

D. HIGHAM.
SOUND REPRODUCER.
APPLICATION FILED DEC. 15, 1909.

1,034,014.

Patented July 30, 1912.

Fig. 1

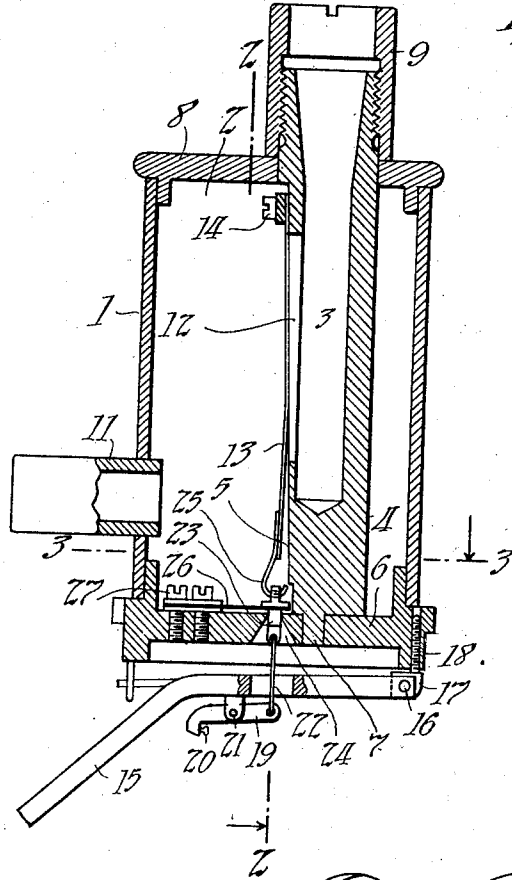


Fig. 2

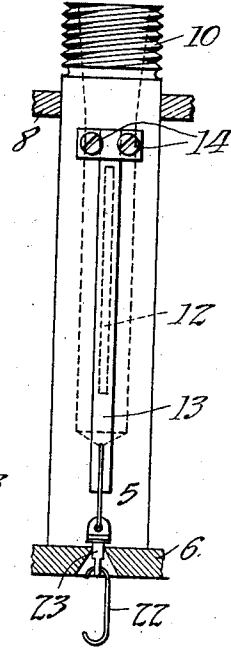


Fig. 3

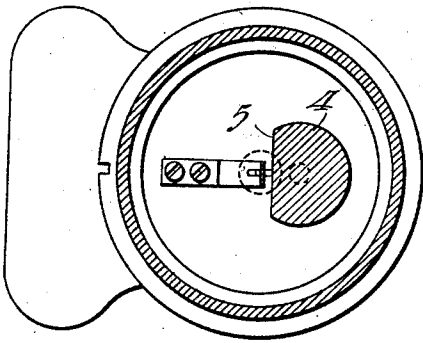
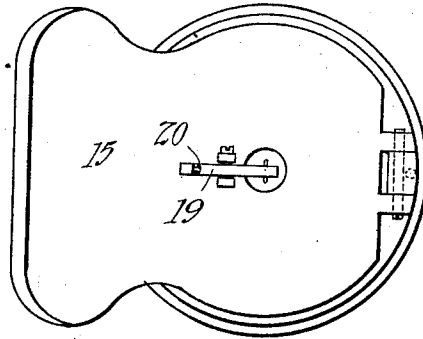


Fig. 4



Witnesses:
Frank D. Lewis
Dyer Smith

Inventor:
Samuel Higham
by Frank L. Dyer
his Atty.

UNITED STATES PATENT OFFICE.

DANIEL HIGHAM, OF NEW YORK, N. Y.

SOUND-REPRODUCER.

1,034,014.

Specification of Letters Patent.

Patented July 30, 1912.

Application filed December 15, 1909. Serial No. 533,265.

To all whom it may concern:

Be it known that I, DANIEL HIGHAM, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Sound-Reproducers, of which the following is a description.

My invention relates to phonograph reproducers of the pneumatic type, or, generally speaking, of the type in which undulations corresponding to sound waves are impressed upon a current of any suitable moving fluid by the operation of a suitable valve through which the fluid is allowed or caused to pass, the valve being operated in accordance with the sound waves as by connection with a reproducing stylus tracking a record groove.

The objects of my invention are the construction of a sound reproducer whose tones will be characterized by more perfect quality than those of reproducers ordinarily used, and which will cause undulations corresponding to the original sound waves, but greatly amplified thereover, to be impressed upon the current of air or other moving fluid passing through the reproducer with the result that tones of much greater volume may be reproduced than is commonly possible in devices of this character.

My invention operates upon a new principle by which the movement imparted to the valve member by connection with the stylus lever is greatly amplified in the vibration of the valve member. This is accomplished by forming a valve of flexible material which is seated upon a port connecting two communicating chambers, or is otherwise suspended across the path taken by the moving fluid in its passage through the sound box, this valve normally being bent in an arc of slight curvature. The valve member is fixed at one end and is connected to the reproducing stylus at its other or free end in such a manner that the reciprocating motion derived from the movement of the stylus in traveling over the record groove is communicated to the free end of the valve member by alternate pushes and pulls lengthwise of the valve member or substantially parallel to the valve plate upon which it is seated. The longitudinal movements thus imparted to the free end of the valve member result in a corresponding, but greatly amplified, movement of that portion of the member

which is seated upon the port toward and away from the port as the curvature of the member increases and decreases. The movement of the center of the flexible member as it vibrates at right angles to its length may easily amount to seven or eight times the movement imparted longitudinally of the valve member by connection with the stylus where the arc of the flexible member is quite flat. I have also constructed the sound box in a novel manner, one chamber being formed within a member which extends within the other chamber, somewhat in the form of a pipe of smaller diameter than the first named chamber, this member or pipe being provided with a port upon which the flexible valve is seated. This construction need not necessarily be used, however, in connection with the valve connections just described.

In view of the foregoing, my invention consists in the features hereinafter described and claimed.

Reference is hereby made to the accompanying drawings, forming part of this specification and embodying one form of my invention, and in which—

Figure 1 represents a vertical cross section through a reproducer embodying my invention, certain parts being shown in side elevation. Fig. 2 is a view of my improved valve and the member containing the port upon which it is seated taken on line 2—2 of Fig. 1. Fig. 3 is a horizontal section taken on line 3—3 of Fig. 1. Fig. 4 is a bottom plan view of the device shown in Fig. 1.

The same reference numerals will be used in all of the above figures to denote corresponding parts.

Referring to the drawings, the sound box 1 is provided as is common with two interior chambers 2 and 3. I prefer, however, to form these chambers in a novel manner, although it is not essential to my main invention that they be so formed. As shown in the drawings, the chamber 3 is formed longitudinally in the elongated member 4 which is secured within sound box 1 so that it extends through the whole interior of chamber 2 of sound box 1. Member 4 may conveniently be in the form of a cylinder having a flattened portion 5 on one side thereof to constitute a valve seat. The lower end of this cylinder 4 may conveniently be secured to the bottom 6 of sound box 1 by a

mortise and tenon joint, as shown at 7. This joint is made sufficiently tight to hold member 4 securely in place. The top 8 of sound box 1 is then placed in position with member 4 extending therethrough and a cylindrical member 9 screw threaded on its bore is screwed upon the threaded periphery 10 of the upper cylindrical portion of member 4 above top member 8 to secure the parts firmly in position. The chamber or passageway 3 extends downwardly through member 4 a considerable distance within the interior of the sound box, and this chamber 3 communicates through member 9 with any suitable horn or sound amplifying means. The pipe connection 11 is provided with an opening into chamber 2 of sound box 1, preferably at right angles to the surface 5 of member 4 for the introduction of a continuous current of air or other suitable fluid into the sound box. A port 12 preferably in the form of an elongated vertical slit is provided in the surface 5 of member 4, this port thus connecting chambers 2 and 3. The valve 13 formed of any suitable thin elastic material is seated upon port 12 and is secured to member 4 by any suitable means as screws 14 immediately above the upper end of the port. It is, of course, obvious that a plurality of such ports and valves might be provided if desired.

By forming chamber 3 in a member as described, a simple and compact device is provided which also has the advantage that chamber 2 surrounding member 4 in which chamber 3 is situated, constitutes a reservoir or equalizing means for the pressure of the air or other moving fluid entering through pipe 11.

Valve member 13 is seated upon port 12 and is curved or bent inwardly therefrom in an arc of slight curvature, so that the lower end of the valve member below the port 12 juts forwardly a slight distance from surface 5 of member 4. Floating weight 15 is pivoted at 16 to block 17 which is pivoted within bottom member 6 of sound box 1 in the well known manner, as indicated by screw 18. Stylus lever 19 bearing stylus 20 is pivotally connected to floating weight 15 in any convenient manner as indicated at 21. Link 22 extends upwardly from the tail of stylus lever 19 through a suitable opening in floating weight 15 and is connected at its upper end to a link or rod 23 vertically in line therewith, which link is adapted to reciprocate in a vertical plane through an opening 24 in bottom plate 6 of the sound box 1, in which opening link 23 is closely fitted to slide. The upper end of rod 23 is provided with a hole threethrough through which is passed a hook 25 which is secured to the lower end of valve member 13 as shown. Oo, link 24 may be connected to valve 13 in any other suitable manner. Horizontal spring

26 is preferably provided, being mounted on the upper surface of bottom plate 6 of the sound box as by screws 27, the free end of this spring being connected to rod 23 to regulate the amount of curvature of valve 13 and the tension under which it is held. As stylus 20 rises and falls in following the vertical undulations of the sound groove of the record being reproduced, link 22 and rod 23 reciprocate in a plane substantially parallel to the face 5 of the valve seat, or in a plane which may be considered as being tangential to the curvature of valve 13 at the port opening. The alternate up and down movement thus communicated to the lower end of valve 13 flexes the latter, the downward movement of rod 23 straightening out valve 13 or decreasing the curvature thereof, while upward movement of member 23 increases the curvature of the valve. Thus, the downward movement of rod 23 moves the valve member from its port, while upward movement of rod 23 causes the valve to be seated more firmly upon its port, thus reducing the port opening. Where the valve member is curved in a very slight arc, as shown in the drawings, the movement lengthwise of the valve member communicated from the stylus results in a movement of the center of the arc at right angles to the movement of link 23 much greater than the movement of link 23. In a construction such as that shown in the drawings, the movement of the valve toward and away from the port resulting in a decrease and increase of the extent of port opening, easily amounts to seven or eight times the amount of movement parallel to the valve causing such movement of the valve. The result of this construction is that sound undulations corresponding to the vibrations of the stylus in reproducing, but very greatly amplified in character are impressed upon the current of air or other fluid passing through the sound box with consequent amplification of the sound reproduced.

It is obvious that my invention is not limited to the exact construction shown, but is as broad as is indicated by the appended claims. My invention is based upon a principle of amplification which is apparently broadly new in the art.

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

1. In a sound reproducer, the combination with a plate having a port there-through, of a flexible member seated upon said port and secured at one end to said plate adjacent the end of said port, the end of said member being curved away from the surface of said plate, and means for causing said free end to move lengthwise approximately parallel to said plate in accordance with sound vibrations to vary the extent of

opening of said port correspondingly, substantially as described.

2. In a sound reproducer, the combination with a plate having a port therethrough, of
5 a flexible member seated upon said port and secured at one end to said plate adjacent the end of said port, the end of said member being curved away from the surface of said plate in an arc, and means for communicating movement in accordance with sound vibrations to the free end of said member lengthwise of the same to vary the extent of opening of said port correspondingly, substantially as described.

15 3. In a sound reproducer, the combination with a plate having a port therethrough, of a flexible member covering said port and secured at one end to said plate adjacent one end of said port, said member being bent into the form of a flat arc, and means for reciprocating the free end of said member in accordance with sound vibrations in the direction of a tangent to said arc to increase and decrease the amount of curvature of the
20 member to vary the extent of opening of said port correspondingly, substantially as described.

4. In a sound reproducer, the combination of a hollow body having two chambers communicating through a port, a flexible member seated upon said port, anchored at one end, and slightly curved away from the plane containing the mouth of said port at its other end, a link secured to the free
30 end of said member and extending in a plane substantially parallel to that containing the mouth of said port, and means for reciprocating said link in accordance with sound vibrations to vary the extent of opening of said port correspondingly, substantially as described.

5. In a sound reproducer, the combination with a plate having a port therethrough, of a flexible member covering said
45 port and secured at one end to said plate adjacent one end of said port, said member being bent into the form of a flat arc, and means for communicating movement in accordance with sound vibrations to the free end of said member in a direction to exert alternate pushes and pulls lengthwise of the same to increase and decrease the amount of curvature of the member correspondingly, substantially as described.

55 6. In a sound reproducer, the combination of a hollow body having two chambers communicating through a port, a flexible member seated upon said port, anchored at one end, and slightly curved away from the

plane containing the mouth of said port at
60 its other end, a floating weight, a pivoted stylus lever carried thereby and connections between the tail of said lever and the free end of said member substantially parallel to the latter, substantially as described.

7. In a sound reproducer, the combination of a body containing a chamber, a pipe connection thereto, a hollow member secured within said body and extending through said chamber and outside said body
70 at one side, said member having a port connecting the interior thereof with said chamber and an opening from said interior outside said body, a flexible valve anchored at one end and seated upon said port, and
75 means for communicating movement in accordance with sound vibrations to the free end of said valve lengthwise of the same to vary the extent of opening of said port, substantially as described.

8. In a sound reproducer, the combination of a hollow body having two chambers, a substantially vertical wall separating said chambers and having a port therein connecting said chambers, a flexible valve seated
85 upon said port and secured at its upper end, a stylus lever pivoted below said body, and a link connecting said lever to the lower end of said valve and extending through the lower wall of said body in an approximately vertical direction, substantially as described.

9. In a sound reproducer, the combination with a hollow body adapted to have a column of fluid under pressure pass there-
95 through, of a flexible member normally bent in the form of an arc of slight curvature suspended at one end across the path of said fluid within said body, and means for imparting reciprocating movement in accordance with sound vibrations to the free end of said member lengthwise of the same to set said fluid into corresponding amplified vibration, substantially as described.

10. In a sound reproducer, the combination with a flexible member normally bent in the form of an arc of slight curvature anchored at one end, of means for imparting reciprocating movement in accordance with sound vibrations to the free end of said
110 member lengthwise of the same, substantially as described.

This specification signed and witnessed this 10th day of December 1909.

DANIEL HIGHAM.

Witnesses:

DYER SMITH,
JOHN M. CANFIELD.

It is hereby certified that in Letters Patent No. 1,034,014, granted July 30, 1912, upon the application of Daniel Higham, of New York, N. Y., for an improvement in "Sound-Reproducers," errors appear in the printed specification requiring correction as follows: Page 2, line 61, for the word "threthrough" read *therethrough*, and same page, line 64, for the letters "Oo" read *Or*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of September, A. D., 1912.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.