

No. 814,839.

PATENTED MAR. 13, 1906.

J. L. GRAY.
SOUND REPRODUCING AND MAGNIFYING MEANS.

APPLICATION FILED JUNE 23, 1904.

2 SHEETS—SHEET 1.

Fig. 1

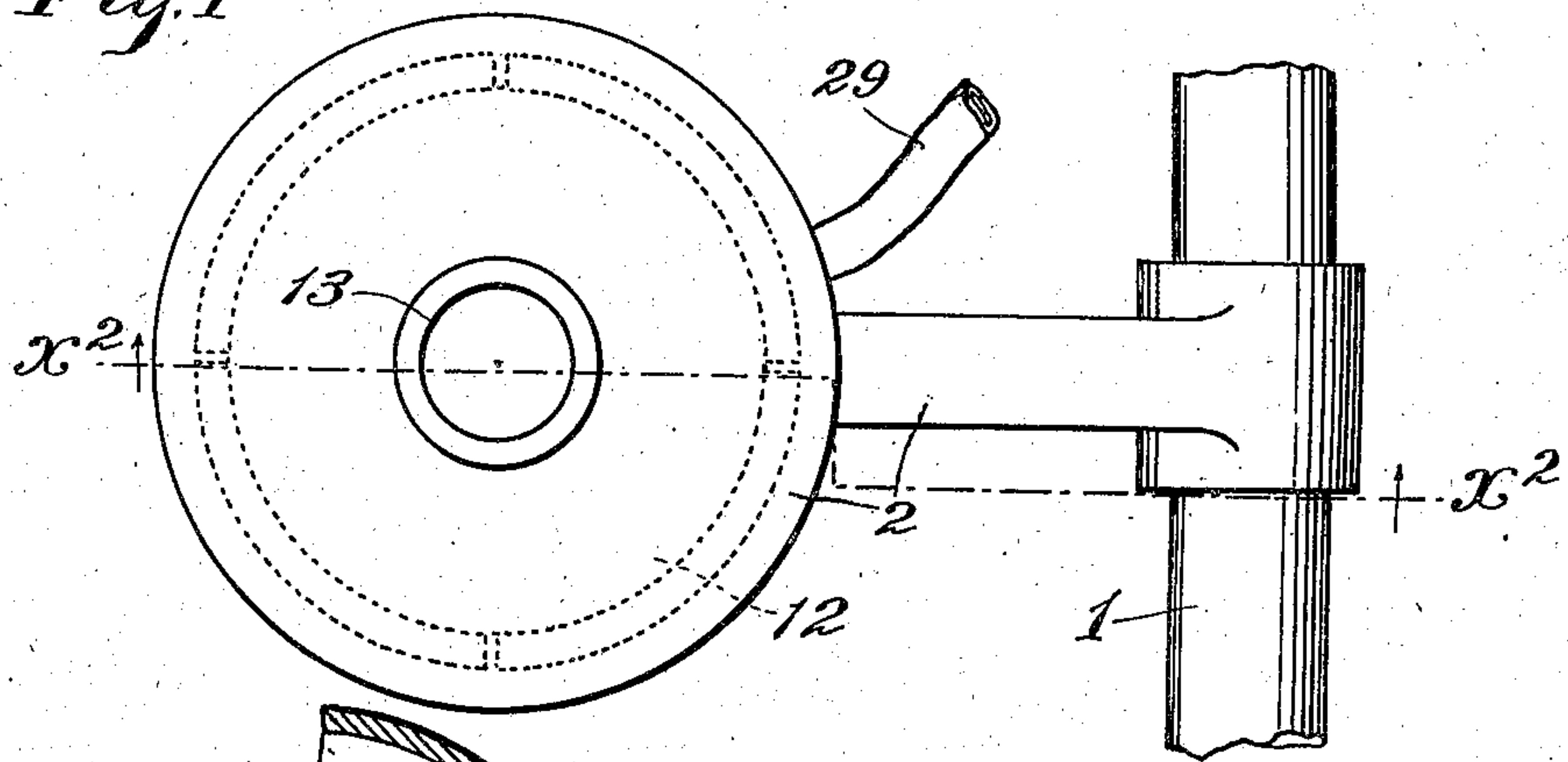
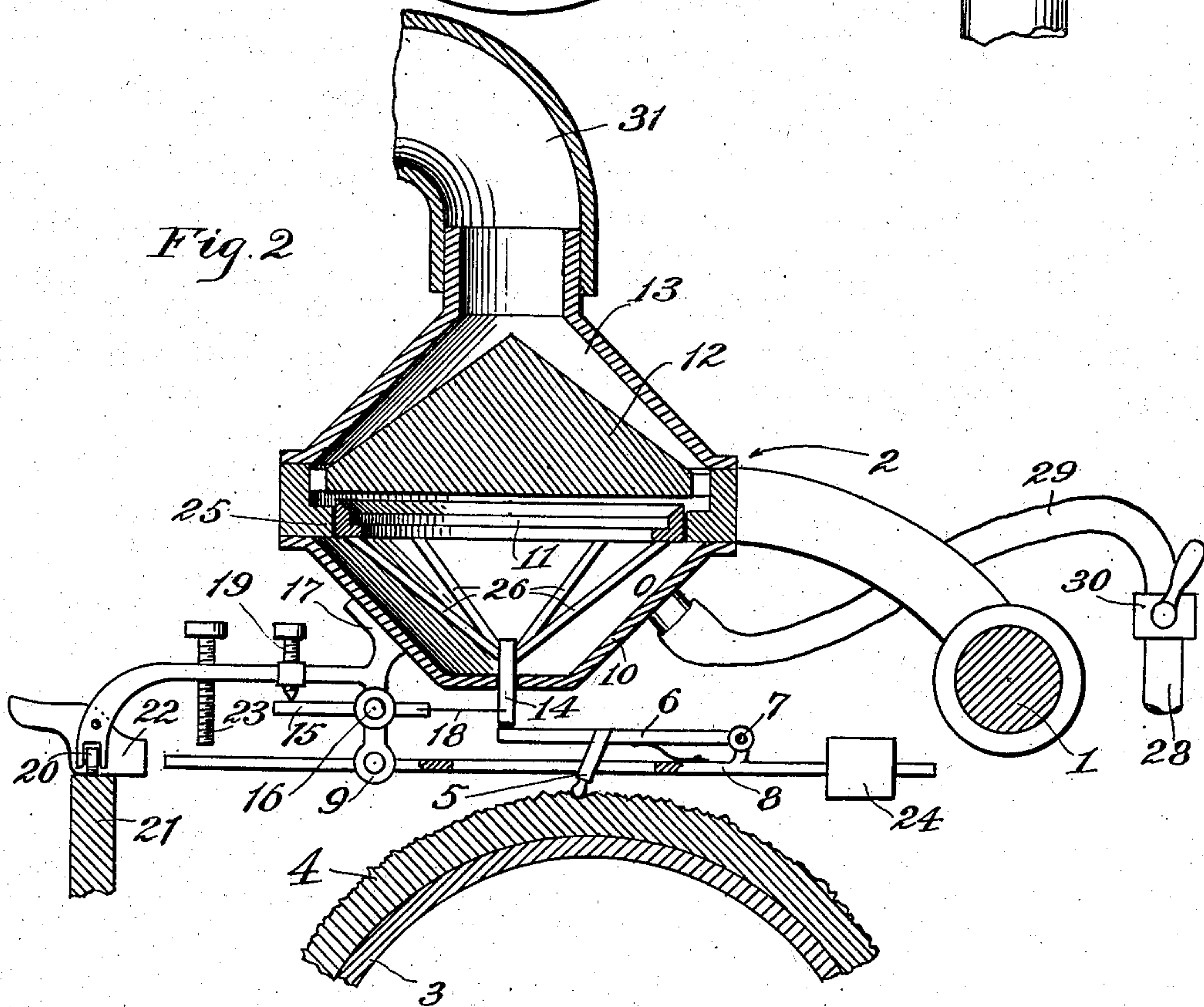


Fig. 2



Witnesses:
C. C. Holly
A. P. Knight

Inventor
Jesse L. Gray.
by Townsend Bros
His Atty's

No. 814,839.

PATENTED MAR. 13, 1906.

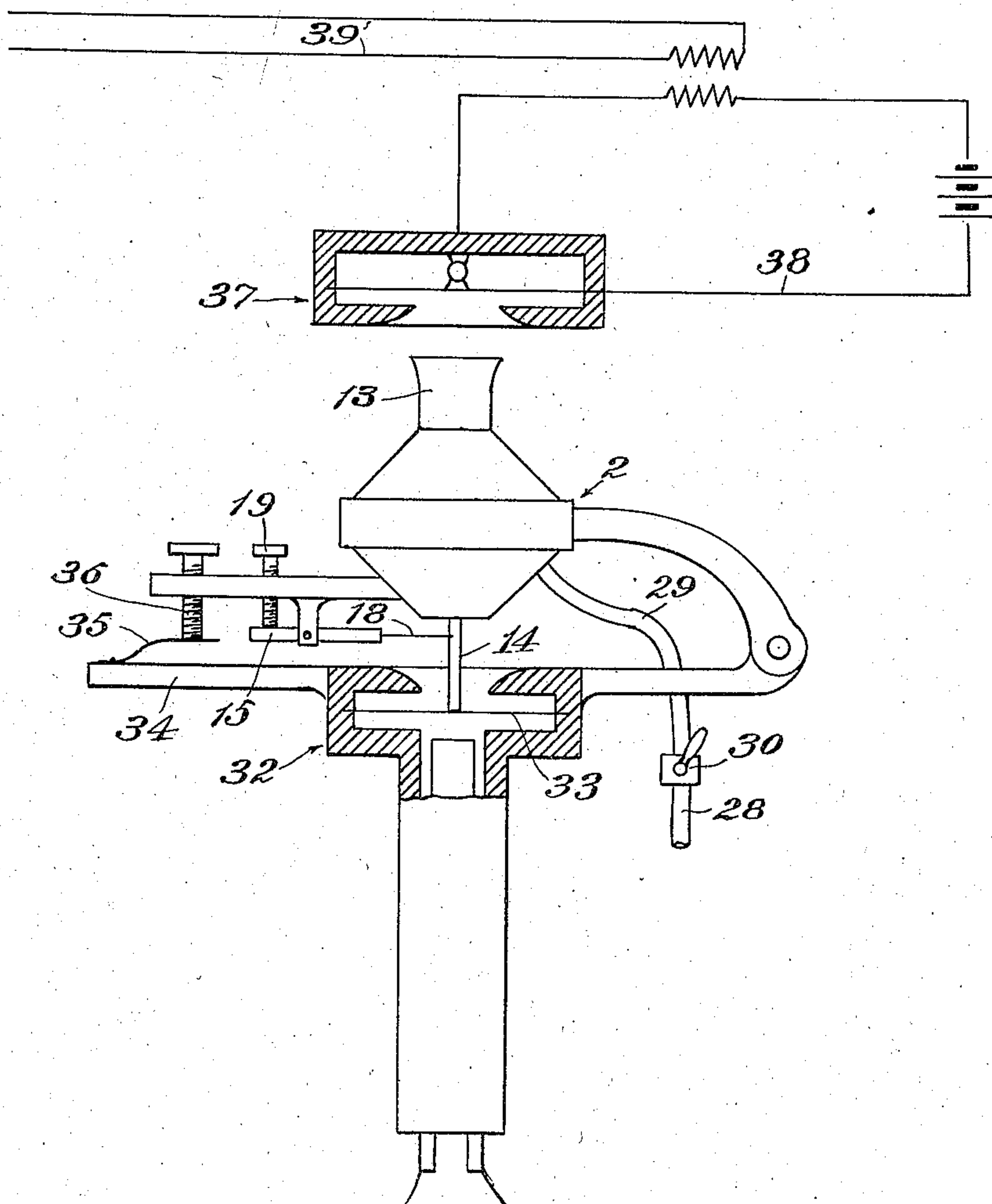
J. L. GRAY.

SOUND REPRODUCING AND MAGNIFYING MEANS.

APPLICATION FILED JUNE 23, 1904.

2 SHEETS—SHEET 2.

Fig. 3.



Witnesses:

C. C. Holly
A. P. Knight

Inventor
Jesse L. Gray
by Townsend Bros
His Atty

UNITED STATES PATENT OFFICE.

JESSE L. GRAY, OF SANTA ANA, CALIFORNIA, ASSIGNOR OF ONE-HALF
TO PERCY F. RICE, OF SANTA ANA, CALIFORNIA, AND WILLIAM H.
FAUST, OF LOS ANGELES, CALIFORNIA.

SOUND REPRODUCING AND MAGNIFYING MEANS.

No. 814,839.

Specification of Letters Patent.

Patented March 13, 1906.

Application filed June 23, 1904. Serial No. 213,808.

To all whom it may concern:

Be it known that I, JESSE L. GRAY, a citizen of the United States, residing at Santa Ana, in the county of Orange and State of California, have invented a new and useful Sound Reproducing and Magnifying Means, of which the following is a specification.

The primary object of this invention is to provide means for use in connection with a phonographic reproducer for producing impulses in the air directly corresponding to the undulations in the record without the intervention of a solid sound-distributor, such as a diaphragm, thereby preserving the character of the sound-waves without any scratching, rattling, or other extraneous noises.

Another object of the invention is to provide for amplification of the sound to any desired extent and for regulation or variation of the intensity of the sound.

The invention comprises, in connection with a reproducer and means for moving a record in coöperative relation therewith, a valve responsive to the movements of the reproducer and an elastic-fluid-pressure means having an outlet controlled by said valve, the movement of the valve being transverse to the movement of the fluid through the valve and the construction of the valve being such that there is no pressure on the valve due either to the pressure of the fluid or to the movement of the fluid.

The invention also comprises means for regulating the action of the valve and other features, as hereinafter set forth and claimed.

The accompanying drawings illustrate the invention.

Figure 1 is a plan of a phonograph provided with my invention. Fig. 2 is a vertical section on the line $x^2 x^2$ in Fig. 1. Fig. 3 is a diagram showing the application of my invention as a relay for telephones.

1 designates a part of the frame of a phonograph on which the reproducer-carrier 2 is movably mounted.

3 designates a part of the record-carrier, and 4 the record. The means for rotating the record and for moving the reproducer over the record transversely to the movement of the latter are not shown, as they form no part of my present invention.

5 designates the reproducer, which will be of any usual form adapted to the record and

to the machine being used. The form here shown is adapted to a cylindrical record and is supported by a reproducer-arm 6, pivoted at 7 to a weight arm or lever 8, which is pivoted to the carrier 2 at 9.

A chamber or valve-chest 10 is formed in or on the carrier member 2, and a valve member 11 works therein, coöperating with a seat member 12 to control communication from said chamber 10 to an outlet or discharge 13. Said valve is operated by a connection from the reproducer—for example, by means of a pin 14, connected to the valve and bearing against a portion of the reproducer-arm 6—the arrangement of the reproducer-arm 6, the weight-arm 8, and the pin 14 being such that the weight-arm holds the reproducer against the record and by the same action presses the said portion of the reproducer-arm against the end of said pin, so that the said pin and the valve connected thereto will vibrate in correspondence with the undulations in the record. The valve and pin may press on the reproducer-arm by gravity; but it is desirable to provide regulable means for adjusting this pressure. A convenient means for this purpose consists of a lever 15, pivoted at 16 to a bracket 17, attached to the carrier member 2, said lever being provided at one end with a spring extension 18, engaging with the pin, and said lever being engaged at its other end by a set-screw 19, working in said bracket 17. The bracket 17 may also serve as a support for the pivot 9 of the weight-arm and may also carry the usual roller 20, which runs on a track 21 to hold the reproducer-carrier at the proper height. 22 designates a lifting-cam on said bracket 17 to engage the track 21 and hold the reproducer-carrier in elevated position when desired, so that the reproducer will be free of the record.

23 designates an abutment, which may be formed as a set-screw working in the bracket 17, adapted to engage a part or extension of the weight arm or lever 8 to limit the movement thereof, so that when the carrier member 2 is raised, either partially by means of the cam device 22 or is thrown clear over for any reason, the said abutment will prevent the weight-arm from moving except for a limited distance, this distance being, however, sufficient to allow of the movement of the parts required in the reproducing action.

24 designates the weight on the weight-arm, which may be adjustable.

It is desirable that the valve should have a considerable linear extension of port-opening, so as to provide for a considerable variation in size of the opening with an extremely limited movement of the valve, and it is also desirable that the valve should be as light as possible, so as to respond readily and accurately to the movements of the reproducer. To this end the valve 11 may be formed as a ring working in a cylindrical bearing or guide 25 in the carrier 2 at the top of chamber 10 and having its upper edge or lip opposing the flat lower face of the seat member 12, the said valve-ring being connected with the operating-pin 14 by a spider or connecting-arms 26. The seat 12 extends in a plane transverse to the direction of the movement of the valve. The pin 14 extends through a hole in the wall or casing 10, fitting sufficiently close in said hole to substantially prevent leakage thereat, while enabling its free longitudinal movement therein. The valve-ring 11 works by a sliding fit within the cylindrical bearing 25, and the upper edge of the valve-ring is flared or beveled outwardly, so that its lip or part cooperating with or opposing the flat lower face of the seat member 12 is substantially limited to a peripheral portion of the valve-ring of negligible width, and the pressure of the fluid medium on the parts of said valve within the chamber and exposed to such pressure is substantially balanced as regards movement of the valve toward and from its seat. The valve being annular, the pressure is also balanced in a transverse direction. The pressure of the medium does not, therefore, resist or interfere with the movement of the valve in response to the undulations of the record.

28 designates an air-supply pipe or connection connected to any suitable source of air or gas pressure, (not shown)—for example, to any ordinary form of pump—said pipe being connected through a flexible tube 29 with the valve-chamber 10. Means may be provided for regulating the air-pressure—for example, a valve 30 in the supply connection, which may also be used to cut off the air or gas supply whenever desired.

31 designates a conveyer for the sound-waves from the outlet 13, which may be connected to any of the usual means, such as a horn or tube, for properly directing the sound.

In using the device it will be understood that the valve 11 is so close to the valve-seat that the passage of air therethrough will be restricted and the minute movements of the valve, due to the undulations in the record, will appreciably affect the passage of air between the valve and seat. Assuming that the record has been put in place, that the reproducer has been lowered thereonto, and that the machine has been set in opera-

tion, the record traveling under the reproducer will raise and lower the same and correspondingly move the valve to vary the cross-section of the port or outlet of the valve in correspondence with the undulations of the record. The air or gas or other elastic fluid having been turned on at 30 will fill the chamber 10 and will escape therefrom through the valve in a current whose flow will vary or undulate in accordance with the undulations in the record, thereby reproducing in pulsations of air emitted through the outlet 13 the sound which the record represents.

By means of the adjusting device 19 the valve can be adjusted to or from its seat without disturbing the position of the reproducer; but the movements of the reproducer are communicated to the valve by reason of the pressure of the weight 24. Said weight 24 serves to maintain constant pressure on the stylus and to maintain the lever 6 in contact with pin 14 irrespective of the movement of said pin under the influence of the device 19. The bearing of the valve-ring 11 on the seat 12 is limited substantially to a single annular line of contact, so that the normal pressure of fluid in the valve-chamber will not tend to force the valve to its seat on the disk 12. The valve member 11 will be preferably adjusted so as to normally lie in close proximity to the seat member 12, so that the compressed-air or fluid pressure medium will stream or pass between said valve under the action of the record in a diverging annular current, whose volume, quantity, or force is dependent on the size of the outlet between the valve and its seat. This outlet extends transversely to the movement of the valve.

The air or medium moving through the outlet has therefore no effect of itself on the valve, and the valve in its movement does not have to overcome the momentum of the air-current, nor is it, on the other hand, accelerated by such momentum. The movements of the valve are therefore not affected by the pressure or the movement of the air or fluid pressure medium, and thus there is no distortion or interference with the vibration of the valve in correspondence with the record, even at high pressure. The spring 18 and weight 24 serve to yieldingly hold the valve and the reproducer in proper position, while allowing their independent adjustment, but enabling the reproducer to operate the valve in correspondence with the record or with the sound undulations.

Various modifications may be made in the device without departing from my invention, and the invention may also be used for various purposes—for example, by suitable adaptation it may be used in repeating or relaying telephone-messages.

The intensity of sound reproduced can be regulated by properly controlling the air-

pressure, and clearness of sound can be obtained by proper adjustment of the means for regulating the pressure on the valve. When properly controlled, the reproduction both of musical sound and of articulate speech, and particularly of the singing voice, is clear and free from any scratching or rattling noise.

The adaptation of my invention to a telephone repeater or relay is shown in Fig. 3, where 32 designates the telephone whose diaphragm 33 is connected to or engages with the pin or member 14 of the valve, which may be of the same construction as shown in Fig. 2, this valve-chamber body 10 being supported on an arm 34, adjustable and yieldingly supported by spring 35 and set-screw 36 to enable the pressure on the valve and diaphragm to be regulated. A telephone-transmitter 37 is located in position to receive the magnified and amplified sound emitted from the outlet 13 of the valve and is connected to the transmitting local and line circuits 38 39 in the usual manner. Adjusting device 15 18 19 and pneumatic connection 28 29 30 may be the same as in Fig. 2.

What I claim is—

1. In combination with a phonograph-reproducer, an annular valve controlled thereby to move in response to the movements of the reproducer, a chamber having a supply connection for an elastic fluid and provided with a bearing within which said annular valve slides, and a seat for said annular valve, the annular valve having a seat-opposing portion of substantially the same diameter as the part that slides in the bearing.

2. In combination with a phonograph-reproducer, an annular valve controlled thereby to move in response to the movements of the reproducer, a chamber having a supply connection for an elastic fluid and provided with a bearing within which said annular valve slides, and a seat for said annular valve, said annular valve having a flared upper end terminating in an annular valve-lip of the same diameter as the bearing for the valve.

3. In combination with a phonograph-reproducer, an annular valve controlled thereby to move in response to the movement of the reproducer, a chamber having a supply connection for elastic fluid and provided with a bearing wherein said valve slides, and a flat seat for the valve extending in a plane transversely to the movement of the valve.

4. In combination, a chamber having a fluid-pressure supply and outlet valve, a record-carrier, a reproducer, a movable support for the reproducer operatively engaging the valve, means for operating on the movable support to press the reproducer toward the record-carrier, and adjustable means connected to the valve to adjust its position independently of the reproducer.

5. In combination with a phonographic

reproducer, a valve-chamber and a valve working therein, and operatively connected to the reproducer, means for passing fluid through said chamber and valve, a movable support for the reproducer, means to control the operating pressure of the reproducer and adjustable resilient means connected to the valve to adjust its position independently of the position and pressure of the reproducer.

6. In combination, a carrier, a lever pivoted thereto and provided with pressure means, an arm pivoted to said lever and carrying a reproducer, a valve-chamber, a valve working in said chamber and operatively engaging the reproducer-carrying arm, and adjustable resilient means connected to the valve to adjust the same independently of the position of the reproducer and of the pressure exerted thereon by the aforesaid pressure means.

7. In combination with a record-carrier, a pivoted reproducer-carrier, movable bodily with its attached parts to and from the record-carrier to bring it into and out of operative position, a lever pivoted to the reproducer-carrier and having pressure means, an arm pivoted to said lever and carrying a reproducer, a valve-chamber carried by the reproducer-carrier, a valve working in said chamber and operatively engaging the reproducer-arm, a lever pivoted to the reproducer-carrier and having a resilient connection with said valve, means for adjusting the last-named lever and means for passing fluid through said valve-chamber under control of said valve.

8. In a sound-reproducing apparatus, in combination, a member movable in accordance with sound undulations, a carrier movable toward and from said member, a valve-chamber on said carrier, a valve working within said chamber and operatively connected to said member, means for passing fluid through said chamber under control of said valve, an independent means for adjustment of the carrier and of the position of the valve, each of said adjusting means comprising a part for yielding by supporting the parts adjusted thereby.

9. In a sound-reproducing apparatus, in combination, a member movable in accordance with sound undulations, a carrier movable toward and from said member, a valve-chamber on said carrier, a valve working within said chamber and operatively connected to said member, means for passing fluid through said chamber under control of said valve, the movement of the fluid being transverse to the movement of the valve, and the parts of the valve exposed to pressure by said fluid, being balanced relatively to the direction of movement of the valve.

10. In a sound-reproducing apparatus, in combination, a member movable in accordance with sound undulations, a carrier mov-

able toward and from said member, a valve-
chamber on said carrier, a valve working
within said chamber and operatively con-
nected to said member, means for passing fluid
5 through said chamber under control of said
valve, the movement of the fluid being trans-
verse to the movement of the valve, and the
parts of the valve exposed to pressure by
said fluid, being balanced relatively to the di-
10 rection of movement of the valve, and means

for adjusting the position of the valve inde-
pendently of the position of the operating
member.

In testimony whereof I have hereunto set
my hand, at Los Angeles, California, this 15th 15
day of June, 1904.

JESSE L. GRAY.

In presence of—

ARTHUR P. KNIGHT,
JULIA TOWNSEND.