

No. 891,367.

PATENTED JUNE 23, 1908.

A. N. PIERMAN.  
SOUND REPRODUCER.  
APPLICATION FILED FEB. 2, 1907.

Fig. 1

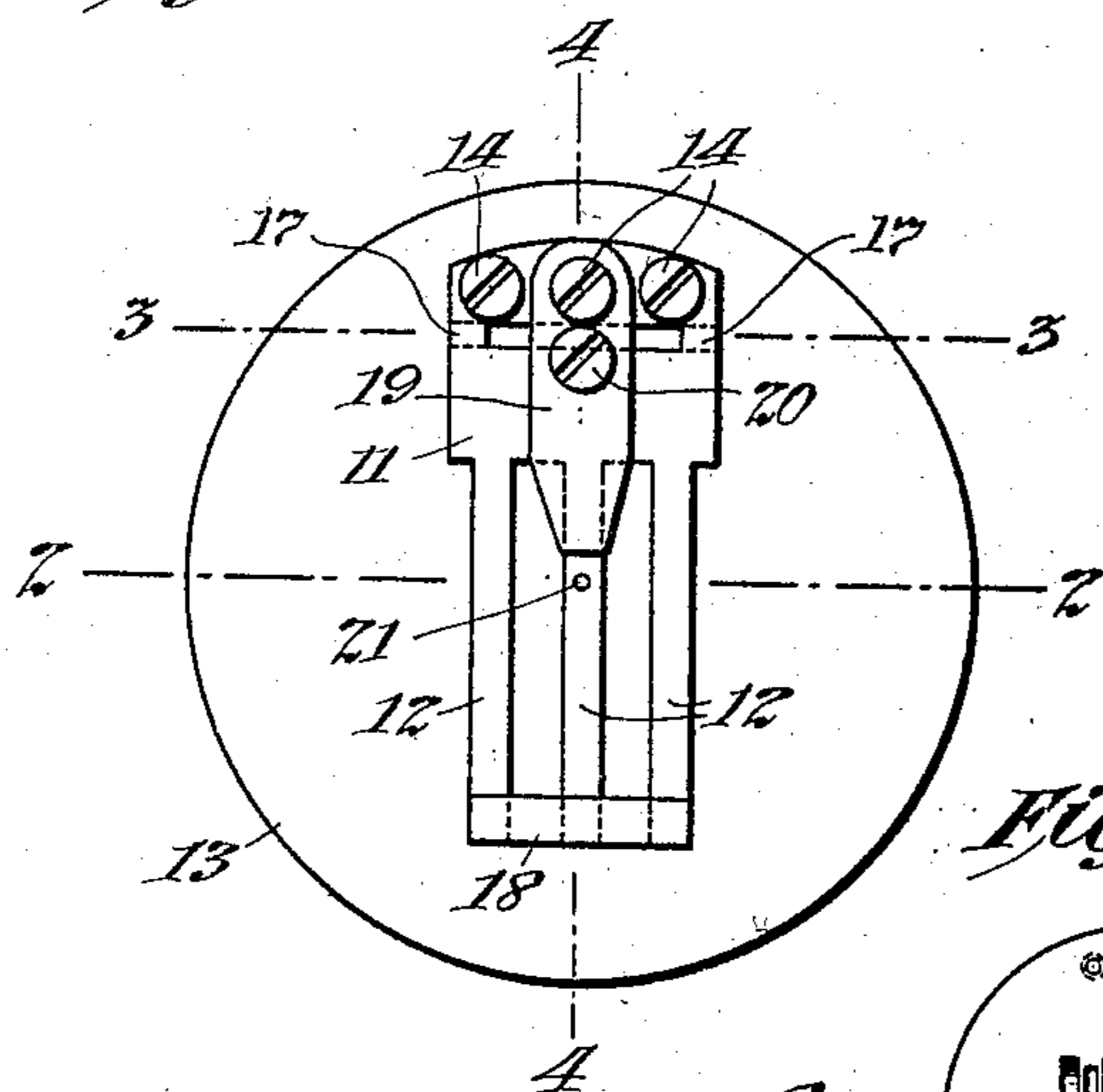


Fig. 5

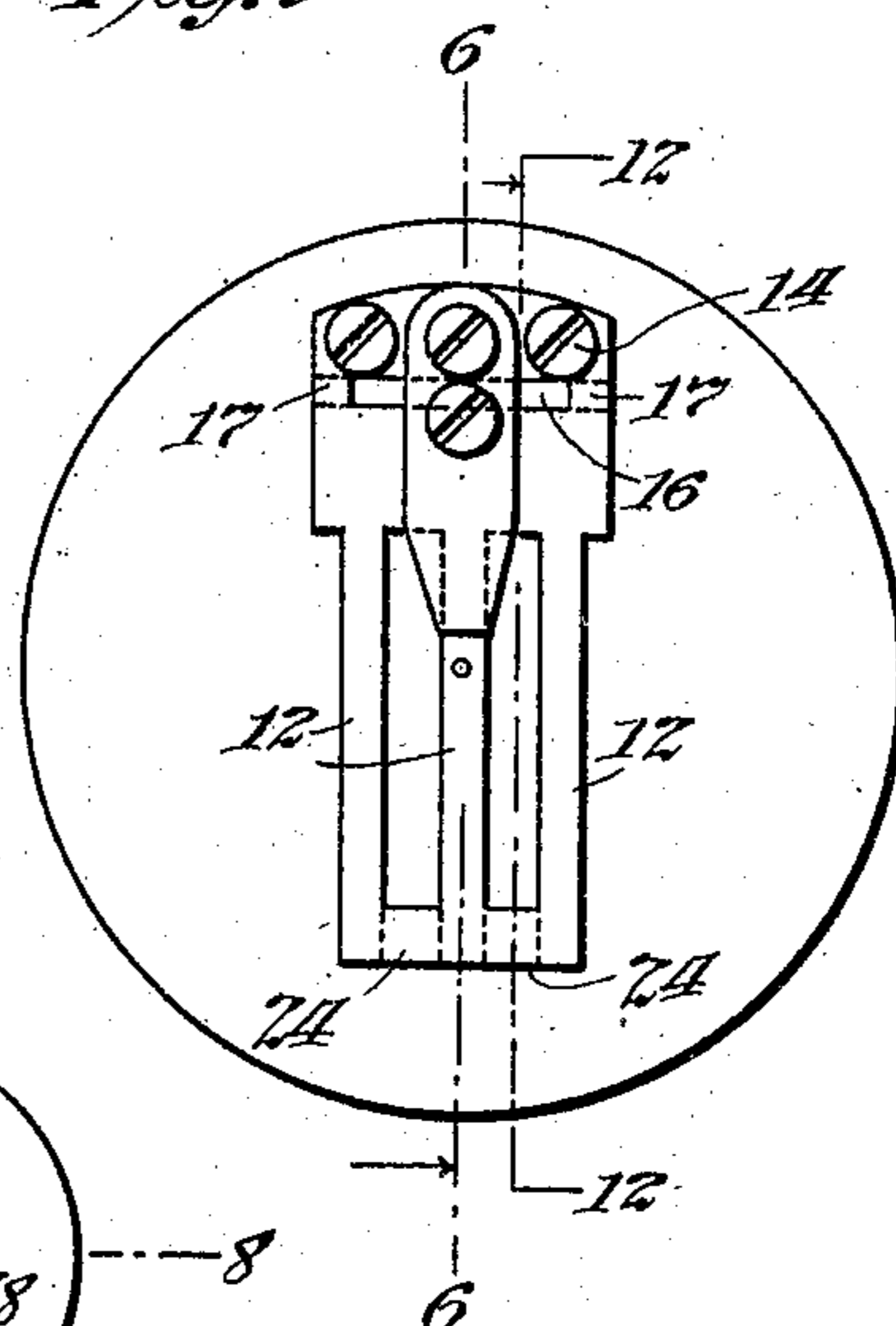


Fig. 7

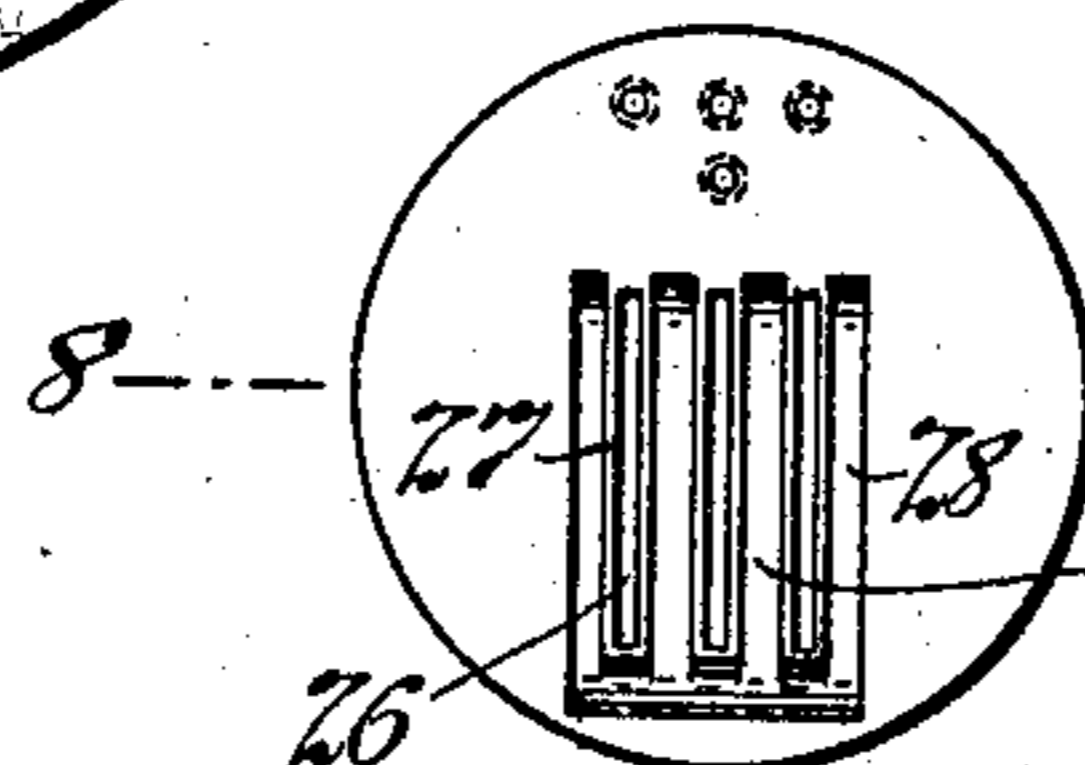


Fig. 2

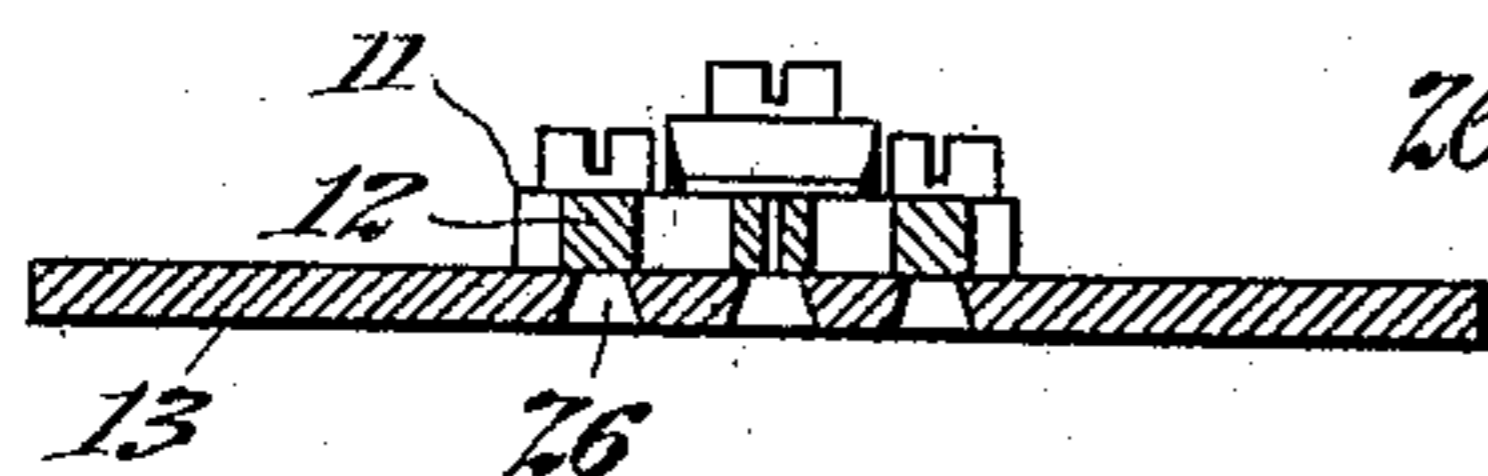


Fig. 3

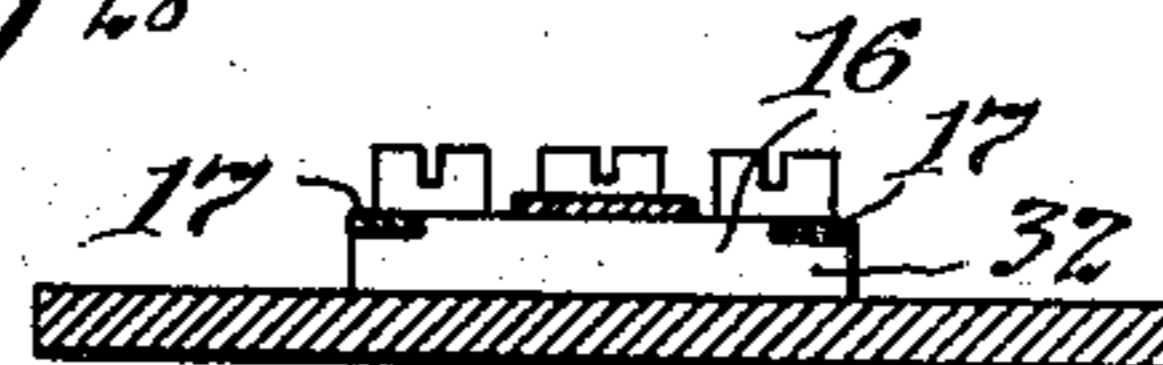


Fig. 12

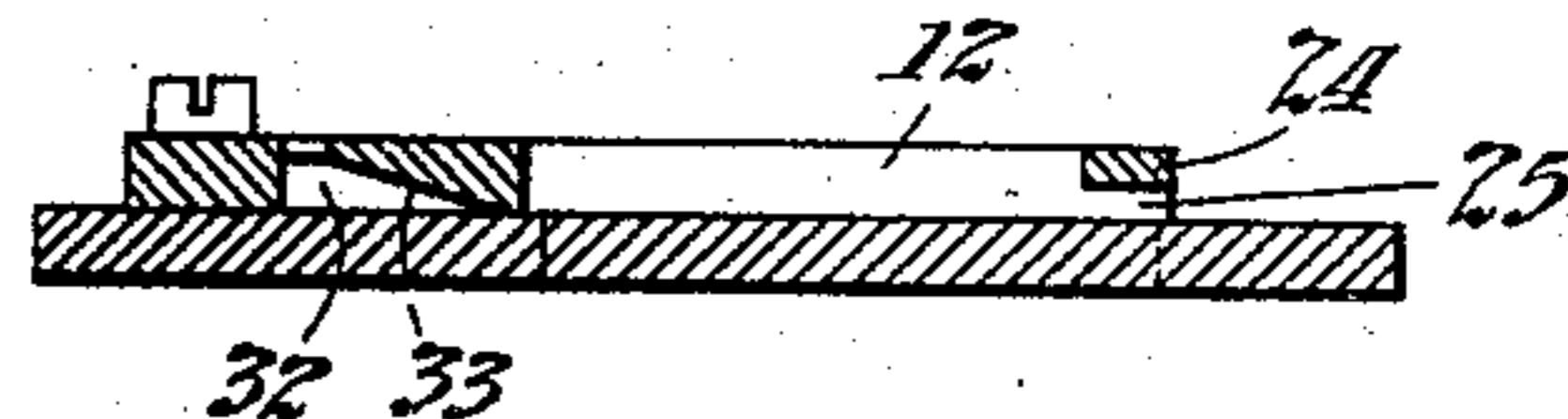


Fig. 8

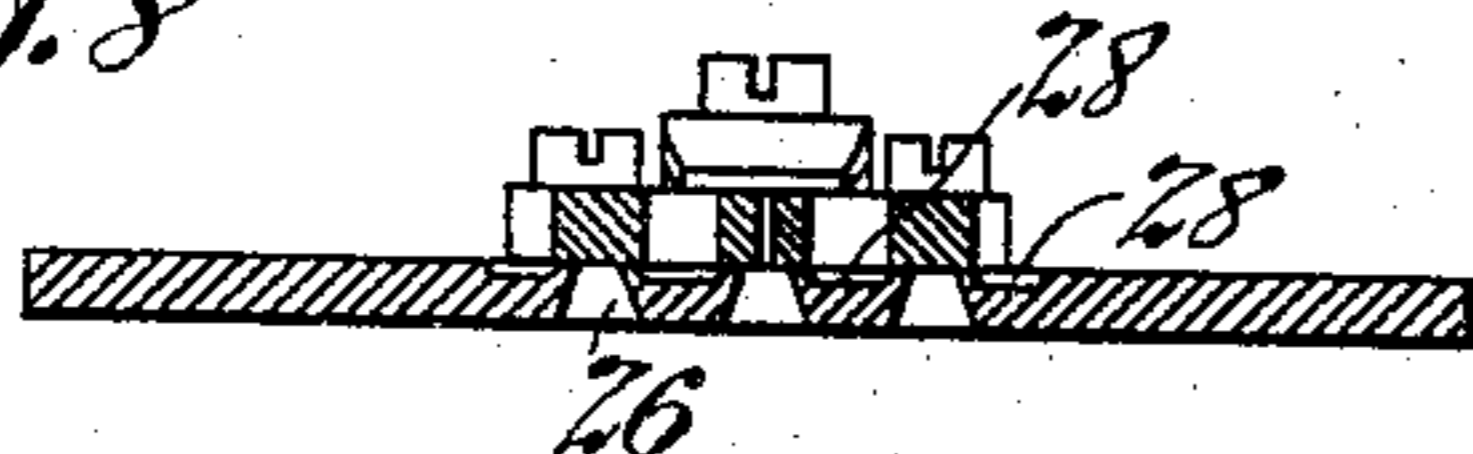


Fig. 6

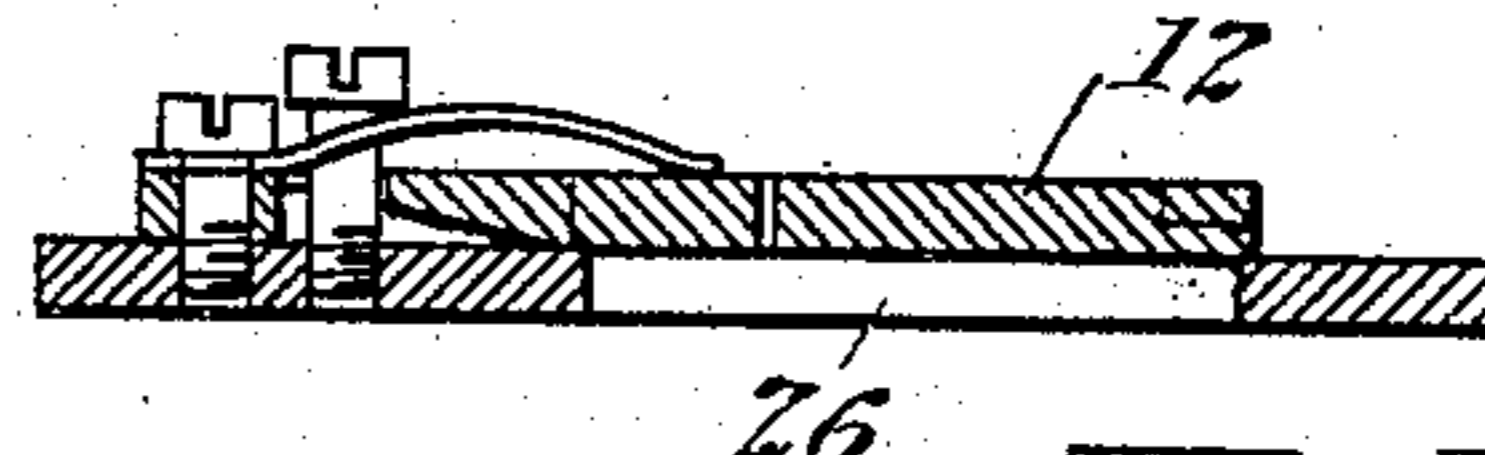


Fig. 4

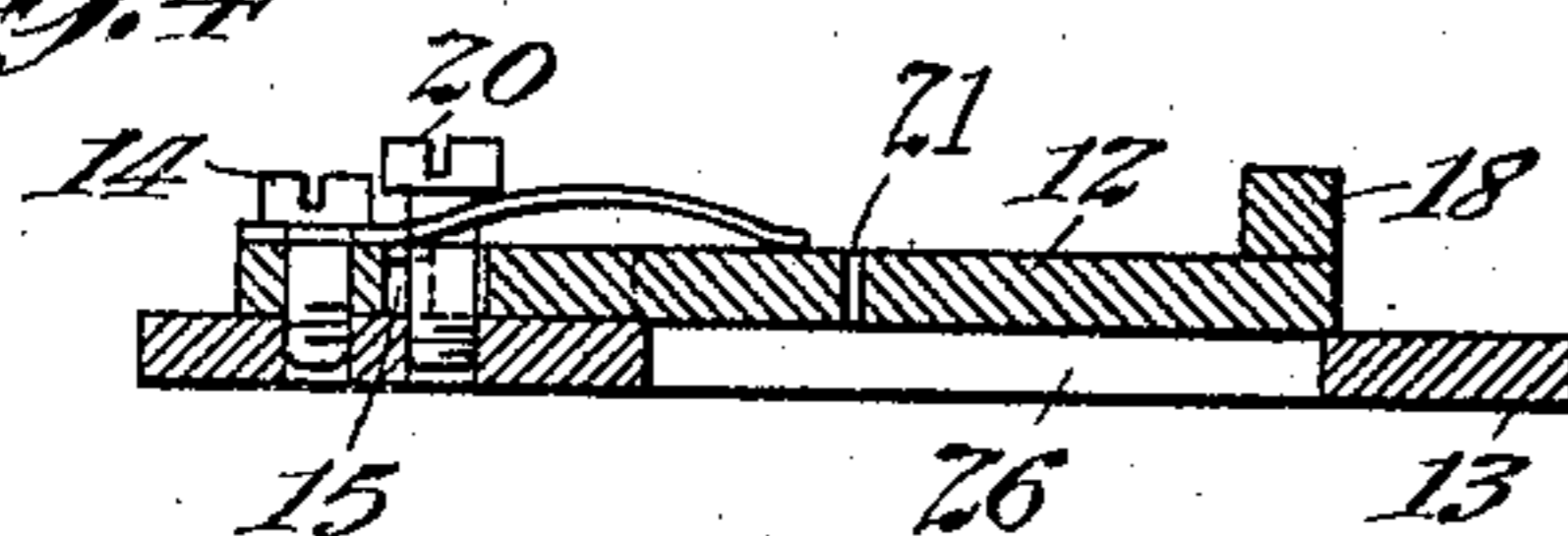


Fig. 9

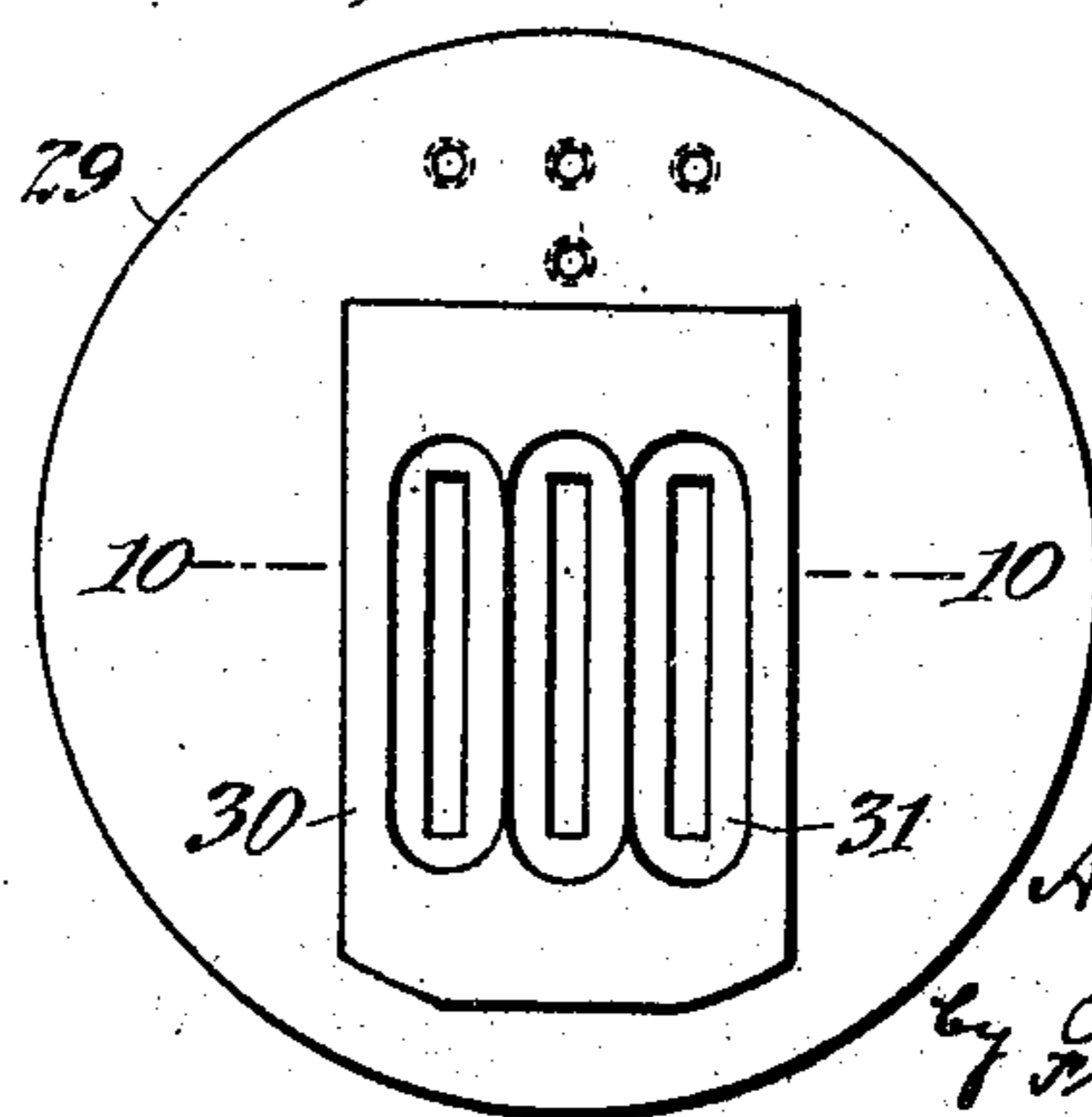


Fig. 11

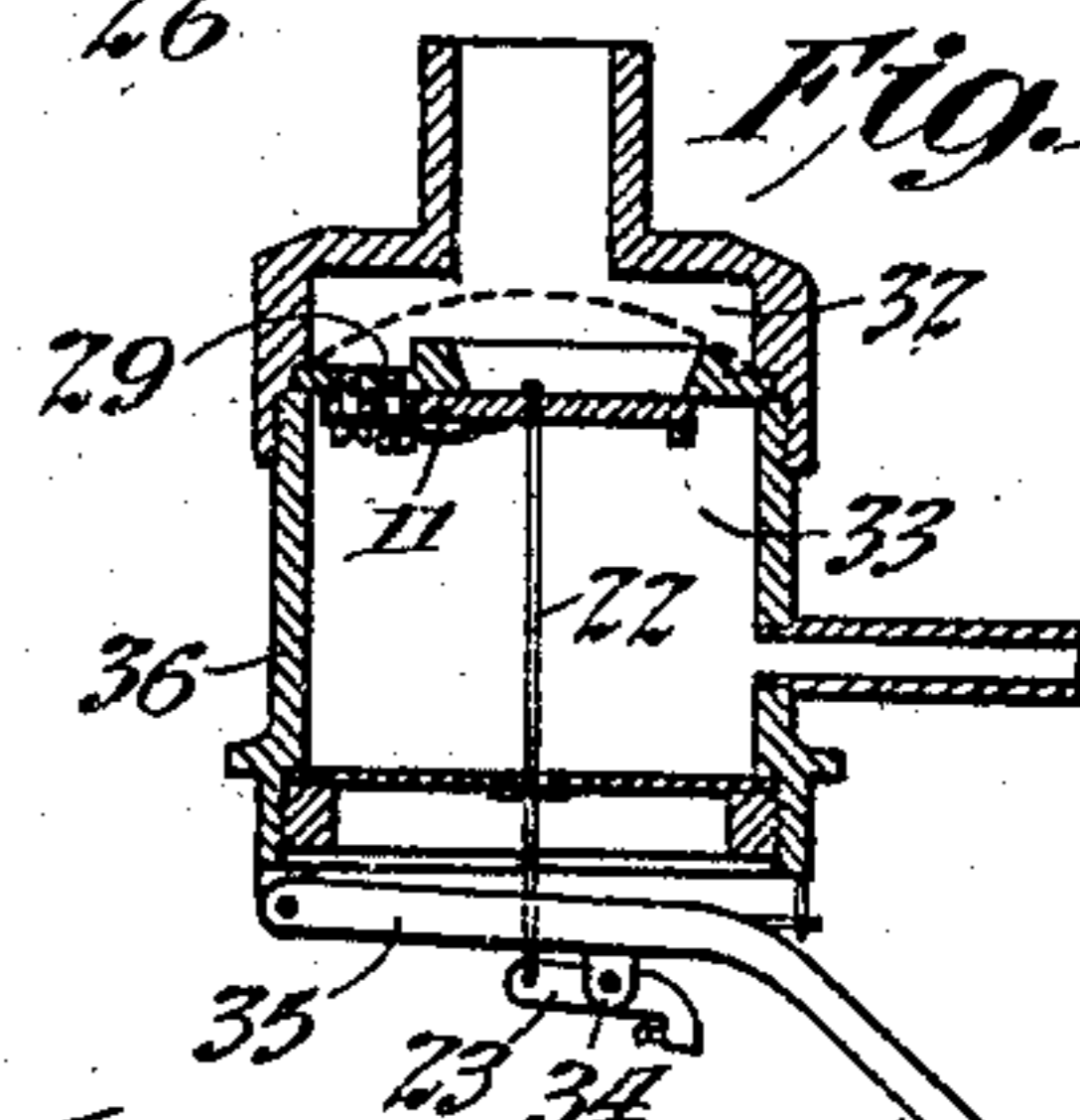
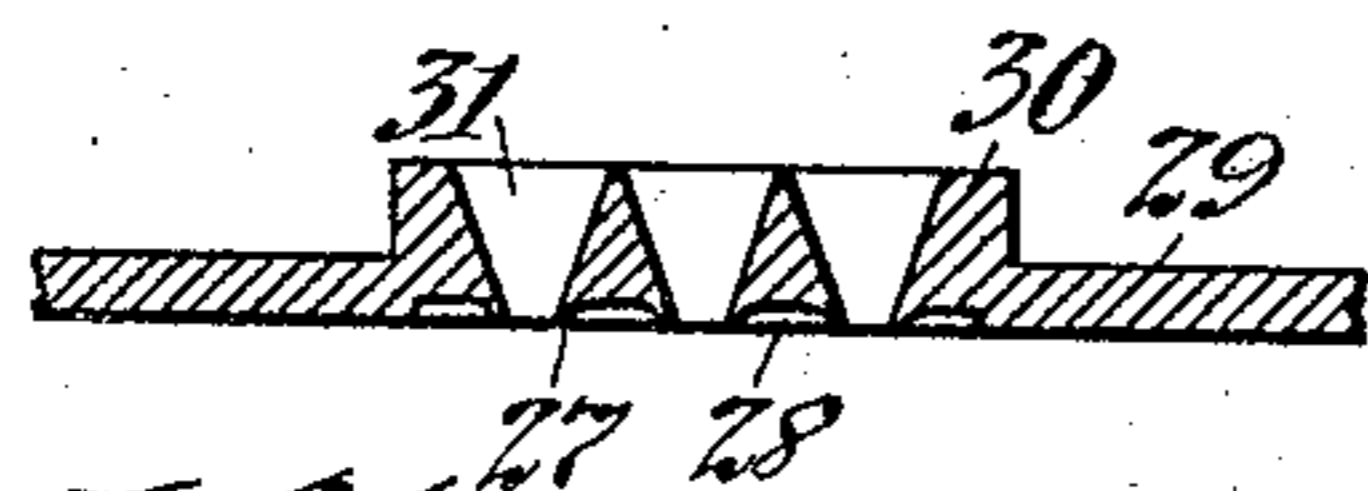


Fig. 10



Witnesses:

Frank D. Lewis  
Delos Holden

Inventor:

Alexander N. Pierman  
by Frank L. Brown

Atty.

# UNITED STATES PATENT OFFICE.

ALEXANDER N. PIERMAN, OF NEWARK, NEW JERSEY, ASSIGNOR TO NEW JERSEY PATENT COMPANY, OF WEST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

## SOUND-REPRODUCER.

No. 891,367.

Specification of Letters Patent.

Patented June 23, 1908.

Application filed February 2, 1907. Serial No. 355,388.

*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-Reproducers, of which the following is a description.

My invention relates to sound reproducers of the general type disclosed and claimed in my applications Serial No. 288,837, filed November 24, 1905 and Serial No. 307,324, filed March 22, 1906, and has for its object the provision of means whereby improved results will be secured.

My invention consists of an improved form of valve for varying the rate of flow of elastic fluid through the ports which communicate with the resonating chamber, and an improved form of port for cooperating with the valve referred to, as will be hereinafter pointed out and claimed.

Reference is hereby made to the accompanying drawing of which

Figure 1 is a bottom plan view of a port plate to which one form of valve is applied; Figs. 2, 3 and 4 are sections upon lines 2—2, 3—3 and 4—4 respectively of Fig. 1; Fig. 5 is a bottom plan view of a port plate provided with a modified form of valve; Fig. 6 is a section on line 6—6 of Fig. 5; Fig. 7 is a bottom plan on a smaller scale of a port plate adapted to be used with either of the valves illustrated or with any other valve which is adapted to vary the flow of elastic fluid through the ports in accordance with the vibrations of sound waves; Fig. 8 is an enlarged section on line 8—8 of Fig. 7 with a valve seated upon the ports thereof; Fig. 9 is a plan view of a modified form of port plate; Fig. 10 is a section on line 10—10 of Fig. 9; Fig. 11 is a vertical section of a phonographic sound reproducer showing the relative locations of the ported plate, valve, resonating chamber, stylus, etc., and Fig. 12 is a section on line 12—12 of Fig. 5.

Referring to Fig. 1, the improved valve comprises a plate 11, the greater portion of whose length is slotted to form parallel tongues 12, the number of which corresponds with the number of ports with which the valve is to cooperate. I have obtained favorable results by the use of valves having three tongues of the relative proportions illustrated. The valve 11 when in use will

be secured to a port plate 13 in any suitable manner, as by means of screws 14 passing through openings in the plate 11 and threaded in the plate 13. The plate 11 is weakened along a line adjacent the screws 14 by being cut away to form a transverse groove 15. The bottom of this groove is cut out throughout its intermediate portion as shown at 16, (Figs. 1, 2 and 3) so as to leave two thin narrow tongues 17 as the only connection between the main body of the plate 11 and that portion which is held by the screws 14. Secured to the free ends of the tongues 12 is a transverse bar or bridge 18 which serves to bind the tongues together and prevent torsional movements thereof. It also keeps the valve plate flat and prevents separate or individual vibrations of the tongues. The plate 11 and bar 18 are preferably made of aluminum and are cemented together by shellac or other suitable material. A flat spring 19 is secured at one end to the plate 11 by the middle screw 14 and presses with its free end upon the middle tongue 12. The point of contact of the free end of the spring may be either at the point shown in the drawing or the spring may be prolonged so as to rest upon that portion of the tongue 12 which is at the point of greatest pressure of the air stream which passes through the ports, or it may even extend close to the free end of the tongue 12. This spring 19 is centered with respect to the tongue 12 and the tension of the spring regulated by the adjusting screw 20. The tongue 12 is shown as having a pin hole 21 for receiving the link 22 which connects the tongue 12 with the stylus lever 23.

The valve shown in Figs. 5 and 6 is somewhat similar to that of Figs. 1 to 4, but differs therefrom in the shape of the transverse groove 15. In the valve of Fig. 5 the metal is cut away immediately at the base of the tongues 12, see Fig. 12, so as to form a groove 32 with a sloping wall 33 which extends close to the ends of the ports through which the elastic fluid passes. By this means the flow of the fluid is facilitated and there is much less chance for dirt to find lodgment between the valve and part plate so as to hold the valve permanently open. In the valve of Fig. 5, the bar 18 is dispensed with and the tongues 12 are connected by integral bridge members 24 which are flush with the outer surface thereof but whose depth is less

than that of said tongues so as to provide spaces 25 for the escape of air passing through the ports 26. The port plate 13 of Figs. 1 to 6 is a flat plate having ports 26 cut there-  
 5 through and the tongues 12 of the valve 11 rest upon the flat surface of the plate 13 adjacent the edges of the ports 26. With this construction the flow of air depends upon the width of the tongue 12 as regards the port 26,  
 10 that is, if the width of the tongue 12 is increased, other conditions being unchanged, the flow of air will be diminished; and also if the tongue 12 is not accurately centered with respect to the port 26 so that the over-  
 15 lap or bearing surface of the tongue is greater at one side of the port than the other, there will be an unequal flow of elastic fluid at the opposite sides of said tongue because more air will escape from the side where  
 20 there is the smaller amount of overlap. Such irregularities in flow produce defects in the sound reproduction.

Another reason why inaccurate centering of the tongues 12 produces defects in repro-  
 25 duction is because when the valve moves from an open to or toward a closed position the air between the tongues 12 and plate 13 acts as a cushion and in case the tongues are not properly centered, there will be a greater  
 30 cushioning effect on one side than on the other which will tend to tilt or twist the tongue laterally and thereby prevent it from closing the port. It is therefore highly important, in constructing a sound reproducer  
 35 with this type of valve plate, to use the greatest accuracy as to the width of the tongues 12 and slots 26 and as to the centering of the said tongues with respect to the said slots. In order to avoid the necessity  
 40 for the extreme accuracy referred to, I prefer to cut away the portions of the ported plate which surround the ports 26, as shown in Figs. 7, 8 and 10, thus forming knife edges 27  
 45 surrounding each of the ports 26, upon which edges the tongues 12 are adapted to lie. These knife edges may be either sharp or slightly flattened. The cut away portions of the plate 13 form channels 28 for the escape  
 50 of the elastic fluid passing through the ports 26. It will be obvious that with this construction the flow of fluid through the ports 26 will be independent of the width or centering of the tongues 12.

In the plate of Figs. 9 and 10 the central  
 55 portion 30 is of increased thickness and the ports 31, having walls which converge towards their lower edges, form a series of funnels of considerable depth and with their upper edges in immediate juxtaposition. These funnels amplify the sounds produced  
 60 by the variations in flow of elastic fluid there-through. The lower surface of the plate 29 is shown as being cut away to form channels 28 and knife edges 27 similar to those of Figs.  
 65 7 and 8.

Fig. 11 shows the preferred arrangement of parts, when my invention is used for phonographic reproduction, although it is obviously capable of being applied to other  
 70 classes of sound reproducers such as telephone receivers, etc. The port plate 29 is situated between a resonating chamber 32 and an equalizing chamber 33 in which the valve  
 75 plate 11 is located, the same being operated by a link 22 connected with the stylus lever 23 whose pivot 34 is carried by the floating weight 35 which is pivoted to the body 36.

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

1. In a sound reproducer, a valve consist-  
 85 ing of a plate weakened along a line of flexure by a groove the bottom of which is cut through along part of its length, substantially as set forth.

2. In a sound reproducer, a valve consist-  
 90 ing of a plate of elastic material formed with parallel tongues and a transverse groove which forms a line of flexure, substantially as set forth.

3. In a sound reproducer, a valve consist-  
 95 ing of a plate formed with tongues and a bridge across the ends thereof remote from the point of support of the plate, substantially as set forth.

4. In a sound reproducer, a flat plate pro-  
 100 vided with a port, the surface of said plate being cut away and sharpened adjacent the edges of said port to form knife edges, substantially as set forth.

5. In a sound reproducer, the combina-  
 105 tion of a flat plate provided with a set of ports the edges of which project to form knife edges and a valve consisting of a plate formed with tongues, said tongues resting against said knife edges to vary the extent of  
 opening of said ports, substantially as set forth.

6. In a sound reproducer, a member pro-  
 110 vided with a set of funnel shaped ports, and means for varying the flow of elastic fluid therethrough, substantially as set forth.

7. In a sound reproducer, a plate formed  
 115 with funnel shaped ports, the edges of which are in immediate juxtaposition, substantially as set forth.

8. In a sound reproducer, the combina-  
 120 tion of a body formed with resonating and equalizing chambers and ports connecting said chambers, said ports being formed with walls which converge from the resonating chamber toward the equalizing chamber, forming funnels of greater depth than width,  
 substantially as set forth.

9. In a sound reproducer, the combina-  
 125 tion of a plate having a port and a valve therefor consisting of a plate weakened along a line of flexure by a groove, said groove extending close to the edge of said port, substantially as set forth.  
 130

10. In a sound reproducer, a valve consisting of a plate formed with tongues and a transverse groove which forms a line of flexure, said groove extending to the base of said  
5 tongues, substantially as set forth.

11. In a sound reproducer, a valve consisting of a plate formed with tongues and a transverse groove which forms a line of flexure, said groove extending to the base of

said tongues and increasing gradually in 10 depth as it leaves said tongues, substantially as set forth.

This specification signed and witnessed this 1st day of February 1907.

ALEXANDER N. PIERMAN.

Witnesses:

DELOS HOLDEN,  
FRANK D. LEWIS.

Correction in Letters Patent No. 891,367.

It is hereby certified that in Letters Patent No. 891,367, granted June 23, 1908, upon the application of Alexander N. Pierman, of Newark, New Jersey, for an improvement in "Sound-Reproducers," an error appears in the printed specification requiring correction, as follows: In line 105, page 1, the word "part" should read *port*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of October, A. D., 1908.

[SEAL.]

C. C. BILLINGS,  
*Acting Commissioner of Patents.*