

July 26, 1927.

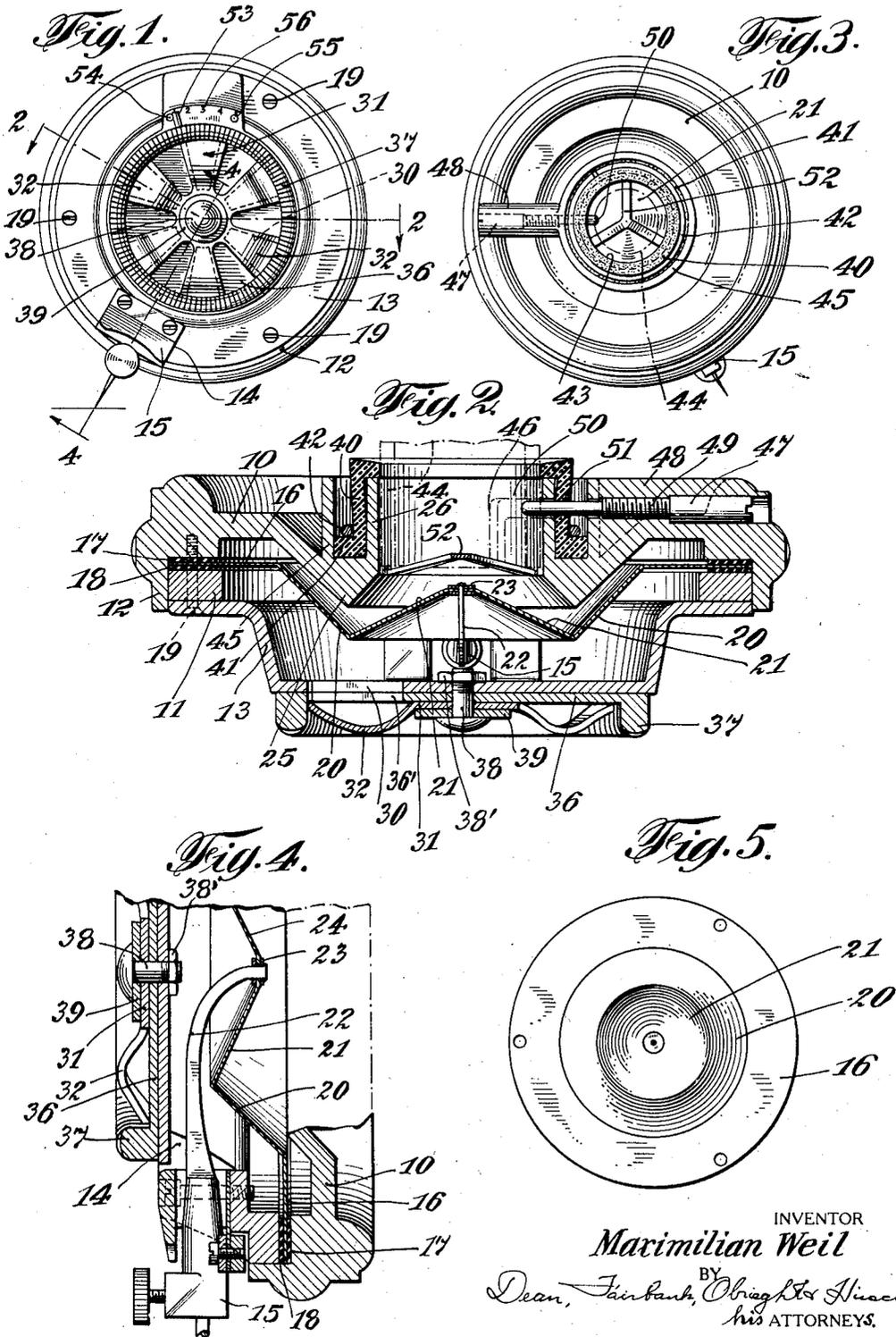
1,637,322

M. WEIL

SOUND REPRODUCER

Filed Aug. 14, 1926

2 Sheets-Sheet 1.



INVENTOR

Maximilian Weil

BY Dean, Fairbank, Obright & Hirsch
his ATTORNEYS.

July 26, 1927.

1,637,322

M. WEIL

SOUND REPRODUCER

Filed Aug. 14, 1926

2 Sheets-Sheet 2

Fig. 8.

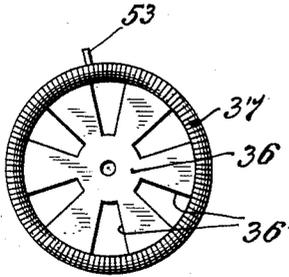


Fig. 6.

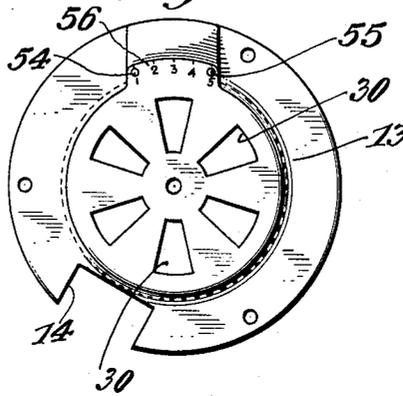


Fig. 7.

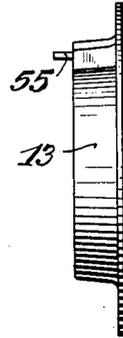


Fig. 9.

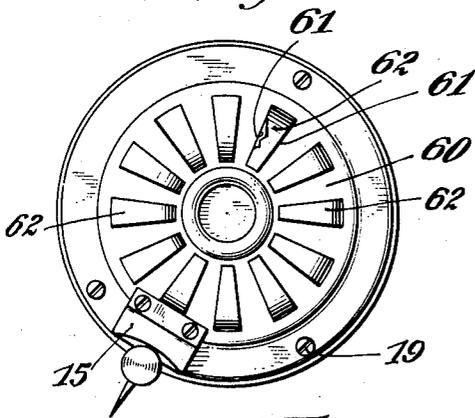


Fig. 10.

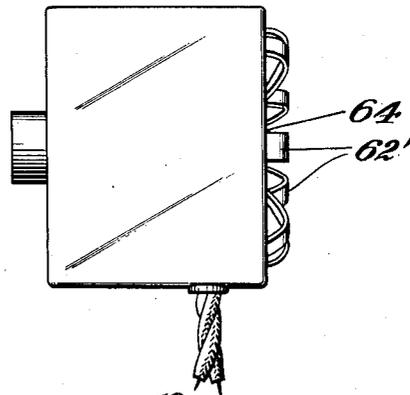


Fig. 11.

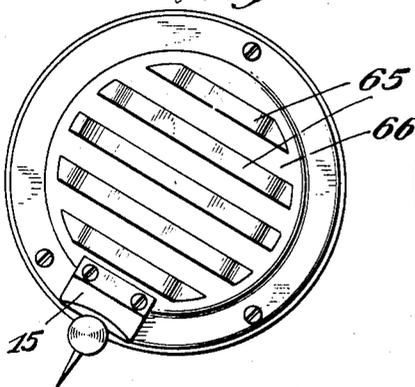
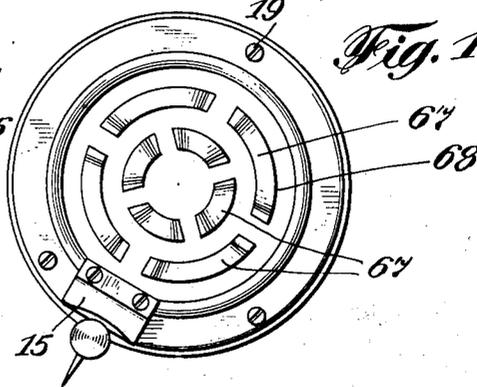


Fig. 12.



INVENTOR

Maximilian Weil

BY *Dean, Fairbank, Obright & Hinck*
his ATTORNEYS

UNITED STATES PATENT OFFICE.

MAXIMILIAN WEIL, OF NEW YORK, N. Y.

SOUND REPRODUCER.

Application filed August 14, 1926. Serial No. 129,144.

My present invention relates to sound reproducers and has a preferred application to sound boxes for phonographs, although certain of the features thereof are also applicable for telephonic or radio use.

It is an object of the invention to provide a reproducer which though of relatively small diameter will, when employed with any of the wide variety of known amplifying systems produce the ample volume usually associated with large reproducers.

Another object is to provide a reproducer of the type mentioned which will reproduce faithfully and realistically without tubby, throaty, or blaring effect.

Another object is to provide a reproducer of the type mentioned which can be applied with equal facility to each of the various constructions of amplifying systems and affords a substantially sound-proof connection from the compression chamber of the reproducer to the amplifying system.

Another object is to provide a sound reproducer of the type mentioned, in which may be used an extremely thin and correspondingly vulnerable metal diaphragm, thereby maintaining the inertia at a minimum, yet one of sufficient stiffness to initiate a strong sound wave, said diaphragm being shielded to preclude tampering therewith from the exterior of the reproducer case, the shielding instrumentality being of character such as to improve the quality of the performance.

Another object is to provide a sound reproducer or sound box of the character described of attractive construction so flat that it can be laid upon a table without danger of marring the same.

Another object is to provide for the reproducer a mounting connection upon the tone arm or other sound conduit, which will avoid leak of sound and yet afford a secure non-wobbling attachment for the reproducer.

The latter object is accomplished by affording a telescopic engagement of the reproducer sleeve with respect to the tone arm or other sound conduit, of sufficient length to avoid wobbling and affording a rubber or other yielding annulus snugly compressed between the sleeve and the conduit to prevent leak of sound thereat.

Every sound amplifying system has a characteristic sound impedance depending on the size, shape and material of which the amplifier wall is made, and varying with

the characteristics of the selection being amplified. Entirely satisfactory operation is readily attained according to my tests by the use of a sound reproducer having an impedance characteristic matching that of the amplifying system and the selection being amplified. Even special constructions of reproducer matched in impedance for each of the wide variety of sound amplifying systems in use are not entirely satisfactory for different types of selections.

I have devised a sound reproducer of readily adjustable impedance so that it can be adapted to any amplifying system or selection. If the adjusting feature involved loss of energy in the course from the diaphragm into the amplifying system the matching of impedance would entail sacrificing of volume.

It is, accordingly, an object of the invention to provide a reproducer readily adaptable with regard to its impedance effect and without sacrifice of volume, to the sound characteristics of any amplifier system through which it is to deliver and to each of various types of selections to be played thereby.

The latter object is accomplished by providing the sound reproducer with an impedance chamber at the side of the diaphragm opposite the compression chamber, which latter delivers into the amplifying system with which the reproducer is associated. The impedance chamber is not completely sealed but is opened preferably adjustably to a degree and in manner such as to impose the desired load or impedance upon the diaphragm.

The impedance chamber has a closure or wall preventing direct blaring emission of sound into the atmosphere from the otherwise exposed face of the diaphragm without, however, producing a muffled or damped effect or cutting down the volume due to the reproducer. I have accomplished this result by avoiding any direct outwardly opening aperture, in the impedance case, the case being, however, provided with outwardly stamped or embossed bridging parts having lateral slits or apertures and serving to reflect the sound originating at the diaphragm and to allow it to escape into the air only by lateral diffusion.

The construction of case or closure set forth has also the important advantage of serving to protect the enclosed vulnerable

diaphragm from contact with the finger or pencil or other prying or tampering.

The impedance chamber may be rendered adjustable for varying the impedance of the reproducer at will, by providing under the anti-blaring protective cover, an adjustable plate. For ready adaptation of the reproducer to the characteristics of the sound conduit or amplifying system, through which it delivers and in accordance with the pitch characteristics of the selection, said cover is disposed for convenient manual adjustment, without the need for removing the reproducer from the instrument. For this purpose, the face of the reproducer cover may be formed with perforations and the adjustable plate with corresponding perforations and may be manually rotated to increase or decrease the effective opening.

Another feature of the invention is to provide the thin sheet metal diaphragm with the major portion of the area thereof deflected out of the plane of its rim, whereby the main area of the diaphragm becomes a stiff body, vibrating as a unit about its rim as a hinge, and of such form that vibrations originating near the hinge may be reflected from another part of the diaphragm directly through the sound exit from the reproducer into the amplifying or other conduit system.

Another feature is to so shape the delivery side or base of the reproducer case with respect to the form of the diaphragm as to afford therebetween an amplifying chamber for permitting wave front expansion to a degree, in the passage from the outer part of the diaphragm toward the amplifying system.

Another feature is to provide the mounting sleeve of the reproducer by which the latter is secured upon the tone arm or other conduit system, in inobtrusive position, preferably with its entire length countersunk below the limiting plane of the reproducer case.

The three features last referred to, while each capable of embodiment in a reproducer construction apart from the other two, are all accomplished by the simple expedient of providing a diaphragm with the main area thereof conical in form and with the apex thereof reversely bent inward into the base of the cone, so as to form the diaphragm W-shaped in axial cross-section. The base of the reproducer case within which the rim of the diaphragm is preferably lodged is conformed with a crater-like ridge at its inner face, following the general contour of the conical diaphragm portion and affording the desired divergence from the rim to the hub. By the use of the countersunk base construction, the supporting sleeve or hub is countersunk below the end face of the reproducer case.

Inasmuch as the countersunk arrangement

of mounting sleeve does not afford room for the usual set screw for connecting the sleeve at the bayonet slot of the sound box, I provide a set screw of much greater length extending from the outer periphery of the reproducer case radially inward to grip the tone arm or to extend into the bayonet slot thereof.

In the accompanying drawings in which is shown one of various possible embodiments of the several features of the invention,

Fig. 1 is a front elevation of one embodiment of my invention, shown as a phonographic reproducer or sound box,

Fig. 2 is a sectional view taken on the line 2-2 of Fig. 1,

Fig. 3 is a rear view of the apparatus,

Fig. 4 is a sectional view taken on the line 4-4 of Fig. 1,

Fig. 5 is a plan view of a preferred form of diaphragm,

Fig. 6 is a plan view of the cover member,

Fig. 7 is a side elevation of the cover member,

Fig. 8 is a front view of the adjustable closure member,

Fig. 9 is an elevation of an alternative form of protective closure,

Fig. 10 is a side elevation of an application of the instrument for radio use,

Fig. 11 shows a modified form of cover plate corresponding to that of Fig. 9, and

Fig. 12 shows a further modified form of cover plate.

Referring now to the drawings, I have shown a reproducer embodied as a phonograph sound box, comprising a base member 10 of a case or box having therein a stylus bar carrying annulus 11 fitting into the rim 12 thereof and a cover plate 13 cut-away as at 14 to straddle the stylus bar carrier 15 and thereby position it. Between the stylus bar annulus and the base is clamped the rim 16 of the diaphragm, said rim for accurate hold being interposed between a pair of washers 17 and 18. For assembly, a plurality of screws 19 are extended through the cover member, the stylus bar annulus, the diaphragm and its washers, the screw shanks being threaded into the base 10.

In a preferred embodiment, the diaphragm is made of an extremely thin metal alloy, preferably in the order of .002" in thickness. Substantially the entire area of said diaphragm within the rim is shaped to extend outward toward one side of the rim in a conical form as at 20, the apex of the cone being reversely bent inward as at 21. The diaphragm is thus shaped so that each axial cross-section is of the general shape of the letter W or in the shape of a crater. By this construction, the entire conical deflected part of the diaphragm is stiffened, so that its entire area will vibrate substantially as a unit about the rim 16 as a hinging axis.

The particular form of diaphragm described requires a thickness or depth of sound box, much less than it would if the apex were not returned. The end of stylus bar 22 is attached by a washer 23 and by solder to the apex of the diaphragm cone 21, as shown in Fig. 4.

The reproducer base is formed of a countersunk construction to afford a circular crater-like ridge 25 extending generally along the corresponding conformation of the diaphragm, but diverging somewhat with respect thereto, as shown in Fig. 3 from the rim of the diaphragm to the center thereof. By this construction, some amplification will result within the reproducer itself, of vibrations originating near the rim of the diaphragm and traveling radially inward between the diaphragm and the base support to the axial outlet sleeve or hub 26. By the countersunk arrangement of reproducer case employed by me, the hub or sleeve 26 may itself be and preferably is completely countersunk, as shown, with its outer extremity substantially in the limiting plane of the face of the reproducer case. By this construction, the reproducer case is devoid of the protruding sleeve or collar commonly employed on sound boxes, so that my construction is not only neater in appearance, but is more easily disposed where limited space is available and can be laid on an article of furniture without danger of marring or scratching the same.

The arrangement of diaphragm and reproducer case described, also affords the advantage that sound waves originating near the rim of the diaphragm and impinging on the inner and conical part 21 thereof, would be reflected directly through the outlet sleeve 26.

Thus, in performance, the entire conical area of the diaphragm vibrates as a stiff unit about the rim as an axis and through a substantial range by reason of the low inertia of the light diaphragm; the wave front originating near the rim of the diaphragm, diverges somewhat in its travel radially along the diaphragm between the latter and the box base for amplification and the vibrations that pass radially inward from near the rim of the diaphragm through the compression chamber, are reflected by the inner conical part 21 thereof and projected into the amplifying system. This combination of actions affords an extremely efficient operation, preserving various overtones and greatly improving the quality of reproduction. It will also be seen that by the diaphragm and base plate conformation employed, I provide an effective area of diaphragm and of compression chamber considerably larger than the diameter of the reproducer as a whole, with corresponding increase of volume.

If the side of the diaphragm opposite that in communication with the amplifying system were left completely open, the sound vibrations would escape therefrom with a blaring effect and interfere with the performance. On the other hand, if said opposite side were completely sealed or closed, the considerable buffer effect of the imprisoned air would materially reduce the volume. According to my invention, the reproducer case cover is provided with openings 30 closed by a plate 31 having outwardly curved bridging tongues 32 extending completely over the openings, so that no direct access can be had through the openings from the face of the cover, the latter appearing to be completely closed in plan view. However, the sides of the outwardly bent bridges are open so that there is fairly free communication from the impedance chamber to the external air. The openings determined by the bridge pieces thus face in the direction of the casing wall surface. The vibrations due to the diaphragm are thus blocked from direct escape, axially of the sound box or reproducer, out of the impedance chamber and are reflected back at the bridge pieces 32 and only escape by lateral diffusion through the spaces determined by the edges of said bridging pieces. The sound waves escape in a devious indirect or deflected course from one face through the other of the cover member. By this effect, the reproduction is considerably mellowed and enriched and the difficulties incurred by keeping the diaphragm entirely exposed on the one hand, and completely shut off on the other, are obviated.

With ordinary reproducers designed to effectively recreate the ordinary range of pitch, the higher pitched sounds, as for instance, those of the piccolo are inadequately rendered, if they become at all audible to the ordinary listener. The effect of my impedance cover is obviously relatively less upon the longer wave lengths of greater energy and more marked upon the shorter or high pitched waves of little energy. It is more particularly the higher range of pitch with which the impedance load will resonate so that in performance the value of the lower ranges is maintained, and that of the higher ranges of pitch sufficiently enhanced to become truly effective, so that the entire range of pitch is adequately recreated.

The air chamber between the diaphragm and the cover plate thereof, which constitutes the impedance chamber largely determines the characteristics of the reproducer or sound box, the more open the impedance chamber is to the air, the lighter the resistance to vibration of the diaphragm. In a properly playing instrument, the impedance should be correlated with respect to that of the conduit or amplifying system with which

the reproducing system is being employed and adjustment should also be effected with regard to the character of selection being performed. According to the present invention, such adjustment is effected manually by the simple expedient of providing the aperture 30 in the cover plate, preferably of wedge-shape radiating from the center and providing an adjusting plate 36 thereover having corresponding apertures 36' and having a finger grip rim 37, said adjusting plate being pivotally mounted by means of a central pin 38. The cover bridging plate 31 previously described has its bridge pieces 32 extending directly over the openings in the fixed plate and has its outer ends preferably extending into snug engagement with the finger grip rim 37. Preferably the pivoting pin is locked by means of a nut 38' against the fixed cover member and has a washer 39 below its head fixing the guard plate 31 against rotation.

For proper reproduction, it is desirable that no sound leakage occur between the reproducer case and the tone arm or other sound conduit upon which the reproducer is mounted. For this purpose, I preferably provide a yielding or elastic, preferably a rubber collar 40 over the mounting hub or sleeve 26, said collar having an inner flange 41, by which it is held in position by means of an encircling split ring 42. The outer end of the collar has an inwardly extending flange 43, the rim of which will hug or embrace the tone arm end 44 for a sound-tight fit when mounted in position. Yet the length of outlet sleeve 26 fits so securely upon the length of tone arm over which it is telescoped that a firm non-wobbling mechanical fit is provided. In the specific construction described, the reproducer base member is preferably also cast integral with an outstanding wall 45 concentric with sleeve 26 and affording a stop for the flange 41 of the rubber collar which is protected and housed in the deep annular cavity determined between the sleeve 26 and the wall 45.

Inasmuch as the usual bayonet slot 46 of the tone arm is not accessible in a construction such as described, to the set screw ordinarily used for mounting the protruding mounting sleeve of a sound box in position, I have provided the construction shown, comprising a set screw 47 of considerable length inserted through the periphery of the sound box at a correspondingly thickened part 48 thereof, into which the threaded portion 49 of the set screw is threaded. Set screw 47 has point 50 extending through a corresponding aperture 51 in the rubber collar 46 and through the mounting sleeve 26 into the bayonet slot 46 of the tone arm. Of course, in constructions in which the tone arm is not provided with a bayonet slot, the end of a corresponding screw 47 would merely be

jammed against the surface of such tone arm.

My diaphragm being of thin material and vulnerable construction, it should be protected against tampering by insertion of a pencil or other sharp object. The anti-blaring cover 31 described, serves to thus protect the face of the diaphragm at the impedance chamber. To prevent tampering from the mounting side of the diaphragm, a spider construction 52 is preferably cast integral with the reproducer base at the inner end of the mounting sleeve 26 thereof.

In a preferred embodiment, the readily adjustable closure plate 31 is provided with a finger 53 movable between stops 54 and 55 along a scale 56 on the fixed cover 13. This scale may consist of an ordinary sequence of numbers, such as shown, 1 to 5. There will be a setting of the valve which will produce the best results in such use. This setting may be ascertained by experience and in the case of phonograph records, it may be marked directly thereon, so that the player will readily set the reproducer for an impedance value corresponding to that noted on the record.

In Fig. 9 is shown a modified embodiment of phonograph sound box which lacks the impedance adjusting feature, and has the anti-blare sound softening protective cover 60. This cover is similar to cover 32 in Fig. 2, except that instead of having spring fingers, the metal of the cover plate is provided with radiating pairs of slits 61 terminating short of the rim thereof and the metal between the slits is embossed upward or outward to form bridging straps 62 which function in the manner previously described.

In Fig. 10 is shown in elevation merely, a radio speaker unit, the interior of which is not material to this invention, and including the usual electromagnetically operating diaphragm (not shown). This unit embodies a closure provided with an anti-tampering flat cover plate 64 identical with that shown in Fig. 9. Fig. 10 clearly shows in side elevation the curved formation of the bridging straps 62' shown in plan in Fig. 9.

In Fig. 11 is shown a cover plate of the same general principle of that of Fig. 9 with the exception that the protective sound reflecting bridging straps 65 do not radiate, but are arranged parallel to each other and of variable lengths corresponding to the lengths of chord of the circular cover 66 along which they extend.

In Fig. 12 is shown another slight modification in which the bridging straps 67 are formed between pairs of slits arranged in an ornamental manner, preferably concentrically of the cover plate.

I claim:

1. A sound reproducer comprising a cas- 130

ing having a diaphragm therein and affording a compression chamber at one face of the diaphragm and an impedance chamber at the other face of the diaphragm, said latter chamber having a wall enclosing said face and having openings in a part of said wall, said openings having cover portions associated therewith which permit emission of sound only by lateral diffusion.

2. A sound reproducer comprising a casing having a diaphragm therein and affording a compression chamber at one side of the diaphragm and an impedance chamber at the other side of the diaphragm emitting sound vibrations, said impedance chamber having a wall perforated for emission of sound and provided with deflecting means to direct the sound waves passing through said perforations in a devious path from the inner to the outer face of the wall, said compression chamber having a mounting device for attachment of a sound amplifying system and means rendering said connection sound tight.

3. A sound reproducer comprising a cylindrical casing having a base and a cover, a diaphragm having its rim clamped in place between said case elements, said base comprising a compression chamber provided with a mounting sleeve, said cover comprising an impedance chamber and having a face plate perforated for emission of sound and provided with deflecting means to direct the sound waves passing through said perforations in a devious path from the inner to the outer face of the plate.

4. A sound reproducer comprising a cylindrical casing having a base and a cover, a diaphragm having its rim secured in place between said casing elements, said base comprising a compression chamber provided with a rigid mounting sleeve to fit a sound conduit, said cover comprising an impedance chamber, having a wall perforated for emission of sound and provided with deflecting means to direct the sound waves passing through said perforations in a devious path from the inner to the outer face of the wall, said rigid mounting sleeve having a yielding annular part associated therewith to snugly engage said sound conduit.

5. A sound reproducer comprising a cylindrical casing having a base and a cover, a diaphragm having its rim clamped in place between said casing elements, said base comprising a compression chamber provided with a rigid mounting sleeve to fit for direct contact with a sound conduit to be encircled thereby, said cover comprising an impedance chamber and having a face plate perforated for emission of sound and provided with deflecting means to direct the sound waves passing through said perforations in a devious path from the inner to the outer surface of said plate, said rigid mounting sleeve hav-

ing a yielding annular part associated therewith to snugly engage said sound conduit.

6. A sound reproducer comprising a casing having a thin vulnerable diaphragm therein, said casing having means at one face of said diaphragm for attachment thereof to a sound conduit and having pairs of slits at the opposite face of said diaphragm determining impedance bridges therebetween for devious communicating passage from the inside of the casing to the external air, the entire area of said slitted portion appearing closed when viewed from a direction normal thereto.

7. A sound reproducer comprising a casing including a base and a cover, said base having means for attachment thereof to a sound amplifier system, a diaphragm clamped at its rim between said base and said cover to prevent communication of air from one side to the other thereof, the cover member including a plate, the metal between adjacent slits in said plate determining bridging members pressed out of the general plane of the plate to prevent direct manual access from the exterior to the enclosed diaphragm while affording communication to the exterior.

8. A sound reproducer comprising a flanged base member, a cover member having its rim countersunk therein, a diaphragm of thin metal having its rim clamped between said base and cover members and affording an air tight closure preventing direct passage of air from one side to the other side of said diaphragm within said reproducer, said base having a neck portion adapted for attachment to a sound conduit, said cover having a plate with radiating pairs of slits, the metal between said slits being bent outward beyond the plane of the plate to determine substantially temper proof openings.

9. A sound reproducer including a diaphragm, a casing therefor, having means for connection at one side of the diaphragm to a sound conduit, and adjustable closure means for the side of said casing opposite that of said sound conduit for varying the impedance of the reproducer without substantial variation of the volume of sound emitted from the amplifying system.

10. A sound reproducer comprising a cylindrical case, a thin metal diaphragm therein secured at its rim with an air tight seal, one side of said casing having means for attachment to a sound conduit, the other side of said case including a plurality of slots, and a manually adjustable closure for said slots by which the effective area of said openings may be varied.

11. A sound reproducer comprising a cylindrical case, a thin metal diaphragm therein secured at its rim with an air tight seal, the casing part at one side of said diaphragm having means for attachment to a sound con-

duit, the casing part at the other side of the diaphragm constituting a compression space and including a closure conformed to preclude insertion of an object such as a pin into contact with the diaphragm, said closure including a manually adjustable member for varying the effective area of communication from the compression space to the exterior of the reproducer.

10 12. A sound reproducer comprising a cylindrical case having a base portion for attachment to a sound conduit, a cover portion and a diaphragm clamped at its rim between said base and cover and hermetically sealed
15 thereat to prevent communication of air within said case from one side to the other of said diaphragm, said cover including a circular plate with openings therein and a closure plate having corresponding openings
20 and manually adjustable to determine the effective area of communication to the exterior.

13. A sound reproducer comprising a cylindrical case having a base portion for attachment to a sound conduit, a cover portion and a diaphragm clamped at its rim between said base and cover and hermetically sealed thereat to prevent communication of air within said case from one side to the
30 other of said diaphragm, said cover including a circular plate with openings therein and a rotatably mounted closure plate having corresponding openings and manually adjustable to determine the effective area of
35 communication to the external air, and protective means closing said openings and substantially preventing insertion of an object such as a pin while maintaining the effective open communication to the exterior.

40 14. A sound reproducer comprising a cylindrical base, a cover therefor, a diaphragm clamped at its rim between said base and said cover and effecting an air tight closure between the transmission chamber at one
45 side thereof and the impedance chamber at the other side thereof, said transmission chamber having means for connection thereof to a sound amplifying system, said impedance chamber having a cover with a plurality of slots therein, an adjustable closure
50 disk pivotally mounted on said cover and having corresponding slots, the effective open area of said slots being determined by the manual adjustment of said closure plate, and a protective plate secured with respect
55 to said cover and having outwardly bent fingers superposed over the openings and substantially preventing insertion of a pointed object through said openings.

60 15. A sound reproducer including a case having a diaphragm fixed therein at its rim, means for connecting one side of said case to a sound conduit, the space within said reproducer at the opposite side of said diaphragm determining an impedance chamber,
65

said impedance chamber including a cover portion provided with a plurality of integral curved bridging straps determining lateral openings for communication with the external air and presenting a substantially
70 closed uninterrupted surface in plan view, said bridging straps serving to soften the performance of the instrument.

16. A sound reproducer comprising a base, a cover and a diaphragm clamped at its rim
75 between said base and said cover, a substantial part of the central area of said diaphragm extending to one side of the plane of said rim, said base member having its central part extending inward beyond the plane
80 of said rim and having a mounting sleeve, substantially the entire length of which extends between the extreme lateral faces of the reproducer case.

17. A sound reproducer comprising a case
85 having a base and a cover, a thin metal diaphragm clamped at its rim between said base and said cover the main portion of the central area of said diaphragm extending to one side of the plane of said rim and being
90 thereby stiffened to move in vibration substantially as a rigid unit with respect to the hinge rim, said base portion having a central hub part extending inward into the deflected part of the diaphragm and a central mounting sleeve substantially countersunk within
95 the end face of the case.

18. A sound reproducer comprising a case having a base and a cover member, a thin metal diaphragm clamped at its rim between
100 said members, the main area of said diaphragm within said rim being W-shaped in axial cross-section, the base member being conformed with a hub extending inward within the annular crater space determined
105 by the central part of the diaphragm, and having a central mounting sleeve the main length of which extends between the end faces of the case.

19. A sound reproducer comprising a case
110 having a diaphragm fixed therein at its rim, said case having a mounting exit sleeve for attachment to a sound delivery conduit, and said diaphragm having an integral crater conformation W-shaped in axial cross section
115 the inner part of which will project into said sound conduit, some of the vibrations originating near the outer part thereof.

20. A sound reproducer comprising a casing, a diaphragm fixed therein and clamped
120 to establish an air tight seal between the air chambers within the case at opposite faces of the diaphragm and having a conformation symmetrical with respect to its center, the case having a delivery outlet, the end
125 face of the case extending from the rim of the diaphragm to said opening diverging with respect to the diaphragm to afford an amplifier chamber within the reproducer.

21. A sound reproducer comprising a cas-

ing, a diaphragm fixed therein and clamped to establish an air tight seal between the air chambers within the case at opposite faces of the diaphragm, said diaphragm having a conformation symmetrical with respect to its center, the case having an outlet sleeve the end face of the case extending from the rim of the diaphragm to said sleeve diverging with respect to the diaphragm to afford an amplifier chamber within the reproducer, said diaphragm having a reversely extending stiffening part affording a reflector for projecting into the outlet sleeve, sound waves originating near the rim of the diaphragm and impinging on the stiffening part.

22. A sound reproducer comprising a case having a base member and a cover member, a thin sheet metal diaphragm clamped at its periphery between said case parts, said diaphragm being conical in form with the apex portion thereof reversely bent inward into the base portion thereof, the base portion of the case having a crater shaped part extending inward into the generally annular space determined between the base and the apex part of the diaphragm, and a mounting sleeve integral with said base extending outward from said crater part, with the main length thereof between the end faces of the case.

23. A sound reproducer comprising a case having a diaphragm fixed therein, a mounting part for said case to communicate with an amplifying system, said case being also open to the air at the side of the diaphragm opposite that facing said mounting part, means within the mounting part preventing tampering with the diaphragm while affording a free exit for sound waves, and means at the opposite side of the casing for likewise preventing tampering with the enclosed diaphragm.

24. A sound reproducer comprising a casing having a base member with an integral axial mounting tube countersunk within the outer face of the base member, a spider structure unitary therewith to prevent tampering, a vulnerable thin metal diaphragm within said case member, a closure member secured to said case member and clamping the rim of said diaphragm thereagainst, said diaphragm being formed to follow the general contour of the contiguous face of the base member.

25. A sound reproducer comprising a casing having a base member with an integral axial mounting tube countersunk within the outer face of the base member, a spider structure unitary therewith to prevent tampering, a vulnerable thin metal diaphragm within said case member, a closure member secured to said case member and clamping the rim of said diaphragm thereagainst, said diaphragm being formed to follow the general contour of the contiguous face of the

base member, said closure member having a shield plate appearing closed in plan view and including outstanding parts overlapping lateral openings for communication of the interior of the reproducer with the external air.

26. A sound reproducer comprising a base or support member having a sleeve hub of material sufficiently rigid and of diameter and length sufficient for mechanically secure mounting telescoping engagement directly upon a sound conduit, and a yielding annulus associated with said sleeve hub to be compressed by and to snugly engage a part of the sound conduit.

27. A sound reproducer comprising a base, or support member having a sleeve hub for telescopic fit over a sound conduit and an elastic collar member about said hub having an inturned part beyond said hub overlapping the end thereof and determining a substantially sound-tight connection with respect to the conduit.

28. A sound reproducer comprising a casing having a vibratory sheet metal diaphragm enclosed therein, said casing including an integral mounting sleeve for attachment to a sound conduit, a rubber sleeve thereabout, means securing said rubber sleeve in position, said sleeve having an inturned rim in contact with the extreme edge of said hub for effecting a sound-tight engagement by circumferential engagement with the conduit.

29. A sound reproducer comprising a case having an integral countersunk conduit embracing sleeve, an integral wall concentric with said sleeve and spaced therefrom, a rubber collar having a base flange filling the annular space between said sleeve and said wall, a wire against said base flange securing said collar in position, the outer edge of said collar being inturned over the inner edge of said sleeve to afford a sound-tight engagement with the tube over which the reproducer hub is to be telescoped.

30. A sound reproducer for a phonograph comprising a diaphragm enclosing casing, the base of said casing having a mounting sleeve countersunk thereinto, the diaphragm being of a form to accommodate the inner part of the countersunk portion, and a securing screw extending substantially from the rim of the sound producer case radially inward through the hub for engagement with the end of the tone arm to which the sound reproducer is affixed.

31. In a phonograph, a sound box comprising a base, a cover, a diaphragm W-shaped in axial cross-section, and clamped at its rim between said base and said cover, said base having a countersunk inwardly extending portion to follow the general contour of said diaphragm and including a hub portion, substantially the entire length of

which is between the end faces of the casing, and a long set screw threaded from the perimeter of the casing through the hub for extension into the bayonet slot of the tone arm mount.

32. In a phonograph, a sound box comprising a base, a cover, a diaphragm W-shaped in axial cross-section and clamped at its rim between said base and said cover, said base having a countersunk inwardly extending portion to follow the general contour of said diaphragm and including a mounting sleeve portion, substantially the entire length of which is between the end faces of the casing, a long set screw extending from the perimeter of the casing through the sleeve for protrusion at its inner end into the bayonet slot of the tone arm mount, and a rubber collar encircling said hub and having an inwardly extending rim for snug engagement with the tone arm to render the construction sound-tight thereat, said set screw extending through a corresponding aperture in the elastic collar.

33. A sound reproducer for a phonograph comprising a base member, a cover member, a diaphragm having its rim clamped between said members, said diaphragm being conical in form with the apex thereof reversely bent inward into the base of the cone, said cover member being of countersunk formation to follow the general contour of the conical diaphragm and including a mounting sleeve for engagement with the end of the tone arm, said mounting sleeve being substantially entirely between the limiting end faces of the sound box case, a set screw extending inward from the perimeter of said casing through the thickness thereof and through the sleeve into effective locking engagement with the tone arm, means for preventing leak of sound between the tone

arm and the sound box, said means comprising an elastic collar encircling said hub, a wire ring securing said collar in position, said collar having an inturned flange at its outer end overlapping the extremity of the sleeve for engagement with the tone arm, said collar having a perforation through which the set screw protrudes, and a protective spider integral with the sound box base for engagement against the extremity of the tone arm, said cover having a protective shield to prevent tampering with the enclosed diaphragm, and said shield having out-standing bridging parts the edges of which define lateral openings for communication with the external air.

34. A sound reproducer comprising a casing having a vibratory diaphragm held therein at its rim, said diaphragm having a substantial part of the area thereof extending out of the plane of the rim thereof, the casing having a conformation at one face thereof to follow the general contour of the diaphragm area, whereby the effective area of the diaphragm and of the chamber determined between said casing face and the diaphragm is materially larger than that of the casing.

35. A sound reproducer comprising a base or support member having a sleeve hub of material sufficiently rigid and of sufficient length for mechanically secure mounting fit with respect to a sound conduit, and a yielding annulus associated with said sleeve hub to be compressed by and to snugly engage a part of the sound conduit, beyond and of length shorter than that of said sleeve hub.

Signed at New York city in the county of New York and State of New York this 13th day of August, A. D. 1926.

MAXIMILIAN WEIL.