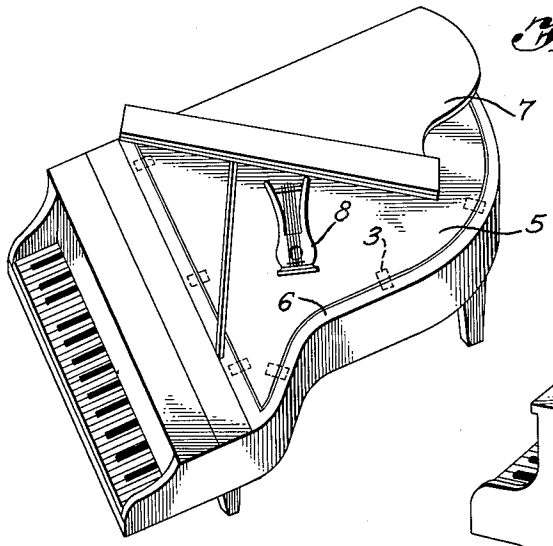
May 15, 1962 F. P. DA COSTA 3,034,391

HOUSING AND SOUNDING BOARD FOR A STRINGED MUSICAL INSTRUMENT

Filed Aug. 27, 1957

Fig. 1.



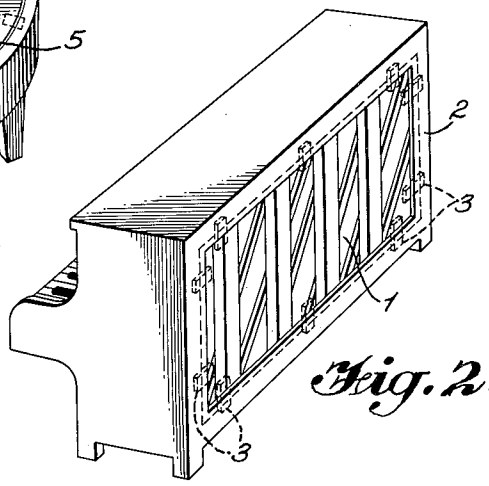


Fig. 2.

Fig. 3.

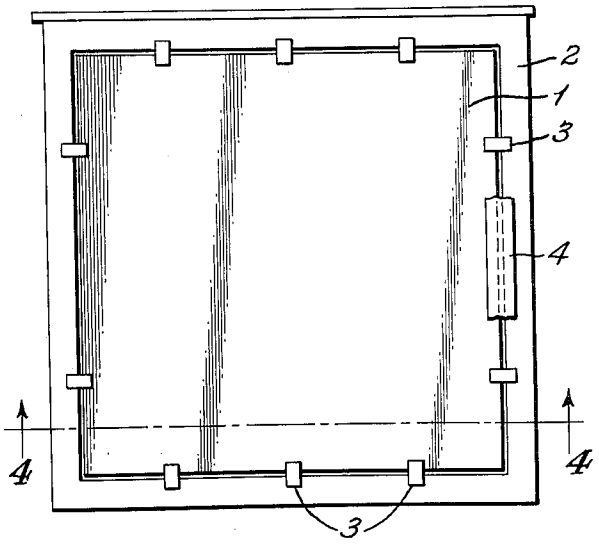
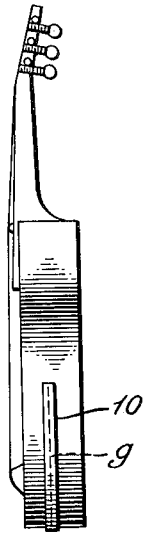


Fig. 5.



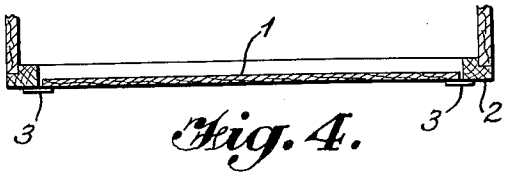


Fig. 4.

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HOUSING AND SOUNDING BOARD FOR A STRINGED MUSICAL INSTRUMENT

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This invention relates to musical instruments and, more specifically, to stringed instrument sound boards.

In many situations, the vibratory phenomena in musical instruments are better explained when compared to similar phenomena produced on liquid surfaces in a state of calmness. It is a fact that sound waves and waves on liquid surfaces are produced in the same manner, under similar conditions. This comparison will serve to clarify the effect produced by sound vibrations in stringed instruments.

For example, an ordinary glass may be filled to the brim with water, and a small lead ball is then dropped into the glass. Immediately a series of concentric waves are formed which expand to the edge of the glass and then overflow the glass, thus spilling some of the water.

It has been verified in the repetition of this experiment that, as the level of the liquid in the glass becomes lower, it becomes impossible to produce an overflow, as concentric waves are not formed on the surface of the liquid in the glass. In place of the concentric waves, the liquid surface is stirred in a chaotic and disorderly manner.

This is easily explained for the liquid waves in their natural manner of expansion, when striking against the sides of a glass, return towards the center and in their return collide with other waves originating from the center. This results in a clash between the waves that come from the center and the ones that come from the periphery, thus creating a chaotic condition by disturbing all the waves and changing their direction.

This same condition occurs to a greater extent in sound waves produced in the cases and sound boards of stringed instruments. For example, when each string of a piano is stroked, a series of waves are originated which expand throughout the sound board toward its periphery. Since the periphery of the sound board is in the body of the piano, it can be verified that the vibrations on the periphery are practically non-existent. This results in sound waves which are very much reduced in strength and greatly distorted. Thus a non-sonorous sound results from the clash of the out-going waves with the returning waves. In other words, it is as though a stiff frame were placed over the face of a loose gong. The sonority of this instrument would be greatly reduced and considerably affected.

Consequently, it is an object of this invention to present improvements in the cases and sound boards of stringed instruments which obtain new and improved sonorous effects never before accomplished in known instruments.

Ideally, according to the invention, the periphery of the sound board or covering board of pianos and other stringed instruments would be left entirely free so that the sound effect may be enhanced to a maximum extent. Of course, since the sound board must be supported, it is not possible to eliminate all mounting members. This invention presents several specific examples of stringed musical instruments embodying a sound board, covering board, or its equivalent which is connected to the frame of the musical instrument only to the extent necessary to achieve sufficient support so that the periphery of the sound board is free to vibrate.

The excellent results obtained in achieving greater and better sonority surpassed all expectations. Superior results have been obtained in various instruments including old pianos, the reconditioning of which was believed impossible. Such pianos became much better than when they were new and considered to be of good quality.

In general terms, the new improvements consist in giving the sound boards or cases of stringed instruments as much freedom to vibrate relative to the frame housing of the instrument as possible. The sound board is not attached to the body of the piano in all of its periphery but is attached to the piano only in some parts of the periphery in order to permit it to vibrate to its fullest extent without, at the same time, decreasing the strength of the whole. Thus, it is possible for the sound board to vibrate substantially freely over all its surface and up to the periphery and, under certain conditions, vibrations may be set up in the suspension points though, of course, to a lesser degree. This will also occur in the sound boards of other stringed instruments according to the invention as will be more fully described hereinafter.

The improvement contemplated by the invention can be made in the covering board of upright pianos which have removable boards. In grand pianos, similar improvements can be made. In addition to the conventionally hinged covering board of a grand piano, which covering board is usually lifted, another harmonic board can be attached only at some points and provided with connections to the instrument frame which connections may be flexible.

Finally, the same improvements applied to pianos may be applied, with minor changes or alterations, to such stringed instruments as violins, violas, violoncellos, mandolins and others, in order that the sounds resulting from vibration of the cover or lid under the easel which supports the strings may be splendidly enriched. A simple crevice or slot is provided in the side wall of the case of such instruments, preferably in the lower portion of the side wall. This crevice or slot may be covered with a ribbon or tape of flexible or pliable material. Thus, greater vibration of the lid or cover of the harmonic box of the instrument is permitted. Consequently, there is less weakening and distortion in the transmission of the sonorous waves and thereby greater extension of them. The player of a musical selection can therefore obtain unexpeced and pleasant musical effects including a fundamental harmonious sound which is enriched both in quantity and quality.

It is proper to observe that the opening between the harmonic board and the frame of a piano and the fissure or slot in the lower side wall of the sound box of other stringed instruments are for the sole purpose of freeing the edges of the boards or the sonorous lid as much as possible. Such openings or slots do not serve to drain off the air or to provide passages for the sound as some lay persons commonly believe. This fissure or crevice is preferably always closed by an elastic or flexible ribbon. If the fissure or crevice is too wide, a detrimental effect will be produced and the advantages derived from the ability of the harmonic cover, sound box or equivalent to freely vibrate will be diminished.

For a greater and better knowledge and comprehension of the improvements introduced in the boxes and harmonic boards of stringed musical instruments contemplated by this invention, said improvements are specifically illustrated in the drawings appended hereto:

FIGURE 1 represents a perspective of an opened grand piano in which the harmonic board is provided with the improvements according to the invention;

FIGURE 2 also represents in perspective the back of an upright piano embodying an improved harmonic board according to the invention;

FIGURES 3 and 4 represent a plan view and a sec-

tional view taken along line 4—4 of FIGURE 3, respectively, of the harmonic board for pianos; and

FIGURE 5 represents a lateral view or profile of a viola or the like having a harmonic box embodying the improvements according to the invention.

It is clear that the improvements with respect to pianos consist of the freedom of the edges of the harmonic board 1 which may consist of a solid wooden sheet. These edges are not glued or permanently or rigidly attached along their entire length to the frame structure or the case of the piano, but are attached at only a few points to a frame 2 which, in turn, is securely held to the body of the instrument in a tight manner. The bindings at these points could be elastic or flexible but preferably consist of wooden members 3, staples or other appliances that connect the sound board to the frame at spaced locations but permit free movement of the sound board between the connections so as not to materially interfere with the integral vibration of the above-mentioned wooden sheet up to its own periphery. The members 3 may be secured to the harmonic board and the case either on the exterior of the frame structure as shown in FIGURES 3 and 4 or on the interior if desired. Any conventional means may be employed to connect the members 3 to the frame and harmonic board, it being understood that the drawings are schematic showing only sufficient detail to enable an adequate understanding of the invention. An elastic ribbon, tape or its equivalent 4 may be applied over the opening, fissure or crack between the support board and the harmonic board. The ribbon or tape may be applied either on the inside or on the outside of the fissure, opening or crack.

In grand pianos, the improvements of this invention can be provided by the addition of a supplementary wooden board 5 over the strings. This supplementary board is affixed to the case 6 in the same manner described above. Also connected to the case 6 is the normal movable piano top 7. This supplementary or vibration board 5 may include a representation of a lyre or a harp or any other instrument 8 of artistic motif that may give greater esthetic beauty to the interior of the piano as a whole, in addition to the technical effects that can be obtained.

The harmonic board according to the invention can also be applied to upright pianos to form the back cover of such a piano as shown in FIGURE 2 or to form the board or top cover that is over the key board or both such covers to amplify and improve the qualities of the sound. Moreover, a harmonic board according to the invention may form the vertical board or cover below the key board.

The improvements contemplated by the invention with small variations that are within the ambit of the invention may also be applied to other stringed musical instruments such as violins to achieve maximum freedom of the vibratory board in the harmonic box of such instruments. The upper lid or cover, that is the surface of the

body next to the strings, of the harmonic box is transformed as much as it is possible into a diaphragm.

With respect to the viola (FIGURE 5), the improvements are obtained by providing a crevice or slot 9 in the lateral side of the body or frame of the instrument. Such crevice or slot is preferably covered by a strip of elastic or flexible material 10. The surface of the body next to the strings is thus more free to vibrate, thereby considerably improving the quality of the sound from the harmonic box of the instrument in the same manner as hereinbefore explained. The surface of the body next to the strings may be connected to the body or frame by spaced binders which extend across the crevice or crack. These binders should be flexible or otherwise permit the cover to vibrate relative to the frame.

As an alternative to the construction shown in FIGURE 3, the sound board 1 and the frame 2 may be formed from a single piece of material with the periphery of the sound board being defined by a deep groove which does not extent completely through the material, thus leaving the sound board 1 and frame 2 connected by a thin strip of material which is sufficiently flexible to permit vibration of the sound board 1 relative to the frame 2. If desired, the groove may extend completely through the material at spaced locations to leave an interrupted flexible strip between the sound board 1 and frame 2.

Similarly, the crevice or slot 9 in the instrument shown in FIGURE 5 may be replaced by a groove as described above which leaves the upper and lower portions of the instrument movably connected by a thin flexible strip of material, either continuous or interrupted.

It will be understood that various modifications may be made from the specific embodiments described herein without departing from the scope of the appended claim.

I claim:

In combination with a piano having a sound board, strings and case, a sheet-like member mounted on said case in spaced relation to said sound board, said member being spaced peripherally from said case to provide for passage of sound waves, and said member forming with said case a resonant chamber.

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