Aug. 25, 1931. W. J. HANNA 1,820,137

MAXIMUM RANGE RADIO LOUD SPEAKER

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Fig. 1

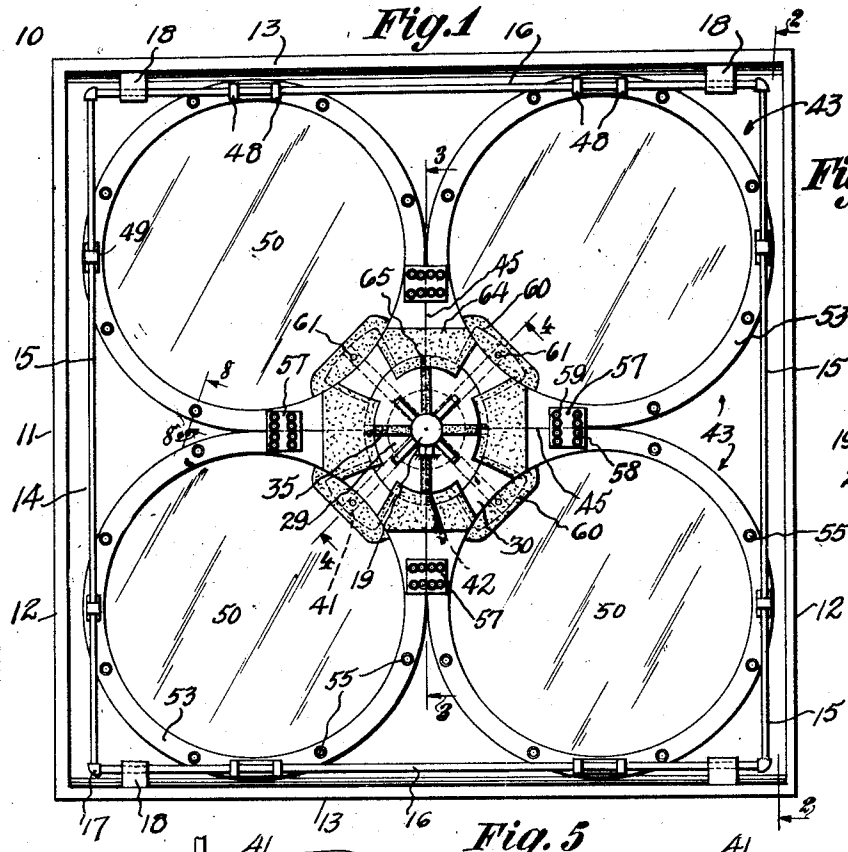


Fig. 2

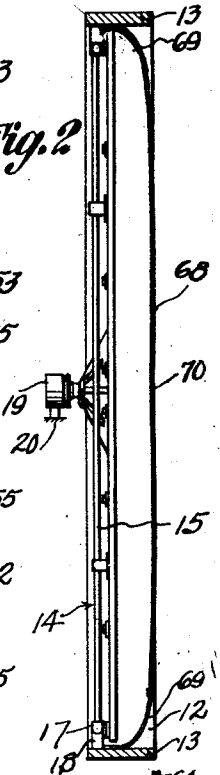


Fig. 3

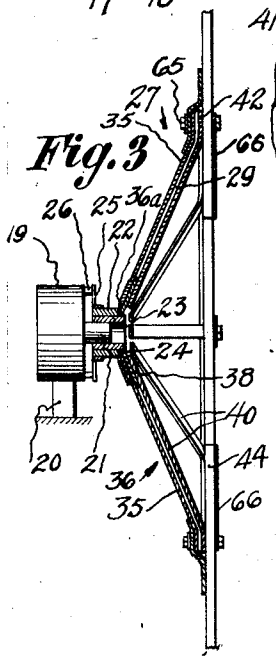


Fig. 5

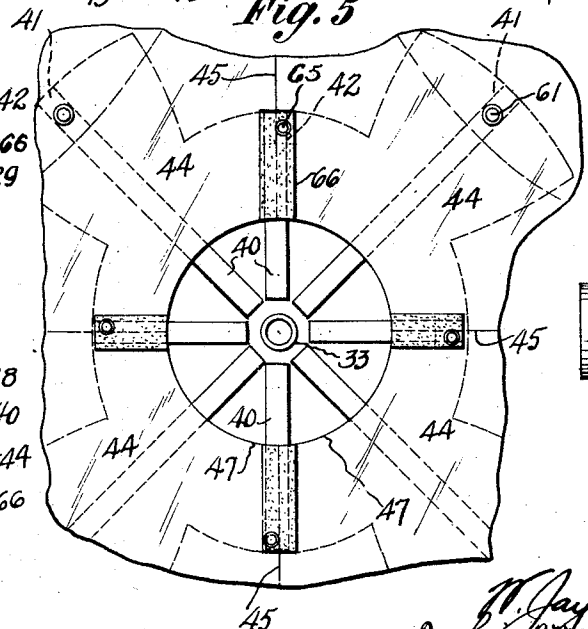
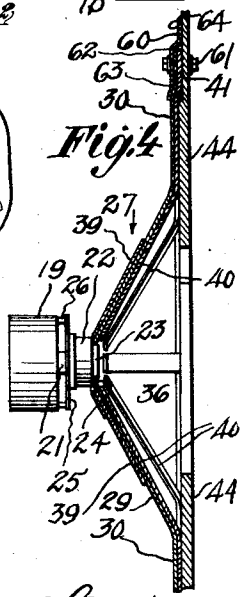


Fig. 4



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Fig. 6

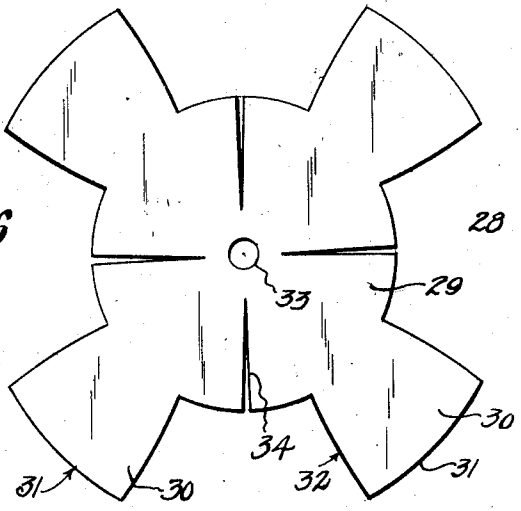


Fig. 7

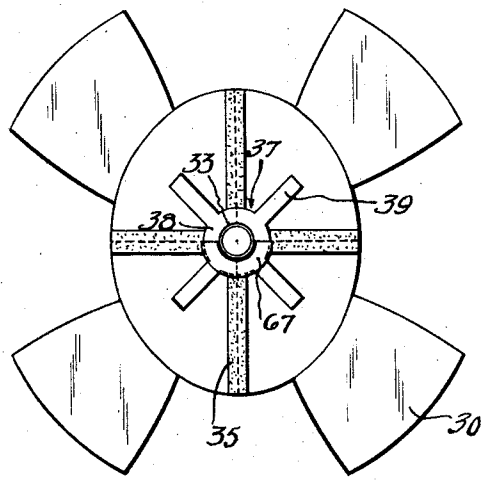
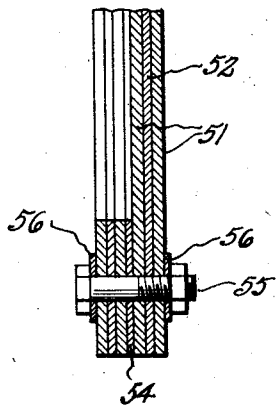


Fig. 8



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UNITED STATES PATENT OFFICE

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MAXIMUM RANGE RADIO LOUD SPEAKER

Application filed November 9, 1928. Serial No. 318,172.

This invention relates to radio loud speakers.

One object of this invention is to provide a device of the character described having a maximum range of tone reproduction and which is capable of generating sufficient volume for a hall of large capacity without distortion of the music, and with a delicate sound reproduction, and which may also be used in the average sized home, or even in a single room, with the highest degree of clarity.

Another object of the invention is to provide a device of the nature set forth which is especially adapted to accurately reproduce the bass notes in music.

Another object of the invention is the provision of an improved device of the type mentioned, the same having a sound reproducing diaphragm operated by a speaker unit having a large travel, or the like, for a vibrational movement of all parts of the diaphragm, the latter including a central area having a large range, including both high and low notes, and adjoining areas for the reproduction of low notes to which the central area readily transmits sound vibrations.

A further object of the invention is to provide an improved loud speaker which is of comparatively simple construction, as to its essentials, and which is reliable and efficient to a high degree in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawings, wherein like parts are designated by the same reference characters throughout the several views.

In the drawings:

Figure 1 is a front view in elevation of a device embodying the invention.

Fig. 2 is a vertical section thereof taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical section taken on line 3—3 of Fig. 1.

Fig. 4 is a section taken on the line 4—4 of Fig. 1 at an angle of 45° with the vertical.

Fig. 5 is an enlarged fragmentary rear view in elevation of the central portion of the loud speaker.

Fig. 6 is a view of a blank of which the central portion of the speaker is made.

Fig. 7 is a view of the central portion of the loud speaker in detached position.

Fig. 8 is an enlarged sectional view taken on line 8—8 of Fig. 1.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawings, therefore, are submitted merely as showing the preferred exemplification of the invention.

Generally described, the device provided by my invention includes a radio speaker unit connected centrally to a light vibrating member, which is made of a material that is unaffected by moisture, as for example, a specially treated paper, or the like. This member, which may be termed a primary sounding medium is of any suitable form, and while it is shown herein as being slightly conical, its principal of operation is totally different from that of the well known cone speaker, it being an essential feature of this invention that the peripheral portion of the primary sounding medium transmit vibrations to a plurality of bass boards, which are of relatively extended size. In the cone speaker heretofore known, the bass vibrations are lost at the periphery of the cone. In this invention, the main sounding medium is of smaller area than that of the cone referred to, the peripheral portion that has heretofore been relied upon for the reproduction of bass notes being removed or used to transmit the bass notes to the bass boards, or secondary sounding medium. According to this invention, the central sounding mem-

ber is re-enforced and has improved engagement with the bass sounding boards for efficient transmission of vibrations. Pliable or fabric parts are used to avoid strains and to assure the best and clearest performance. All of the parts of the device are constructed to be unaffected by moisture.

Referring in detail to the drawings, 10 denotes a device embodying the invention. The same includes any suitable frame or support 11, in the nature of a box, and comprising vertical and horizontal members 12 and 13, which may consist of wood and are interconnected by any practical fastening means. Within the frame 11, is a metallic supporting structure 14, which is made of vertical and horizontal tubes 15 and 16 that extend in proximity to and in parallel relation with the members 12 and 13, and are interconnected at their ends by the elbows 17. Fastening clips or brackets 18 secure the tubular support 14 to the frame 11.

Centrally positioned with respect to the frame 11, is a speaker unit 19, which is rigidly mounted on any suitable support 20. The axis of the unit 19 is horizontal, and it includes an armature 21, having mounted thereon a plurality of collars 22 and 23, the former being outside of the latter, and shorter to form a shoulder 24, for a purpose hereinafter described. The said collars are fastened together and to the armature in any suitable manner, as, for instance, by means of an adhesive. A flat spring 25 having a ring portion to engage the collar 22, and a plurality of narrow tongues attached to the unit at 26, supports the armature construction and is capable of a high degree of lateral deflection to permit the requisite axial movement of the armature. The construction as it relates to the unit is conventional, and is described herein to clearly indicate the cooperation thereof with my invention.

Connected to the armature is a primary sounding medium 27. This is of slightly conical shape, and is made of a material that is unaffected by moisture. Without desiring to limit myself, I may state that paper which is used in the making of patterns for clothing has been found highly satisfactory. As shown in Fig. 6, I construct a blank 28, having a central circular portion 29, from which extend at angles of forty-five degrees four projecting flap-like portions 30. The outer edges 31 of the latter lie along a circle concentric with 29, and the side edges 32 thereof are substantially radial. In the center of the blank is a hole 33, and cut in vertical and horizontal directions in the central portion 29 are the slits 34, whose inner ends are in spaced relation to the hole 33. On bringing the slits together as shown in Fig. 7, the conical form referred to is produced, and preferably the cone is slightly deformed into an oval shape in cross section.

To hold the device 27 in the conical form referred to, the slits 34 are spanned by pliable or fabric strips 35 that are secured by adhesive, and extend to the edge of the conical section 36. To re-enforce the conical section, a metallic device 37, which is made of aluminum, or the like, is formed of a piece of plane thin metal, which is cut with a central ring portion 38, from which radiate a plurality of arms 39. The device 37 is formed into a conical shape, so as to be adapted to be applied to the section 36, and secured thereto, as, for instance, by means of adhesive. The ring portion 38 extends about the hole 33, while the arms 39 are disposed at angles of forty-five degrees with the vertical and horizontal. As will be noted, the said arm 39 terminate in spaced relation to the edge of the section 36, and the fabric strips 35 begin at the annular ring portion 38.

The section 36 is secured to the speaker unit 19 be cement or adhesive applied at 36*a* at the shoulder 24, on which the adjacent edge portion of the said section is seated.

At the concave side of the section 36 is provided additional re-enforcement in the nature of a plurality of radially extending thin strips 40 of a material such as soft wood. These also serve to transmit sound vibrations from the primary to the secondary sounding medium, as hereinafter described. The sound strips 40 are eight in number and are disposed in equal angularly spaced relation, and directly opposite relative to the parts 35 and 39. The said wood strips are secured to the section 36 by fastening means such as adhesive, or the like. Certain of them extend with their ends 41 at the edges 31 of the portions 30, while others of them terminate at the periphery of the section 36 as shown at 42.

Disposed around the primary sounding medium 27, is a secondary sounding medium to accurately reproduce the low notes which are ordinarily lost or distorted. This same includes a plurality of bass boards 43, which are made of wood, and are substantially flat throughout. All of the said bass boards lie in a plane determined by the edge of the section 36. The bass boards are four in number, and are exact duplicates of one another. Each is substantially circular in form, except that each has a right angle extension 44 formed by the edges 45 that are tangent to the bass boards. The edges 45 referred to are in contact with one another, thus providing a continuous central bass board area. In the latter is preferably formed a circular opening 47, as shown in Fig. 5, which opening is concentric with the speaker section 36.

The bass boards 43 are supported from the tubular frame 14, by means of the clips 48 and 49 which are secured to the bass boards and engage the horizontal and vertical sections of the said frame. Between the bass

boards and the frame 14 at the said clips are placed pieces of paper or fabric. The bass boards are also fastened together as hereinafter described.

Each bass board 43 includes a main body 50, made of a plurality of layers of very thin wood, cemented together with a material that is unaffected by moisture. More particularly, each portion 50 consists of a plurality of outer layers 51 such as mahogany, between which is disposed a layer of soft wood 52, but the portion 50 of each bass board is comparatively very thin. Overlying the bass board portions 50, and extending along the edges thereof, are stiffening members 53 in the nature of annular members or rings, which are exactly like the portions 50 in cross section, being also made of a plurality of plies of wood. The said members 53 are coextensive in area with the portions 50, and accordingly extend to the central opening 47 hereinbefore described. Interposed between the bass board portions 50 and the said annular members are strips of paper 54, which are of the moisture proof character described in connection with the section 36. The ring members 53 are secured to the portions 50 by fastenings 55, which are in the nature of bolts. Felt washers 56 are placed under the heads and nuts of the said bolts.

Securing the bass boards 43 together are a plurality of fastening strips of wood 57, through each of which pass eight screws 58, four for each bass board. Felt washers 59 are used in conjunction with each bolt.

The section 36 of the loud speaker is positioned against the central portions of the bass board, and has coaction therewith to transmit sound vibrations thereto, as will now be described. Thus the extending members 30 are bent along a circle defining the edge of the conical portion of the loud speaker to lie flat against the bass boards. The wooden sounding strips 40 are similarly bent to lie in the same manner. Over the extending members 30 are placed pieces of felt 60 that are secured with adhesive to the bass boards and to the members 30. The latter and the wood strips 40 are fastened to the bass boards by screws 61, but are otherwise free to vibrate independently with respect to the bass boards.

The remaining portions of the section 36 of the loud speaker are secured to the bass boards by pieces of a pliable or felt material 62, that is cemented at 63 to the edge portion of the section 36, and also to the bass boards at 64. Fastening devices or screws 65 pass through the various bass boards 43 and secure the remaining wood strips 40. In the rear of the bass boards, may be placed felt strips 66, which are cemented to the bass boards at their edges 45 to secure the same together, the screws 65 passing also through these strips.

In order to divide the bass boards into regions, which are best adapted to take care of a certain range or quality in notes, to obtain the highest general efficiency, a strip of parchment, or the like, which is in the nature of a half of a frusto conical ring in shape, is shown at 67, at the part of the section 36. This piece of parchment is secured with adhesive to the ring portion of the metal device 37, and acts to slightly deaden the lower bass boards 43, so that these may take the very lowest notes.

In the rear of the device 10, may be formed a wall 68 of paper, the same being curved at 69 for better sound reflection and being fastened to the frame 12 in any suitable manner. An opening 70 facilitates inspection of the loud speaker.

In conclusion it is desired to emphasize that in this invention the full "excursion" of the unit is taken advantage of. Thus there is an appreciable movement of the bass boards, this being facilitated by the flexible character of the fastenings thereof.

Again, it is noted that concentration of the sound waves is avoided, but these are free to expend their energy along free and extended lines of travel, to the end that the reproduction may be clear, and yet possess the maximum strength; and furthermore, it will not be merely directional.

The bass boards provide a large area for the great energy possessed by vibrations that produce low notes. At the edges of the bass boards, the rings afford a large mass in which the energy of very low bass notes, may properly expend itself, instead of being ineffectively lost or diffused. In other words, if a wave transmitted to a bass board is too powerful to be taken up by the body of the same, it will travel into the said ring. The paper between the ring and the said body acts to prevent sympathetic vibrations.

I claim:

1. A device of the character described, including a speaker unit, a primary sounding medium of a light material operated by said unit to reproduce high notes and a secondary sounding medium of a heavier material connected to the primary sounding medium for reproduction of bass notes, said secondary sounding medium being divided into a plurality of areas, and means being provided to slightly deaden one of the said areas with respect to the other, for reproduction of the lowest notes.

2. A device of the character described, including a vibrating means, and a unit to vibrate the same for sound reproduction, said means comprising a plurality of sections, said sections being made of materials of different weights for reproduction of sound over a maximum scale, said sections being in contact with each other, and a separate flexible means yieldingly interconnecting said sections.

3. A device as set forth in claim 2, wherein

one of said materials is of a pliable nature, and the other is of a stiff character.

4. A device as set forth in claim 2, wherein one of said materials is of a fibrous nature, and the other consists of wood.

5. A device as set forth in claim 2 wherein one of said sections is of a light material and is directly connected to the said unit, and the other section is of a heavy material for reproduction primarily of bass notes and is connected to the first section.

6. A device of the character described, including a sounding means, and a unit to vibrate the same, said means comprising a section for high notes connected to the unit, and a section for reproduction of bass notes, the latter section being plane and connected to the first section, and means movably supporting the said latter section independently of the first section.

7. A device of the character described, including a sounding means, and a unit to vibrate the same, said means comprising a section for high notes connected to the unit, and a section for reproduction of bass notes, the latter section being plane and connected to the first section, the first section having re-enforcements, said re-enforcements coacting with the second section to effectively transmit sound vibrations thereto.

8. A device of the character described, including a sounding means, and a unit to vibrate the same, said means comprising a section for high notes connected to the unit, and a section for reproduction of bass notes, the latter section being plane and connected to the first section, the second section extending about the first section, and the latter having projecting portions connected to the second section.

9. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said means comprising a concave section centrally connected to the unit, and a second section connected to the first section at the edge portions thereof. the second section being of a heavier material than the first to reproduce high notes, the size of the concave section being such as to possess ample stiffness at the said edge portions, the second section consisting of a plurality of coplanar members yieldingly connected with each other and with the first section for the purpose set forth.

10. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said means comprising a concave section centrally connected to the unit, and a second section connected to the first section at the edge portions thereof, the second section being of a heavier material than the first to reproduce low notes, the size of the concave section being such as to possess ample stiffness at the said edge portions, for the purpose set forth, fibrous members co-operating to afford a connection between the said sections.

11. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said means comprising a concave section centrally connected to the unit, and a second section connected to the first section at the edge portions thereof, the second section being of a heavier material than the first to reproduce low notes, the size of the concave section being such as to possess ample stiffness at the said edge portions, for the purpose set forth, strips of wood, extending along the first section and being connected with the second section for transmission of vibrations.

12. A device as set forth in claim 9, wherein the second section comprises a plurality of bass boards which are connected to one another and to the first section.

13. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said sounding means comprising a concave section of a light material, and a large plane section of heavier material, the first section being connected to said unit and having its edge portions resting against the second section to transmit sound vibrations thereto, the large section having radial lines of division to permit of maximum excursion.

14. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said sounding means comprising a concave section of a light material, and a large plane section of heavier material, the first section being connected to said unit and having its edge portions resting against the second section to transmit sound vibrations thereto, means being provided to slightly deaden the transmission of sound vibrations to a portion of the second section.

15. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, said sounding means comprising a concave section of a light material, and a large plane section of heavier material, the first section being connected to said unit and having its edge portions resting against the second section to transmit sound vibrations thereto, the second section including a plurality of bass boards, the first section having a plurality of extending portions connected separately to the bass boards.

16. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, the sounding means comprising a central section of a light material connected to the unit, and a bass section extending about the central section and movably connected thereto, said bass section being rigid along lines extending radially from the central section, said bass

section being flexible at said radial lines in directions at an angle to each respective line.

17. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, the sounding means comprising a central section of a light material connected to the unit, and a base section extending about the central section and connected thereto, and a supporting means for the sound means, the outer portions of the base section being connected to the supporting means, for the purpose set forth, the bass section comprising a plurality of separate base boards, and means being provided interconnecting said base boards and having cushioned engagement therewith.

18. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, the sounding means comprising a central section of a light material connected to the unit, and a base section extending about the central section and connected thereto, and a supporting means for the sound means, the outer portions of the base section being connected to the supporting means, for the purpose set forth, the base section including a plurality of separate base boards re-enforced along their edges.

19. A device of the character described, including a sounding means, and a unit to vibrate the same for sound reproduction, the sounding means comprising a central section of a light material connected to the unit, and a base section extending about the central section and connected thereto, and a supporting means for the sound means, the outer portions of the base section being connected to the supporting means, for the purpose set forth, the bass section including a plurality of separate base boards which are arcuate in form remote from the central section.

20. A device of the character described, including a primary sounding medium of light material to reproduce high notes, a secondary sounding medium of heavy material connected thereto to reproduce the other notes, a heavy sound deadening element extending along the secondary sounding medium, and means for impressing vibratory sound producing frequency on the primary medium.

21. A device as set forth in claim 20, wherein means is disposed between the element and the secondary sounding medium to avoid sympathetic vibrations.

22. A device of the character described, including a primary sounding medium of light material to reproduce high notes, a secondary sounding medium of heavy material connected thereto to reproduce the other notes, means for impressing vibratory sound producing frequency on the primary medium, and means at the primary sounding medium to cause portions of the secondary sounding medium adjacent thereto to reproduce notes of a pitch lower than those of other similarly adjacent portions of the secondary sounding medium.

23. A device of the character described, including a primary sounding medium of light material to reproduce high notes, a secondary sounding medium of heavy material connected thereto to reproduce the other notes, means for impressing vibratory sound producing frequency on the primary medium, and means to secure said sounding mediums together, said means including cushioning fastening means.

24. A device of the character described, including a primary sounding medium of light material to reproduce high notes, a secondary sounding medium of heavy material connected thereto to reproduce the other notes, the secondary sounding medium including a plurality of sections, yielding means securing said sections together, and means for impressing vibratory sounding frequency on the primary medium.

25. A device of the character described, including a primary sounding medium of light material to reproduce high notes, a secondary sounding medium of heavy material connected thereto to reproduce other notes, means connected to the primary sounding medium for impressing vibratory frequency thereon, and rigid re-enforcing means at the point of connection having projections extending along the said primary medium.

26. A device of the character described, including a primary sounding medium of light material, a secondary sounding medium of heavy material, fabric means interconnecting the same with the mediums in contact with each other, and means for impressing vibratory sounding frequency on the primary medium.

27. A device of the character described, including a primary sounding medium of light material for reproduction of high notes, a secondary sounding medium of heavy material for reproduction of low notes, the secondary consisting of a plurality of separate sections, the primary having portions extending toward the center of said sections and contacting the same, and means to impress vibrating sound frequency on the primary medium.

28. A device of the character described, including a primary sounding medium of light material for reproduction of high notes, a secondary sounding medium of heavy material for reproduction of low notes, the secondary consisting of thin layers of hardwood and softwood connected together into a single sheet with the grain crossed, and means to impress vibratory sound producing frequency on the primary medium.

29. A device of the character described,

including a primary sounding medium of light material for reproduction of high notes, a secondary sounding medium of heavy material for reproduction of low notes, the secondary consisting of hardwood and softwood layers cemented together with a waterproof cement, and means to impress vibratory sound producing frequency on the primary medium.

30. A device of the character described, including a primary sounding medium of light material for reproduction of high notes, a secondary sounding medium of heavy material for reproduction of low notes, the secondary consisting of a plurality of thin wood layers cemented together with a waterproof cement, and means to impress vibratory sound producing frequency on the primary medium.

31. A device of the character described, including a sounding cone of light material for the reproduction of high notes, a sounding medium of heavy material for the reproduction of low notes movably connected thereto, sounding means for impressing vibrational sounding frequency on the cone, and other means to movably support the sounding medium independently of the cone, the sounding medium including portions radially extending from the cone and being relatively inflexible along radial lines, said portions being movable with respect to each other.

32. A device of the character described, including a primary sounding medium of a light material adapted to be operated by an electrical speaker unit to reproduce high notes, and a plurality of boards disposed in a plane around the primary sounding medium and coacting to receive vibrations therefrom, said boards having each a relatively considerable body adjacent to the primary sounding medium, and the portions of the boards remote therefrom being each bounded by a substantially curved line.

In testimony whereof I affix my signature.

W. JAY HANNA.