

G. LAUDET.

APPARATUS FOR THE REPRODUCTION AND AMPLIFICATION OF SOUND.

APPLICATION FILED DEC. 1, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

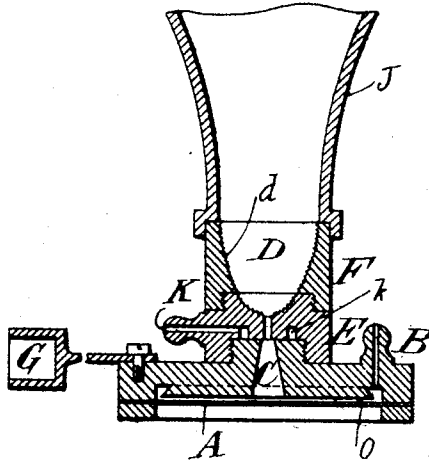


Fig. 3.

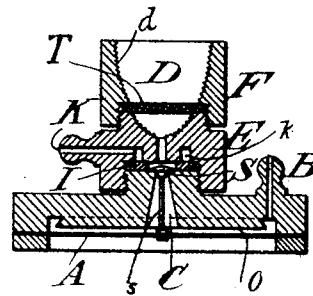


Fig. 2.

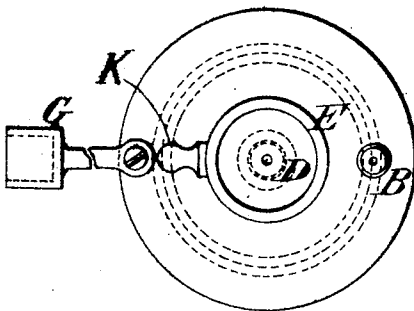


Fig. 4.

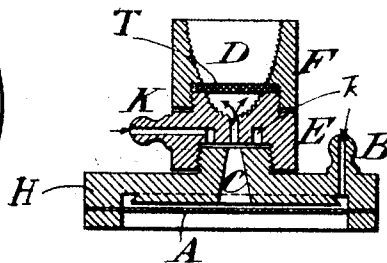


Fig. 5.



Fig. 6.



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2 SHEETS—SHEET 2.

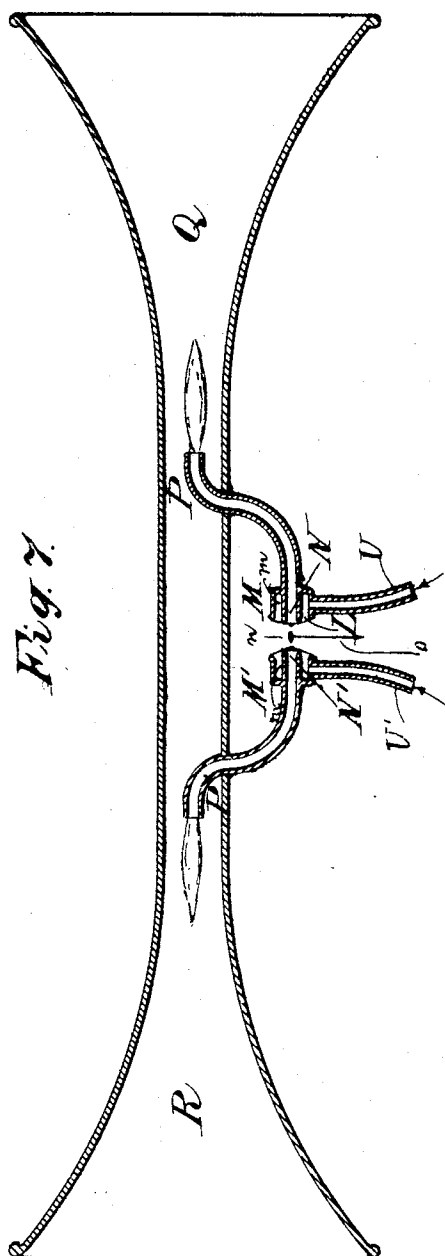


Fig. 7.

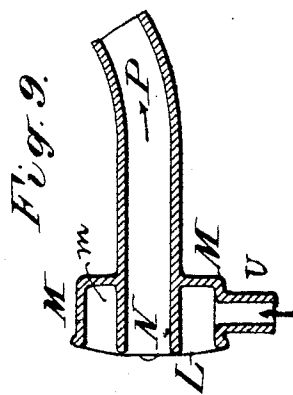


Fig. 9.

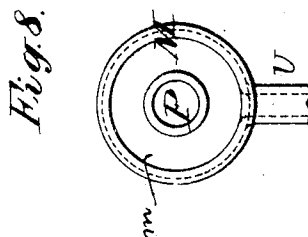


Fig. 8.

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APPARATUS FOR THE REPRODUCTION AND AMPLIFICATION OF SOUND.

SPECIFICATION forming part of Letters Patent No. 782,146, dated February 7, 1905.

Application filed December 1, 1903. Serial No. 183,365.

To all whom it may concern:

Be it known that I, GEORGES LAUDET, a citizen of the French Republic, residing at Meudon, Seine-et-Oise, France, have invented certain new and useful Improvements in Means for the Reproduction and Amplification of Sounds, of which the following is a specification.

This invention relates to means for the production of amplified sounds of any kind—such as noises, spoken words, musical sounds, and the like; and it resides in means whereby a diaphragm which is itself vibrated by sounds acts to control the distribution of a detonating gas or gaseous mixture of a combustible nature in such a manner that the vibrations of the diaphragm has the effect of continuously modifying the amplitude of the detonations of the ignited gases proportionately to the amplitude of the vibrations of the diaphragm which controls them, the detonations being reproduced in sounds emitted by the apparatus which are very much stronger than those which have been received by the vibrating diaphragm. Such is the principle on which rests the operation of reproduction and amplification of sounds by means which will be hereinafter described with reference to the accompanying drawings, which show several forms of apparatus for carrying out the invention.

In said drawings, Figure 1 is a vertical axial section of the apparatus. Fig. 2 is a plan thereof. Figs. 3 and 4 are sectional views showing slight variations in the construction. Fig. 5 is a detached view of the diaphragm and valve of the construction seen in Fig. 3. Fig. 6 is a plan view of a washer seen in Fig. 3. Fig. 7 is a sectional elevation of a form of the apparatus which is actuated by gas at high pressure. Figs. 8 and 9 are detached and enlarged sectional views of the chamber where the gaseous mixture is received in the construction of Fig. 7, the former being a transverse section and the latter an axial section.

Referring primarily to Figs. 1 and 2, H designates a box, here shown as facing downward. On the back of this box is a screw-threaded nipple, on which is screwed a section E, and on this section is screwed another sec-

tion, F. On the section F is secured the base of a horn or megaphone J for augmenting sounds. Only a part of this horn is shown in Fig. 1. Across the lower end or face of the box H is secured a diaphragm A, capable of vibrating under the influence of sounds. Back of the diaphragm and in the box H is a chamber O, to which a gas or mixture of gases may be admitted at an inlet B, and up through the box H and section E is a passage C, through which the gases may pass to a burner-chamber D, formed in the sections E and F and open to or housed by the megaphone J. To the chamber O is admitted a combustible gaseous mixture, and this mixture may be, for example, composed of illuminating-gas and air or air and acetylene or the gaseous vapor of a volatile liquid mixed with air. If the diaphragm A is not vibrating, the gaseous combustible mixture back of the diaphragm remains in the chamber provided for it; but under the influence of vibrations of the diaphragm the chamber O back of the latter will be found to vary in capacity incessantly. From this it results that there will be successive aspirations and evacuations of some part of the gaseous mixture at the passage C. The gaseous mixture burns in passing out through the passage E to the burner-chamber D, thus producing a series of rapid detonations, due to the successive jetting out of portions of the mixture through the passage C under the influence of the vibrations of the diaphragm, the successive quantities emitted or jetted out varying with the amplification of such vibrations. The gaseous mixture is maintained ignited because of the rapid succession of the detonations and also by reason of certain asperities *d* on the walls of the chamber D. These asperities form an obstacle to the easy flow of the gaseous mixture along the walls of the chamber D, and thus escaping into the horn J before producing the full effect of detonating for effecting amplification of the sounds. These asperities, moreover, augment the metallic surface at the contact of which the successive detonations of the gaseous mixture are effected.

In place of admitting the mixed gases at the inlet B we may admit but one gas at this in-

let—as, for instance, the air—the other gas being admitted at an inlet K. This second gaseous element, which contributes to form the combustible mixture, enters an annular
 5 space *k*, formed in the section E, from which space it finds its way to the passage C, where the gaseous elements mix before entering the chamber D.

This apparatus can amplify and reproduce
 10 not only vibrations which act directly on the diaphragm A, but on vibrations analogous to those received in the reproducer of a phonographic apparatus under the influence of undulations registered by impression on a cylinder or disk. In this case the box H carries,
 15 as seen in Figs. 1 and 2, a piece G, which may be adapted directly to the reproducer of a phonograph. In this case the entire apparatus receives the vibrations of the reproducer and produces fluctuations of the gaseous mixture back of the diaphragm. The gas escapes
 20 by more or less important fractions through the passage C to the chamber D for producing successive detonations therein.

If the pressure or tension of the gaseous mixture is great, we may dispose between the section E and box H, as seen in Figs. 3 and 6, a washer I and in the aperture in said washer mount a valve S on a stem *s*, which connects
 30 the valve with the diaphragm A. In Fig. 5 said connected diaphragm and valve may be seen detached. This valve closes more or less the passage or orifice C and prevents the gas from flowing through the same too rapidly,
 35 which latter would be injurious to the production of suitable detonations and the resultant vibrations.

If the vibrations received by the diaphragm A are sufficiently energetic to cause the mixture of gases to be forced strongly through
 40 the orifice or passage C, we may place between the sections E and F one or more disks of wire-gauze T (see Fig. 3) and between or on these disks place some fragmentary substance, if necessary, to detain the outflow of gas and maintain conditions suitable for producing
 45 the best results. The shock and friction of the impact of the gas against these particles or fragments serves only to augment the sonority of the vibrations.

In the form of the apparatus illustrated in Figs. 7, 8, and 9, and which employs gas at a high pressure, a relatively small diaphragm L is placed over a box M and controls the inlet
 55 N of a conduit P. The gaseous detonating mixture supplied by a pipe U enters an annular chamber *m* in the box M and acting on the inner face of the diaphragm L passes it outward slightly and passing through the narrow opening thus made enters the pipe P.
 60 This pipe enters at one side of the point of junction between two horns or megaphones Q R and forms a jet in the horn Q. The gaseous mixture will obviously be admitted to the tube or pipe P proportionately to the

vibrations of the diaphragm, which tend to vary the size of the inlet N. Obviously, also, the pipe P may connect with the end of a horn, as shown in Fig. 1, through a chamber D; but, as shown in Fig. 7, the gaseous mixture
 70 on issuing from the pipe P burns in a long flame in the axis of the horn and directed toward its open end. This figure shows the apparatus constructed in a double form, the parts at the left being distinguished from
 75 those at the right by prime-marks on the reference-letters. In this double construction there is disposed between the centers of the two diaphragms L and L' a short transversely-disposed pin *n* on a flexible stem *o*.
 80 This pin holds one diaphragm so as to shut off the gas whenever the other is open or pressed outward, the diaphragm which is thus pressed outward impinging on said pin *n* and pressing it forcibly against the opposite diaphragm. The flexible stem *o* permits of this
 85 movement of the pin. Thus the orifice N will be closed whenever the orifice N' is open. If the quantity of the gaseous mixture which is emitted at the burners of the two pipes P and P' were always equal, the air contained in the space at the junction of the horns Q and R would be immovable. If one of the burners has the advantage, this establishes in that direction a flow of air which is continually being
 90 modified by the variations in the quantities of gas being detonated at the different burning-points, thus producing much amplified sounds.

It will be noted that the burner or point of
 100 ignition of the gas is in all cases housed in or by the base portion of the horn or megaphone J. In Figs. 1 and 3, for example, the burner or burner-chamber D forms operatively a part of the base of the megaphone, while in Fig.
 105 7 the outlet of pipe P is the burner, and this burner is housed in the base or narrower part of the megaphone Q. In Fig. 1 also the diaphragm A forms one wall of the gas-chamber O and by its vibrations rapidly varies the capacity of this chamber. Thus in this construction of Fig. 1 the operation is similar to that of a bellows, the gas being under no material tension, while in Fig. 7, where the gas is under some tension or pressure, the diaphragm acts as a valve.

The asperities *d* in the burner-chamber D may be of any kind—as, for example, such as would be formed by cutting V grooves in the walls and extending roundwise thereof.
 120

Having thus described my invention, I claim—

1. An apparatus for the purpose specified, having a diaphragm, a gas-chamber back of the diaphragm, a burner, a conduit which connects said gas-chamber with the burner, and a horn or megaphone housing the burner, said diaphragm controlling by its vibrations the supply of gas to said burner.

2. An apparatus for the purpose specified, 130

having a horn or megaphone, a gas-burner housed thereby, means for supplying gas to said burner, and a diaphragm controlling by its vibrations the supply of gas to said burner.

5 3. An apparatus for the purpose specified, having a horn or megaphone for augmenting sounds, a gas-chamber, a burner-chamber D housed at the base of the megaphone, a gas-
10 passage connecting said gas-chamber with the burner-chamber, and a diaphragm forming one wall of the gas-chamber and serving, by its vibrations, to vary the capacity of said chamber proportionate to the amplification of the vibrations.

15 4. An apparatus for the purpose specified, having a horn or megaphone for augmenting sounds, a gas-chamber, a diaphragm which forms one wall of said chamber and by its vibrations varies the capacity of the latter, a
20 burner-chamber D, having roughened walls, said chamber being housed at the base of the megaphone, and a conduit connecting the gas-chamber with the burner-chamber.

25 5. An apparatus for the purpose specified, having a horn or megaphone for augmenting sounds, a gas-chamber, a diaphragm which forms one wall of said gas-chamber and by its vibrations varies the capacity of the latter, a burner-chamber housed at the base of
30 the megaphone, a conduit connecting the gas-

chamber with the burner-chamber, and a valve connected operatively with the diaphragm and controlling the flow of gas through said conduit.

6. An apparatus for the purpose specified, 35 having a horn or megaphone for augmenting sounds, a gas-chamber, a diaphragm which forms one wall of the gas-chamber and by its vibrations varies the capacity of said chamber, a burner-chamber, a conduit connecting the
40 said gas-chamber and burner-chamber, and a foraminous diaphragm T at the base of the burner-chamber to somewhat obstruct the flow of the gas to the burning-point.

7. An apparatus for the purpose specified, 45 comprising a box H having in it a gas-chamber O, an inlet B, an inlet K, and an outlet-conduit C, sections E and F, having in them a burner-chamber D, a megaphone J, connect-
50 ed with the section F and housing the chamber D, and a vibrant diaphragm A, forming one wall of the gas-chamber O.

In testimony whereof I have hereunto signed my name, this 19th day of November, 1903, in the presence of two subscribing witnesses. 55

GEORGES LAUDET.

Witnesses:

JULES ARMENGAUD, Jeune,
H. C. COXE.