said air reproducer, for imparting to said movable mem- 105 ber amplified movements corresponding to the movements of said stylus, and causing the air passing said movable member to be thrown into vibrations corresponding to the movements of said movable member, but 110 still further amplified, substantially as described.

3. In a phonograph, the combination with a sound box having two chambers, a valve plate between said chambers and a valve co- 115 acting therewith, of means for conducting a steady current of air or gas to one of said chambers, a rotating frictional member, a brake shoe co-acting therewith, connections from said shoe to said valve, a reproducer 120 stylus, and connections from said stylus to said brake shoe, substantially as described.

4. In a phonograph, the combination with a sound box having chambers closed at one end, a valve seat and co-acting valve at the 125 other end, means for conducting air or gas under pressure to said chamber, and a chamber on the other side of said valve connected to an outlet, of co-acting frictional members, a reproducer stylus, connections from 130



said stylus to one of said frictional members, and connections from said member to said valve to impart such movement of said member to said valve as causes said valve to move toward its seat, the pressure of air tending to move it from its seat, substantially as described.

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5. In a phonograph, the combination with a sound box having chambers closed at one end, a valve seat and co-acting valve at the other end, means for conducting air or gas under pressure to said chamber, and a chamber on the other side of said valve connected to an outlet, of a rotating frictional member and a co-acting frictional member, an apertured floating weight, a stylus lever

mounted on said weight, a connection from said lever to said co-acting frictional member extending through said aperture, a one way connection from said co-acting member to said valve to move the latter in opposition to the air pressure, and additional means steadily but resiliently acting to hold the valve on its seat, substantially as described.

This specification signed and witnessed this 17 day of March 1909.

ALEXANDER N. PIERMAN.

Witnesses:

DYER SMITH,  
FRANK D. LEWIS.