

April 23, 1929.

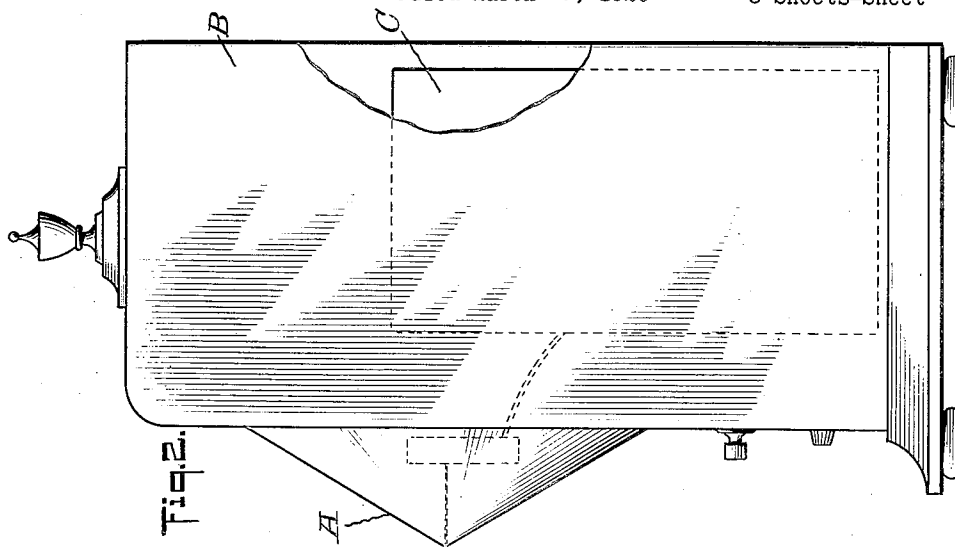
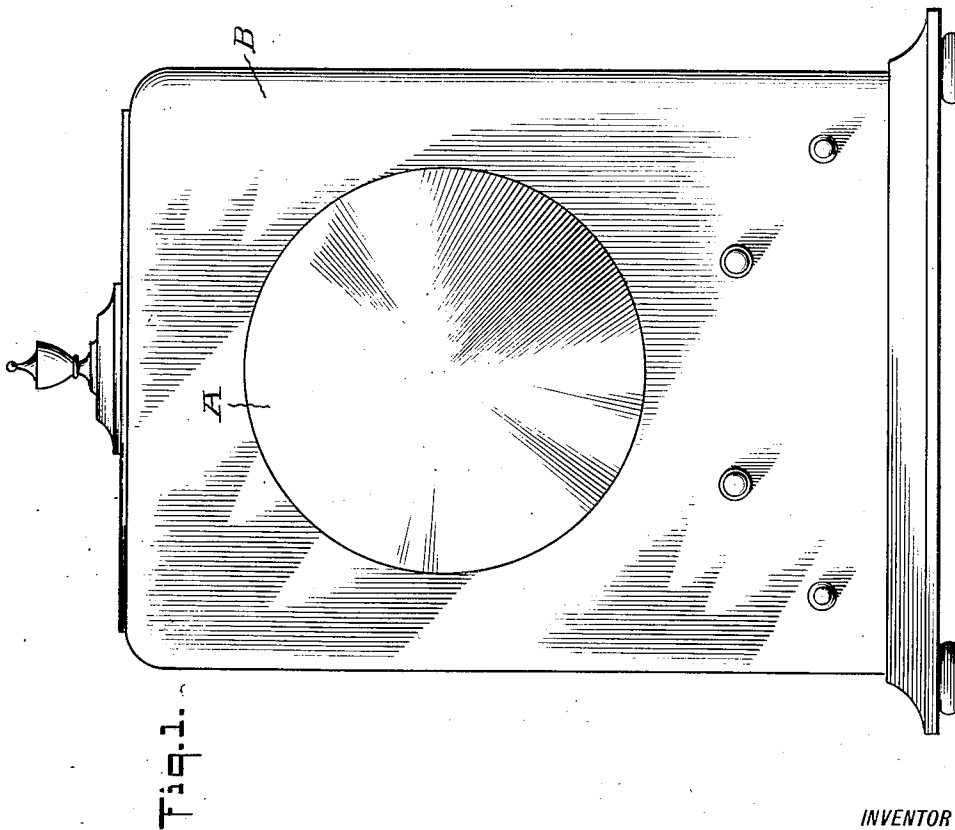
R. E. THOMPSON

1,710,035

SOUND REPRODUCING INSTRUMENT

Filed March 13, 1926

3 Sheets-Sheet 1



INVENTOR  
ROY E. THOMPSON.

BY  
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April 23, 1929.

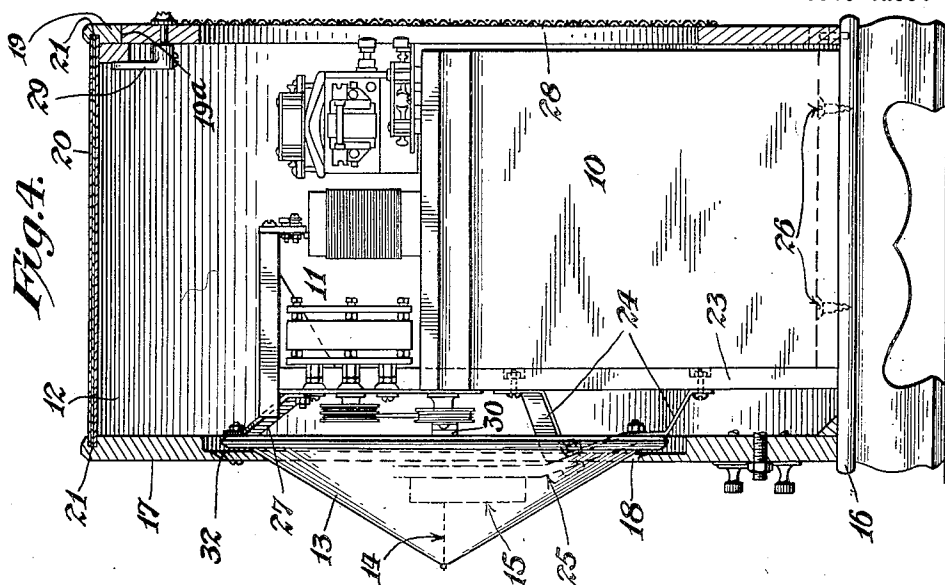
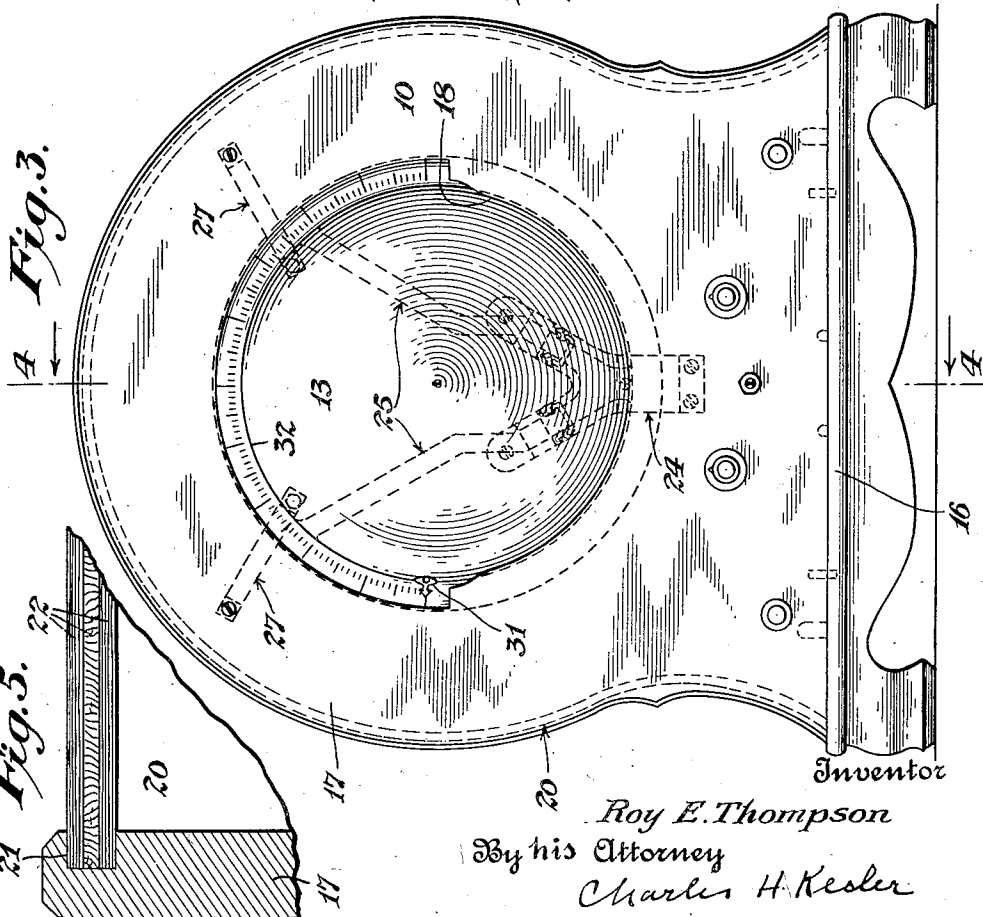
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SOUND REPRODUCING INSTRUMENT

Filed March 13, 1926

3 Sheets-Sheet 2



Inventor

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By his Attorney

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April 23, 1929.

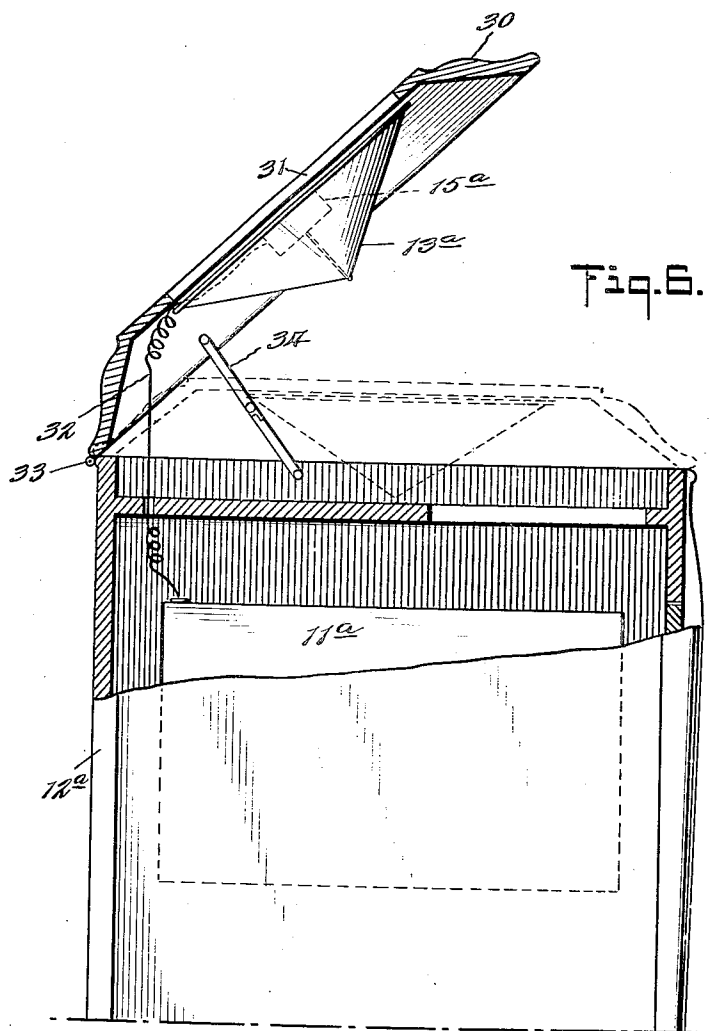
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SOUND REPRODUCING INSTRUMENT

Filed March 13, 1926

3 Sheets-Sheet 3



INVENTOR  
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Patented Apr. 23, 1929.

1,710,035

# UNITED STATES PATENT OFFICE.

ROY E. THOMPSON, OF NYACK, NEW YORK.

SOUND-REPRODUCING INSTRUMENT.

Application filed March 13, 1926. Serial No. 94,389.

My invention relates to improvements in sound reproducing means in which a large diaphragm, such as that generally known as a "cone" reproducer, is disposed in exposed relation to the air and is adapted to be mechanically or electrically actuated to cause the same to vibrate; and said invention has for its object more particularly to provide a simple, inexpensive and efficient instrument which serves to improve the operation of the diaphragm incorporated therewith.

Further, said invention has for its object to provide an instrument of the character specified in which means is employed for improving the operation or tonal range of the diaphragm, and in which said means is such as to effect useful economies in the cost of manufacture and in the space required for the sound reproducer together with the apparatus for actuating the same, or for supplying the sound energy thereto.

Further, said invention has for its object to provide an instrument of the character specified in which the same means serves to improve the tonal range of said diaphragm and to enclose or house the apparatus or mechanism for actuating said diaphragm or reproducer.

Further, said invention has for its object to provide an instrument of the character specified which serves to improve the tonal range of the sound reproduction and to amplify or enhance the sound produced without causing echoing or other effects tending to detrimentally affect the quality of said sound.

Further, said invention has for its object to provide an instrument of the character specified in which a sound chamber is associated with the diaphragm for the purpose of improving the operation thereof and the quality of the sound produced thereby.

Further, said invention has for its object to provide an instrument of the character specified in which the casing, or a portion thereof, for receiving the apparatus or mechanism for actuating the diaphragm serves as a baffle or reflector around the edge of said diaphragm for the purpose of improving the operation thereof.

Further, said invention has for its object to provide an instrument of the character specified in which a casing is associated with said diaphragm, and serves as a sound-

ing board or reflector and as a sound chamber therefor for the purpose of improving the quality of the sound produced by said diaphragm.

Further, said invention has for its object to provide an instrument of the character specified in which the casing or cabinet serving to receive the radio or other apparatus or mechanism for actuating the large diaphragm is usefully and economically employed in connection with said diaphragm to form a sound chamber and a reflector or sounding board therefor, whereby to improve the tonal range of said diaphragm, and the quality of the sound produced thereby.

Further, said invention has for its object to provide an instrument of the character specified in which the sound reproducer or diaphragm and the apparatus for actuating the same or for supplying the sound energy thereto are combined to form a unitary structure, and in which the casing or cabinet for enclosing said apparatus is economically employed to form a baffle and reflector about the edge of said diaphragm and a sound chamber at the rear thereof for the purpose of improving the tonal range of said diaphragm and enhancing or amplifying the resulting sound.

Further, said invention has for its object to provide an instrument of the character specified in which the casing or cabinet associated with said diaphragm is constructed to permit of its vibration in response to the vibration of said diaphragm whereby to reinforce the sound produced.

Further, said invention has for its object to provide an instrument of the character specified in which the reproducer or diaphragm together with the apparatus or mechanism for actuating the same and the cabinet or casing serving to enclose said parts may be readily assembled.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends, my invention consists in the novel details of construction, and in the combination, connection and arrangement of parts hereinafter more fully described and then pointed out in the claims.

In the accompanying drawings showing an illustrative embodiment of the invention;—

Fig. 1 is a front elevation showing one

form of apparatus constructed according to and embodying my said invention;

Fig. 2 is a side elevation thereof with parts broken away;

Fig. 3 is a front elevation showing the invention embodied in a radio receiver;

Fig. 4 is a sectional elevation thereof on the line 4-4 of Fig. 3;

Fig. 5 is an enlarged detailed view of a portion of the casing; and

Fig. 6 is an elevation showing a modification.

In my invention I employ a relatively large diaphragm, such as that known as the "cone" reproducer.

Heretofore, in practice, such diaphragms were employed with the opposite faces thereof fully exposed to permit of the free vibration thereof in unconfined air. This was deemed the best practice, because diaphragms of such ample area, when actuated, acted upon a sufficient quantity of air to produce the required loud sound without employing amplifying means in connection therewith. Hence, the use of horns or the like which, because of structural or acoustical defects therein, impaired the quality of the sound produced, was considered unnecessary.

I have discovered, however, that the operation and particularly the tonal range, of a large diaphragm may be improved by employing in connection therewith a casing or cabinet, which, preferably, is economically utilized for receiving the apparatus or mechanism for actuating said diaphragm or for supplying the sound energy thereto, as a sounding board, baffle, or reflector disposed around the edge of the diaphragm, or as a sound chamber, or as a baffle or reflector and sound chamber combined.

Referring to Figs. 1 and 2, illustrating the invention in its simplest form, the diaphragm A is shown disposed within an opening in one wall of a cabinet or casing B, which is preferably economically utilized to receive the usual apparatus or mechanism, such as that employed in radio receivers, phonographs or the like, for supplying energy to the diaphragm in the usual manner, and indicated diagrammatically at C.

The front wall portion of the cabinet B surrounding the edge of the diaphragm A serves to reflex forwardly the sound waves produced by the diaphragm at the front thereof, and said front wall portion together with the side wall portions of the cabinet B serves as a baffle or barrier to prevent "leakage" of the sound impulses around the edge of the diaphragm.

The front wall portion of the casing B and the side wall portions thereof, which extend rearwardly from the front wall portion, not only provide a barrier sufficient in extent to effectively retard or resist leakage of the

sound impulses around the edge of the diaphragm, but also this arrangement, in which the baffle portions are disposed angularly relative to each other, effects a useful economy in the space required therefor and in the cost of manufacture thereof, particularly when said casing is employed to receive the apparatus or mechanism for actuating the diaphragm, or for supplying energy thereto.

In the preferred embodiment of my invention I also employ the casing B to form at the rear of the diaphragm A what I call or term herein a "sound chamber". This sound chamber has been found by actual trial to further enhance the effect or operation of the sound reproducer, improving the quality and clearness of the sound throughout the frequency range without causing echoing or other detrimental effects. Further, the presence of the actuating mechanism or apparatus C within said sound chamber does not affect the action thereof in improving the operation of the diaphragm.

One explanation of the effect of said sound chamber is that the partially confined air within said sound chamber, the latter preferably being open at the rear, is more effectively "gripped", as it were, by the diaphragm than if the air on both sides of said diaphragm was entirely unconfined. I do not desire, however, to bind myself to this theory of the action of said casing. It is sufficient that the use thereof results in improved operation.

The action of the instrument may also be further improved by constructing the walls of the casing B, or portions thereof, relatively thin, so that the same, responding to the vibrations of the diaphragm, serve to reinforce the sound produced.

For the purpose of rendering the disclosure of the invention more complete, at Figs. 3 to 5 I have illustrated a radio receiver 10 embodying my said invention which is in actual use. The circuits 11 thereof, which may include the usual electrical elements, such as the detector and amplifying tubes, transformers, condensers, batteries, etc., are disposed within the casing or cabinet 12 corresponding to and functioning like the casing B above described. The diaphragm 13 associated with said casing 12 is actuated through the cord or wire 14 from the usual cone actuating mechanism 15 controlled by the electrical impulses from the circuits 11. The casing 12 serves to improve the tonal range of the diaphragm 13 and the quality of the sound produced in the manner set forth in connection with Figs. 1 and 2.

For this purpose, the casing or cabinet 12, as illustrated, consists of a base 16, a front wall 17, having an opening 18 therein, in which the vibratory member or diaphragm 13 is disposed, a rear wall 19 having an

opening 19<sup>a</sup> therein through which access may be had to the casing, and a relatively thin intermediate top and side wall 20 secured in the recesses or grooves 21 in the front and rear walls. The wall 20 preferably consists of a plurality of thin plies 22 of veneer disposed one upon the other, and conformed in shape to that of an arch. The plies 22 may consist of a suitable wood, such as mahogany, the grain of the outer plies running from front to rear and the grain of the intermediate ply running circumferentially of the casing in order to provide a construction which will not split. The wall 20 is made thin so that the casing 12 vibrates in response to the vibration of the diaphragm and serves to enhance the effect thereof. In actual practice, the thickness of each ply has been made about 1/27 of an inch.

The front wall 17 extending about the edge of the diaphragm 13 serves as an efficient sound reflector and together with the wall 20 at the rear thereof forms a baffle serving to prevent or reduce leakage of the sound impulses around the edge of the diaphragm, whereby to improve the total range thereof. The casing 12 also serves to form a sound chamber at the rear of the diaphragm 13 for the purpose described in connection with Figs. 1 and 2.

The diaphragm 13 is preferably secured to the support 23 on which the radio circuits 11 are mounted by means of the bracket 24 attached to said support and to the diaphragm frame or spider 25. The support 23 with the parts thereon may be readily placed within the casing 12 through the opening 19<sup>a</sup>, and secured in position by means of the screws 26 and brackets 27. The casing 12 is closed against access thereto by means of the reticulated or open member 28 disposed within the opening 19<sup>a</sup> and secured in position by the fastening device 29, whereby the air is only partially confined within the casing 12 to permit of the freer action of the diaphragm.

In operation, the receiver 10 is tuned to the desired wave length by suitable means, such as, for example, the member or arm 30 connected at one end to the tuning element or elements and having at its opposite end a finger piece 31 operating in a slot 32 formed between the scale shown and the upper portion of the edge of the diaphragm 13. The signals received, when amplified and detected, are rendered audible by means of the reproducer 13.

At Fig. 6 is shown a modified form of instrument in which the diaphragm 13<sup>a</sup> is supported upon the cover or lid 30 of the cabinet or casing 12<sup>a</sup> serving to receive the apparatus or mechanism 11<sup>a</sup> for supplying energy to the actuating means 15<sup>a</sup> for the diaphragm 13<sup>a</sup>. The diaphragm is preferably disposed upon the inner side of said lid,

the latter having an opening 31 therein at the rear of the diaphragm to prevent the confinement of air during the vibration of said diaphragm. The apparatus 11<sup>a</sup> is electrically connected with the diaphragm actuating element 15<sup>a</sup> by means of the flexible lead 32. The lid or cover 30 is preferably hinged, as at 33, to permit of the same being raised to the position shown in full lines. The cover is held in elevated position by the usual means 34. In the modification of the invention shown at Fig. 6 the lid 30 is also economically employed as a baffle or barrier for improving the tonal range of the diaphragm 13<sup>a</sup> in the manner above described, although the casing 12<sup>a</sup> thereof does not in this form serve as a sound chamber. When the lid is closed, as shown in broken lines, the diaphragm 13<sup>a</sup> is disposed within the confines of the casing 12<sup>a</sup> out of the way. Access may be made to the actuating mechanism or apparatus 11<sup>a</sup>, either through the top of the casing or through the front thereof, or both. The usual actuating members may be conveniently arranged upon or within said casing or cabinet 12<sup>a</sup> for controlling the apparatus therein.

My said invention provides a compact structure in which the sound reproducer or large diaphragm and the apparatus or mechanism for actuating the same or for supplying energy thereto are combined to form a unitary instrument, and in which the cabinet or casing serving to enclose or house the said apparatus or mechanism is economically employed either as a reflector and baffle, or as a sound chamber and baffle or reflector combined, whereby to improve the operation of said reproducer or diaphragm.

Having thus described my said invention, what I claim and desire to secure by Letters Patent is:

1. The combination of a large diaphragm, with a casing disposed about the edge of said diaphragm and providing a single sound chamber therefor at the rear thereof, serving to enhance the operation of said diaphragm throughout the frequency range thereof, and actuating means for said diaphragm disposed within said sound chamber.

2. The combination of a large conical diaphragm, with a casing disposed about the edge of said diaphragm and providing a sound chamber therefor at the rear thereof serving to enhance the operation of said diaphragm throughout the frequency range thereof; the wall portions of said casing which extend peripherally about said diaphragm consisting of relatively thin material responsive to the vibrations of said diaphragm.

3. The combination of a large diaphragm, with a casing having an opening in the wall thereof in which said diaphragm is disposed and an opening at the rear thereof; said

casing providing an open sound chamber at the rear of said diaphragm serving to enhance the operation thereof throughout its frequency range, and apparatus for actuating said diaphragm disposed within said sound chamber.

4. The combination of a large conical diaphragm, with a casing having an opening centrally in the front wall thereof in which said conical diaphragm is disposed and an opening at the rear thereof; said casing providing an open sound chamber at the rear of said diaphragm serving to enhance the operation thereof throughout its frequency range, and having the wall portions thereof which extend peripherally about said diaphragm composed of relatively thin material responsive to the vibrations of said diaphragm.

5. The combination of a large conical diaphragm, with a casing open at opposite ends disposed about the edge of said diaphragm and providing an open sound chamber at the rear of said diaphragm serving to enhance the operation thereof throughout its frequency range.

6. The combination of a conical diaphragm, and apparatus for actuating the same, with a cabinet having front and side wall portions and receiving said apparatus; said cabinet having an opening centrally in the front wall portion thereof in which said conical diaphragm is disposed and an opening at the rear thereof; and said front and side wall portions providing a baffle for improving the tonal range of said diaphragm, and a reticulated member across the opening at the rear of said cabinet.

7. The combination of a support, a diaphragm carried thereby, and apparatus for actuating said diaphragm carried by said support, with a cabinet having an opening therein to permit of the reception of said support and the parts thereon within the cabinet, and having an opening therein adapted to register with said diaphragm.

8. The combination of a support, a diaphragm carried thereby, and apparatus on said support for actuating said diaphragm, with a cabinet adapted to receive said support and the parts thereon; said cabinet having an opening in the front wall thereof adapted to receive said diaphragm, and an opening at the rear thereof, and a reticulated closure for said rear opening.

9. The combination of a cabinet including a base, a vertical front wall having an open-

ing therein, and a top and side wall composed of a plurality of plies of thin veneer, with a support disposed within said cabinet, a diaphragm carried by said support and aligned with said opening, and means carried by said support for actuating said diaphragm.

10. The combination of a cabinet including a base, a vertical front wall portion having an opening therein, and top and side wall portions composed of a plurality of plies of thin veneer conformed to the shape of an arch with the direction of the grain of the intermediate ply running angularly to the direction of the grain of the outer plies, with a large diaphragm disposed within said opening, and means within said cabinet for actuating said diaphragm; said cabinet providing a sound chamber at the rear of said diaphragm; and said wall portions about said diaphragm providing a baffle for improving the tonal range of said diaphragm, and for reinforcing the sound produced thereby.

11. The combination of a large conical diaphragm, and apparatus for actuating the same, with a cabinet receiving said diaphragm and said apparatus and having an opening thereon registering with said diaphragm; said cabinet providing a single sound chamber at the rear of said diaphragm serving to enhance the operation thereof throughout its frequency range, and having relatively thin top and side wall portions responsive to the vibrations of said diaphragm.

12. The combination of a large conical diaphragm, and apparatus for actuating the same, with a cabinet receiving said diaphragm and said apparatus, and having an opening thereon to permit of the reception of said diaphragm and apparatus within the same and an opening registering with said diaphragm; said cabinet providing an open sound chamber at the rear of said diaphragm, and having relatively thin top and side wall portions responsive to the vibrations of said diaphragm, and the wall portions about said diaphragm serving as a baffle for improving the tonal range of said diaphragm and for reinforcing the sound produced thereby.

Signed at Jersey City, in the county of Hudson and State of New Jersey, this 11th day of March, one thousand nine hundred and twenty-six.

ROY E. THOMPSON.

### DISCLAIMER

1,710,035.—*Roy E. Thompson*, Nyack, N. Y. SOUND-REPRODUCING INSTRUMENT.  
Patent dated April 23, 1929. Disclaimer filed October 22, 1931, by the patentee,  
assignee, *Hazeltine Corporation*, consenting.

Therefore, enters this disclaimer to claims 1 and 5 of said Letters Patent, to-wit:

He disclaims from claim 1 "the combination of a large diaphragm with a casing disposed about the edge of said diaphragm," except the said combination in which said casing is in effective contact with the peripheral edge of said diaphragm, whereby the passage of sound waves from one side to the other of said diaphragm is substantially eliminated.

He disclaims from claim 5 "the combination of a large conical diaphragm with a casing open at opposite ends disposed about the edge of said diaphragm," except the said combination in which said casing is in effective contact with the peripheral edge of said diaphragm, whereby the passage of sound waves from one side to the other of said diaphragm is substantially eliminated.

[*Official Gazette November 17, 1931.*]