

A. N. PIERMAN.
SOUND REPRODUCER.
APPLICATION FILED MAY 1, 1909.

1,010,311.

Patented Nov. 28, 1911.

Fig. 4

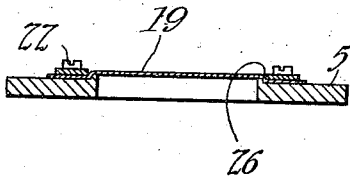


Fig. 1

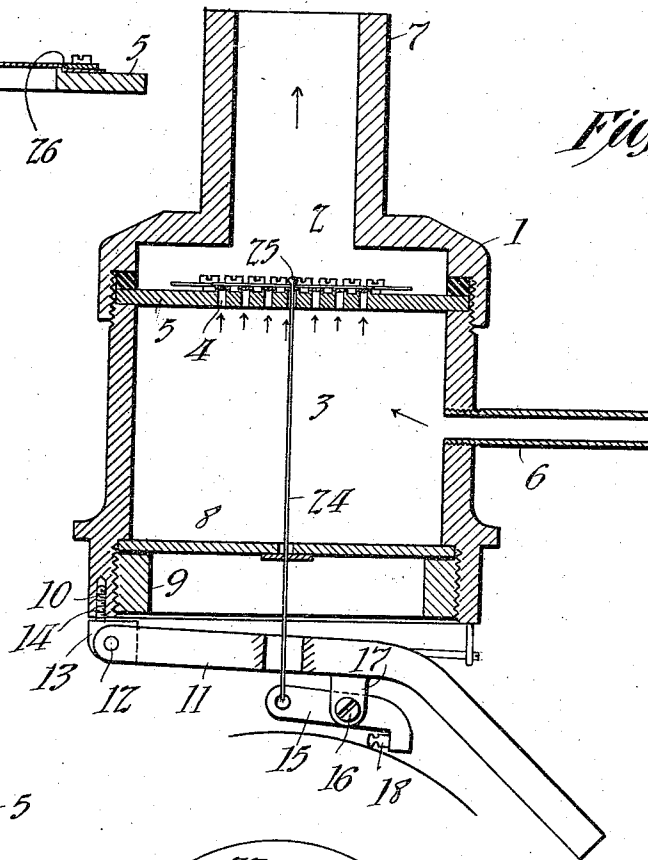


Fig. 3

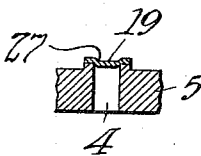
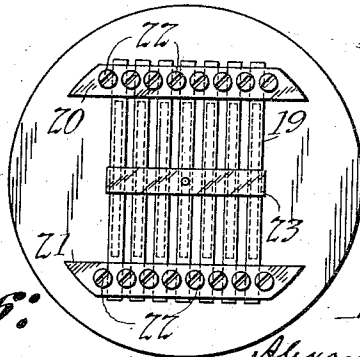


Fig. 2



Witnesses:

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UNITED STATES PATENT OFFICE.

ALEXANDER N. PIERMAN, OF NEWARK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THOMAS A. EDISON, INCORPORATED, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SOUND-REPRODUCER.

1,010,311.

Specification of Letters Patent. Patented Nov. 28, 1911.

Application filed May 1, 1909. Serial No. 493,281.

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 Invention in Sound-Reproducers, of which the following is a description.

My invention relates to talking machines 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 to construct a sound reproducer in which the moving fluid is caused to operate a sensitive valve of a novel character in a novel manner, whereby a sound reproduction of clear and excellent qualities and the desired degree of loudness or amplification is secured.

The valve or vibratory member or members constructed in accordance with my invention is of minimum mass, whereby defects due to inertia and momentum of parts are largely avoided. In accordance with these objects, thin, flexible, reed-like members are interposed in the path of the moving fluid current and are vibrated in accordance with sound vibrations to set up corresponding undulations in the moving fluid current in the sound box of the reproducer.

In the preferred form of my invention, a port plate is provided having one or more slit-like ports therein, upon which ports are seated thin, flexible, reed-like members of elastic material which are placed under tension and secured to the port plate at both ends. Also, preferably, these reed-like members are burnished or otherwise given such a conformation that they rest upon the mouths of the ports in close contact, partly within the same, to accurately close the said ports when the members are in their normal position. The reed-like members are joined together and are flexed by connection with the stylus to vary the extent of opening of the ports to a greater or less extent in accordance with the sound vibra-

tions which originally produced the record groove tracked by the stylus.

Other objects of my invention than those referred to above will appear below in the specification and claims.

So far as I am aware, the valves or vibratory members of devices of the general type referred to above constructed prior to my invention have been generally in the form of rigid plates or bodies which are moved bodily in accordance with sound vibrations to vary the extent of opening of the ports, as by moving the same in planes perpendicular to the plane in which the mouths of the ports are situated, or parallel thereto, or by an angular movement, the valves being pivoted or balanced on a knife-edge, or the like, at one side of the ports. It has also been proposed to constitute the valve of elastic material and secure it firmly at one extremity, and vibrate the same across the port opening in the manner of a tuning fork, the material of the valve flexing chiefly in a line adjacent to its point of support, this manner of mounting being therefore similar to the pivotal mounting referred to above. In the case of the rigid valves a considerable amount of mass is necessitated, with consequent inertia and loss of sensitiveness, and in the case of the vibratory valves last referred to, it has been impossible to make the tongues thin and light, since in that case they might set up audible vibrations of their own. The reed-like members of my invention, on the contrary, are held at both ends, preferably under tension, and hence vibrate not like tuning forks but rather in the manner of violin strings. The analogy, however, is not complete. The reed-like members are constrained to vibrate only in accordance with the sound vibrations to be reproduced, and can not produce audible tones of their own. Also, they are of such proportions and so short that they cannot vibrate in parts and produce nodes to produce audible tones. The stiffening of the material by the burnishing referred to above also conduces to this result.

Reference is hereby made to the accompanying drawings, forming part of this specification, in which the same reference numerals are used throughout to denote corresponding parts, and in which—

Figure 1 is a side elevation, partly in sec-

tion, of a sound reproducer embodying my invention. Fig. 2 is a plan view of the port plate with the valve members secured thereto. Fig. 3 is an enlarged fragmentary cross section through one of the ports of the port plate showing one of the reed-like members burnished into contact therewith, and Fig. 4 is a detail view showing the preferred method of securing the reed-like members to the port plate under tension.

Referring to the drawings, the sound box 1 may be formed with two chambers 2 and 3 communicating through the ports 4 in the port plate 5, air being conducted into chamber 3 by means of conduit 6 and escaping from chamber 2 through the reproducer neck 7 as is common. The chamber 3 is closed by the closure 8 which is secured in position against the shoulder of the circular wall of the chamber 3 by means of the ring 9 which is screwed into the depending flange 10 of the sound box to hold the closure 8 tightly in position. The floating weight 11 is pivotally mounted at 12 to the block 13 which is mounted as by the screw 14 on the lower surface of the depending flange 10. The stylus lever 15 is pivotally mounted at 16 to the lugs 17 depending from the floating weight, and the said stylus lever is provided with stylus 18. All of the above mentioned parts are common.

The ports 4, which are preferably in the form of lengthened slits, are normally closed by means of the flexible reed-like members 19 seated upon the same. These members are very thin and preferably are formed of a light metal such as aluminium. These reeds are secured in position on the port plate by fastening them securely to the same at both their ends at the opposite extremities of the ports. I prefer to secure the reeds 19 in position by the means shown in the drawings. As there illustrated, the strips 20 and 21 are placed transversely across the ends of reeds 19 beyond the two extremities of the ports 4, and screws 22 are screwed through the strips 20 and 21 and into the port plate 5, the shanks of the screws extending between the reed-like members 19 and the heads of the screws each overlapping one of the said reeds 19 on each side of the same. By this means a very secure connection is made which is at the same time detachable. It is, of course, obvious that members 19 might be secured permanently to the plate 5 as by solder. The reeds 19 are fastened together as by strip 23, which is soldered or otherwise secured to the same transversely of the same and midway between the strips 20 and 21. The link 24 which is attached to the tail of stylus lever 15 is also secured to strip 23. I prefer to use the construction shown in the drawings, in which link 24 passes through a hole in strip 23 and is provided

on the upper side thereof with a button or head 25, so that the upward movement of stylus 18 in tracking the record groove pulls the reeds 19 downwardly at their central points, the pressure of air or other fluid passing from chamber 3 through ports 4 into chamber 2 tending to constantly keep the reeds 19 flexed upwardly. The result of this construction is that when the stylus 18 passes into depressions in the record groove, the current of air or other fluid passing through the port plates flexes the reeds 19 to open the ports to a greater extent, while when the stylus 18 passes over hills or shallower places in the record groove, the link 24 draws the reeds 19 down to reduce the extent of opening of the ports. It is, of course, obvious that the proportion of parts as shown could be changed without departing from the spirit of the invention, and that, if desired, the direction of flow of the fluid could be reversed and the valve seated on the opposite side of the port plate 5 from that indicated with appropriate connection to the stylus lever.

Preferably, the reeds 19 are secured in position and held under a uniform tension. This may be secured in a number of ways, as, for example, that indicated in Fig. 4. Here, the port plate 5 is represented as being formed with slightly raised bearing surfaces surrounding the orifices of the ports on the side of the plate on which the reeds are mounted, the lips so formed having their edges rounded with a smooth curve beyond the ends of the slit-like ports, as shown at 26. The reeds 19 are placed in position over the ports 4 and are so held temporarily by any suitable means. The screws 22 are then secured in position in the portions of the port plate of reduced thickness, as indicated, and by the pressure produced by their heads upon that portion of the reeds 19 lying on curved portions 26 of the port plate 5, a tension is produced which is the same in all the reeds 19, since the adjustment of screws 22 is the same in each case. When the reeds 19 have been properly secured in position, they are preferably forced into close contact with their bearing surfaces, and bent somewhat into the mouths of the ports, in any suitable manner, as with a burnishing tool, as indicated at 27 in Fig. 3, to cause the said reeds 19 to conform closely to the irregularities of the mouths of the ports, and thus normally seat themselves accurately and closely thereon. The valve so produced operates entirely by elastic flexure, vibrating back and forth in symmetrical arcs to a very slight extent to increase or decrease the amount of port opening and admitting the current of air into the chamber 2 in a series of puffs. It would seem that the reeds 19 normally entirely close the ports 4. The valve so constructed

is exceedingly sensitive and copies the vibrations of the stylus with amplification and with great faithfulness. Any desired number of ports and corresponding reeds may be used, the loudness of the sound reproduced varying with the number used.

Where, in the various claims, I have referred to members seated upon the ports, it is to be understood that the reed-like members may be seated upon either the upper or the lower surface of the port plate as previously stated, and by the language used I do not limit myself to the seating of the members upon the upper surface of the plate merely.

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 of a hollow body containing chambers communicating through a plurality of ports, stretched members of elastic material held rigidly at both extremities, seated upon and covering said ports, and means for flexing the said members in accordance with sound vibrations, substantially as described.

2. In a sound reproducer, the combination of a hollow body containing chambers communicating through a port, a stretched member of elastic material held rigidly at both extremities, seated upon and covering said port, and means for flexing the said member in accordance with sound vibrations, substantially as described.

3. In a sound reproducer, the combination of a hollow body containing chambers communicating through one or more ports, thin members of elastic material seated one upon each of said ports, means situated at both extremities of said members for holding the same immovable at both ends, and means for flexing the said members in accordance with sound vibrations, substantially as described.

4. In a sound reproducer, the combination with a sound box and means for conveying a fluid therethrough, of elongated flexible means interposed in the path of said fluid for producing undulations therein by its flexure, and means for flexing the said means in arcs having their centers in a single straight line in accordance with sound vibrations, substantially as described.

5. In a sound reproducer, the combination with a sound box and means for conveying a fluid therethrough, of a vibrating thin strip interposed in the path of said fluid and held only at both ends for producing undulations in said fluid, and means for causing said strip to vibrate substantially as a whole in accordance with sound vibrations, substantially as described.

6. In a sound reproducer, the combination with a sound box and means for conveying a fluid therethrough, of a vibrating thin

strip interposed in the path of said fluid and held only at both ends for producing undulations in said fluid, and means acting upon said strip substantially midway between its ends for causing the same to vibrate in accordance with sound vibrations, substantially as described.

7. In a sound reproducer, the combination with a sound box and means for conveying a fluid therethrough, of a member interposed in the path of said fluid and provided with a passageway through which the fluid passes, and a vibratory reed covering said passageway and held firmly at both ends, and means for flexing the said reed to uncover the said passageway more or less in accordance with sound vibrations, substantially as described.

8. In a sound reproducer, the combination with a sound box and means for conveying a fluid therethrough, of a member interposed in the path of said fluid and provided with a passageway through which the fluid passes, a vibratory reed held under tension and secured at both ends to cover said passageway, and means for flexing the said reed to uncover the said passageway more or less in accordance with sound vibrations, substantially as described.

9. In a sound reproducer, the combination of a hollow body containing chambers communicating through a plurality of slit-like ports, vibratory reed-like members of somewhat elastic material seated one upon each of said ports and covering the same, means for securing fixedly both the ends of all said members, and means for flexing all said members together to open said ports more or less in accordance with sound vibrations, substantially as described.

10. In a sound reproducer, the combination of a hollow body containing chambers communicating through a plurality of slit-like ports, vibratory reed-like members of somewhat elastic material seated one upon each of said ports and covering the same, means for holding all said members under an equal tension and anchoring the ends thereof, and means for flexing all said members together to open said ports more or less in accordance with sound vibrations, substantially as described.

11. In a sound reproducer, the combination of a hollow body containing chambers communicating through one or more ports, a valve of elastic material rigidly held at both ends and seated upon said ports, and means for flexing the said valve for varying the extent of opening of said ports in accordance with sound vibrations, substantially as described.

12. In a sound reproducer, the combination of a hollow body containing chambers communicating through one or more ports, thin reed-like members of elastic material

normally seated upon said ports and convexed somewhat to fit accurately into the adjacent orifices of the same, means rigidly holding the ends of said members and means
 5 for flexing the said members for varying the extent of opening of said ports in accordance with sound vibrations, substantially as described.

13. In a sound reproducer, the combination of a hollow body containing chambers communicating through one or more ports, thin reed-like members of elastic material normally seated upon said ports and constituting a valve, means holding said members rigidly at both ends, a stylus, and connections from the said stylus to the said members for flexing the latter in accordance with the movements of the former in tracking a sound groove, substantially as described.
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14. In a sound reproducer, the combination with a sound box, of a ported plate therein, means for introducing fluid into said sound box on one side of said plate, a
 25 member or members of elastic material secured upon said plate and covering the port or ports in the same on the opposite side thereof, a stylus and a one-way connection from said stylus to said member or members for flexing the same toward the said plate in accordance with movements of said stylus in one direction, substantially as described.
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15. In a sound reproducer, the combina-

tion with a sound box, of a ported plate
 35 therein, means for introducing fluid into said sound box on the lower side of said plate, a member or members of elastic material secured upon said plate at both extremities and covering the said port or ports
 40 in the same on the upper side thereof, a stylus below the plate and a one-way connection from said stylus to said member or members for flexing the same toward the said plate in accordance with movements of
 45 said stylus in one direction, substantially as described.

16. As a new article of manufacture, a port plate for an air sound reproducer, having slit-like ports therein, and thin flexible
 50 reed-like members seated upon said ports and bent or forced into position to normally closely cover the same, substantially as described.

17. As a new article of manufacture, a
 55 port plate for an air sound reproducer, having slit-like ports therein, thin flexible reed-like members seated upon said ports and normally closely covering the same, and secured to the port plate at both ends, substantially as described.
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This specification signed and witnessed this 30th day of April 1909.

ALEXANDER N. PIERMAN.

Witnesses:

DYER SMITH,
 JOHN M. CANFIELD.