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P. WEATHERS

2,866,514

CORRECTIVE LOUD SPEAKER ENCLOSURE

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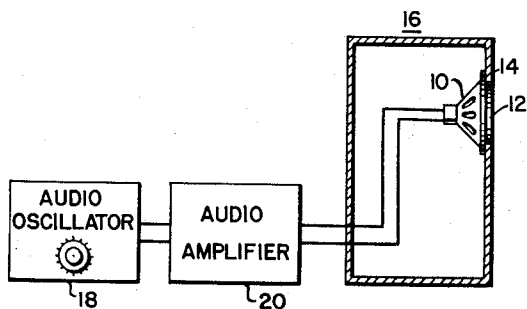


FIG. 1.

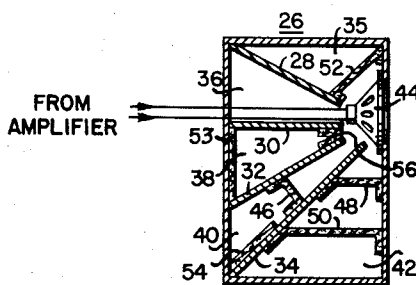


FIG. 2.

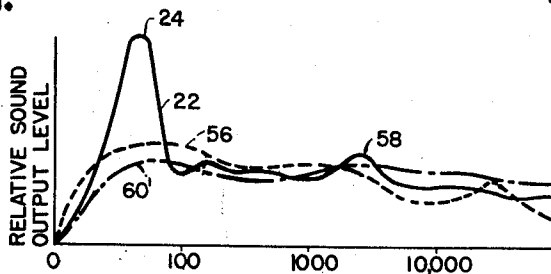


FIG. 3.

FIG. 7.

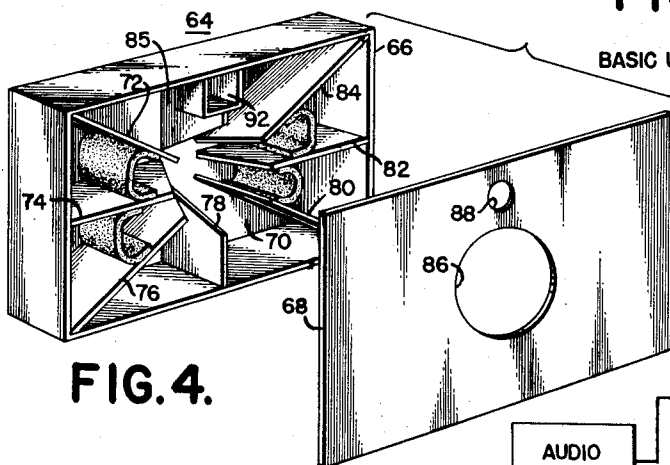


FIG. 4.

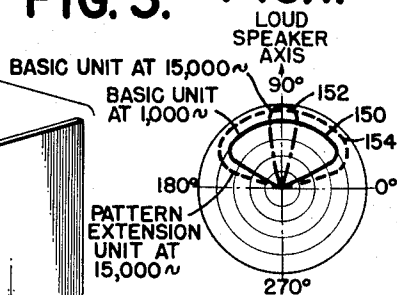


FIG. 5.

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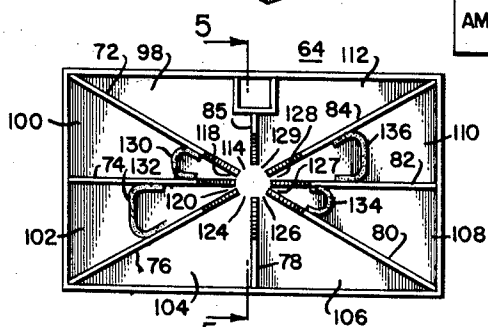
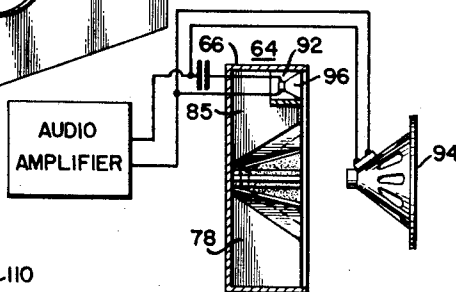


FIG. 6.



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CORRECTIVE LOUD SPEAKER ENCLOSURE

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9 Claims. (Cl. 181—31)

The present invention relates to improvements in acoustical systems for faithfully translating audio frequency electrical signals into corresponding acoustical sound pressure variations.

More particularly, the present invention relates to improvements in what is generally termed loud speaker systems and more specifically, loud speaker systems of the wide range high fidelity type.

It has been recognized in the prior art that known types of diaphragm or cone type electro-acoustical drivers or loud speakers have certain undesirable mechanical resonances which tend to distort the sound waves produced by the speaker. Moreover, cone type loud speakers of the general type often fail to provide sufficient uniformity in frequency response due to mechanical resonances, edge reflection and cone mounting difficulties so that it becomes difficult to provide an acoustical reproducing system which will produce realistic reconstruction of electrical signals representing music and voice.

In an attempt to overcome some of the basic limitations in loud speaker driver units, it has been the general practice to mount such units in relatively large cabinets. Such cabinets have been diverse in design, some providing critically positioned vents and low frequency horn structures which permit the back pressure of the cone diaphragm to be utilized to improve low frequency responses while others have been versions of the closed or infinite baffle. In designing closed cabinets for loud speakers in the prior art, particular care has been taken to provide substantial air tightness of the enclosure cavity with sufficient cubic volume so that the theoretical increase in the resonant frequency of the speaker was minimized and a lower usable frequency response realized. As the volume of the closed speaker cabinet becomes larger, however, the loading effect on the rear or back surface of the cone becomes less and hence the compressive action of the air in the cavity has less effect in aiding in overcoming non-linear distortion in the speaker caused by any inherently undesired cone suspension characteristics. The amplitude of cone resonance in the larger volume speaker enclosures, although occurring at a lower frequency, unless critically damped sometimes produces objectionable distortion in low frequency sound reproduction. Moreover, the increased size of a larger volume closed speaker cabinets often renders them undesirable for use in small homes where space consumption is a factor.

It is therefore an object of the present invention to provide a speaker cabinet which is small in size but when employed as a housing for a cone diaphragm type loud speaker, permits low distortion sound reproduction over a wide range of audible frequencies in such a way that most of the above-mentioned undesirable characteristics of conventional loud speaker mechanisms are largely overcome.

A further object of my invention is to provide an improved loud speaker enclosure of the type set forth

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which is very simple in construction yet highly efficient in use and which is relatively inexpensive to manufacture.

In accordance with the present invention I provide a speaker enclosure having a closed hollow cavity for acoustically loading the rear surface of the loud speaker diaphragm. I then divide the cavity into a number of separate chambers each arranged for direct acoustic excitation by the loud speaker cone. Frequency selective direct acoustic filtering material is then placed in filtering relation to all air displacement in one or more chambers. By adjusting the size and shape of the chambers and properly selecting the characteristics and positioning of the frequency selective filters, known deficiencies in the loud speaker unit can be largely corrected resulting in increased low frequency handling power and a wider useful frequency range.

In accordance with one particular form of the present invention, I provide a hollow cabinet having an outer wall through which is provided an opening to the atmosphere in which may be mounted a diaphragm type electro-acoustical driver or loud speaker mechanism. The driver mechanism when mounted is substantially contained within the cavity defined by the cabinet such that the rear or back surface of the diaphragm is in compressive relation to the air within the cabinet cavity. The cabinet is preferably made such that the depth of the cabinet is substantially little more than the depth of the loud speaker mechanism. Partition means are included in the cabinet which divide the over-all cavity into a plurality of closed chambers each having an opening in an acoustically direct driven or excitable relation to the rear surface of the loud speaker diaphragm. Frequency selective acoustical filter means are mounted in one or more positions in at least one of the closed chambers and in filtering relation to substantially all air displacement in and out of the associated closed chamber such that varying degree of damping is imposed on the loud speaker diaphragm by the cabinet, which damping is rendered a function of the frequency selected properties of the acoustical filter means. One or more of the cavities may then be effectively conformed into an acoustical absorption means effective at one or more resonant frequencies typical of the loud speaker mechanism when mounted in the cabinet.

In accordance with still another feature of the present invention I provide an improved wide frequency range duplex loud speaker system which avoids the prior art requirement for expensive frequency cross over networks between individual loudspeaker units of the duplex system. I accomplish this result through the use of what I term a basic speaker and a pattern extension speaker. This improved loud speaker system is particularly advantageous when employed in conjunction with an enclosure constructed in accordance with the above described frequency selective damping techniques.

The problems associated with conventional woofer-tweeter type wide range loud speaker systems are well known. Two loudspeaker units are generally employed, one having exceptionally good low frequency response and power handling capabilities (the woofer) while the other unit (the tweeter) is provided with an exceptionally good high frequency response at the sacrifice of low frequencies. The low frequency unit has poor high frequency response and has an inherent high frequency cutoff at a value well below the upper cutoff frequency of the high frequency unit. Cross over networks are then employed to feed low frequency signals to the low frequency unit and high frequency signals to the high frequency unit. That frequency where the output of the low frequency unit is made substantially equal to the high frequency unit is

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called the cross over frequency. It is known that substantial phase distortion takes place in the vicinity of the cross over frequency due to the general characteristics of most cross over networks and the physical displacement of the woofer and tweeter speakers. I have also found, however, that this type of distortion is less objectionable to the human ear than the transient distortion attributable to the usual sharp high frequency cutoff of the woofer. This sharp cutoff causes ringing of the woofer even when excited by lower frequency transients, delivered from the woofer section of the conventional crossover network.

In accordance with the present invention I replace the conventional "woofer" with an extended range loud-speaker having good low frequency response and an extended high frequency response on axis up to the highest frequency to be reproduced. I call this speaker the basic unit. The high frequency distribution pattern of the basic unit will tend to be inherently poor in speakers of present art design due to the large area and consequent relatively large mass of the large cone required to obtain good low frequency response. I then employ a pattern extension speaker having a top frequency not necessarily higher than the basic unit but having a wider angle of sound distribution. This is provided with signal frequencies above 2,000 or 3,000 cycles per second. Such a combination provides a much more lifelike sound reproduction since transient distortion due to ringing of the basic unit is avoided while the distribution pattern of the overall system may be made excellent.

It is therefore another object of the present invention to provide an improved duplex loudspeaker system having a minimum transient distortion.

A more complete understanding of the present invention as well as other of its objects and features of advantage may be obtained from a reading of the following specification, taken in combination with the accompanying drawings, in which:

Fig. 1 is a combination block and schematic representation of a sound reproducing loud speaker and enclosure representing prior art techniques;

Fig. 2 is a sectional view of a loud speaker enclosure embodying the novel features of the present invention;

Fig. 3 is a graphical representation of several loud speaker-enclosure frequency response characteristics which illustrates the advantage of the present invention;

Fig. 4 is an exploded perspective view of a preferred form of loud speaker enclosure made in accordance with the present invention;

Fig. 5 is a sectional view of the speaker enclosure shown in Fig. 4 when assembled, taken on line 5-5 of the elevational view shown in Fig. 6;

Fig. 6 is a front elevational view of the speaker enclosure shown in Fig. 5 with the front wall removed for inspection purposes;

Fig. 7 is a graphical representation of preferred distribution characteristics for duplex speaker systems in accordance with the present invention.

To illustrate the advantages of the present invention there is shown in Fig. 1 a typical frequency response testing arrangement for electro-acoustical drivers sometimes referred to as loud speakers. A loud speaker shown at 10 is mounted over an opening 12 on the inner surface 14 of the speaker enclosure 16. The speaker enclosure 16 is shown to be of the closed type with no vent to the outer atmosphere being provided when the loud speaker is in place. For purposes of test an audio-oscillator 13 is shown connected with audio-amplifier 20, the output of which is connected to the loud speaker 10.

In determining the characteristics of the loud speaker-enclosure combination shown in Fig. 1, a sound level indicating device (not shown) is placed in front of the speaker 10 while the audio oscillator 18 is caused to swing through the audible frequency range. The curve 22 in

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Fig. 3 is illustrative of a typical prior art loud speaker-enclosure combination of the type shown in Fig. 1. The resonant peak 24 may be attributable to inherent diaphragm resonance of the speaker 10 taken in combination with the cavity volume of the enclosure 16. The peak 24 may extend as high as 15 to 20 decibels above the flat characteristics of the curve at high frequencies. The peak 24 in practice is for example found to fall in the range from 40 to 200 cycles per second and seriously detracts from the realism of musical sound reproduced by the loud speaker. Severe distortion generally occurs in any loud speaker system in the range below its low frequency resonance peak such as 24.

I have found, however, that the over-all resonant condition resulting from the low frequency resonance of the loud speaker diaphragm acting in combination with the enclosure cavity may be substantially reduced by providing a plurality of partitions within the enclosure positioned so as to define a number of closed chambers having openings in direct acoustically responsive or driven relation to the rear surface of the loud speaker cone. This is illustrated in the embodiment of the invention shown in Fig. 2.

In Fig. 2 an enclosure 26 is shown having substantially the same outer and loud speaker mounting characteristics as the enclosure 16 of Figure 1. The overall cubic volume of the cavity defined by the cabinet 26 may be considered the same as that defined by the cabinet 16. However, in accordance with the present invention, partition means 28, 30, 32 and 34 are provided which divide the cavity of the cabinet 16 into a plurality of closed chambers 35, 36, 38, 40 and 42. Each of the chambers 35, 36, 38, 40 and 42 has an opening positioned in an acoustically responsive or driven relation to the rear surface of the loud speaker cone contained in the loud speaker unit 44. For purposes of illustration, the closed chambers 35, 36, 38, 40 and 42 are shown to be of different cubic volumes with the entrance to these chambers juxtaposed and essentially facing the rear of the loud speaker. In this way each of the chambers supports a different resonant mode which may be conformed in corrective relation to the particular characteristics of the loud speaker mechanism 44. Partition means 28, 30, 32 or 34 are preferably made very rigid to minimize mechanical vibratory coupling between the chambers and to prevent mechanical resonances of the partition means themselves which could otherwise tend to act as individual diaphragms and produce spurious responses in the over-all loud speaker-enclosure combination.

Still considering the embodiment of the invention shown in Fig. 2 and in accordance with the present invention, frequency selective acoustical filter means are placed in one or more positions in one or more of the chambers in filtering relation to all air displacement and compressional wave motion into and out of the respective chambers. Acoustical filters in position are shown in Fig. 2 and indicated at 46, 48, 50, and 52. The acoustical filtering means may comprise a quantity of cotton batting, glass or wool fiber, cushioning material such as "Ozite," cellulose sponge or the like. It is essential in the practice of the present invention that the acoustical filter means have a selective frequency response characteristic in the sense that its sound absorptiveness varies as a function of frequency. I have found that such a material when properly chosen and experimentally positioned in a multi-chambered loud speaker enclosure of the type shown, will provide what may be thought of as a differential or frequency selective damping effect on the cone diaphragm of the loud speaker mechanism. This selective damping produced by the over-all cavity, comprising chambers 35, 36, 38, 40 and 42, may by adjustment be caused to significantly smooth out the effective response of the loud speaker and make possible the production of high fidelity sound from low cost loud speaker units whose characteristics would not permit

their use for high fidelity sound reproduction in speaker cabinets of prior art design. By maintaining the entrance or opening to the separate chambers in direct driven relation to the rear of the loud speaker diaphragm and by placing acoustical filtering material in the chambers as shown the amount of inter-coupling from one chamber to another may be reduced to a degree which is small compared to the direct excitation by the loud speaker mechanism. Depending upon the particular characteristics of the acoustical filter material used, I sometimes provide two or more filtering elements in a given chamber. I have also found it to be advantageous to use acoustical filtering material of different types within the same chamber such as shown in the chamber 42.

For example, if the filtering means 48 has a lower absorptive characteristic at a given frequency than the filter means 50, the sound pressure waves at this given frequency will tend to be reflected somewhat from the surface of the filtering means 50, and produce a form of damped resonance which I find quite useful in correcting certain types of loud speaker resonances. The individual chambers themselves may be further supplied with conventional sound damping material along the partition walls as shown in 53 and 54.

The rather startling effects that can be obtained in the practice of my invention are illustrated in part by the graphical representation of Fig. 3, referred to hereinbefore. The frequency response of an experimentally designed loud speaker-enclosure combination of the type shown in Fig. 2 is shown by the dashed-line curve 56. The loudspeaker driver units 10 of Fig. 1 and 44 of Fig. 2 are identical in characteristics. It can be seen that the resonant peak typifying the loud speaker-enclosure combination of Fig. 1 has been considerably reduced and broadened. This improves the effective low frequency power handling ability of the loud speaker since a greater range of low frequency signals can be handled without resonance. Moreover, the uniformity of the response over the entire audio frequency range is much greater thereby reducing the tendency of ringing of the cone diaphragm when excited by transients. Irregularities in the frequency response of the loud speaker 44 at higher frequencies such as shown at 58 may also be corrected to a substantial degree by the techniques described.

Further improvement in the over-all response of the loud speaker-enclosure combination may be realized, in accordance with the present invention, by conforming one or more of the chambers as an absorptive resonator for relatively low audio frequencies in the range in which the combination of the loud speaker 44 and the entire cavity, comprising all the chambers collectively, tends to resonate. This is illustrated by the dot-dash line curve 60.

It can therefore be seen that by using the techniques of the present invention the characteristics of the cavity in which the excitation from the rear surface of a speaker cone is damped can be adjusted to appear as a corrective complement to certain undesirable characteristics of the loud speaker diaphragm over a substantial portion of the audio frequency range. For example, once the characteristics of a low cost loud speaker are known, the particular configuration and arrangement of the chambers comprising the over-all enclosure cavity may be arrived at to provide an acoustical system which will faithfully translate audio frequency signals into corresponding acoustical sound pressure variations. It is therefore a feature of the present invention as aforementioned that the individual chambers receive substantially direct excitation from the rear of the speaker cone in order to make possible a more useful control in arriving at an over-all frequency selective damping action having a corrective damping influence on the loud speaker mechanism.

It is further a feature of the present invention, as shown in Fig. 4, that the characteristics of the cavity be the controlling influence on the frequency response character-

istic of the over-all acoustical translating system. For this reason a preferred form of the present invention is that in which the loud speaker enclosure is of relatively small cubic volume. This makes it possible to provide a loud speaker-enclosure system having exceptionally good low frequency transient response in an enclosure whose depth is substantially no greater than the over-all depth of the loud speaker mechanism itself. This is shown in the embodiment of the invention of Fig. 4. Here a two-unit speaker enclosure is shown for housing what is commonly known as a "tweeter-woofer" loud speaker combination. The enclosure 64 comprises a rectangular frame 66 having front and rear walls respectively shown at 68 and 70. For illustrational convenience, the front wall 68 has been detached from inspection purposes and is shown detached from the frame. The partitioning means 72, 74, 76, 78, 80, 82, 84 and 85 are shown to be separate walls running edgewise between the front and back walls 68 and 70. The partitioning walls are therefore mounted in the enclosure such that the edges of the walls are securely fastened to the front, back and sides of the enclosure and are substantially radially disposed about an extension of the cone axis when mounted in the opening 86. This arrangement of the partitioning walls lends exceptional structural rigidity to the overall enclosure such that the rear and front walls are restricted from vibrating with respect to one another. The loud speaker for mounting in the opening 86 may be of the low frequency "woofer" variety type while the loud speaker for mounting in the opening 88 may be of the high frequency "tweeter" type. Enclosed chamber 92 is provided for isolating low frequency pressure variations produced by the loud speaker mounted in the opening 86 from the diaphragm of the high frequency loud speaker when it is mounted in the opening 88.

The enclosure of Fig. 4 is shown in side elevation in Fig. 5 and in front elevation in Fig. 6. In Fig. 5 it can be seen that the partitioning walls are cut away in the vicinity of the hole 86 to form a conically shaped recess of a size which will permit the loud speaker unit 94 to be substantially contained by the speaker enclosure when the wall 68 is fastened on the frame 66. In Fig. 5, a high frequency loud speaker unit 96 is also shown as contained within the isolating chamber 92 aforementioned.

With this arrangement, the over-all cavity of the loud speaker enclosure, 64, is divided into a plurality of closed chambers 98, 100, 102, 104, 106, 108, 110 and 112. See Fig. 6. The openings to these chambers are shown at 114, 118, 120, 124, 126, 127, 128 and 129 as radially disposed about the extended axis of the cone to be enclosed by the enclosure. The closed chambers are therefore seen to each have an opening which is in direct acoustical driven relation to the rear of the loud speaker diaphragm when mounted in the enclosure. Frequency selective filter means 130, 132, 134 and 136 are shown positioned to be in filtering relationship to all compressive wave movement into and out of the chambers 100, 102, 108 and 110, respectively.

With the particular rectangular enclosure configuration shown in Fig. 6 it is convenient to conform the cavities 100, 102, 108 and 110 as absorptive resonators, with the acoustical filter means 130, 132, 134, and 136 positioned to absorb the high frequency elements of the sound signals. The characteristics of the chambers 98, 104, 106 and 112 act to provide controlled damping of the loud speaker diaphragm in a manner determined by the known characteristics of the low frequency units to be placed in the enclosure. Additional acoustical filtering materials may advantageously be placed (not shown) in one or more of the cavities 98, 104, 106 and 112 as experimental tests may indicate to be necessary to correct the characteristics of a particular type loudspeaker. Conventional wall absorbing material such as shown at 53 in Fig. 2 may be employed along the walls of one or more

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of the chambers shown in Fig. 6 as desired. For illustrational simplicity, this has not been shown in the arrangement of Fig. 6. An experimental speaker, constructed in accordance with the arrangement shown in Fig. 4, provided substantially sine wave response down to 30 cycles per second at less than 1% distortion employing a low cost standard 12" loudspeaker mechanism for the "woofer" having a cone resonance of 70 cycles per second and a 3" cone type "tweeter." The over-all size of the enclosure was 3 feet long, 2 feet high and 6" deep. With proper cross-over between the high and low frequency loudspeaker units the overall range of the speaker system was substantially flat from 40 to 18,000 cycles per second with a safe power handling capacity considerably exceeding the normal power rating of the low frequency loudspeaker.

However, the over-all pleasantness of the sound produced by the loud speaker arrangement shown in Figs. 4, 5 and 6 is greatly improved by practicing the other feature of the present invention mentioned above. Instead of using a conventional cross-over network between the speaker units 94 and 96, I employ a simple capacitive coupling to the high frequency unit 96. In practicing this form of the present invention I choose the low frequency unit 94 so that it has a substantially uniform response on axis up to the highest frequency I desire to reproduce. This unit I call the basic unit of the speaker system. The high frequency distribution pattern of the basic unit, however, may be poor, as shown in Fig. 7. The solid line curve 150 illustrates the lower frequency distribution pattern of the basic unit, for example, taken at 1000 cycles. This same speaker unit, however, has a restricted distribution pattern for the higher frequencies such as shown by the dot-dash line 152 shown for example at 15,000 cycles. The high frequency unit 96 is then selected as a pattern extension unit having the characteristics shown by the dotted line 154 in Fig. 7. This supplements the pattern deficiencies of the basic unit at the high frequencies.

With such an arrangement the basic unit will produce negligible transient distortion due to ringing while the over-all distribution pattern of the speaker system will be good. Phase distortion in the area where the basic unit and pattern extension unit overlap at the higher frequencies is found to be unobjectionable to the ear. With such an arrangement the pattern extension unit may be made to take over in the range from 2,000 to 3,000 cycles. This aspect of the present invention may perhaps be more clearly understood by considering the following illustration. Let it be desired to faithfully transduce into sound waves an electrical sound signal having a frequency range of f_1 to f_3 (for example, $f_1=40$ C. P. S. and $f_3=15,000$ C. P. S.). Let it further be desired that all frequencies in the resulting sound waves substantially uniformly cover an angle of distribution in excess of a predetermined minimum value (for example 150°). In accordance with the present invention I then provide a first loudspeaker unit having a frequency response covering the entire range f_1 to f_3 (i. e. 40 C. P. S. to 15,000 C. P. S.), however, this first unit may be relatively inexpensive and as a consequence have a relatively restricted angular distribution for high frequencies. This first unit may for example provide an angular distribution for frequencies f_1 - f_3 substantially under the above desired minimum (150°). Here f_2 - f_3 may correspond to the band—3,000 C. P. S. to 15,000 C. P. S. I then provide a second loud speaker which I call a "pattern extension unit." This unit is selected to have a distribution pattern providing an angle of distribution equal to or greater than the desired minimum (150°) for frequencies f_2 to f_3 (2,000 to 15,000 C. P. S.). A cross over network is not used however to excite the first and second loud speakers. Instead a low frequency discriminating means (such as a capacitor) is connected between the sound signal source and the second loud speaker, while the

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full signal is applied to the first loudspeaker. Although this may result in some reinforcement of high frequencies in a direction along the axis of the first loudspeaker, this is theoretically only at one point in space—i. e., where the axis of the first loudspeaker intersects the second loudspeaker axis. Thus the overall effect is to provide a substantially uniform frequency distribution pattern for the transduced signal. The resulting sound will be free of distortion attributable to phase shift effects produced by conventional cross-over networks.

Having thus described my invention, what is claimed is:

1. An apparatus for use in sound signal translation comprising in combination: a hollow cabinet including an outer wall through which is provided an opening to the atmosphere for snugly receiving a diaphragm type electro-acoustical driver mechanism having a relatively low frequency diaphragm resonance in mounting relation to said wall such that the driver mechanism when mounted is substantially contained within said cabinet with the frontal surface of the driver diaphragm exposed to the atmosphere and the rear surface of the driver diaphragm in compressive relation to the air within said cabinet; partition means rigidly positioned within said cabinet dividing the cavity defined by said cabinet into a plurality of chambers each having an opening in direct acoustic driven relation to the rear surface of said electro-acoustical driver when mounted in said wall said partition means being of a material having substantial stiffness so as to acoustically isolate said chambers from one another by restricting mechanical motion of said partition means upon electrical excitation of said driver mechanism, said partition means being further characterized by providing surfaces of high acoustic reflectivity in a uniform manner for substantially all sound frequencies to be transduced by said driver mechanism such that each chamber imposes a low acoustic loss to sound waves entering each chamber; and frequency selective acoustical filter means mounted within at least one of said chambers in filtering relation to substantially all air displacement into and out of said one chamber such that a majority of the surface within said one chamber and said remaining chambers is of high sound reflectivity so that a varying degree of damping is imposed on said diaphragm by said partitioned cavity which damping is rendered a function of the frequency selective properties of said acoustical filter means and the conformation of said cavities.

2. An apparatus for use in sound signal translation comprising: a hollow closed cabinet including an outer wall through which is provided a mounting opening for an electro-acoustical driver mechanism of the conical diaphragm type having a low frequency diaphragm resonance such that when said driver is mounted, the frontal surface of said driver diaphragm is exposed to the ambient atmosphere while the rear surface of said diaphragm is exposed in compressive relation to the air enclosed in the cavity defined by said hollow cabinet, said driver having a sound radiating axis falling along a line defining the axis of said conical diaphragm; a plurality of rigid partitioning walls fastened within said cabinet dividing said cabinet cavity into a plurality of separated chambers each having an opening oriented for substantially direct acoustic coupling to the rear surface of the diaphragm of said driver when mounted in said opening, said partitioning walls being further so conformed and positioned relative to one another that among the chambers so formed are included chambers of different size and acoustic resonance said partition means being of a material having substantial stiffness so as to acoustically isolate said chambers from one another by restricting mechanical motion of said partition means upon electrical excitation of said driver mechanism, said partition means being further characterized by providing surfaces of high acoustic reflectivity in a uniform manner for substantially all sound frequencies to be transduced by said driver mechanism

such that each chamber imposes a low acoustic loss to sound waves entering each chamber; frequency selective acoustic filter means fastened within a plurality of said chambers in filtering relation to compressional wave motion entering the opening of chambers associated with said filter means, said filter means being characterized by exhibiting increasing acoustic resistance as a function of increased sound frequencies, at least one of said plurality of chambers containing said filter means being conformed for acoustic absorptive resonance over a range of frequencies embracing the frequency of system resonance produced by the combined interaction of said low frequency diaphragm resonance with the entire effective cavity contained by said cabinet.

3. Apparatus according to claim 2 wherein said partitioning walls are positioned such that the edges of said walls running transverse to the depth of said cabinet are substantially radially disposed about an extension of said conical diaphragm axis when mounted in said mounting opening such that the openings to said individual chambers are radially disposed about the rear of said driver mechanism when mounted in said mounting opening.

4. An acoustical baffle for an electro dynamic type acoustical driver mechanism of the conical diaphragm type, the driver mechanism having lineal dimensional extremities in depth defined along an extension of the conical diaphragm axis, the base of said conical diaphragm being forward of the apex of said conical diaphragm in the direction of sound wave travel as produced by said driver upon excitation by electrical sound signals; a closed rectangularly shaped cabinet having a front wall with a centrally located opening through which said driver is to be mounted such that when mounted the base of said cone is in close proximity with said wall, the front surface of said diaphragm is exposed to the atmosphere and the rear surface of said diaphragm is in compressive relation to the air within the cavity defined by said cabinet, the depth of said cabinet being substantially no greater than that required to accept said driver through said opening; a plurality of partitioning walls running from front to back within said cavity along lines substantially radially disposed about an extension of the conical diaphragm axis of said driver when mounted in said opening said walls making substantially air tight contact with the inside surfaces of the front, back, sides, top and bottom of said rectangular cabinet, said walls being cut away within said cavity in the vicinity of said opening so as to snugly receive said driver mechanism through said mounting opening, the cutaway portions of said partition walls thereby defining a plurality of chambers each having an opening in acoustically excitable relation to the rear surface of said driver diaphragm and radially disposed about the diaphragm axis of said driver, such that actuation of said driver will produce compressional wave flow in and out of said chambers; and frequency selective filtering means positioned in at least two of said chambers to filter all compressional waves in and out of said chambers, such that the effective acoustic volume of said chambers varies with frequency as a function of the frequency selective characteristics of said filtering means.

5. Apparatus according to claim 4 wherein the frequency response characteristics of the driver mechanism is predictable and known to have certain irregularities and wherein the conformation of the cavities formed by said partitions and the characteristics and positioning of said filtering means is such to correctively complement the frequency response characteristics of said driver mechanism by frequency selective damping of said conical diaphragm.

6. A sound transducing means comprising in combination: a hollow cabinet including an outer wall through which is provided an opening to the atmosphere for snugly receiving a diaphragm type electro-acoustical driver mechanism having a conical diaphragm in mounting relation to said wall such that the driver mechanism when

mounted is substantially contained within said cabinet with the frontal surface of the driver diaphragm exposed to the atmosphere and the rear surface of the driver diaphragm in compressive relation to the air within said cabinet; an electro-acoustical driver mechanism mounted in said opening, said driver mechanism having undesirable predictable and known irregularities in frequency response; partition means rigidly positioned within said cabinet dividing the cavity defined by said cabinet into a plurality of chambers of air tight construction, each with a single opening directed toward and in close acoustic coupling with the rear surface of said diaphragm; and frequency selective acoustic filtering means positioned in a plurality of said chambers in filtering relation to compressional waves passing in and out of the openings of said chambers, the conformation of the chambers defined by said partitioning means and the positioning of said filtering means forming diverse resonances within said cavity specifically complementary to and corrective of said known undesirable irregularities in the frequency response of said driver.

7. An enclosure for an electro-acoustical sound reproducer of the type having a movable electrically driven diaphragm, the front surface of which is designated for radiation of sound energy in a given direction and the back surface of which is designated for acoustical loading, said reproducer diaphragm being characterized by known undesired mechanical resonances and vibrational modes tending to distort the character of radiated sound waves from the waveform of the electrical energy applied to said reproducer, said enclosure comprising a substantially closed cabinet having front and rear walls with an opening in the front wall thereof of a size permitting the substantial air-tight mounting therein of a given sound reproducer of the type described such that the front surface of said diaphragm is exposed to the atmosphere to permit radiation from said enclosure; partition means included in said cabinet defining a plurality of acoustically resonant chambers having resonant frequencies complementary to the undesired resonances and vibrational modes of said diaphragm, said partition means being comprised of a rigid material extending between the front and rear walls of said cabinet and rigidly mounted therebetween to lend rigidity to said cabinet and to minimize mechanical transmission of compressional variations from one chamber to another by restricting motion of said partition means, said partition means being so further dimensioned and placed within said cabinet as to provide each chamber with two substantially parallel walls essentially defined by the inner surfaces of said front and rear enclosure walls and to form a plurality of chamber entrances conformed for close acoustical coupling to the rear surface of said diaphragm when said reproducer is mounted within said cabinet.

8. An enclosure for an electro-acoustical sound reproducer of the type having a movable electrically driven diaphragm, the front surface of which is designated for radiation of sound energy in a given direction and the back surface of which is designated for acoustical loading, said reproducer diaphragm being characterized by known undesired mechanical resonances and vibrational modes tending to distort the character of radiated sound waves from the waveform of the electrical energy applied to said reproducer, said enclosure comprising a substantially closed cabinet having front and rear walls with an opening in the front wall thereof of a size permitting the substantial air-tight mounting therein of a given sound reproducer of the type described such that the front surface of said diaphragm is exposed to the atmosphere to permit sound radiation from said enclosure; partition means included in said cabinet defining a plurality of acoustically resonant chambers having resonant frequencies complementary to the undesired resonances and vibrational modes of said diaphragm, said partition means being comprised of a rigid material extending between

the front and rear walls of said cabinet and rigidly mounted therebetween to lend rigidity to said cabinet and to minimize mechanical transmission of compressional variations from one chamber to another by restricting motion of said partition means, said partition means being so further dimensioned and placed within said cabinet as to provide each chamber with two substantially parallel walls essentially defined by the inner surfaces of said front and rear enclosure walls and to define chambers angularly disposed with respect to one another and to form a plurality of chamber entrances having cross-sectional areas smaller than any other cross sectional area of said chambers and conformed in close spaced relation to the rear surface of said diaphragm when said reproducer is mounted within said cabinet.

9. An enclosure for an electro-acoustical sound reproducer of the type having a movable electrically driven diaphragm, the front surface of which is designated for radiation of sound energy in a given direction and the back surface of which is designated for acoustical loading, said reproducer diaphragm being characterized by known undesired mechanical resonances and vibrational modes tending to distort the character of radiated sound waves from the waveform of the electrical energy applied to said reproducer, said enclosure comprising a substantially closed cabinet having an opening in one surface thereof of a size permitting the substantial air-tight mounting therein of a given sound reproducer of the type described such that the front surface of said diaphragm is exposed to the atmosphere to permit sound radiation from said enclosure; partition means included in said cabinet defining a plurality of acoustically resonant chambers having resonant frequencies complementary to the

undesired resonances and vibrational modes of said diaphragm, said partition means being comprised of a rigid material extending between the walls of said cabinet and rigidly mounted therebetween to lend rigidity to said cabinet and to minimize mechanical transmission of compressional variations from one chamber to another by restricting motion of said partition means, said partition means being so further dimensioned and placed within said cabinet as to form a plurality of chamber entrances conformed for close acoustical coupling to the rear surface of said diaphragm when said reproducer is mounted within said cabinet, and frequencies selective acoustical filter means mounted in substantially air-tight relation to each of the walls of at least one of said chambers in filtering relation to substantially all air displacement into and out of said chamber such that the damping imposed on said diaphragm by said chamber is rendered a function of the frequency selective properties of acoustical filter means.

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