

June 25, 1940.

A. W. WELLS

2,205,804

tone modifier device for electrical musical instruments

Filed Aug. 16, 1938

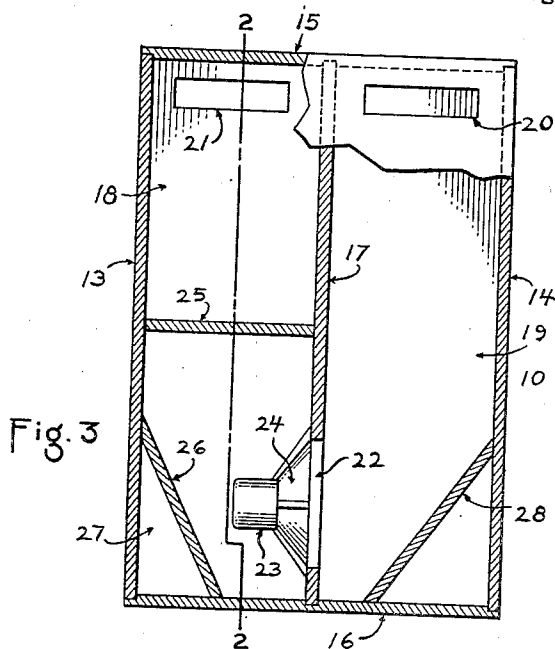


Fig. 3

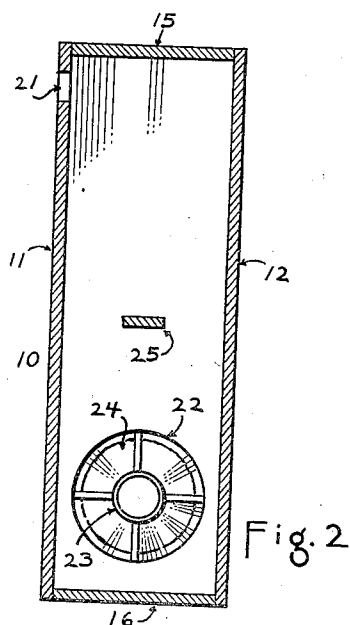


Fig. 2

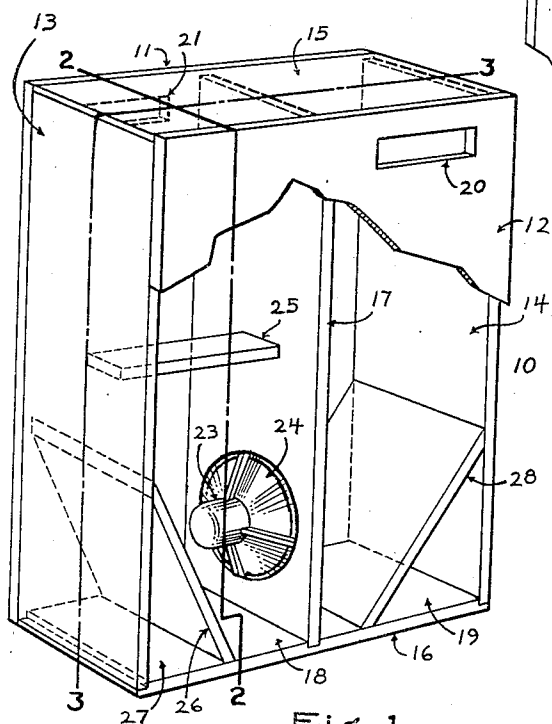


Fig. 1

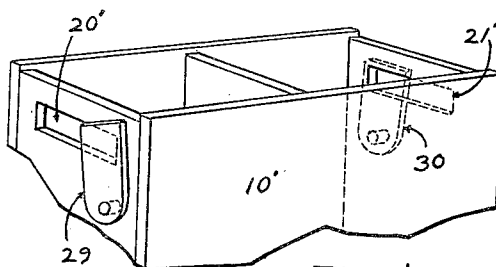


Fig. 4

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2,205,804

TONE MODIFIER DEVICE FOR ELECTRICAL
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Application August 16, 1938, Serial No. 225,101

10 Claims. (Cl. 181—31)

This invention relates generally to acoustical apparatus and more particularly to sound reproducing systems.

More specifically my invention relates to a tone modifier device for electronic musical instruments and the like, used in sound reproducing systems.

The primary object of my invention is to provide a suitable baffle for a loud speaker used in conjunction with an electric musical instrument such as an electric organ, or the like, in which I obtain an increased degree of efficiency particularly in the reproduction of sounds of low frequency such as the pedal or base notes of an organ.

Another object of my invention is to provide a loud speaker cabinet or chamber of peculiar construction which creates a certain degree of reverberation of its own irrespective of the acoustical properties of the room in which it is located. In actual practice the principle of my invention may be embodied in a separate cabinet, or may be built into the construction of a room, thus obviating the necessity of providing a separate cabinet.

A further object of my invention is the provision of ample baffling within the cabinet irrespective of its physical location, that is whether the cabinet is suspended from a cable secured to the ceiling or wall, or resting on the floor of the room.

A still further object of my invention is to provide a loud speaker cabinet of relatively small size and of inexpensive construction; the characteristics of which, particularly at low frequency, are substantially equivalent to those of cabinets of previous types having much larger baffle space.

Another and important object of my invention is the provision of a loud speaker baffle device which will eliminate or minimize the audible effects of transient electrical impulses such as "key clicks" and the like, key clicks being the clicking sounds produced in an electrical organ or a similar musical instrument when the electrical circuits are intermittently closed in the course of playing the instrument by means of depressing the keys, which keys constitute the switches for such circuits. Such clicking sounds are made audible by the amplifier associated with such an instrument.

Loud speaker cabinets of all previous relatively low-priced types, of which I am aware, have the following named objectionable features:

In the first place all such cabinets to have sufficient low frequency response must be made

of such large size as to render them not only exorbitantly expensive for ordinary use, but unsuitable for homes or other buildings in which the space is limited.

In the second place such cabinets of previous types have been so constructed that the sound from the speaker has been received direct resulting in the prominence of the transient sounds and the lack of reverberation to which I have already referred.

In the third place the sound from speakers of previous types is not sufficiently diffused to give a pleasing effect at close range, when used with an electronic organ.

In the fourth place the few small sized loud speaker cabinets, of which I am aware, which are constructed to afford adequate low frequency reproduction, are acoustically inefficient in that they require relatively great driving power for comparatively low sound output, thus rendering them impractical where loud volume is required.

Therefore, in the construction of my loud speaker cabinet I have provided means to overcome such objectionable features as those referred to above.

Other specific objects and advantages of my invention will appear from the following specification and accompanying drawing forming a part thereof.

In the drawing:

Fig. 1 is a perspective view of my improved loud speaker cabinet partly broken away to show its interior construction.

Fig. 2 is a side elevation in cross-section taken on the line 2—2 of Fig. 1.

Fig. 3 is a front elevation in cross-section taken on the line 3—3 of Fig. 1.

Fig. 4 is a perspective view of a modified form of cabinet in which the sound outlet openings are in the end walls of the cabinet.

Referring to the drawing by numerals in which like numerals designate like parts in the several views, 10 is a cabinet constructed in the usual manner out of thin boards, plywood or other suitable material, having front and back walls 11 and 12 respectively, side walls 13 and 14 respectively, and also a top wall 15 and a floor 16.

In accordance with approved cabinet work the walls and floor are preferably glued or otherwise firmly secured together to form a substantially air-tight shell or casing, a preferred embodiment thereof being of rectangular formation of greater width than depth and of greater height than width.

A partition 17 preferably extending parallel to

side walls 13 and 14 is fixedly secured to the top wall 15 and floor 16, thus forming two elongated substantially air-tight chambers 18 and 19. An opening 20 is formed through rear wall 12 communicating with chamber 19 and a similar opening 21 is formed through front wall 11 communicating with chamber 18. It is to be understood that location of said openings is not restricted. They may for example be located in the side walls 13 and 14 as shown in Fig. 4. Said openings should be as far apart as possible consistent with placing them near the end of the cabinet opposite the end in which the loud speaker is located.

An opening 22 is formed through partition 17 a short distance from its lower end and a loud speaker 23 is mounted within chamber 18 with the cone 24 facing the opening 22. In the embodiment of my improved cabinet shown in the drawing, the loud speaker is mounted on partition 17 but it may be mounted on a support resting on the floor of the cabinet or in any other suitable manner.

A brace consisting of a flat strip 25 is placed end to end between partition 17 and side wall 13 to aid in bracing the partition against vibration to permit the use of relatively thin material for the walls and other parts of the cabinet. I have found that in using thin wood and other materials in the construction of a loud speaker cabinet of the type herein described that the objectionable effects of the vibration of the wall may be controlled by the proper placement of one or more braces of the type indicated.

In chamber 18 is fixedly secured a reflector consisting of a board-like member 26 having the same width as said chamber, said reflector being placed at an angle forming a triangular compartment 27 between said reflector 26 and the wall 13. A similar but oppositely disposed reflector 28 is fixedly mounted in chamber 19. Reflector 28 is in front of cone 24 and is preferably disposed at a greater angle with relation to the walls 13 and 14 than reflector 26, but the angle of each reflector may be varied according to different conditions.

As shown in Fig. 4, I may for some conditions use adjustable openings 20' and 21'. In such modified construction I provide adjustable shutters 29 and 30 for the purpose of manually reducing or controlling the outlet areas of said openings.

In principle, what I accomplish in the structure described in foregoing specification is to increase the length of the air path between the front and back of the speaker, thus preventing the cancellation of the front and back waves on the low frequencies.

It will be observed by reference to Fig. 3 that the front waves generated by speaker cone 24 are directed upwardly by reflector 28 and they finally emerge through opening 20. Likewise, the back waves are directed upwardly by reflector 26 and they finally emerge through opening 21. It will thus be seen that the low frequency front and back waves must travel a distance equal to twice the height of cabinet 10, plus the distance between openings 20 and 21 before meeting.

Thus by the construction shown and described, I provide in a relatively small cabinet the baffle element necessary to reproduce the lowest desired frequency. By means of this arrangement both the front and back waves are effectively utilized.

Another particularly advantageous result of locating the speaker 23 at the end of the cabinet

opposite the end containing openings 20 and 21, as shown in the drawing, is that it permits the multiple reflection of the sound inside the cabinet against the walls thereof before it emerges through openings 20 and 21. This creates a certain degree of reverberation which is desirable in a room in which the reverberative time is low. This effect is also advantageous in that it tends to minimize the audibility of "key clicks," previously mentioned, and other transient sounds common to present day electronic organs. Moreover, it tends to give the sound better diffusion thereby making it more pleasing at close range.

The application of this principle is less expensive and more effective than other elaborate devices available to the art.

Coating the interior of the cabinet with a varnish or other substance which will increase the sound reflection will accentuate the reverberative properties of the cabinet.

Further modifications of my invention will occur to persons skilled in the art and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A tone modifier device for electronic musical instruments including in combination a pair of spaced closed members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent one end thereof for communicating the same with the atmosphere, said chambers being completely closed from the atmosphere except through the lateral openings, means communicating the chambers with each other adjacent the ends thereof opposite to the lateral openings, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker in one of the chambers adjacent said communicating means for delivering sound waves to said chambers, said loud speaker being spaced from the lateral openings to provide relatively long paths in said chambers for the sound waves in front and to the rear of the loud speaker so that the sound waves are reflected back and forth against the walls of the chambers before they emerge to the atmosphere through the lateral openings, the multiple diffusion of the sound waves in the chambers distinctly modifying the tone characteristics of the sounds reproduced by the loud speaker.

2. A tone modifier device for electronic musical instruments including in combination a pair of spaced closed members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent one end thereof for communicating the same with the atmosphere, said openings being disposed on opposite sides of the device, said chambers being completely closed from the atmosphere except through the lateral openings, adjustable means associated with each of the lateral openings for controlling the size thereof, means communicating the chambers with each other adjacent the ends thereof opposite to the openings, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker in one of the chambers adjacent said communicating means for delivering sound waves to said chambers, said loud speaker being spaced from the lateral openings to provide relatively long paths in said chambers for the sound waves in front and to the rear of the loud speaker so that the sound waves are reflected back and forth against the walls of the chambers

before they emerge to the atmosphere through the lateral openings, the multiple diffusion of the sound waves in the chambers distinctly modifying the tone characteristics of the sounds reproduced by the loud speaker and so as to increase the efficiency of reproduction of low frequency waves.

3. A tone modifier device for electronic musical instruments including in combination a pair of spaced closed elongated members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent one end thereof for communicating the same with the atmosphere, said chambers being completely closed from the atmosphere except through the lateral openings, means communicating the chambers with each other adjacent the ends thereof opposite to the openings, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker in one of the chambers adjacent said communicating means for delivering sound waves to said chambers, said loud speaker being spaced from the lateral openings to provide relatively long paths in said chambers for the sound waves in front and to the rear of the loud speaker so that the sound waves are reflected back and forth against the walls of chambers before they emerge to the atmosphere through the lateral openings, the multiple diffusion of the sound waves in the chambers distinctly modifying the tone characteristics of the sound reproduced by the loud speaker, and means in each of said chambers opposite the loud speaker for further breaking up the sound waves in the chambers so as to improve their tone effects and increase the efficiency of reproduction of low frequency waves.

4. A tone modifier device for electronic musical instruments including in combination a pair of spaced closed members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent the upper end thereof for communicating the same with the atmosphere, said openings being disposed on opposite sides of the device, means communicating the chambers with each other adjacent the ends opposite to the lateral openings, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker located in one of the chambers adjacent said communicating means for delivering sound waves to the other of said chambers, said loud speaker and communicating means being spaced from the openings to provide relatively long paths in said chambers for the sound waves in front and to the rear of the loud speaker so as to produce a balance effect to the sound waves as they emerge from said apertures and thus increase the efficiency of reproduction of low frequency waves, a reflector located in the same chamber with and to the rear of said loud speaker, and a similar reflector located in the other of said chambers in front of said loud speaker, each of the reflectors being upwardly and outwardly inclined away from the front and back respectively of said loud speaker so as to further break up the sound waves in the chambers to improve the tone effects of the sounds as they issue through said openings.

5. A tone modifier device for electric organs including in combination a pair of spaced closed members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent one end thereof for communicating the same with the atmosphere, said chambers being completely closed

from the atmosphere except through the lateral openings, means communicating the chambers with each other adjacent the ends thereof opposite to the openings, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker in one of the chambers adjacent said communicating means for delivering sound waves to said chambers, said loud speaker being spaced from the lateral openings to provide relatively long paths in said chambers for the sound waves in front and to the rear of the loud speaker so that the sound waves are reflected back and forth against the walls of chambers before they emerge to the atmosphere through the lateral openings, the multiple diffusion of the sound waves in the chambers distinctly modifying the tone characteristics of the sounds reproduced by the loud speaker and also eliminating objectionable key clicks of the organ.

6. A tone modifier device for electronic musical instruments including in combination a pair of spaced closed members, said members being separated to provide tone chambers, each of said chambers having a lateral opening adjacent its upper end for communicating the same with the atmosphere, said chambers being completely closed from the atmosphere except through the lateral openings, means communicating the chambers with each other adjacent their lower ends, said communicating means constituting a single air passage extending transversely between the chambers, and a loud speaker in one of the chambers registering with said communicating means for delivering sound waves to said chambers, said loud speaker and communicating means being spaced from the lateral openings to provide relatively long paths in said chambers for the sound waves in the front and to the rear of the loud speakers so that the sound waves are reflected back and forth against the wall of the chambers and against the ceiling thereof before they emerge to the atmosphere through the lateral openings, the multiple diffusion of the sound waves in the chambers acting to distinctly modify the tone characteristics of the sounds reproduced by the loud speaker and so as to increase the efficiency of reproduction of low frequency waves.

7. A tone modifying device for electronic musical instruments having in combination an elongated cabinet provided with a vertically disposed partition for separating the cabinet into two oblong tone chambers, each of said chambers having a lateral aperture adjacent the upper end thereof for communicating the same with the atmosphere, said partition adjacent its lower end having an opening for communicating the chambers with each other, a loud speaker in one of the said chambers adjacent said opening for delivering sound waves to the chambers, said loud speaker being vertically spaced from the apertures in the opposite ends of the chambers to provide a long path for the sound waves issuing from both sides of the loud speaker in order to subject the sound waves to multiple reflection against the sides of the chambers before they emerge to the atmosphere through said apertures, so as to distinctly modify the tone characteristics of the sound waves reproduced by the loud speaker.

8. A tone modifying device for electronic musical instruments having in combination an elongated cabinet provided with a vertically disposed partition for separating the cabinet into two

oblong tone chambers, each of said chambers having a lateral aperture adjacent the upper end thereof for communicating the same with the atmosphere, said apertures being disposed on opposite sides of the cabinets, an adjustable shutter for each of said apertures for controlling the size thereof, said partition adjacent its lower end having an opening for communicating the chambers with each other, a loud speaker in one of the said chambers adjacent said opening for delivering sound waves to the chambers, said loud speaker being vertically spaced from the apertures in the opposite ends of the chambers to provide a long path for the sound waves issuing from both sides of the loud speaker in order to subject the sound waves to multiple reflection against the sides of the chambers before they emerge to the atmosphere through said apertures, so as to distinctly modify the tone characteristics of the sound waves reproduced by the loud speaker.

9. A tone modifying device for electronic musical instruments having in combination an elongated cabinet provided with a vertically disposed partition for separating the cabinet into two oblong tone chambers, each of said chambers having a lateral aperture adjacent the upper end thereof for communicating the same with the atmosphere, brace means in one of said chambers and engaging opposite sides thereof for reducing vibration of the walls of the chamber, the interior surface of said chambers being coated with lacquer material to facilitate the reflection of sound waves against the walls thereof, said partition adjacent its lower end having an opening for communicating the chambers with each other, a loud speaker in one of the said chambers and adjacent said opening for delivering sound waves to the chambers, said loud speaker being vertically spaced from the apertures in the opposite ends of the chambers to provide a long path

for the sound waves issuing from both sides of the loud speaker in order to subject the sound waves to multiple reflection against the sides of the chambers before they emerge to the atmosphere through said apertures, so as to distinctly modify the tone characteristics of the sound waves reproduced by the loud speaker and increase the efficiency of reproduction of low frequency waves.

10. A tone modifying device for electronic musical instruments having in combination an elongated cabinet provided with a vertically disposed partition for separating the cabinet into two oblong tone chambers, each of said chambers having a lateral aperture adjacent the upper end thereof for communicating the same with the atmosphere, said apertures being disposed on opposite sides of the cabinets, an adjustable shutter for each of said apertures for controlling the size thereof, shiftable brace means in one of said chambers and engaging opposite sides thereof for reducing vibration of the walls of the chamber, the interior surface of said chambers being coated with lacquer material to facilitate the reflection of sound waves against the walls thereof, said partition adjacent its lower end having an opening for communicating the chambers with each other, a loud speaker in one of the said chambers adjacent said opening for delivering sound waves to the chambers, said loud speaker being vertically spaced from the apertures in the opposite ends of the chambers to provide a long path for the sound waves issuing from both sides of the loud speaker in order to subject the sound waves to multiple reflection against the sides of the chambers before they emerge to the atmosphere through said apertures, so as to distinctly modify the tone characteristics of the sound waves reproduced by the loud speaker.

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