A. N. PIERMAN.

SOUND REPRODUCING APPARATUS.

APPLICATION FILED JULY 18, 1907.

**1,042,034.** Patented Oct. 22, 1912.

Fig. 1

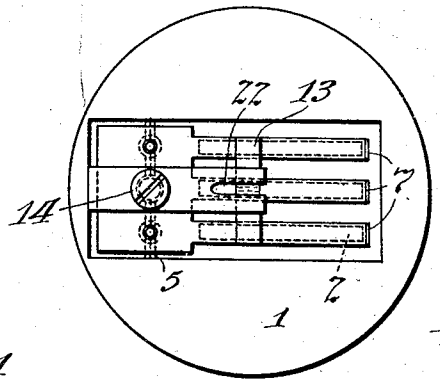



Fig. 5

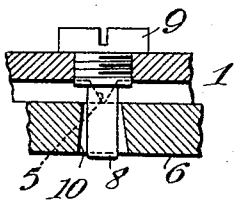



Fig. 7

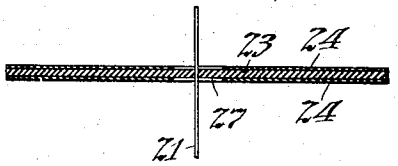



Fig. 2

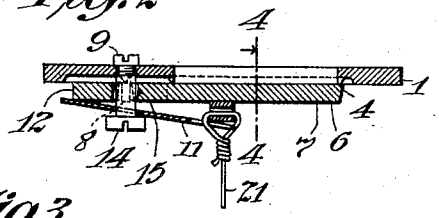



Fig. 3

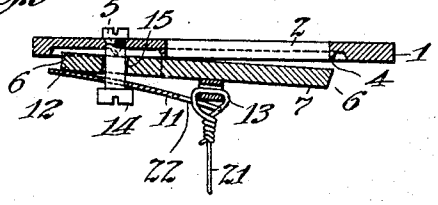



Fig. 4

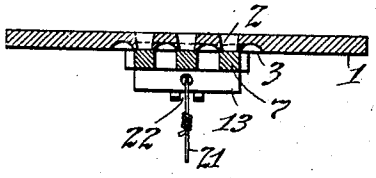
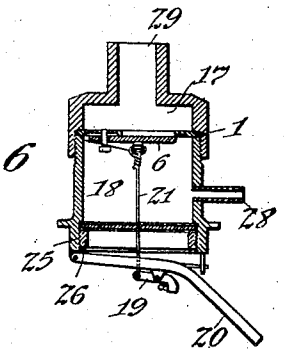



Fig. 6




Witnesses:
Frank D. Lewis
H. H. Dyke

Inventor:
Alexander N. Pierman
by Frank L. Dyer
Atty.

# 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-REPRODUCING APPARATUS.

1,042,034. Specification of Letters Patent. Patented Oct. 22, 1912.

Application filed July 18, 1907. Serial No. 384,328.

*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 invented certain new and useful Improvements in Sound-Reproducing Apparatus, of which the following is a description.

My invention relates to sound reproducers which operate by varying the rate of flow of an elastic fluid through valve governed ports.

The present invention is directed to the improvement of the valve and the parts immediately coöperating therewith, and to the improvement of the means for preventing the admission of air into the reproducer past the valve operating means.

In order that the invention may be better understood, attention is directed to the accompanying drawings wherein the same reference characters are used uniformly to designate the same parts and in which—

Figure 1 is a bottom plan view of the ported plate and the valve; Figs. 2 and 3 are vertical central cross-sectional views of the same, showing the valve in closed and open positions respectively; Fig. 4 is a cross-sectional view on the line 4—4, Fig. 2; Fig. 5 is a detail of the valve positioning means; Fig. 6 is a vertical cross-sectional view of a reproducer fitted with my improved valve and port plate and air excluding means, and Fig. 7 is a detail cross-sectional view of the said air excluding means.

The port plate 1 is provided with a number of ports 2, preferably having downwardly converging walls, as shown in Fig. 4. These ports are preferably situated slightly at one side of the center of the port plate, as shown in Fig. 1, in order that the valve as a whole may be placed substantially centrally thereof. At the sides of these slots or ports, the material of the port plate, which is preferably of metal, is cut away as shown at 3, thus leaving only the knife edges 4 for the air to pass over and preventing any cushioning of the valve. At that end of the ports where the greater portion of the port plate is left, the material of the port-plate is cut away, not only immediately adjacent the ports but to a considerable distance therefrom, leaving only the knife edge 5 for the valve plate to turn on. Manifestly this knife edge 5 may be formed of the metal of the port plate or a specially hardened piece may be inserted as desired. The considerable cutting away of the port plate just referred to provides room to accommodate the movement of the valve.

The valve plate 6 is provided with as many tongues 7 as there are ports 2. I have obtained good results with the use of three ports and tongues, which is the number shown in the drawings. My invention, however, is not limited as to the number of ports of which I may make use. This valve 6 is preferably formed of a light metal, such as aluminum, although, of course, other materials may be used. At each side of the valve plate and in the same line with the knife-edge 5, I provide positioning means for properly positioning the valve tongues with respect to the ports. The positioning means which I have shown consists of studs 8 formed on screws 9 by which they are secured in the port plate, and fitting loosely into the openings 10 in the valve plate. These openings are preferably made slightly larger on the side of the valve plate farthest from the port plate, but this, of course, need not be done unless desired. The valve plate is held resiliently against the port plate by means of a spring 11 which bears against one end 12 of the valve plate and against the cross-bar 13 which connects the tongues 7 and is situated at substantially the middle of the valve plate. This spring is supported between its ends by a screw 14 which is passed loosely through an opening 15 in the valve plate and is threaded into the port plate. The screw 14, like the studs 8, has its axis in the same line with the knife edge 5, and the pressure of the spring 11 upon the valve may be controlled by adjusting this screw.

The port plate and valve just described are placed between the resonating chamber 17 and the equalizing chamber 18, of a reproducer of the type above mentioned, and the valve plate is connected to the stylus lever 19 which is pivoted to the floating weight 20 by a link 21 which is preferably secured to the cross-bar 13, the spring 11 being preferably bifurcated as shown at 22, to permit the link to be secured to the said cross-bar at its center.

I have devised an improved form of closure for the lower end of the equalizing chamber 18, through which the link 21

passes, this closure comprising a piece 23 of soft, flexible material, such as rubber, interposed between the two plates 24 of stiffer material, such as metal or celluloid, and which are secured within the annular recess 25 in the reproducer by a screw ring 26. Openings 27 of relatively large area are provided in these plates 24, so that the link 21 may work freely therein, and the opening in the rubber piece 23 is made just large enough to admit the link 21. This opening may be conveniently made with a needle. This construction allows the link 21 the requisite play necessary to the proper operation of the device, and effectually prevents the passage of air around the link 21.

The operation of my improved device is as follows: An elastic fluid, preferably air, is drawn into the reproducer by means of a suction device attached to the nipple 28 connected with the equalizing chamber 18, and enters into the resonating chamber 17 through an opening 29 to which a horn may be attached. The valve plate 6 is rapidly vibrated by the stylus which follows the record grooves in the sound record, and the variation in the rate of flow of fluid through the ports 2, produced thereby, throws the column of air in the resonating chamber and the horn into vibration, and by this means the sounds which have been recorded are reproduced with great fullness and purity.

Having now described my invention, what I claim is:

1. In an elastic fluid sound reproducing apparatus, the combination of a valve seat provided with ports, a knife edge, a valve adapted to turn on the knife edge, means in line with the knife edge for positioning the valve on the seat, a cross-bar on the said valve, a spring bearing against the valve and against said cross-bar, and an adjusting screw in line with the knife edge for pressing said spring against the valve, substantially as set forth.

2. In an elastic fluid sound reproducing apparatus, the combination of a valve seat provided with ports, a valve coöperating therewith, a cross-bar on the said valve, a spring bearing adjacent to its ends against said valve and cross-bar, means for pressing the spring against the valve and means for actuating the valve connected with the said cross-bar, substantially as set forth.

3. In an elastic fluid sound reproducing apparatus, the combination of a valve seat provided with ports, a valve coöperating therewith, a cross bar on said valve, actuating means for the valve connected to the said cross-bar, a spring bearing against the said valve and cross-bar, the said spring being bifurcated to permit the connection of the actuating means to the cross-bar between its forks, and means for pressing the spring against the valve, substantially as set forth.

4. A sound reproducer comprising in combination a resonating chamber and an equalizing chamber, a ported valve seated between the chambers and provided with a knife edge, a valve adapted to turn on said knife edge, means for resiliently holding the valve to its seat and actuating means for said valve comprising a stylus, a stylus lever, a floating weight to which the stylus lever is pivoted and a connection between said stylus lever and valve, substantially as set forth.

5. A closure for an equalizing chamber of an elastic fluid sound reproducing apparatus, comprising a piece of soft rubber perforated for the passage of the valve operating link, plates of stiffer material between which the rubber piece is interposed, and means for securing the same in place, substantially as set forth.

6. In an elastic fluid sound reproducing apparatus provided with an equalizing chamber, a valve seat, a valve operating link extending through said chamber, and a closure for said chamber comprising a piece of soft rubber perforated for the passage of the valve operating link, plates of stiffer material provided with openings of relatively large area and between which the rubber piece is interposed, and means for securing the same in place, substantially as set forth.

7. In an elastic fluid sound reproducing apparatus, the combination of a valve seat provided with ports, a valve comprising a plurality of tongues coöperating therewith, resilient means for holding the valve to its seat, a cross bar on said valve connecting said tongues and positioned intermediate the edges of said valve and means connected with said cross bar for actuating the said valve, substantially as set forth.

8. In an elastic fluid sound reproducing apparatus provided with an equalizing chamber, a valve, a valve operating link extending through said chamber, and a closure for said chamber, comprising a piece of soft material perforated for the passage of the said link, plates of stiffer material between which the soft material is interposed, and means for securing the same in place, substantially as set forth.

This specification signed and witnessed this 16th day of July 1907.

ALEXANDER N. PIERMAN.

Witnesses:
FRANK D. LEWIS,
CHARLES F. ROBSON.