Aug. 18, 1936.

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SOUNDBOARD FOR PIANOS AND OTHER INSTRUMENTS OR DEVICES USING SOUNDBOARDS

Filed March 30, 1935

2 Sheets–Sheet 2

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The present invention relates to soundboards for pianos and other instruments or devices using soundboards.

It is an object of this invention to provide a uniform and scientifically correct soundboard adaptable for mounting in a piano case in a manner by holding the edges of the soundboard therein.

Another object of the invention is to provide a soundboard shaped to act in the same manner as a single diaphragm, whereby the soundboard vibrates as a whole.

A further object is to secure a more sensitive response to the vibrations of the strings on the part of the soundboard by changing the cross section of the latter by tapering the soundboard in all directions from the thinnest portion to the thinnest portion thereof at the point of contact of the soundboard with the piano case.

Another object of the invention is to provide a soundboard having at least one side convex or curved in all directions on parabolic curves, or substantially so, so as to graduate the thickness of the soundboard in all directions, and thereby compensate uniformly all around the soundboard for the stiffening induced by anchoring the soundboard at its edges.

Finally, the invention comprises the disposition of parts wherein the greatest mass or depth of the soundboard, the geographical center of the soundboard, and the bridge are substantially coincident.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claim appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views —

Figure 1 is a plan view of my improved soundboard for a grand piano viewed from the convex side thereof, the respective dotted line figures showing generally points of the same depth, the depth decreasing with the increase in size of the dot-dash line figures, and also showing in dot-dash line, the cross sectional line 2 — 2;

Figure 2 is a plan view of one form of the blank for the improved soundboard, the dot-dash line showing the final shape of the board for application to a piano, and showing means for obtaining the so-called geographical centre;

Figure 3 is a vertical section taken on line 3 — 3 of the soundboard, shown in Figure 1, which is constructed according to the present invention, and showing the symmetrical tapering in thickness of the board from its deepest point to its marginal edge;

Figure 4 is an edge view of the soundboard blank in its original flat or plane condition; and

Figure 5 is a sectional view taken through the soundboard fitted to its form or mold, to impart to it a substantially concavo-convex formation to the soundboard and showing the form or mold of slightly larger area than that of the soundboard to support the upwardly curved marginal edges of the board above the face of the form, the dot-dash line showing the line of cut to remove the material of the soundboard above the line of cut.

Referring now to the drawings, and first to Fig. 15 are 1, the soundboard 15 is shown in plan view looking towards the convex side. This convex side is shown in the lower part of Figure 3, the upper part thereof being flat or in a plane.

The greatest depth of the soundboard is indicated generally by the character 9 and the dot-dash line figures indicate uniform depth lines. These figures are obtained from imaginary parallel planes passing through the soundboard, these planes being parallel with the uncurved side of the soundboard. These planes pass through the intersection points of vertical lines 16a, 11a, 12a, 13a, and 14a and the curved surface of the soundboard shown in Figure 3. So the figure 16a has the greatest depth of the figures indicated, the figure 11 represents less depth, the figure 12 still less depth and the figure 13 the least depth, except that the rim portion 14 has still less depth, and the least depth. The figures are arbitrarily chosen to clarify the description. Any other chosen depth figures will show the same relationship, namely, the gradual decrease in depth from the greatest depth point 9 to the thinnest portion of the board at the rim. The relationship of the bridge 29 to the lines of varying depth is shown in Fig. 2. The respective positions are relative only, as they are not intended to be mathematically accurate in drawings of this nature.

One manner of proceeding to provide the mold for shaping the soundboard is indicated in Fig. 2. The general outline of the initial blank board is shown by the character 16 in Figure 2. This shape is in a sense arbitrary, as most suitable to practical working conditions. It conforms closely to the ultimate outline of the soundboard itself, which is shown in dot-dash line and is indicated by the character 15. Thereupon lines are drawn on this initial blank 16 and from these lines, the geographical center of the board is determined in...
respect to its general position. One manner of ascertaining the geographical center of the board, is to divide the angle at the corner 30 and draw a bisecting line 31 and then divide vertical line 32 equally and draw a horizontal line 33 through the median point 34. Where these lines 31 and 33 intersect is the center. This point is indicated by 9, and in the preferred form corresponds to the greatest depth of the board. Having determined this depth point 9 of the board, in respect to the boundary line of the board, it is used as a point through which vertical planes pass radially in all directions. Each vertical section of the board is intended to show one plane side and one curved side, the curved side being determined by two parabolic curves with their deepest parts at the point 9 in Figure 2, or at the point 9 in Figure 3. The curved figure in Fig. 3 results from the section 3-3 of Figure 1. Here a curved radial plane was utilized to clarify the drawing and description. Each cross-sectional plane would necessarily show a different curvature. Having thus planned the desired curvature of the convex side of the board, a basis for the curvature of the mold hereafter to be described is obtained. These curved lines are preferably of parabolic shape, with their deepest portion coinciding with the geographical center referred to. Thus whatever vertical radial section be taken, the deepest point of the curved cross section will be at the geographic center or at any point decided to have the greatest depth, and the lines of curvature will be preferably of parabolic shape. Such a section is shown in Fig. 3, where the depth of the center 9 is slightly exaggerated to enable the two parabolic curves to be clearly shown. A horizontal plane passing through the intersection of the line 23 with the curve, would result in a point contact.

A mold 10 is shown in section in Figure 5, and the curved line 17 forms the concave portion of the mold, made in accordance with the hereinabove set forth description. The mold has rim portions 18, to hold the soundboard against movement when placed therein. A soundboard blank 23 is shown in Fig. 4, and is constructed of wood and the upper and lower faces thereof are disposed in parallel relation to each other. The solid soundboard shown in Figure 4 corresponds to that of Figure 1, or the dot-dash line contour of Figure 2.

This initial soundboard 20 with both sides flat is placed over a form or mold 10 which is of slightly larger area than the soundboard 20 and which is provided with a cavity or depression of concave configuration and formed preferably on parabolic curves as shown at 17, the curved surface constituting the bottom wall of the cavity. This curved surface corresponds to the intended design of the cavity, designated generally as 17, which has a major depth at its central portion equal substantially to the thickness of the initial soundboard 15 at its central axial portion. The contour of the mold corresponds to the contour of the curved surface of Figure 3 by way of illustration.

As the soundboard 20 and the form 18 are of relatively large longitudinal and transverse area, the middle or axial portion of the soundboard will sag or bend into the cavity 17 and will conform soundboard there to so that placing of the soundboard over the mold imparts a corresponding curvature to the soundboard, as shown in Figure 5. Of course, any suitable means may be utilized in addition to the weight itself, if desired, for insuring the molding or fitting of the lower side of the soundboard 20 to the parabolic curvature of the bottom wall of the cavity 17, in order to give the soundboard its conforming shape.

After the soundboard 20 has been fitted to the desired curvature, the upper surface marginal portion is trimmed and the remaining portion of the soundboard shown in Fig. 5 is thereby flattened or otherwise removed so as to eliminate the upper outer marginal portion of the soundboard along the line 21 which is preferably in a plane passing through the rim of the mold. The upper surface of the soundboard shown in Fig. 5 is thereby flattened to a 10 plane surface. In Fig. 5, the line 21 is shown as slightly below the depth point of the upper curved surface. The cut could be along the line 21 as shown, or the line 21 can be taken as tangential to the upper curved surface. Such a tangential line would not show as clearly in the drawings. The result of these operations on the soundboard is to produce the article shown in Fig. 3, wherein the soundboard has a cross sectional configuration, in all directions about its deepest portion, which is plano-convex with the lower convex surface of the soundboard tapering off to the rim from its greatest depth point.

It will be observed that the molding or cutting of the soundboard, as shown in Fig. 5, results in a certain degree of friction between the fibers of the wood as the center referred to in this condition in the finished article, the soundboard is more susceptible to vibration and thus is increased as to its resonance characteristics. It will also be noted that the tapering in thickness of the soundboard as finished, and shown in one embodiment in Fig. 3, is gradual and symmetrical from and in all directions about the greatest depth point to the extreme outer marginal portions of the soundboard. With this construction, when the soundboard is glued or anchored in a piano case, or the like, there is provided an inherent flexibility and elasticity to the soundboard which is proportioned so that the body of the soundboard decreases in depth from its center and in all directions.

When a soundboard 20 as hereafter used is mounted in a piano or the like, it is glued or otherwise suitably anchored or secured at its marginal edges and consequently vibration is impeded at the edges and the full effect of the soundboard is lost in the damping of the vibrations in the soundboard is not compensated for. This invention provides means for such compensation. Each radial section of the soundboard of Figures 2, 2, 5 and 5 will show a difference in curvature, but all the curvatures will be of like character, in that they have a deepest point and a tapering contour therefrom. The action of the soundboard, with a convex surface struck on the parabola, or substantially so, better meets the scientific construction of the soundboard for diaphragmatic vibratory action and for actuation of the sound waves set up by the action of the soundboard along the entire surface or area of the soundboard.

In mounting the soundboard 20 in the piano casing, it is preferred to dispose the same with the convex or parabolic surface uppermost, and of course the soundboard structure may be given various other configurations than parabolic within the scope of the claims and the spirit of the invention. The improved soundboard vibrates as a whole, in the same manner as a single diaphragm, and the invention solves this problem.

The diaphragmatic vibration is assisted by the relatively thick center and tapering edges. The mass tends to be concentrated at the center and
the flexibility distributed towards the edges, with
the portion adjacent to the rim or edges being
more capable of easy movement.

Finally in the preferred embodiment, the greatest depth point, the geographical center 29 of the
soundboard and the bridge 29 are all coincident
or very nearly so, the vibrations of the bridge re-
sulting from the striking of the strings translating
themselves at the geographical center to the
deepest part of the soundboard, and then distrib-
uting themselves along the radii of the sound-
board to its rim in true diaphragm fashion. The
improved soundboard avoids that effect pro-
duced by segmental or partial vibration, as in
soundboards heretofore proposed. In these, a
certain section vibrated at the same time with
another section, and at certain times these sec-
tions were out of balance with one another. The
improved board acts diaphragmatically over the
maximum vibratory area.

As will be clear to one skilled in the art, sound-
boards, after having been prepared as described,
are then fitted with ribs and bridges in the con-
ventional manner.

The tendency of the improved soundboard to
vibrate as a whole is increased, without breaking
up into higher modes of vibration.

My invention has been illustrated and described,
but it is understood that changes may be made in
the form of details and in the construction and
arrangement of parts without departing from the
spirit and scope of the invention or the scope of
the appended claim.

I claim:

A soundboard for pianos and other instruments
or devices using soundboards, comprising a body
portion having a curved contour the fibers thereof
being under tension, the greatest thickness of the
body portion being at the geographical center of
the soundboard, said body portion decreasing in
thickness progressively from its geographical cen-
ter in all directions to the parts of least thickness
at the rim portion of the soundboard in substan-
tially uniform progression and such tension of the
fibers extending from the geographical center to
the rim portion of the board, planes parallel
with each other and with the plane surface of
the body portion forming sections having a con-
tour symmetrical to the outer contour of the
soundboard, the body portion at each part of said
sections having the same thickness, whereby the
mass is concentrated at the central portion and
the amplitudes of the vibrations decrease towards
the rim portion, said soundboard acting as a
whole, when subjected to vibration, in the same
manner as a diaphragm.

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