

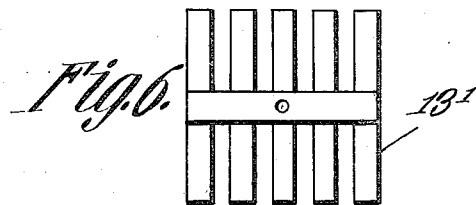
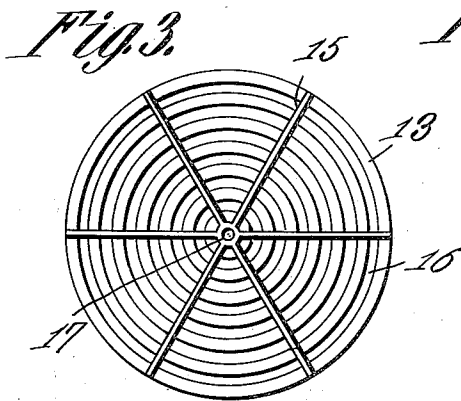
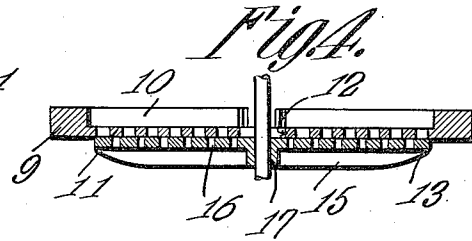
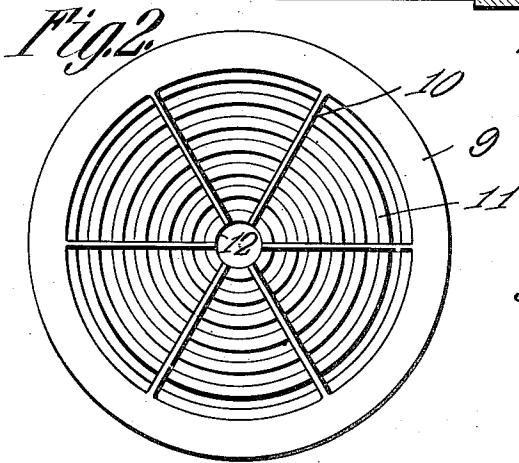
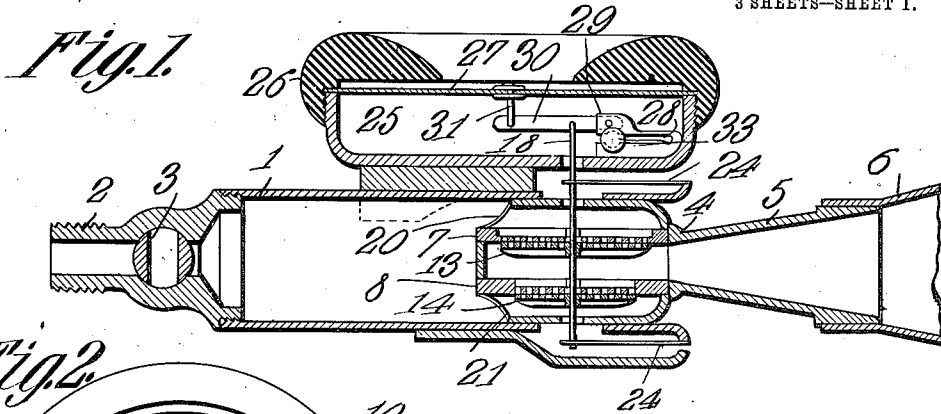
N. BALDWIN.
SOUND AMPLIFIER.

APPLICATION FILED AUG. 29, 1908.

946,096.

Patented Jan. 11, 1910.

3 SHEETS—SHEET 1.



Witnesses

E. J. Stewart
Jno. C. Parker

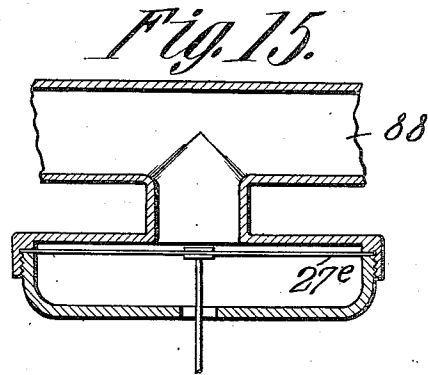
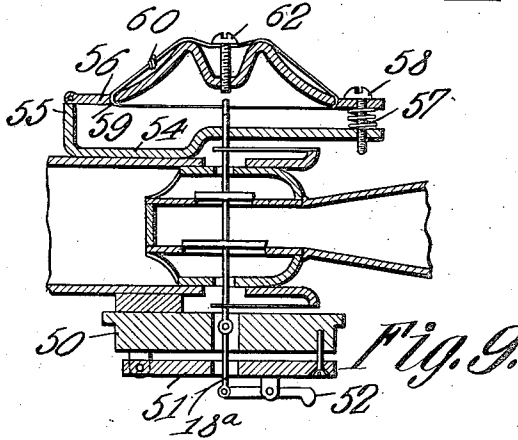
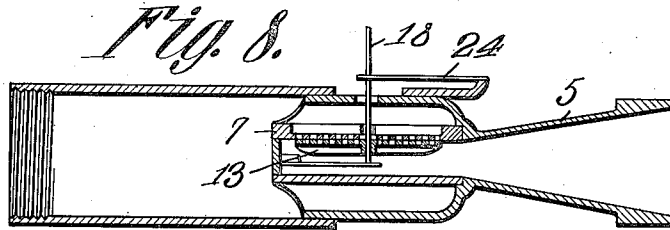
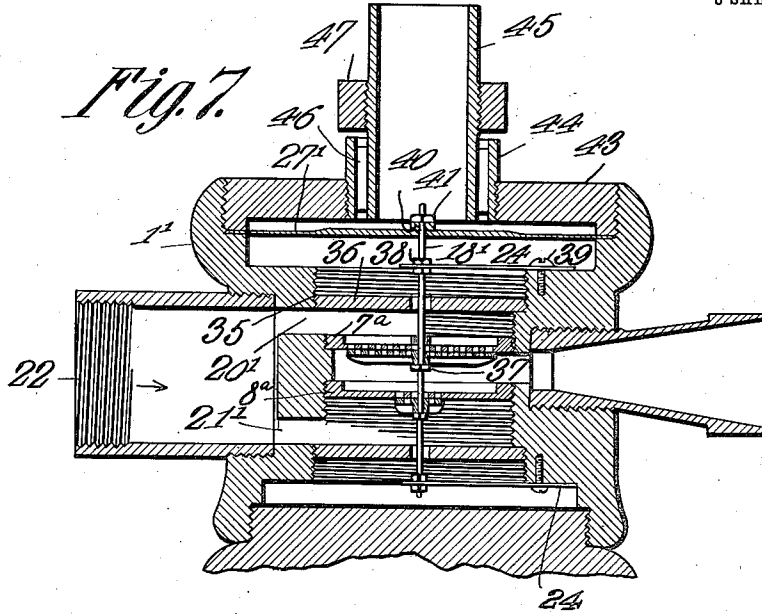
Inventor
Nathaniel Baldwin

By *C. Snow & Co.*
Attorneys

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3 SHEETS—SHEET 2.



Witnesses

E. J. Stewart
Geo. E. Parker

Inventor
Nathaniel Baldwin

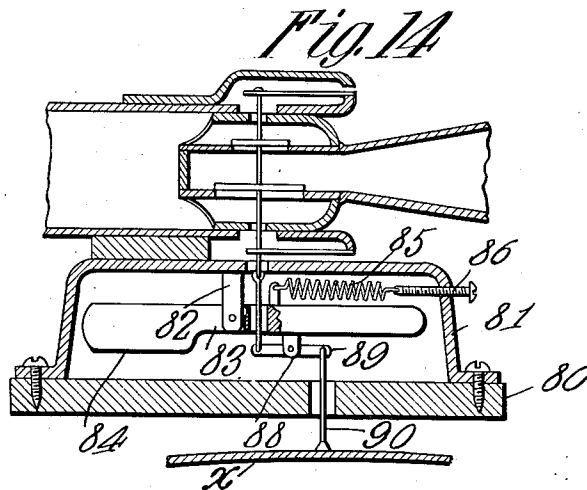
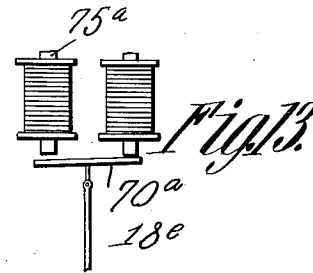
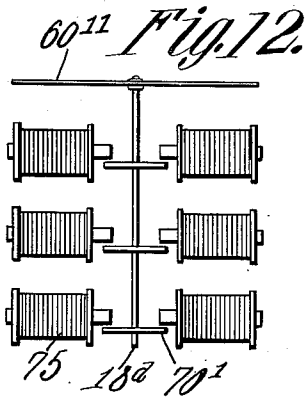
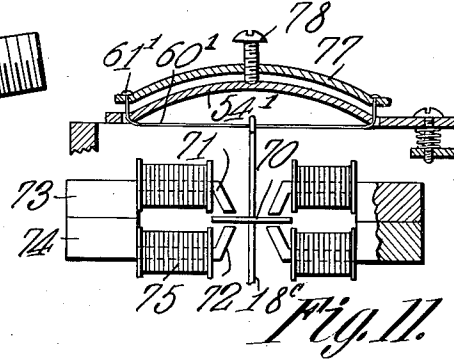
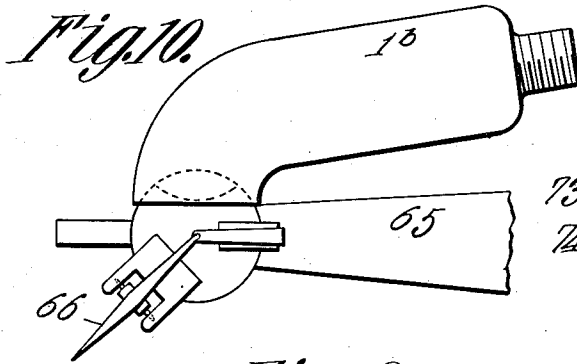
By *C. Snow & Co.*
Attorneys

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3 SHEETS—SHEET 3.



Witnesses

E. J. Stewart
John E. Parker

Inventor

Nathaniel Baldwin

By

C. A. Snow & Co.
Attorneys

UNITED STATES PATENT OFFICE.

NATHANIEL BALDWIN, OF MIDWAY, UTAH.

SOUND-AMPLIFIER.

946,096.

Specification of Letters Patent.

Patented Jan. 11, 1910.

Application filed August 29, 1908. Serial No. 450,798.

To all whom it may concern:

Be it known that I, NATHANIEL BALDWIN, a citizen of the United States, residing at Midway, in the county of Wasatch and State of Utah, have invented a new and useful Sound-Amplifier, of which the following is a specification.

This invention relates to sound amplifiers of that general type illustrated in Letters-Patent of the United States granted to me on October 29, 1907, No. 869,288.

The principal object of the present invention is to improve and simplify the operation of the device and to provide for the more delicate balancing of the controlling valves, so that they may be made more quickly responsive to the vibrations of the diaphragm, armature, or other device to which they are connected.

A further object of the invention is to provide improved means for connecting the diaphragm or other vibrating body to the valve rod for the purpose of securing increased force in the operation of the valve and further to permit of greater delicacy of adjustment.

A still further object of the invention is to arrange the opposing valves which are subjected to the pressure of air, steam, or other actuating fluid, so that one shall present a greater surface area than the other and the pressure operating on the excess area will tend to move both valves to open position, and, further, to provide for counter-balancing of this extra pressure by connecting with the operating device, so that the elasticity of the diaphragm, magnetic force operating through an armature, or the energy of a spring or weight, may be utilized in part as a valve closing means.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts, hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

In the accompanying drawings:—Figure 1 is a sectional elevation of a sound amplifier constructed in accordance with the invention, the instrument here shown being

one which is used in speaking or singing when the instrument can be placed close to the mouth. Fig. 1^a is a detail view. Fig. 2 is a plan view of one of the valve seats drawn to an enlarged scale. Fig. 3 is a similar view of one of the valves. Fig. 4 is a cross sectional view of a valve and its seat on an enlarged scale. Fig. 5 illustrates a modified construction of seat, and Fig. 6 a modified construction of valve that may be employed. Fig. 7 is a sectional elevation illustrating a slightly modified construction that is adapted more especially for use as a secondary instrument and may be used to control the flow of a stream of steam to the amplifying horn. Fig. 8 illustrates a construction in which only a single valve is employed, the valve being so arranged that the fluid under pressure tends to open it while its force is counter-balanced by a mechanical means. Fig. 9 is a sectional elevation illustrating a structure that may be employed in connection with a sound reproducing machine of the cylinder record type. Fig. 10 is an elevation showing the arrangement followed when adapting the device for use in connection with a machine of the disk record type. Fig. 11 illustrates a valve operating mechanism in the form of an armature located between the pole pieces of a telephone receiver. Fig. 12 illustrates a further construction in which the valve rod carries a series of armatures connected in tandem. Fig. 13 illustrates a further modification of the electromagnetically operated valve rod. Fig. 14 is a sectional elevation illustrating the use of the device in connection with a musical instrument having a sounding board, the sound waves being mechanically transmitted through the valves for the purpose of controlling the flow of the stream of fluid to the amplifying horn. Fig. 15 is a sectional elevation showing the manner in which the device may be connected to a wind instrument where the sounding column of air operates on a diaphragm that transmits movement to the valve rod.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

In the construction shown in Fig. 1, the main casing 1 is provided at one end with a nipple 2 for connection to a supply of fluid under pressure, and in the nipple is a controlling valve 3 of any suitable construction. The opposite end of the casing receives a

small casing 4 from the central end portion of which projects a neck 5 for the support of the amplifying horn 6. The chamber 4 is divided into three superposed compartments by a pair of valve seats 7 and 8, the construction of the valve seats being more clearly shown in Figs. 2 and 4. Each seat is formed of stamped sheet metal in the form of a disk having a marginal flange 9, and a series of radially disposed ribs 10, the flange and the ribs being formed integral with the central solid plate of the disk. This disk is preferably placed in a lathe, and cut to form a series of concentric slots 11 and a central opening 12, the slots 11 extending entirely through the plate, while the central opening extends through both the plate and the ribs 10, in order to form a free passage way for the valve rod. The ribs will then serve to hold the rings of metal between the concentric ports in proper position. The valves 13 and 14 are of similar construction, being each formed of a plate of metal having radial ribs 15 and the plate is placed in a lathe and provided with a series of concentric slots 16 that extend entirely through the plate, so that the intervening ribs of metal are held in proper position by the radial ribs. The hub from which all of the ribs radiate is then provided with a central opening 17 for the passage of the valve rod 18. In practice, the metallic rings which constitute the valve are a little wider than the concentric ports in the valve seat, so that when the valve is in closed position there is a slight lap, usually not more than one five hundredth of an inch and it will require but very slight movement of the valve to permit the passage of the current of air or steam while at the same time the flow of the stream of fluid between the seat and valve will not tend to move the latter beyond the initial position. A stream of air passing through the casing 1 enters into the upper compartment through a port 20, and into the lower compartment through a port 21, so that the upper valve 13 is exposed to downward pressure, and the lower valve 14 to upward pressure. The valves are so constructed that the one which the fluid under pressure tends to open, the upper one in Fig. 1, presents a larger surface area to the pressure than the one which the air pressure tends to close. There is thus produced an excess pressure that tends to open the valves, and this is counter-balanced in the manner hereinafter described by the elasticity of a diaphragm, or spring, by a weight or by magnetic force. The valve rod is slightly supported by a pair of small springs 24 which are secured at one end to arms projected from the top and bottom of chamber 4, and the upper end of the rod extends into the diaphragm box for connection to the diaphragm. The diaphragm box or casing 25 is threaded for the

reception of a mouth piece 26, and between the flanged edge of the member 25 and the mouth piece is clamped a diaphragm 27 formed of any suitable material. Secured at one end to the wall of the box 25 is a spring 28 having an enlarged head 29, to which is fulcrumed one end of a lever 30, the opposite end of the lever being connected to the diaphragm by a link 31. To this lever is connected the upper end of the valve rod 18, the connection being preferably made at a point close to the fulcrum of the lever, so that the valve operating force may be increased. The free end of the spring support 28 rests on a tapered screw 33 which may be turned for adjusting the stress of the spring and raising or lowering the fulcrum point of the lever. (See Fig. 1^a). The spring acts merely to force the fulcrum down into firm engagement with the supporting and adjusting screw 33.

When the two valves are subjected to the pressure of the fluid from casing 1, the superior area of the upper valve tends to move both valves to open position and if the upward force exerted by the connection with the diaphragm including the elasticity of the diaphragm proper is sufficient to counter-balance this extra pressure area, the valves will remain closed. If the valves are not exactly balanced, a turn of the screw 33 in one direction or the other is all that is necessary to effect the proper adjustment and such an adjustment may be made with greater ease and more delicacy than is possible where the valves have practically the same pressure area, as in the latter case by the time they are adjusted to open far enough for the best results, from one-tenthousandth to three-ten-thousandths of an inch, they become somewhat unstable and difficult to keep in adjustment. For some purposes it may be preferred to have this excess pressure very slight, or, for other purposes, it may be desirable to have it greater, so the smaller valve may be made short one ring, two rings, or in extreme cases all of them, and the central cap may be omitted. It then becomes a single valve and takes the form illustrated in Fig. 8, wherein the valve is subjected to pressure only in one direction, and this pressure is counter-balanced, or partly counter-balanced by strictly mechanical forces, or by electro-magnetical means for the purpose of securing the desired delicacy of adjustment.

While the valves are described and preferably consist of concentric annular rings and ports, they may be made to assume a great variety of shapes all embodying the same principle. For example, the seats and valves may take the form of a grating, as illustrated at 7' and 13' in Figs. 5 and 6.

In Fig. 7 is shown an instrument operated on the same general principles, but of

slightly different design in construction. It is especially valuable as a secondary instrument, and may be used with steam instead of air. The body portion comprises a casting 1' into which the various parts are threaded. The two seats 7^a and 8^a are screwed down against shoulders formed in the body portion, and above the threaded seat receiving recesses are threaded openings 35 in which are screwed cap pieces 36, so that when the caps are removed, the seats may be taken out. The valves are threaded on to the valve rod 18' and set with jam nuts 37, and the valve rod carrying springs 24 are also clamped into the rod between the nuts 38, while the outer ends of the springs have their ends secured to the body of the casing by screws 39. The supply-pipe 22 is screwed into an opening formed at one side of the casing to supply the steam, or other fluid, and the fluid passing through suitable ports 20' and 21' to points above and below the valves. The neck of the horn is, also, threaded, and screwed into a threaded opening at a point opposite the supply pipe 22. The valve rod 18' passes through an opening formed in the diaphragm 27', and the valves are adjusted by a nut 40 which is locked in place by a jam nut 41. This manner of adjustment may, also, be serviceable in connection with the instrument shown in Fig. 1.

In the construction shown in Fig. 7, the edge of the diaphragm rests on a shoulder formed at the base of a threaded recess at the top of the casing, and is clamped in place by a disk 43 that is provided with a threaded opening for the reception of a sleeve 44. Fitting into the sleeve is a tube 45 which, when the device is used as a secondary instrument, may be connected directly to the neck 5 of the primary instrument, so that the sound waves from the latter will be directed through the tube 45 against the diaphragm. The tube 45 is of much smaller diameter than the sleeve 44, and is held in central position by small spacing ribs 46 and the exterior of the tube 45 is threaded to receive a ring valve 47 which may be adjusted to restrict the escape of air from the sleeve 44, so as to obtain the maximum effect of the air pulsations from the primary instrument. By causing the augmented sound waves from one instrument to operate the sound waves of the other instrument in this way, spoken words may be augmented to such an extent as to replace steam whistles, bells, gongs, or other sound signals.

While the instrument shown in Fig. 7 is especially adapted for a secondary instrument, it may be made sufficiently small and delicate to operate as a primary instrument, in which case a different form of diaphragm clamping and sound wave transmitting means may be employed. The construction of the regulating device for controlling the

escape of air from the sound box may, also, be used in connection with any form of primary instrument to operate a phonograph recorder in which case the diaphragm of the recorder would take the place of the diaphragm 27', or in the operation of a telephone transmitter, in which case the diaphragm of the transmitter would take the place of the diaphragm 27', or it might be used in connection with a telephone relay, in which case the transmitter diaphragm would take the place of the diaphragm 27', and the primary valve would be operated by telephone currents in the manner herein-after described.

It is, of course, possible in connection with either of the instruments shown in Figs. 1 or 7 to replace the diaphragm by the diaphragm of a telephone receiver, or to the armature operated by telephonic currents, and in such case the valve will be operated by the impulse and the stream of fluid will flow through the valve ports to the amplifying horn, so that in this way it is possible to speak, sing or play music to be transmitted telephonically and intensified at the receiving end of the line, so as to be heard by large audiences.

Fig. 9 represents the instrument arranged for use as a reproducer for cylinder record phonograph machines. In this case the valves are represented diagrammatically, and not in detail. At the lower portion of the attachment is a disk 50 that fits within the usual socket in the reproducer carriage and to this is pivoted the weight lever 51 carrying the reproducer stylus 52. The stylus is connected to the lower end of the valve rod 18^a, and in this case the arrangement of the valves shown in Fig. 1 is reversed, that is to say, the larger valve is at the bottom and the smaller valve at the top, so that the excess pressure tending to open the valve operated in an upward direction and thus tends to thrust the stylus into the record. This pressure is to a certain extent counter-balanced by the weight lever 51. Above the main casing is arranged a bracket 54 having an upwardly directed arm 55 on which is pivoted a lever 56. The opposite end of the lever is normally elevated by a compression spring 57 that is coiled around an adjusting screw 58 passing through an opening in the lever and threaded into an opening in the bracket 54. By turning this screw, the free end of the lever may be forced downward, or on turning in the opposite direction the spring will be allowed to slightly raise the lever. The lever is provided with a pair of openings 59 through which extends a wire 60; the ends of the wire passing over the corrugated back of the lever and being connected together so as to form a continuous loop. The upper end of the valve rod is connected to the lower ply of

the loop, and the upper ply extends under the head of a screw 62 that passes through a threaded opening formed in the depressed central portion of the lever. By turning this screw the loop of wire may be stretched taut to a greater or less extent and the valve rod may thus be raised or lowered in order to secure the delicate adjustment necessary to proper operation. In employing the structure shown in Fig. 9, if the force exerted by the weight lever 51 is sufficient to accurately balance the excess of air pressure on the lower valve, the wire adjusting wire may be omitted.

Fig. 10 represents the instrument in use as a reproducer for disk record phonographs. In this case the valve casing is connected directly to the movable arm 65 of the horn, and the main chamber 1^b instead of being connected opposite to the horn connection, is disposed at a right angle thereto, and then bent forward in the direction of the horn, so that the hose carrying the air or other fluid under pressure may be connected or fastened near the joint of the horn in such manner that it will exert no force upon the reproducer. The valve rod in this case is arranged horizontally with its front end connected to the usual lever 66 which carries the needle. Any suitable form of adjusting device or counter-balancing mechanism may be employed in this connection, and it has not been considered necessary to illustrate this in detail.

In Fig. 11 is illustrated a construction in which the valve rod is operated by the electro-magnets of a telephone receiver. In this case the armature 70 is arranged between the polar extensions 71 and 72 of the pole pieces, the latter being made in two parts 73 and 74, so that the coils may be readily wound upon the spools 75. The free ends of the legs of adjacent pole pieces are of the same polarity, and these pole pieces straddling the armature 70 exert upon the latter a substantially equal magnetic pull on each side. The coils are connected in the usual manner in the telephone circuit and the armature is connected directly to the valve rod 18^c. In this figure is represented a slight modification of the adjusting device. The cross bar or lever 54' is provided with openings for the passage of a wire 60' and the latter has an enlarged head 61' which prevents the wire pulling through an extra cross piece 77 that is arranged above the lever. The cross piece has an opening for the passage of a screw 78 which bears against the central portion of the lever and by adjusting this screw the tension on the wire may be increased or diminished for the purpose of adjusting the valve rod.

In the construction shown in Fig. 12, the valve rod 18^a is connected to a plurality of armatures 70' arranged tandem, and adapted

to be operated on by a corresponding number of electro-magnets 75. In this case a portion of the adjusting wire 60'' is shown, or any other form of adjusting mechanism may be employed, as desired. In some cases two or more armatures as shown in Fig. 11 with their pole pieces, may be arranged tandem as in Fig. 12.

Fig. 13 illustrates a still further modification. In this case the valve rod 18^c is connected to an armature 70^a that is acted upon by an electromagnet 75^a.

Fig. 14 illustrates the application of the device to a musical instrument having a sound board. The arrangement is in some respects the same as that for the phonograph. On a suitable supporting means or plate 80 adjacent the sound board is arranged a casing 81 that serves as a support for the valve chamber and the main casing with its air supply and amplifying horn connections. Arranged within the casing is a hanger 82 on which is pivoted a lever 83 having at one end a heavy counter-balance weight 84, and connected to the opposite end of the lever is a spring 85, the outer end of which is swiveled to an adjusting screw 86 that extends through a threaded opening in the wall of the casing. Depending from the lighter arm of the lever is a bracket 88 to which is pivoted a lever 89, and one end of this lever is connected to the lower end of the valve rod. To the opposite end of the valve rod is connected a sound-wave transmitting rod 90 having a blunt point which rests on the sound board X of the instrument and communicates its motion through the lever system to the valves. The inertia lever 83 is balanced with reference to its fulcrum, so that the valve will be under the same stress for all positions of the musical instrument. The downward pressure is produced by the coiled spring 85, and its stress may be adjusted by the screw 86.

In Fig. 15 is shown the connection for wind instruments. In this case 88 represents the sounding air column, such as the tube leading to the horn or bell of a brass instrument, and 27^c indicates the diaphragm to which movement is transmitted by the sound waves, this diaphragm being connected to the controlling valve or valves in any suitable manner.

The amplifier provided with some telephonic receiving apparatus such as represented in Figs. 11, 12 or 13, may take the place of the ordinary receiver on the telegraphone, thus combining the purity and distinctness of reproduction of the telegraphone with as great sound volume as may be desired.

What is claimed is:—

1. In a sound amplifier of the class described, a rod having a valve secured thereto and exposed to the pressure of the actuating

fluid, means for operating said valve, and an adjustable means operatively connected with the valve rod for counter-balancing the pressure on the valve.

5 2. In a sound amplifier of the class described, a valve exposed to the pressure of the actuating fluid and provided with a depending rod, means for actuating the valve, and an adjustable mechanical means opera-
10 tively connected with the valve rod for counter-balancing the pressure on the valve.

3. In a sound amplifier of the class described, a pair of valves exposed to the pressure of the actuating fluid, and operating
15 thereon in opposite directions, respectively, one of said valves being of greater area than the other, and means for counter-balancing the pressure on the excess area of the larger valve.

20 4. In a sound amplifier of the class described, a pair of valves of unequal area exposed to the pressure of the actuating fluid, said pressure tending to move one valve to open position and the other to closed position, and means for counter-balancing the
25 effect of the pressure on the excess area of the larger valve.

5. In a sound amplifier of the class described, a pair of valves of unequal area exposed to the pressure of the actuating fluid, such pressure tending to move the larger
30 valve to open position and the smaller valve to closed position, and means for counter-balancing the effect of the pressure on the excess area of the larger valve.
35

6. In a sound amplifier of the class described, a pair of valves of unequal area exposed to the pressure of the actuating fluid,

such pressure tending to move the larger valve to open position and the smaller valve
40 to closed position, and an adjustable mechanical means for counter-balancing the effect of the pressure on the excess area of the larger valve.

7. In apparatus of the class described, a
45 duct leading from the source of pressure supply to the amplifying horn, a valve in said duct, a rod carrying the valve, a valve rod actuating means, connected with the opposite end of the rod and means connected
50 with the opposite end of the rod and operating through said rod to adjust the valve to compensate for pressure of the fluid thereon.

8. In apparatus of the class described, a
55 duct leading from a source of pressure supply to the amplifying horn, a valve in said duct, a rod carrying the valve, a spring pressed lever to which the rod is connected, means for adjusting the fulcrum of the
60 lever, and means for vibrating said lever.

9. In apparatus of the class described, a
duct leading from a source of pressure supply to the amplifying horn, a valve in
said duct, a rod carrying the valve, a lever, 65
a spring support forming a fulcrum for the lever, an adjusting screw under said support, a diaphragm, and means for connecting the lever to the diaphragm.

In testimony that I claim the foregoing as
70 my own, I have hereto affixed my signature in the presence of two witnesses.

NATHANIEL BALDWIN.

Witnesses:

HENRY WATKINS,

FREDRICK SONDEREGGER.