May 3, 1932. E. W. SCHERR, JR 1,856,730

PIANO LOUD SPEAKER

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Fig. 1.

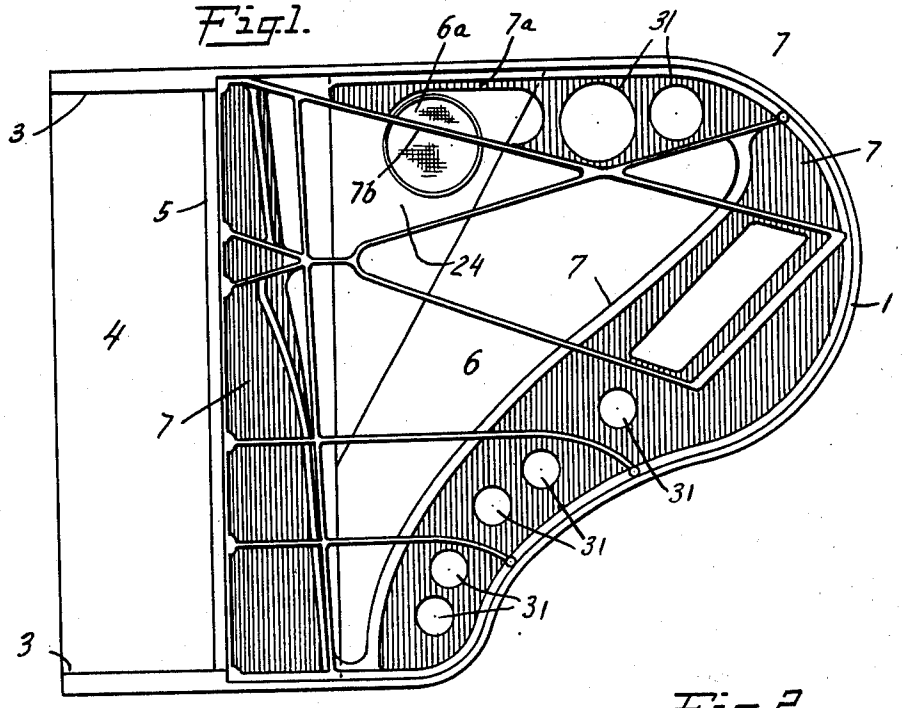

Fig. 2.

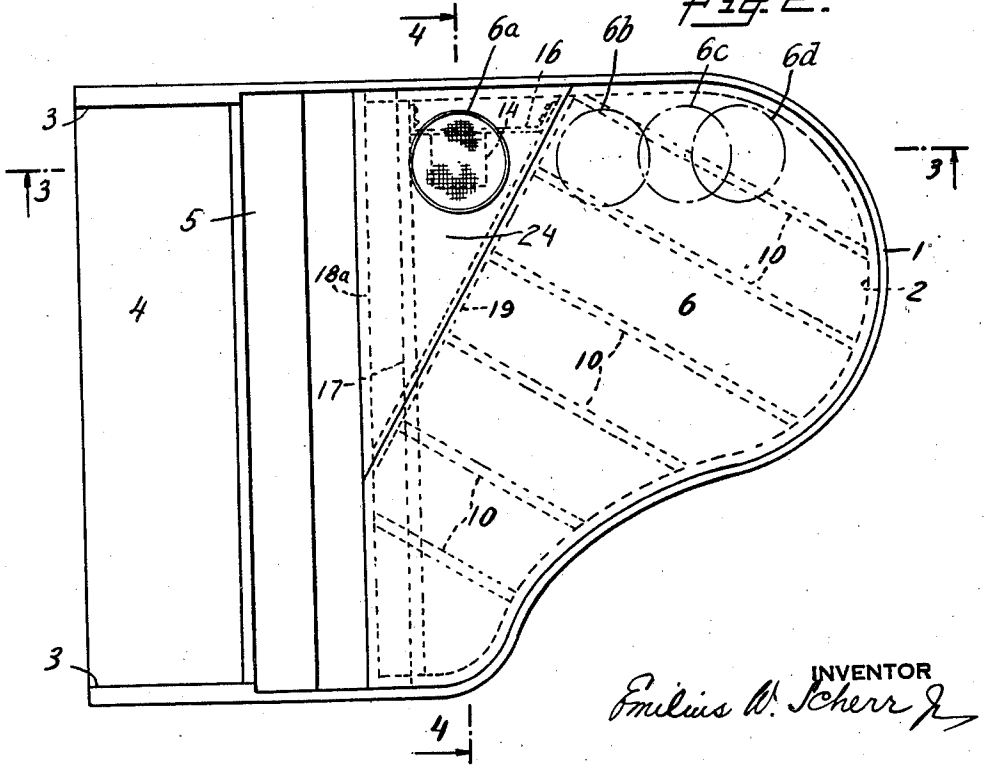

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Fig. 3.

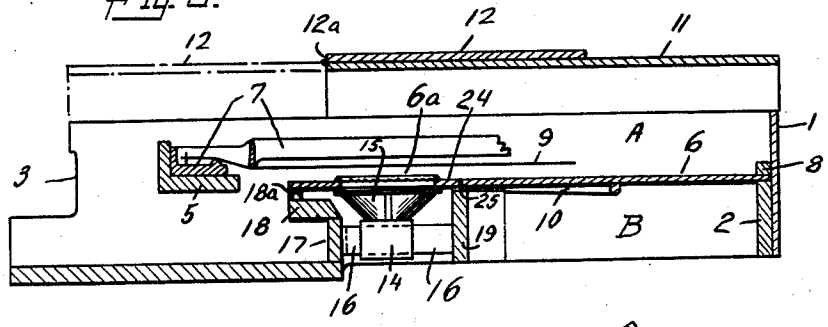


Fig. 7.

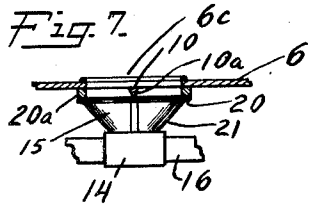


Fig. 4.

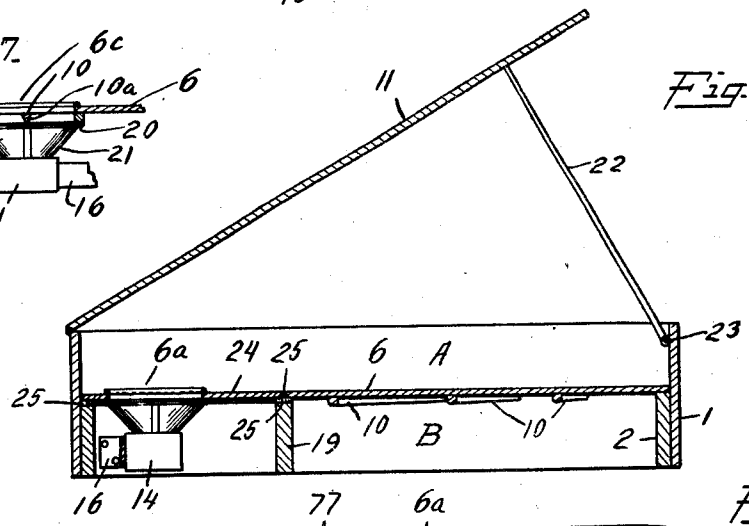


Fig. 8.

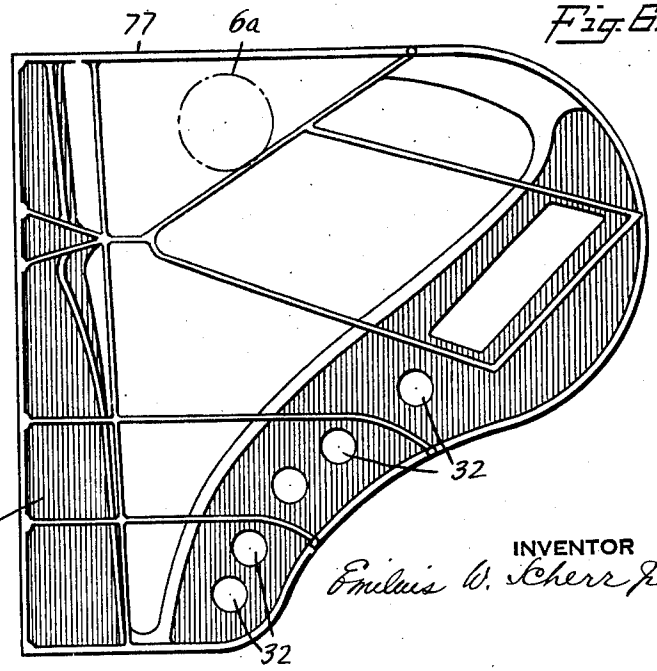
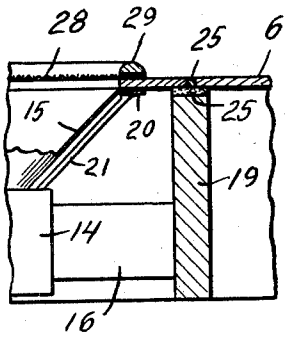


Fig. 5.



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Patented May 3, 1932 1,856,730

UNITED STATES PATENT OFFICE

EMILIUS W. SCHERR, JR., OF NEW YORK, N. Y., ASSIGNOR TO THE AEOLIAN COMPANY, A CORPORATION OF CONNECTICUT

PIANO LOUD SPEAKER

Application filed May 31, 1929. Serial No. 367,235.

My invention consists in the combination of a radio loud speaker, or a loud speaker for an electrical phonograph, with a horizontal or grand piano and analogously with an upright piano whereby the sound board and the case and other construction parts of the piano are caused to act as an efficient baffle for the loud speaker without impairing the operativeness of said sound board or the tone quality of the piano. The object of the baffle is to prevent the tones delivered by one side or face of the cone or diaphragm of the loud speaker from interfering with and cancelling those delivered by the opposite side, this being most likely to happen with the bass tones which but for the baffling would be largely cancelled out and lost. This and other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention has been selected for purposes of illustration herein and is shown in the accompanying drawings in which Fig. 1 is a plan view of a horizontal or grand piano embodying my invention in a preferred form thereof with the piano lid omitted; Fig. 2 is the same as Fig. 1 except that the string plate of the piano has been removed; Fig. 3 is a vertical cross section, partly in elevation, on the line 3—3 in Fig. 2 looking in the direction of the arrows, the piano lid being shown as if open as in Fig. 4 with its front section folded back; Fig. 4 is a vertical cross section, partly in elevation, on the line 4—4 in Fig. 2 looking in the direction of the arrows and showing the piano lid propped up in its raised position; Fig. 5 is an enlarged detail view of a portion of Fig. 4; Fig. 6 is a plan view of another form of piano string plate modified for the purposes of this invention and usable as a substitute for the string plate shown in Fig. 1; and Fig. 7 shows the details of the loud speaker installation if it be desired to install same at an opening 6[c] in the sound board.

I will now describe my invention and will refer to the preferred embodiments thereof shown in the accompanying drawings but, of course, without necessarily limiting my invention thereto.

1 is the usual outer rim of a grand piano case glued to the inner rim 2. 3 designates the cheek pieces formed of the front ends of said outer rim. 4 is the usual key-bed horizontally connecting said cheek pieces. 5 is the usual wrest plank. 6 is the piano sound board supported upon and glued to the top edge of the inner rim as usual. 7 is the string plate supported within the outer rim upon blocks 8, the latter in turn supported by the inner rim, said string plate being supported at the front by the wrest plank 5. 9 designates the piano strings strung as usual on the string plate. 10 designates the wooden ribs glued to the under side of the sound board. The usual bridges on top of the sound board for delivering the vibrations of the strings thereto are not necessary to be shown, nor are such other parts of the piano construction as the piano hammer action. 11 is the usual piano lid hinged to the bass side of the piano case or outer rim 1 and having the usual front section or flap 12 hinged at 12[a] to the main portion of the lid, said flap being shown by the full lines 12 in Fig. 3 folded back and being shown by the dotted lines 12 in its extended or folded down position. 22 is the usual lid prop pivoted to the piano case at 23 for supporting the lid in raised position.

The loud speaker may be of any preferred or well known hornless type which will voice substantially the full range of vocal and musical vibrations and may be of the magnetic, dynamic or other preferred type. The dynamic type, due to its ability to voice the bass tones, is especially desirable.

The chassis of the illustrated dynamic speaker is designated 14 and its vibratory conical diaphragm 15, whose mouth presses against the under side of the board through which there is a circular opening which is comparatively large relatively to the sound board, and which opening is concentric with the mouth of said cone. Thus, said opening through the sound board may be nine inches in diameter or more, whereas the mouth of the cone may be nine and a half inches or larger. In actual practice, the loud speaker cone has at its mouth an outwardly extending flange which is peripherally attached to

the metal ring 20 (Fig. 5) supported by several thin metal arms 21 from the chassis 14. Thus, said ring and arms form a spider which supports the cone without interfering with its vibration and which prevents it from being crushed or injured when the mouth of the cone is pressed sound-tight against the under side of the margin of the hole in the board as hereinafter referred to. The chassis is supported by the metal brackets 16 from the braces and underneath framework and structure of the piano.

17 is a wooden cross bar paralleling the front of the piano located at the rear of the key-bed and extending across between the sides of the piano case. One loud speaker bracket is secured to this cross bar 17. 18 is a similarly located wooden cross bar shelf glued to the top of the cross bar 17, and like it also extending fully across between the sides of the piano case. The front margin of the sound board overlies this shelf 18, as shown in Fig. 3, and is glued to the strip 18^a supported by said shelf, said strip extending for the full length of said shelf between the sides of the piano case.

Thus, the tone is delivered upwardly from the mouth of the cone into the space in the piano case above the sound board at the bass side of the piano, whence it can readily deliver into the room even when the lid is down with the front flap turned back, or will be deflected by the lid into the room when the lid is in its propped up position as in Figs. 3 and 4. Figs. 2, 3 and 4 show how the board and the cross bar 17 and shelf 18 divide the interior of the piano case into an upper space A and a lower space B, and that the opening in the board by which these spaces would otherwise communicate is closed by the diaphragm of the loud speaker. This construction baffles the tones delivered by the two sides or faces of the diaphragm from interfering with each other and is assisted in this by the walls of the outer rim or case of the piano, also by the piano lid (compare Fig. 4), also by the large expense between the diaphragm and the front, back and right side of the piano, in fact, by the large expanse everywhere except at the left or bass side where, however, the outer rim and the piano lid serve to make good the baffling.

In spite of the conventions of piano building to the contrary, the aforesaid large opening for the diaphragm may be put directly through the sound board 6; or the bass corner of the sound board may be entirely cut off and the opening put through a separate corner-piece 24 inserted to close over the triangular opening left by the removed bass corner of the sound board. The latter corner-piece construction is illustrated in Figs. 1 to 5 inclusive. 19 is a diagonal wooden brace extending diagonally across the bass corner of said board between the cross bar 17 and the rim of the piano case. This brace 19 supports the adjacent marginal portions of both the aforesaid corner-piece 24 and of the sound board 6. Sound-deadening material such as felt 25 may be inserted between the corner-piece and the inner rim 2 and the diagonal brace 19; also between said corner-piece and the sound board. This insulation of the loud speaker from the piano sound board and strings is not essentially necessary but nevertheless serves to prevent any rattling of loose loud speaker parts when the piano is played upon and the sound board is vibrated thereby.

I have purposely located the large diaphragm opening at the bass side of the sound board and preferably as aforesaid at its front bass corner, first because the baffling effect is effective at this location, and secondly, because I find this is one of the least active and therefore least needed areas of the sound board when the piano itself is played upon. In other words, in said locations there is not only an adequate baffling effect of the loud speaker so that it voices the entire range of tones quite perfectly, including the bass, but also in spite of what is the general opinion to the contrary of piano constructors, there is no substantial impairment of the operativeness of the sound board or of the tone of the piano. In fact, if anything, the tone is improved.

Fig. 1 shows the usual piano string plate modified by cutting away the web 7^a of the plate wherever it otherwise would overlie and obstruct the delivery of the tone by the loud speaker diaphragm. The result is that in said Fig. 1 only the rib 7^b of the string plate somewhat obstructs the mouth of the diaphragm by crossing it. However, this is not so serious as any substantial obstruction of the mouth of the diaphragm by the web 7^a of the string plate since the latter, due to its close proximity to said mouth, gives a muffled quality to the reproduction. However, it is better not to have any obstruction whatsoever by the string plate and for this reason a specially designed string plate 77 is shown in Fig. 6 wherein neither any part of the web nor of the ribs obstructs the loud speaker opening 6^a in said figure, this being shown in the same relative location as in Figs. 1 and 3.

To prevent foreign matter from getting into the mouth of the cone, a thin fabric covering 28 may be stretched over the hole in the board, said fabric being peripherally gripped between the wooden ring 29 and the margin of the hole through the board.

The opening of the loud speaker diaphragm might also be put through the sound board at 6^b, 6^c, or 6^d (Fig. 2) without impairing the operativeness of the sound board or the tone of the piano, the baffling being better at 6^b and 6^c than at 6^d unless the lid be down.

In either case the web of the string plate should be removed or so designed as not to obstruct the loud speaker's delivery through either of said openings. When the opening is located in most other places through the sound board than those shown at the bass side of the piano, either the sound board or the piano tone are seriously impaired or ruined; or the baffling effect on the loud speaker is insufficient; or both of these effects may result.

It will be noted that the chassis of the loud speaker is preferably not supported from the board. The holes 31 through the string plate in Fig. 1 and the holes 32 through the other string plate in Fig. 6 represent the usual piano string pla'e construction without reference to the present invention. When the form of the invention is adopted which cuts off the bass corner of the sound board, the ribs 10 (Fig. 2) of said board are likewise cut off and have their ends tapered or reduced in thickness as they approach said cut off edge of the board in order to increase the sensitivity of the sound board. Where the loud speaker opening is located at 6c, one of the piano ribs 10 is allowed to extend more or less diametrically across said opening so as to preserve the proper operativeness of the board in spite of the weakening effect on the board of the large diaphragm opening. This construction is shown in Fig. 7, from which it will be seen that where said rib crosses the opening, it may be given a triangular cross-section 10a with the apex of the triangle directed toward the diaphragm so that the rib will cause minimum obstruction. 20a designates arcuate pieces of wood at the margin of the opening 6c filling in the spaces between the ribs 10 to the depth of said ribs so as to make an even surface or rim for the mouth of the loud speaker cone to bear snugly against.

Removing the bass front corner from the sound board as already indicated does not impair the tone of the piano. On the contrary, it tends to improve it. But the removed corner should be replaced as in Figs. 2, 3 and 4, by another corner-piece 24 as heretofore described so that the bass tones delivered by the two faces of the sound board cannot interfere with and cancel each other via the opening made by the removing of said corner.

It will be understood that this invention is not limited to the embodiment herein shown for purposes of illustration, but that on the contrary it may be variously modified and embodied within the scope of the annexed claims, and may also be similarly embodied with an upright piano by locating the loud speaker at an opening positioned and formed analogously to that set forth for the horizontal type of piano.

What I claim is:

1. In combination, a horizontal piano with its case and lid; a construction within said case including the piano sound board which partitions the interior of said case into an upper space and a lower space, said spaces being connected by an opening located at the bass front corner of the sound board; and a hornless vibratable diaphragm loud speaker supported with the margin of its diaphragm at the margin of said opening with the diaphragm closing said opening.

2. In combination, a horizontal piano with its case and sound board, the front corner of said sound board at the bass side being removed; and a closure substituted for said removed sound board corner arranged to prevent the bass tones delivered by the two faces of the sound board from interfering with and cancelling each other at said removed corner.

3. In combination, a horizontal piano with its case and sound board, the front corner of said sound board at the bass side being removed; a closure substituted for said removed sound board corner arranged to prevent the bass tones delivered by the two faces of the sound board from interfering with and cancelling each other at said removed corner; and a brace forming part of the piano framework and supporting the edge of the sound board at said bass front corner.

Signed at New York, in the county of New York and State of New York, this 28th day of May, A. D. 1929.

EMILIUS W. SCHERR, Jr.