Jan. 9, 1940. H. MOERTEL 2,186,424

MUSICAL INSTRUMENT

Filed Aug. 27, 1938

FIG. 1.

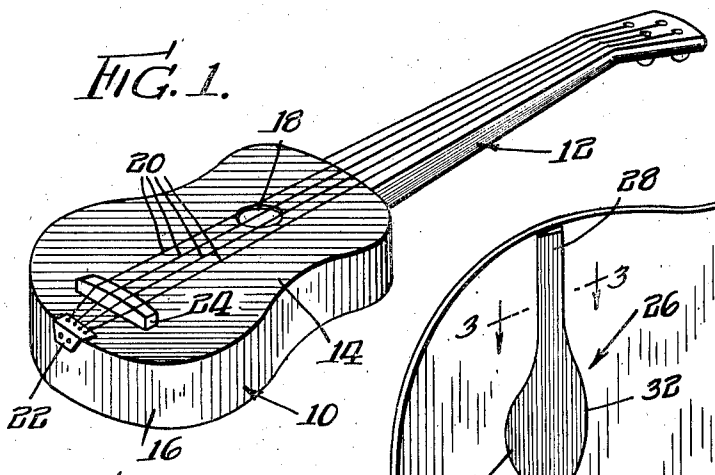


FIG. 2.

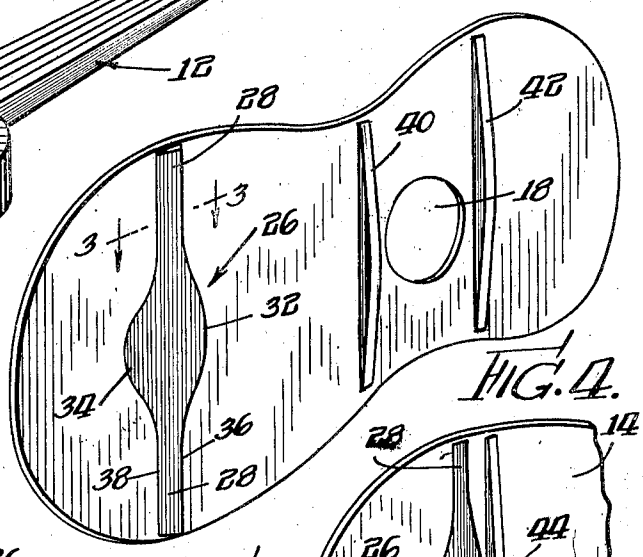


FIG. 3.

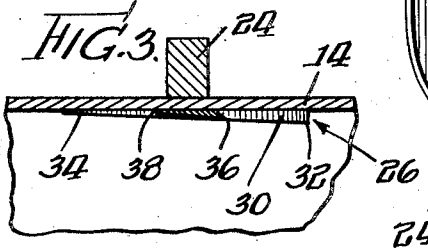


FIG. 4.

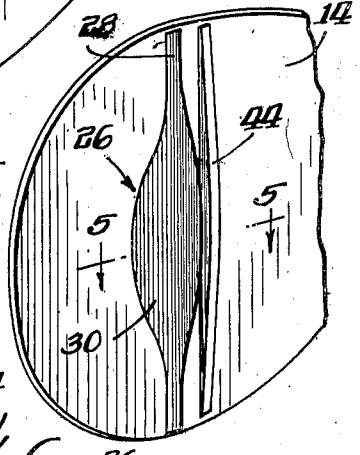


FIG. 5.

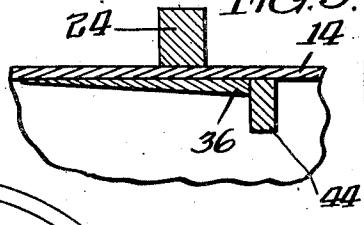


FIG. 7.

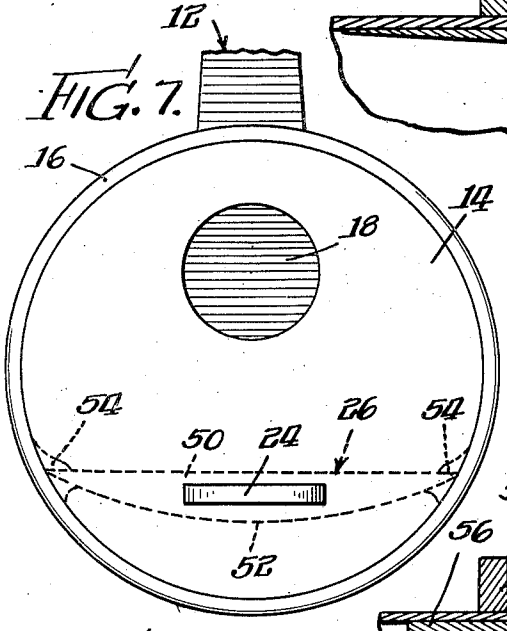


FIG. 6.

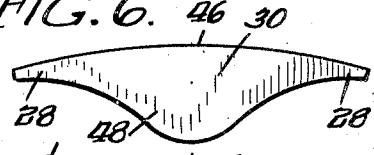


FIG. 8.

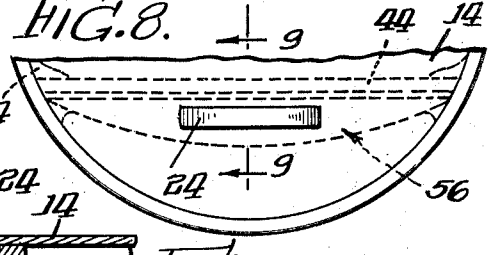


FIG. 9.

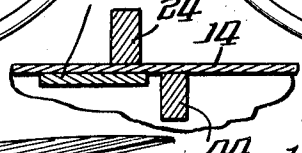
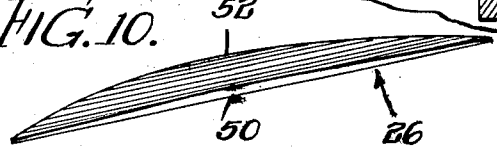


FIG. 10.



INVENTOR.
Henry Moertel
BY: Cox & Moore
ATTORNEYS.

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UNITED STATES PATENT OFFICE

2,186,424

MUSICAL INSTRUMENT

Henry Moertel, Chicago, Ill.

Application August 27, 1938, Serial No. 227,123

9 Claims. (Cl. 84—267)

The present invention relates to a construction for stringed instruments and more particularly to an improved construction for the resonance box thereof.

Yet more particularly the present invention comprehends the provision of an improved supporting and rigidifying structure for supporting and stiffening the belly or sounding board portion of a stringed instrument to the end that a novel and improved sound effect may be produced.

Stringed instruments, such, for example, as guitars, ukeleles, banjo ukes, mandolins and the like, are constructed with the sounding portion having a belly or sounding board just below the strings. The belly or sounding board is set into vibrational movement when the strings are set into horizontal movement by strumming or striking and, accordingly, tends to amplify or increase the volume of the sound or tone. When, as is the usual case, the sounding board comprises the front wall of a sounding chamber, the board is conventionally apertured for emission of the tones created within the body of the instrument.

The structure, configuration and character of the belly or sounding board, and the sounding chamber accordingly determine the quality of the instrument and the tones created thereby, that is, whether the resultant tones are musical, clear and strong or whether they are weak and comprise undesired unmusical elements.

It is an object of the present invention to provide a new and improved sounding board structure for an instrument of the above class which eliminates production of non-musical notes and results in an improved sound effect comprising relatively stronger amplified sound vibrations of great fullness and quality.

Yet more particularly the invention contemplates the provision of an improved stiffening and supporting rib structure for use on the belly portion of the instrument adjacent the bridge for controlling the character of the vibrations originating at and emanating from this point.

An additional object of the present invention consists in the provision of an improved supporting rib structure adapted to substantially underlie the bridge of the musical instrument for retaining the surface of the instrument in proper position under the influence of depressive forces exerted by the strings upon the bridge.

A further object of the present invention is to provide a supporting rib structure as above adapted to facilitate relatively free production of sound vibrations between the lower end of the instrument and the bridge, and for transmitting these vibrations, through the assistance of the sounding board or belly, toward the sound opening while at the same time preventing the formation of weak faults or rushing tones.

Numerous other objects and advantages will more fully appear during the course and progress of the following specification.

Figure 1 is a perspective view of a musical instrument constructed in accordance with the present invention.

Figure 2 is a perspective view of the sounding board of the instrument in Figure 1, the board being shown removed from the assembly to illustrate the interior structure.

Figure 3 is a detail sectional view taken on the line 3—3 in Figure 2.

Figure 4 is a detail perspective view of a similar sounding board embodying a preferred alternative rib structure.

Figure 5 is a detail sectional view taken on the line 5—5 in Figure 4.

Figure 6 is a plan view of an alternative preferred form of rib structure.

Figures 7 and 8 are plan views showing an alternative preferred modification embodying the present invention.

Figure 9 is a detail sectional view taken on the line 9—9 in Figure 8.

Figure 10 is a perspective view of the supporting rib structure shown in Figure 7.

Referring more particularly to the drawing wherein there are shown several illustrative embodiments constructed in accordance with the principles of the present invention, Figure 1 shows a stringed instrument, in this instance comprising a ukelele, having a body portion 10 and a neck portion 12 comprising the usual finger board construction.

The body portion 10 comprises a belly portion or sounding board 14 mounted and supported upon curved side walls 16 to which are joined a back portion, not visible in the figures, several walls and portions being joined together by gluing or any other conventional fastening means. The stringed instrument thus disclosed for purposes of illustration, utilizes the air space or hollow body portion formed by the several walls as a sound increasing and resonance space for developing and amplifying the sound produced by the vibration and, in order to permit free emission of the tones, a sound aperture 18 is provided.

In the present instrument, the tones are origi-

nated and initiated by the several strings **20** secured at one extremity to the lower end of the instrument as at **22** and passing over a bridge **24**. It will be understood that, when the strings **20** are tensioned in the usual manner, they exert a lateral force against the bridge **24**, which force must be resisted solely by the surface of the sounding board or belly against which the bridge resides. The adjacent portions of the sounding board are thus normally deflected or depressed downwardly to produce a bowed, sectional configuration.

In accordance with the present invention, deflection of the sounding board is resisted by the rib structure designated by the reference numeral **26** and disclosed more clearly in Figures 2 and 3. The rib **26** extends transversely across the belly of the instrument and is positioned directly beneath the bridge **24**.

Attention is particularly directed to the fact that centrally of the sounding board or belly, the rib is relatively wide in the plane of the sounding board while at points spaced from this widened central portion, the rib is relatively narrow as at **28**. In other words, in the vicinity of the side walls **10**, the rib is relatively narrow to permit a correspondingly relatively free vibration and deflection of the adjacent portions of the belly while centrally and beneath the vicinity of the bridge the rib is gradually widened on either side of its axial center line and preferably in a gradual curve as at **30** to provide a more firm and rigid support for the bridge; that is to say, the vibrations produced by the strings are directly transmitted through the agency of the bridge **24** directly to a portion of the belly, stiffened by the enlarged central section of the rib for transmission to the remainder of the sounding board while permitting relatively free, though controlled, vibration of the said central portions by providing intermediate supporting rib portions **28** adapted to relatively facilitate vibrational deflection at adjacent points.

Attention is yet more particularly directed to the sectional configuration of the rib **26**, as shown in Figure 3. More particularly, the rib **26** is of varying depth and thickness, which thickness increases gradually in the direction of the sound hole. Thus in Figure 3 it will be understood that the righthand portions of the figure are those portions next the sound hole **18** and it is the adjacent portion of the rib **26**, designated by the reference numeral **32**, which has a maximum thickness.

Thus it will be noted in Figure 3 that the vertical dimensions of the rib along the portions adjacent the lower or lefthand end of the instrument approach a minimum as at **34**. This sectional figure inclination prevails throughout the longitudinal extent of the rib shown in Figures 2 and 3, to the end that the forward edge portions of the relatively narrow sections **28** of the rib **26**, designated by the numeral **36**, are wider than the so-called rearward edge portions **38**.

The rib **26** is firmly secured to the under surface of the belly in the position shown preferably by means of careful and uniform gluing. Additional transversely extending ribs **40** and **42** on either side of the sound aperture **18** strengthen and support the sounding board and the adjacent free edges defining the aperture **18**.

It has been found that the present structure is responsible for a novel improvement in the functioning of the present instrument and the quality and fullness of the sound produced thereby. It is a definite fact, however, that the tones produced by the present instrument are relatively full, concentrated and powerful while at the same time being soft and mellow and free from non-musical rushing noises or so-called "tub" tones. In other words, the resulting sound is full, musical and highly amplified as compared with instruments embodying ordinary rib structures.

Applicant conceives that the novel results are due to the following improved structural factors. First of all, the rib **26** so supports the adjacent portions of the belly that the deflection produced by the tensioning of the strings is ideal for the creation of improved sounds. In other words, just beneath the bridge **24** the arcuate deflection of the belly is conceivably less than at the points supported by the relatively narrow sections **28** of the rib.

Moreover, during vibration of the strings, the vibratory forces transmitted through the bridge are conveyed directly to the widened portion **30** of the rib which forms a relatively less deflectable and firm base portion for receiving these vibrations and transmitting them throughout the sounding board. At the same time the broad base portion **30** of the rib is relatively freely movable or vibratable as a unit since the supporting portions adjacent the relatively narrow sections **28** of the rib are more freely capable of vibratory deflection.

The effect of thickening or increasing the depth of the rib adjacent the sound hole is to produce an increased rigidity of the belly portion forwardly of the bridge while permitting relatively free deflection and vibration thereof at points rearwardly of the bridge. It is thought that this construction facilitates the initiation of sonic vibrations adjacent the bridge and in the closed space away from the sound hole, which vibrations rapidly assume a strong character and are transmitted from their point of creation toward the sound hole **18**. Passage of these vibrations along the belly, however, is controlled by the rib and by the relatively thick portions thereof with the elimination of faults or undesired tones. In other words, it may be said that the configuration of the rib results in the preferential creation of the desired vibrations in the closed end of the sound chamber and for transmission toward the sound opening to produce amplification thereof in order to resist the initiation and creation of undesired sounds.

It is to be understood, of course, that applicant, in advancing the above theory, is setting forth what seems to be the reasonable explanation of the novel results, as based upon long observation and study. In view of the complex factors involved, it is understood that this statement may be subject to revision in accordance with further study of the functions involved.

While the sound hole **18**, herein shown for purposes of illustration, is substantially circular in configuration, the present invention comprehends the use of sound holes of a wide variety of configurations and particularly contemplates the application of the present invention to stringed instruments having the improved sound hole structure, such as disclosed in accordance with my co-pending application, Serial No. 129,409, filed March 6, 1937. The sounding board and sound hole structure disclosed in my aforesaid co-pending application is productive of novel and improved tone effects and may be applied to the instruments disclosed in the present embodiment

in lieu of the sound hole 18 to produce an additional or further improvement in quality and amplification due to the presence of a freely vibratable lip. Improved effects, however, may be had over ordinary structures while employing only a circular sound hole, as shown in the figures, provided the present improved rib structure is availed.

The alternative preferred embodiment illustrated in Figures 4 and 5 contemplates the provision of a sound rib 26 in general similar in construction to that previously described. In instruments which present a relatively large and unsupported expanse of sounding board adjacent the bridge, it has been found desirable to additionally rigidify and support the forward portions of the rib. To this end a separate rib member 44 is glued to the sounding board just adjacent the rib 26 on the side next the sound hole. As shown in Figure 5, the rib 44 is relatively deep or thick but narrow in the plane of the sounding board and it will be obvious that this increased support or rigidity enhances the effects hereinbefore described; that is to say, the effect of the application of the thickened rib 44 adjacent the thickened portion 32 of the rib 36 furthers and advances the effect of the thickened portion, as hereinbefore pointed out. In other words, the rib beneath the bridge is in effect constructed in two pieces instead of one and, when so arranged, will be productive of the same novel effects above described provided the combined ribs are not substantially spaced from one another. It should be noted that the rib 44 is at its greatest depth at a point centrally of the belly, having a decreasing thickness toward the side walls 16 of the instrument.

An alternative preferred form of rib, which may be substituted for those hereinbefore disclosed, is shown in Figure 6, having its central relatively widened portion 30 defined by a gradually arcuate forward edge 36 adjacent the sound hole and a sharply arcuate portion 48 toward the lower end of the instrument.

A preferred alternative variation of the present invention, shown in Figures 7 and 10, contemplates application to a ukelele banjo type of instrument having a substantially circular, continuous side wall 16 supporting the belly 14. The supporting rib 26 is in general constructed in accordance with the principles above enunciated, being provided with a forward or upper edge 50 adjacent the sound hole which extends substantially straight across the instrument although preferably slightly curved away from the sound hole. The lower edge or edge away from the sound hole and designated by the reference numeral 52, has a relatively increased curvature so that the rib terminates in relatively sharpened end portions. As hereinbefore described, the edge 50 of the rib is relatively thick, as shown in Figure 10, the thickness of the element decreasing progressively to the edge 52.

It has been found desirable in instruments of the present class to extend the extremities of the rib to the vicinity of the supporting wall 16 on either side and preferably to mount and position them upon blocks or abutments 54 forming a part of the side wall. This structure is made desirable and/or necessitated by the fact that banjo and mandolin type instruments provide a relatively wide unsupported expanse of sounding board. On the other hand, in many instruments, and particularly those of the ukulele type previously described, such supporting blocks are not a necessity and for many purposes the relatively narrow, laterally extending portions 28 of the rib heretofore mentioned need not extend to the vicinity of the side walls.

A further alternative preferred modification is shown in Figures 8 and 9 and comprises an instrument having a rib substantially identical in plan and configuration with the rib 56 shown in Figure 10. In accordance with the present structure, however, this rib is combined with a rib 44 which has a considerable depth or thickness in a direction transversely to the plane of the sounding board.

It is, moreover, of extreme importance to note that the rib 56 is of substantially the same height or thickness throughout its section, as clearly shown in Figure 9. The lack of variation in sectional thickness, however, is compensated for by the relatively thick rib 44 adjacent the forward edge of the rib 56 which, as pointed out in connection with the embodiment disclosed in Figures 4 and 5, permits the accomplishment in some degree of the novel results which characterize the present invention.

In order to secure the aforementioned novel results, it is important that the combination of ribs 56 and 44 be so arranged as to function substantially like a single rib. To this end it will be noted that the two members are placed in cross juxtaposition. A slight space may be and preferably is provided, however, to the end that glue or adhesive material will not be engaged by or caused to flow by capillarity in the seam between the adjacent parts since it will be obvious that the interposition of an uncontrollable foreign material would probably vary the characteristics of the instrument. The spacing of the ribs 56 and 44, however, will preferably be extremely minor, in an ordinary, small instrument under any circumstances not substantially more than a quarter of an inch. In extremely large instruments, however, the spacing may be proportionately increased.

It should be noted, in accordance with the present invention, that the bridge supporting rib progressively increases in width toward the center. The substantially widened portion preferably occupies about one-third or less of the transverse width of the instrument. Preferably its extent will be sufficient to completely underlie the bridge. In other words, for a distance substantially spaced from the side walls 16, the rib is relatively narrow but from there on decreases in width toward the center line of the instrument. As illustrated by the embodiments disclosed in Figures 7 to 10, the rib may progressively widen throughout its length and various other modifications thereof may be made within the scope and intent of the present disclosure.

Changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein described being a preferred embodiment for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. In a stringed musical instrument, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge cooperating with said strings and said sounding board, said reinforcing structure comprising a rib secured to said sounding board and extending to the side edges thereof and having a central portion

relatively widened in the plane of the board, and relatively narrow portions extending laterally therefrom.

2. In a stringed musical instrument, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge cooperating with said strings and said sounding board, said reinforcing structure comprising a rib secured to said sounding board and having a central portion relatively widened in the plane of the board, and laterally extending portions of decreasing width extending toward the side edges of said sounding board and having end extremities directly supported upon the instrument.

3. In a stringed musical instrument, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge cooperating with said strings and said sounding board, said reinforcing structure comprising a rib secured to said sounding board and having a relatively widened central portion substantially beneath said rib, and relatively narrow portions extending laterally therefrom, said rib adjacent one side edge being substantially relatively thickened, the said rib being relatively thinned along the opposite side edge.

4. In a stringed musical instrument, a body reinforcing structure for a body portion having a belly or sounding board thereon, and having strings arranged in spaced relation above the plane of the sounding board and a bridge spacing said strings from the sounding board, said reinforcing structure comprising an elongated, laterally extending rib secured to said sounding board substantially beneath the bridge, said rib being relatively widened adjacent the central portions thereof and being of progressively increasing thickness toward one side edge whereby to facilitate vibration in the sounding board adjacent the relatively thin portion of the rib while transmitting the vibrations thus produced in an opposite direction.

5. In a stringed musical instrument, a body reinforcing structure for a body portion having a belly or sounding board thereon, and having strings arranged in spaced relation above the plane of the sounding board, a bridge spacing said strings from the sounding board and a sound aperture in said sounding board spaced from said bridge adjacent the central portions thereof and beneath said bridge, said reinforcing structure comprising an elongated, laterally extending rib secured to said sounding board substantially beneath the bridge, said rib being relatively widened adjacent the central portions thereof and in the plane of said sounding board and being of progressively increasing thickness in a direction toward the sound aperture in the lower part of the sounding board whereby to facilitate vibration in the sounding board while transmitting the vibrations thus produced in the direction of the sound aperture.

6. In a stringed musical instrument of the class described, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge and sound aperture in said sounding board, said body reinforcing structure comprising supporting rib means substantially beneath said bridge, said supporting rib means extending generally transversely of the sounding board and having a relatively wide portion substantially beneath said bridge with relatively narrow portions extending laterally therefrom, said supporting rib means in a direction toward said sound aperture having a relatively great thickness in a direction normal to the plane of the sounding board while being relatively thin at points oppositely disposed from said sound aperture whereby to produce an improved sound quality.

7. In a stringed musical instrument of the class described, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge and sound aperture in said sounding board, said body reinforcing structure comprising supporting rib means substantially beneath said bridge, said supporting rib means extending generally transversely of the strings and having relatively narrow, laterally extending portions and a central portion of increasing width in the vicinity of said bridge, said supporting rib means in a direction toward said sound aperture having a relatively great thickness in a direction normal to the plane of the sounding board while being relatively thin at points oppositely disposed from said sound aperture whereby to produce an improved sound quality.

8. In a stringed musical instrument of the class described, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge and sound aperture in said sounding board, said body reinforcing structure comprising supporting rib means substantially beneath said bridge, said supporting rib means extending generally transversely of the sounding board and having a relatively wide portion substantially beneath said bridge with relatively narrow portions extending laterally therefrom, said supporting rib means comprising a relatively thin rib and a second rib relatively thick in a direction normal to said sounding board. said second named rib being arranged substantially adjacent said first named rib on the edge thereof toward the sound aperture whereby to produce an improved sound quality.

9. In a stringed musical instrument of the class described, a body reinforcing structure for a sounding board, having strings arranged in spaced relation above the plane of the sounding board and a bridge and sound aperture in said sounding board, said body reinforcing structure comprising supporting rib means substantially beneath said bridge, said supporting rib means extending generally transversely of the sounding board and having a relatively wide portion substantially beneath said bridge with relatively narrow portions extending laterally therefrom, said supporting rib means comprising a relatively thin rib of substantially flat section and a second rib relatively thick in a direction normal to said sounding board, said second named rib being arranged substantially adjacent said first named rib on the edge thereof toward the sound aperture whereby to produce an improved sound quality.

HENRY MOERTEL.