

July 1, 1941.

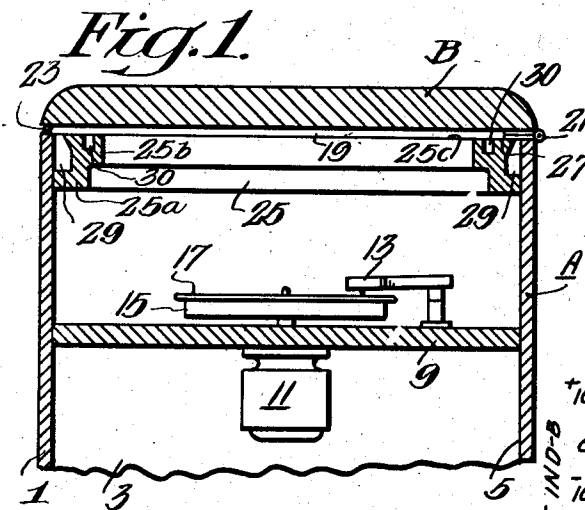
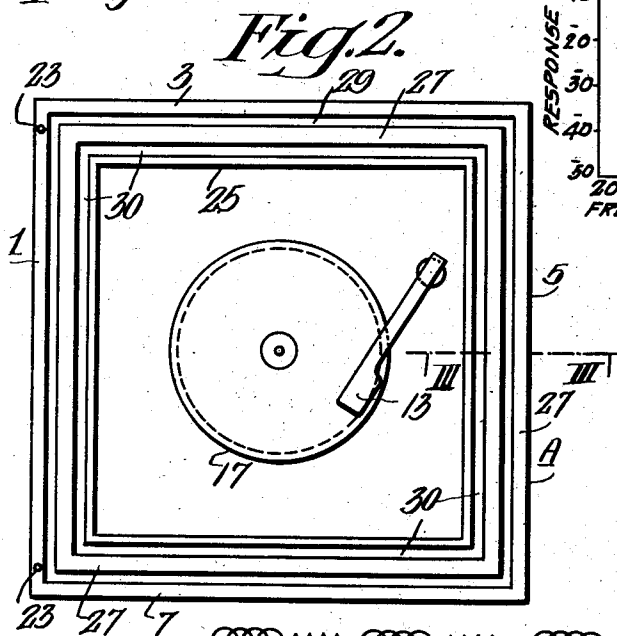
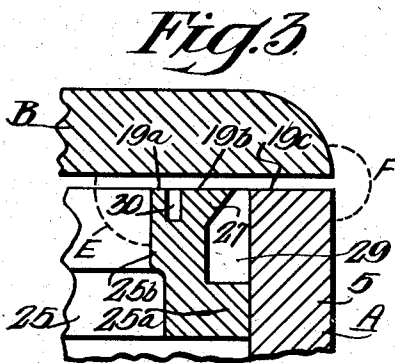
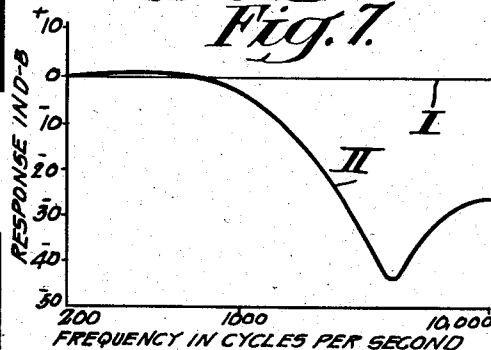
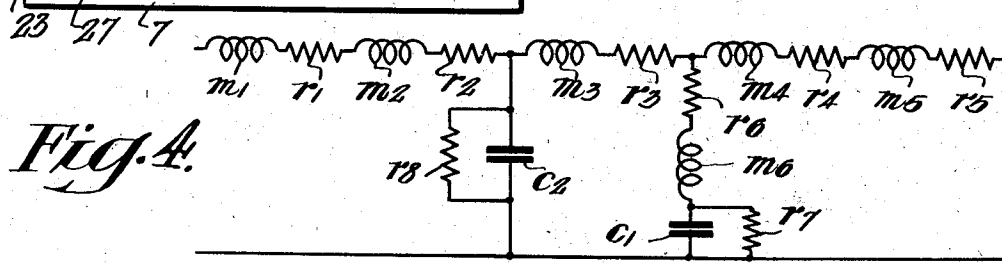
H. F. OLSON

2,247,731

CABINET FOR HOUSING SOUND-REPRODUCING APPARATUS

Filed July 31, 1940

2 Sheets-Sheet 1



Inventor
Harry F. Olson
 Attorney

July 1, 1941.

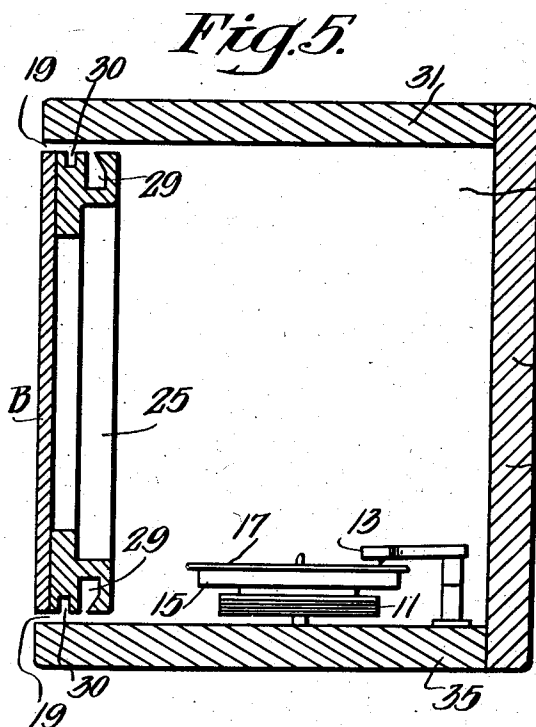
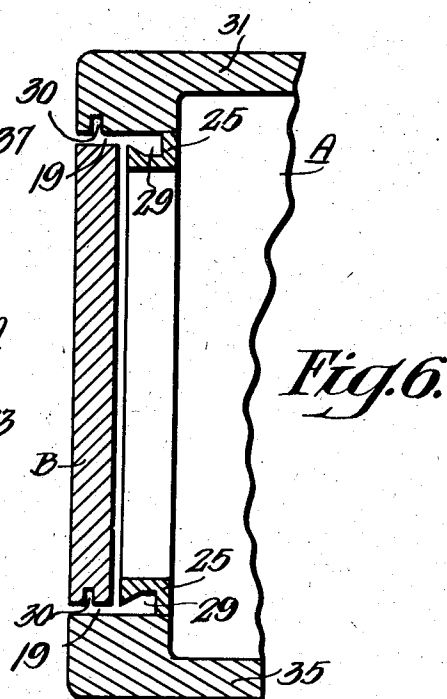
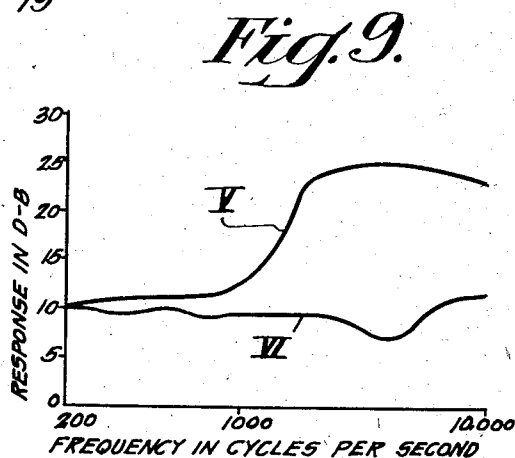
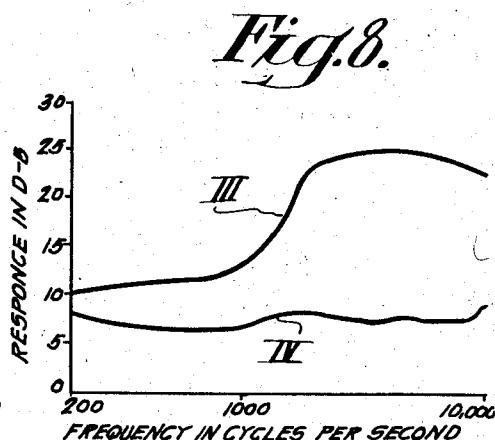
H. F. OLSON

2,247,731

CABINET FOR HOUSING SOUND-REPRODUCING APPARATUS

Filed July 31, 1940

2 Sheets-Sheet 2



Inventor
Harry F. Olson
 Attorney

UNITED STATES PATENT OFFICE

2,247,731

CABINET FOR HOUSING SOUND-REPRODUCING APPARATUS

Harry F. Olson, Haddon Heights, N. J., assignor
to Radio Corporation of America, a corporation
of Delaware

Application July 31, 1940, Serial No. 348,632

14 Claims. (Cl. 274—2)

This invention relates to cabinets for housing sound-reproducing apparatus, and more particularly to an acoustic filter therein for attenuating sounds of certain frequencies reproduced by phonographs housed therein, the present invention being an improvement over that disclosed and claimed in the copending application of Alexander D. Burt, Serial No. 343,107, filed June 29, 1940, and assigned to Radio Corporation of America.

The term "phonograph" is usually applied to a system in which a needle follows the undulations in the groove of a record and transforms the undulations into corresponding acoustical or electrical variations. In the case of a phonograph employing the combination of a pickup, an amplifier and a loudspeaker, the mechanical variations due to the motion of the needle carried by the pickup are transferred to the mechanoelectrical transducer and are transformed into corresponding electrical variations. The vibration of the various elements of the pickup and the vibration of the record itself due to the interaction between the needle and the record leads to the production of very high intensity sounds by direct transformation from mechanical variations into acoustical variations of the air immediately surrounding the pickup and the record. Because of the relatively small sizes of the vibrating elements, the major portion of this energy is confined to the high frequency region. The peculiar conditions under which this sound is generated, in general, leads to considerable distortion in the sound which emanates directly from the pickup and the record. In addition, because of the relatively short wave lengths at the higher frequencies, the sound due to mechanical vibration of the pickup and the record is not in phase with the sound which emanates from the loudspeaker. For the foregoing reasons, it is highly desirable to suppress the sound which issues directly from the pickup and record system.

Various attempts have heretofore been made to suppress the sound emanating directly from the pickup and the record. This can be reduced, for example, by enclosing the pickup in a console type phonograph cabinet having a lid. However, due to manufacturing difficulties and the natural warpage of wood, there is a normal clearance between the door or lid and the body of the cabinet. The use of rubber or other positive seals of this type between the lid and the body of the cabinet has also been suggested, but this is not practical because a locking system which compresses the seal must be used. Unless this expedient is em-

ployed, a slit will be formed between a lesser or greater portion of the cabinet and lid or door system, but the use of a compression lock has not met with public favor.

In the aforementioned copending application of Alexander D. Burt, there is disclosed and claimed an improved cabinet wherein a series of grooves or channels are formed in the upper edges of the walls constituting the body of the cabinet and upon which the lid or cover of the cabinet rests when in closed position. These channels, in conjunction with the slit between the body and the cover of the cabinet, constitute an acoustic filter which attenuates the higher frequencies. While a system of this sort provides excellent results, there are certain manufacturing difficulties involved in forming the filter in the manner disclosed in the aforementioned copending application, and it is some times difficult to obtain a filter in this way which provides the desired attenuation.

The primary object of my present invention is to provide an improved phonograph cabinet which will not be subject to the aforementioned limitation.

More particularly, it is an object of my present invention to provide, in a cabinet for housing sound-reproducing apparatus such as a phonograph, an improved acoustic filter which can be arranged to provide any desired degree of attenuation of the sounds emanating directly from the record and pickup and normally reaching the ear of the listener during operation thereof.

Another object of my present invention is to provide an improved cabinet as aforesaid which is simple in construction, is inexpensive to manufacture, which readily lends itself to rapid quantity production, and which is highly efficient in use.

Instead of forming the grooves or channels in the body of the cabinet itself, as disclosed in the aforementioned Burt application, I provide, in accordance with my present invention, a frame member which is secured internally of the cabinet either to the body walls in proximity to the lid or door of the cabinet, or to the cover in proximity to the body. The frame is preferably made of a plurality of interconnected, preformed molding strips or sections each of which is shaped to provide one or more channels constituting acoustic capacitances of predetermined value. These, in association with the slit between the lid or door and the body of the cabinet, provide a network which very effectively sup-

presses the higher frequency sounds radiated directly from the pickup and the record.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention, itself, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description of several embodiments thereof, when read in connection with the accompanying drawings, in which

Figure 1 is a central sectional view of the equipment according to one form of my invention,

Figure 2 is a top elevation of the body portion thereof with the cover removed,

Figure 3 is an enlarged, fragmentary section taken on the line III—III of Figure 2,

Figure 4 is an electrical wiring diagram corresponding to the acoustical system of the network shown in Figures 1, 2 and 3,

Figure 5 is a sectional view of another form of my invention,

Figure 6 is a fragmentary section of still another form of my invention, and

Figures 7, 8 and 9 are response curves showing the attenuation that may be obtained with my present invention as compared with conventional cabinets.

Referring more particularly to the drawings, wherein similar reference characters designate corresponding parts throughout, I have shown, in Figs. 1, 2 and 3, the cabinet having a body portion A comprised of a plurality of interconnected walls 1, 3, 5 and 7, and a cover or lid B hinged to one of the walls, such as the wall 5, and adapted to overlie the upper ends of the walls when the cover B is in closed relation to the body A, as shown in Fig. 1. The body A is of hollow construction and is provided with a partition or motor board 9 upon which is mounted a suitable phonograph 11 which includes a sound-reproducing instrumentality, such as an electrical pickup device 13, and a turntable 15 which supports a record 17 in operative relation to the pickup device 13.

Due to manufacturing inaccuracies, warpage in the wood of which the cabinet is made, and other similar causes, there is a small space 19 between the body A and the cover B in practically all cabinets. This space has been somewhat exaggerated in the drawings by having the cover A rest on the hinge 21 and on a pair of rubber or felt bumpers 23. It is through this space that sounds emanating directly from the pickup device 13 and the record 17 due to the mechanical vibration thereof pass out to the exterior of the cabinet and cause considerable annoyance, especially at the higher frequencies.

In order to overcome this difficulty, I provide an endless frame member 25 made up of a plurality of interconnected molding strips, one each of which is connected to the upper marginal portions of each of the walls 1, 3, 5 and 7. Each of the molding strips of the frame 25 is substantially L-shaped in transverse cross section to provide a horizontal portion or arm 25a (see Figure 3) through which the strips may be secured in suitable manner to the respective walls of the cabinet, and a vertical arm 25b which extends parallel to the associated wall in spaced relation thereto, the upper surface 25c of the frame member 25 being substantially flush with the upper edges of the walls of the cabinet. The vertical arm 25b may be preformed to any de-

sired shape, and in the particular form illustrated in Figs. 1, 2 and 3, each arm 25b has an enlarged upper portion or head 27 which extends forwardly toward its associated wall, this providing, between the arm 25b and the associated wall, a cavity or channel 29 having a relatively wide bottom and which tapers off to a relatively narrow mouth at the top. Each of the heads 27 of the arms 25b may also be formed with a channel 30 extending parallel to the associated channel 29.

Referring more especially to Fig. 3, it will be noted that the previously described construction affords the spaces or space sections 19a and 19b between the vertical arm 25b of each section of the frame member 25 and the cover B, and also that the overlapping portion of the cover and any one of the walls of the cabinet have a space 19c therebetween. The spaces 19a, 19b, and 19c are, of course, all in series. The equivalent electrical circuit of the acoustical system of Figs. 1, 2 and 3 is shown in Fig. 4 wherein

m_1 is the inductance of the volume of air immediately inside of the frame 25 and under the cover B, as bounded by the dotted line E in Fig. 3, for example,

r_1 is the acoustic resistance of this volume of air, m_2 is the inductance of the air in the space 19a, r_2 is the acoustic resistance of the air in the space 19a,

m_3 is the inductance of the air in the space 19b, r_3 is the acoustic resistance of the air in the space 19b,

m_4 is the inductance of the air in the space 19c, r_4 is the acoustic resistance of the air in the space 19c,

m_5 is the inductance of the volume of air immediately outside of the cabinet in the vicinity bounded by the dotted line F in Fig. 3,

r_5 is the acoustic resistance of this volume of air, m_6 is the inductance of the air at the mouth of the channel or cavity 29,

r_6 is the acoustic resistance offered by the air at the mouth of the cavity 29,

r_7 is the resistance offered by the walls enclosing the volume of air in the lower or larger portion of the cavity 29,

c_1 is the acoustic capacitance of the cavity 29, c_2 is the acoustic capacitance of the channel or cavity 30, and

r_8 is the resistance offered by the walls enclosing the air in the cavity 30.

The values of m_6 , r_6 , r_7 , r_8 , c_1 and c_2 , as well as the values of m_2 , m_3 , r_2 , and r_3 can be easily controlled by making the molding strips of the frame 25 of any desired shape, and thus any degree of attenuation may be obtained.

In Fig. 5, I have shown another form of my invention wherein the cabinet A is constituted by a top wall 31, a back wall 33, a bottom wall 35 and end walls 37, the cover B being constituted by a door hinged to one of the end walls 37 and arranged to swing inwardly between and flush with the ends of the walls 31, 35 and 37 when the door B is in closed relation to the body A. The frame 25 is secured to the door B instead of to the walls of the cabinet, and the channel 30 may be formed between the channel 29 and the door B. It will be noted that the molding members of which the frame 25 is formed are again substantially L-shaped in transverse cross section, the vertical arms being secured to the door B and the horizontal arms having the channels 29 and 30 formed therein.

A somewhat simpler, although equally effective, arrangement is shown in Fig. 6. In this modification, which employs a cabinet and door similar to that shown in Fig. 5, the frame 29 is secured to the top and bottom walls 31 and 35 and to the end walls 37, with one arm of each molding member spaced from the associated wall to provide only the cavity 29. The cavities or channels 30 may be formed either in the door B or in the walls of the cabinet, and, in the particular form illustrated in Fig. 6, I have shown one such channel formed in the lower edge of the door B and another formed in the overlapping portion of the top wall 31.

A comparison of the curves in Figs. 7, 8 and 9 will show the advantages of my present invention. In Fig. 7, the curve I shows the response frequency characteristic of a conventional door and cabinet arrangement, the response being arbitrarily chosen as unity. The curve II in this figure shows the response frequency characteristic of a cabinet having my improved acoustic network incorporated therein as compared with the response of the conventional door and cabinet shown by curve I.

In Fig. 8, the curve III shows the response frequency characteristic of a sound source within a cabinet of conventional design, and curve IV shows the response frequency characteristic of the same cabinet and sound source where a perfect seal is provided between the door and the cabinet.

Figure 9 shows a set of experimental curves, the curve V, like the curve III of Figure 8, showing the response frequency characteristic of a sound source within a cabinet of conventional design, and the curve VI showing the response frequency characteristic of the same cabinet and sound source after being equipped with an acoustic network in accordance with my present invention. It will be noted that the attenuation shown by curve VI is considerable, particularly at the higher frequencies, and that it compares most favorably with the curve IV of Fig. 8.

From the foregoing description, it will be apparent to those skilled in the art that I have provided a novel cabinet and acoustic filter arrangement which will effectively suppress the annoying higher frequency sounds normally associated with phonographs. Although I have shown and described several forms of my invention, it will be apparent to those skilled in the art that many other variations thereof are possible and I therefore desire it to be understood that my invention is not to be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. A cabinet for housing sound-reproducing apparatus comprising a body part, a cover part movably associated therewith, said parts having portions thereof in overlapping and slightly spaced relation when said cover is closed with respect to said body, the space between said body and cover permitting the passage of sound waves emanating from said apparatus out to the exterior of the cabinet, and means connected to at least one of said parts in slightly spaced relation to the other of said parts providing at least one cavity constituting an acoustic capacitance for sound waves emanating from said apparatus.

2. A cabinet for housing sound-reproducing apparatus comprising a body part, a cover part movably associated therewith, said parts having portions thereof in overlapping and slightly

spaced relation when said cover is closed with respect to said body, the space between said body and cover permitting the passage of sound waves emanating from said apparatus out to the exterior of the cabinet, and means connected to one of said parts in slightly spaced relation to the other of said parts to provide a second space therebetween in series with said first space, said means being constructed and arranged to also provide at least one acoustic capacitance for the sound waves passing through said spaces, and said capacitance cooperating with the acoustic resistances and inertances offered to said sound waves by said spaces to constitute an acoustic filter for attenuating at least certain of said waves.

3. The invention set forth in claim 2 characterized in that said capacitance is in shunt relation to said spaces.

4. The invention set forth in claim 2 characterized in that said means is constituted by a substantially L-shaped member one arm of which is secured to the body of the cabinet with the other arm thereof in parallel relation to and spaced from said body, the space between said member and said body providing a cavity constituting said capacitance.

5. A cabinet for housing sound-reproducing apparatus comprising a body part, a cover part movably associated therewith, said parts having portions thereof in overlapping and slightly spaced relation when said cover is closed with respect to said body, the space between said body and said cover permitting the passage of sound waves emanating from said apparatus out to the exterior of said cabinet, and an endless frame member secured to one of said parts in slightly spaced relation to the other of said parts to provide a second space through which said waves will pass, said spaces being in series with each other, and said frame having a portion in spaced relation to the part to which it is secured to provide a cavity therebetween in shunt relation to said spaces, said spaces and said cavity cooperating to provide an acoustic filter for attenuating at least certain of said waves.

6. A cabinet for housing sound-reproducing apparatus comprising a body part constituted by a plurality of interconnected walls, a cover part movably associated therewith, said parts having portions thereof in overlapping and slightly spaced relation when said cover is closed with respect to said body, the space between said body and said cover permitting the passage of sound waves emanating from said apparatus out to the exterior of said cabinet, and an endless frame secured to one of said parts, said frame being substantially flush with those ends of said last-named part with which the ends of the other of said parts cooperates to provide a second space which is between said frame and said other part, and certain portions of said frame being spaced from said first-named part to provide at least one cavity therebetween in shunt relation to said first and second-named spaces, said cavity and said spaces cooperating to provide an acoustic filter for attenuating at least certain of said waves.

7. A cabinet for housing sound-reproducing apparatus comprising a body part constituted by a plurality of interconnected walls, a cover part movably associated therewith, said parts having portions thereof in overlapping and slightly spaced relation when said cover is closed with respect to said body, the space between

said body and said cover permitting the passage of sound waves emanating from said apparatus out to the exterior of said cabinet, and an endless frame secured to said walls interiorly of the cabinet, said frame being substantially flush with those ends of said walls with which said cover cooperates whereby to provide a second space which is between said cover and said frame, and certain portions of said frame being spaced from said walls to provide a cavity therebetween in shunt relation to said first and second-named spaces, said cavity and said spaces cooperating to provide an acoustic filter for attenuating at least certain of said waves.

8. The invention set forth in claim 7 characterized in that said frame is constituted by a plurality of interconnected members each of substantially L-shaped cross section and each having one of its arms connected to one wall of said body part, the other arm thereof being spaced from the cooperating wall to provide said cavity.

9. The invention set forth in claim 7 characterized in that said frame is constituted by a plurality of interconnected members each of substantially L-shaped cross section and each having one of its arms connected to one wall of said body part, the other arm thereof being spaced from the cooperating wall to provide said cavity and being so shaped that said cavity is narrower at one end than at the opposite end.

10. The invention set forth in claim 7 characterized in that said frame is constituted by a plurality of interconnected members each of

substantially L-shaped cross section and each having one of its arms connected to one wall of said body part, the other arm thereof being spaced from the cooperating wall to provide said cavity and being so shaped that said cavity is narrower adjacent said cover than at its opposite end.

11. The invention set forth in claim 7 characterized in that said frame is constituted by a plurality of interconnected members each of substantially L-shaped cross section and each having one of its arms connected to one wall of said body part, the other arm thereof being spaced from the cooperating wall to provide said cavity, and characterized further in that said other arm of each of said members is provided with a channel in parallel relation to said cavity.

12. The invention set forth in claim 5 characterized in that an additional cavity is provided in said frame member in shunt relation to said first-named cavity.

13. The invention set forth in claim 5 characterized in that an additional cavity is provided in at least one of said parts in shunt relation to said first-named cavity.

14. The invention set forth in claim 5 characterized in that at least one additional cavity is provided in said body in proximity to said cover and at least one other cavity is provided in said cover in proximity to said body, said additional cavities being in shunt with said first-named cavity.

HARRY F. OLSON.