

July 3, 1951

O. E. WOLFF
STRING INSTRUMENT

2,558,893

Filed March 19, 1948

3 Sheets-Sheet 1

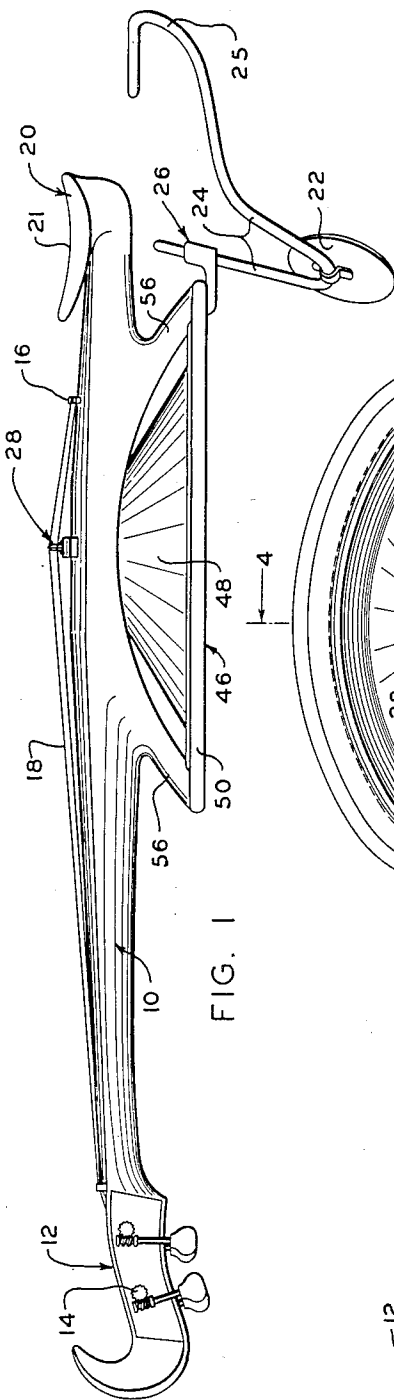


FIG. 1

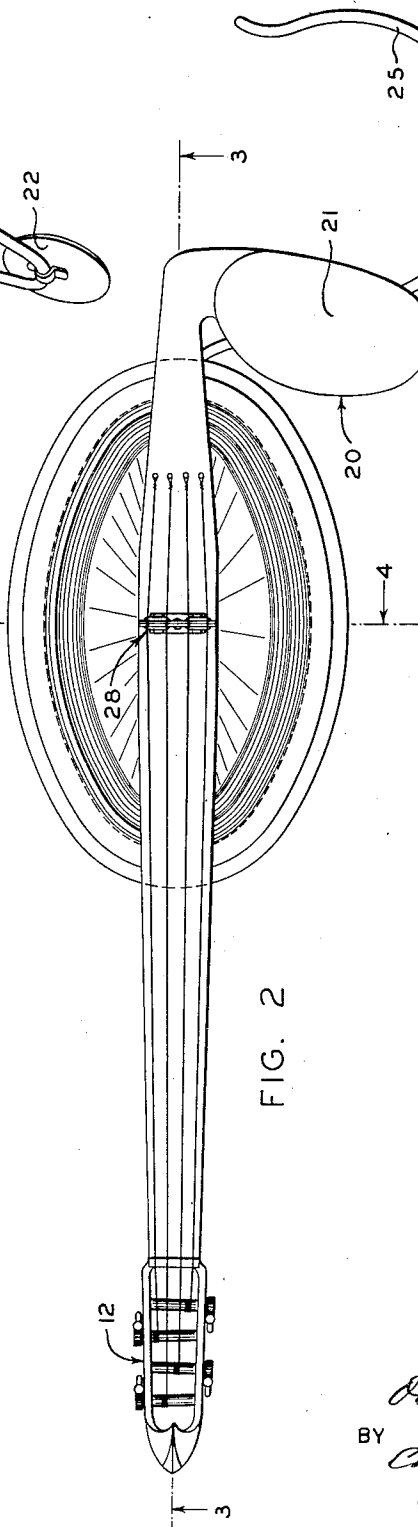


FIG. 2

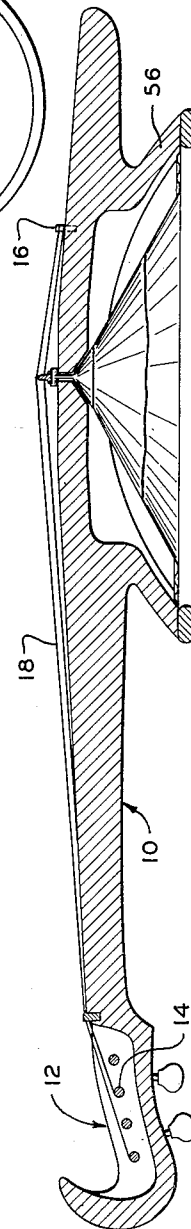


FIG. 3

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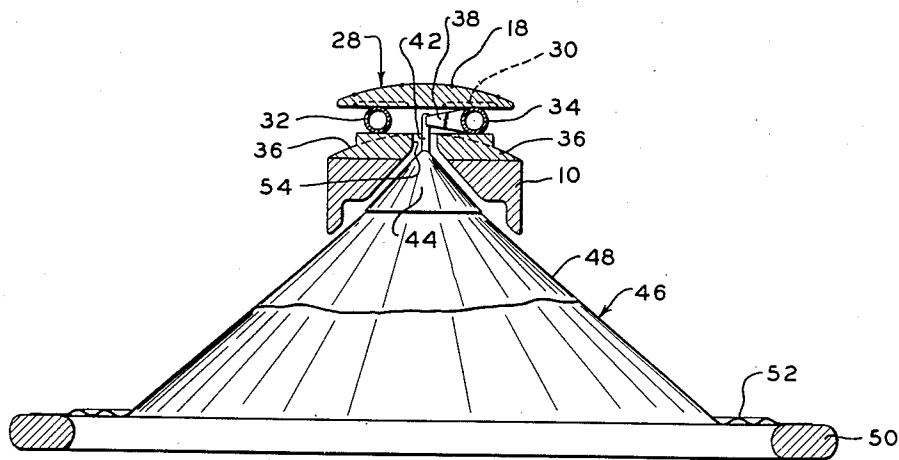


FIG. 4

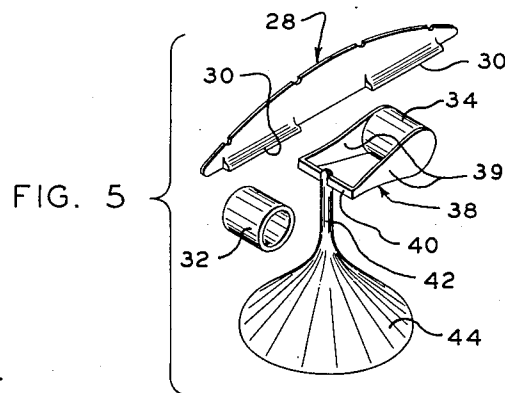


FIG. 5

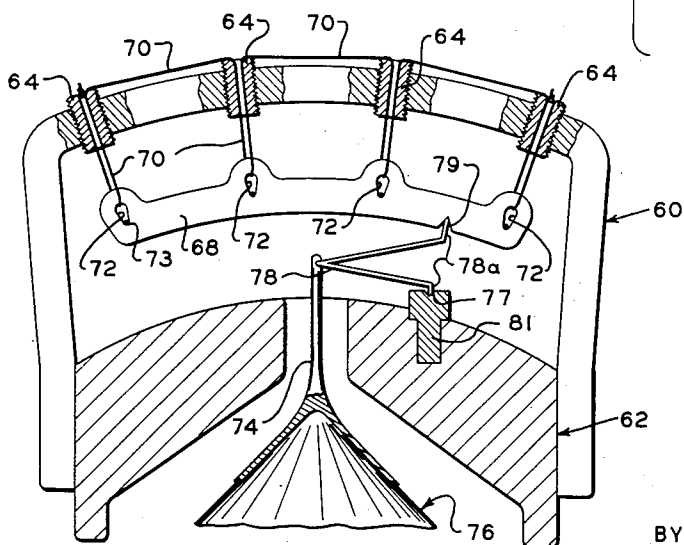


FIG. 6

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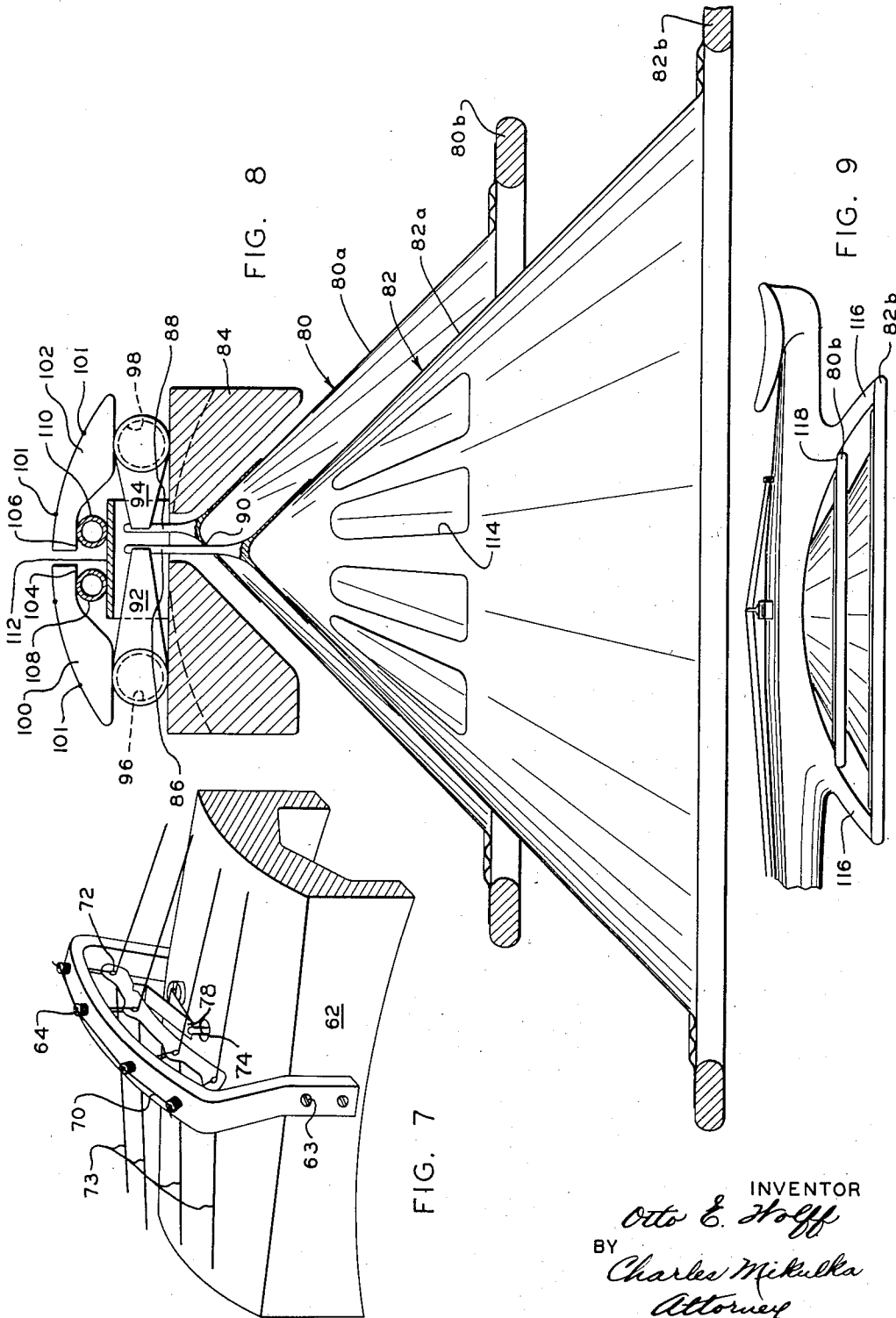
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2,558,893

STRING INSTRUMENT

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Application March 19, 1948, Serial No. 15,920

23 Claims. (Cl. 84—296)

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This invention relates to acoustic instruments, and more particularly to bowed string instruments.

One object of the present invention is to provide a novel bowed string instrument having a high level of tone quality and intensity wherein the various structural components which contribute to the tone of the instrument are capable of accurate and uniform construction by mass production processes.

A further object is to provide a bowed string instrument comprising novel motion-transmitting means interconnecting the bridge of the instrument with the principal sound-producing member thereof.

Still another object of the invention is to provide a string instrument having a cone speaker as its principal sound-producing member.

Still a further object is to provide a bowed string instrument having one or more of the aforementioned novel features and so constructed that one skilled in the playing of a string instrument of conventional construction can play the corresponding instrument of the invention with equal facility and without special training.

A still further object is to provide a violin construction having novel body-engaging elements permitting the same to be handled with ease during use.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the product possessing the features, properties and the relation of components which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a further understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

Figure 1 is a side elevation of one form of a string instrument of the present invention, said instrument being of the violin type and embodying novel body-engaging means for facilitating the handling thereof;

Fig. 2 is a top plan view of the instrument of Fig. 1;

Fig. 3 is a sectional view taken substantially along line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken substantially along line 4—4 of Fig. 2;

Fig. 5 is an exploded perspective view of the bridge and the linkage for mounting and con-

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necting the bridge to the sound-producing member of the instrument;

Fig. 6 is a fragmentary, sectional and somewhat diagrammatic view of a novel form of bridge-mounting means;

Fig. 7 is a fragmentary perspective view of the bridge mounting means of Fig. 6;

Fig. 8 is a transverse, fragmentary sectional view similar to Fig. 4 of a modification of the novel instrument of the present invention wherein a plurality of speaker units are used; and

Fig. 9 is a view in side elevation with parts broken away of the instrument of Fig. 8.

There is provided, in accordance with the present invention, a bowed instrument having a high level of tonal quality and tone intensity in which the sound-producing parts are formed of standard engineering materials and which is so constructed as to permit said parts to be mass-produced and assembled.

In the form illustrated by way of example in the drawings, the instrument comprises a supporting member 10 which provides the principal supports for the sound-producing elements while contributing only negligibly to the tone of the instrument, and is accordingly selected primarily for its strength, lightness and appearance, and may be formed of any suitable natural or synthetic material, for example, wood, metal or plastic.

Member 10 is provided at one end thereof with a suitable peg box 12 comprising a plurality of tuning pegs 14 and adjacent the other end thereof with a plurality of pins 16, each said peg and pin serving to mount a string 18 lengthwise of said member. Any other means may be employed for holding string 18 and for adjusting the tautness thereof. For example, a conventional tail piece may be used in lieu of pins 16 to hold one end of each of the strings.

Connected to member 10 is a novel arrangement of body-engaging members which permits the instrument to be easily held during use and in the form shown said arrangement comprises a chin-engaging member 20 which is preferably rigidly secured to or integrally formed with support 10, said chin-engaging member extending transversely from the end of said support (Fig. 2) and being provided with a chin-engaging surface 21 which may be suitably padded. Mounted beneath chin-engaging member 20 (Fig. 1) is a chest-engaging plate 22, the mounting means therefor comprising, as illustrated, a rodlike element consisting of a V-shaped portion 24 and a curved portion 25. Chest-engaging plate 22 is

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slidably mounted for transverse adjustment adjacent the vertex of said V-shaped portion, and one arm of said V-shaped portion is, in turn, slidably and rotatably mounted in a bracket 25 which is a part of or is secured to member 10. As a result of this mounting arrangement, the vertical and angular position of chest-engaging element 22 with respect to chin-engaging surface 21 may be readily adjusted to suit the convenience of the user of the instrument. Curved portion 25 of said rodlike member has a contour which adapts it for engaging the back of the player's neck whereby it becomes readily possible to adjust portion 25 and plate 22 with respect to member 20 so that the instrument can be fully supported in playing position only by the engagement of these elements with the body of the player.

To pick off the vibrations of the strings and transmit the same to the principal sound-producing element of the instrument, novel means are provided and in one form thereof said means comprise a bridge member 28 (Figs. 1, 4 and 5) which has an arcuate upper surface that is notched to receive the strings and which is located intermediate peg box 12 and pins 16 at a distance from pegs 14 approximately the same as the distance normally separating the bridge from the pegs of a conventional violin. This construction is preferred since it provides a finger board like that of a violin and permits one trained to play a conventional violin to play the instrument of the present invention with equal facility. Bridge 28 is preferably formed of a material such, for example, as aluminum, or one of its alloys, a hard wood such as ebony, or a plastic such, for example, as the formaldehyde thermosetting resins, polymethacrylates, nylons and polystyrenes, or a phenolic laminated material such as micarta, and is preferably provided with broadened base portions 30 that facilitate the mounting thereof.

Means are provided for supporting bridge 28 to permit substantially free lateral movement of the latter in response to the vibration of strings 18, said mounting means constituting part of the motion transmitting linkage whereby the lateral movement of the bridge is converted into a vibration in a direction for efficiently actuating the principal sound-producing member of the instrument. In the form shown, said mounting means comprise a pair of hollow cylindrical members 32 and 34 whose cylindrical surfaces engage and are supported by an upper surface portion of support 10 and engage and support the base portions 30 of the bridge. Each said cylindrical member may rest directly on the upper surface of support 10, but in a preferred construction said support is provided with a pair of inserts 36 whose upper surfaces act as bearing surfaces for said cylinders. Inserts 36 may be adhered or otherwise fixed in a pair of grooves formed in the upper portion of support 10 just beneath the bridge. Each insert has its bearing surface polished smooth and any hard surfaced material may be used to form said inserts such, for example, as ebony, Duralumin or a formaldehyde type resin. Strings 18, being under tension, apply a downward component of force to the bridge which holds the latter in contact with members 32 and 34, and this force in turn presses said members into firm contact with the upper surfaces of inserts 36.

Lateral movement of bridge 28 tends to rotate cylinders 32 and 34, and this rotation is con-

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verted to a substantially vertical motion by a lever 38 connected to one of members 32, 34. Lever 38, in the form shown, is connected to member 34 and may be formed of a single strip of metal bent to form a pair of arms 39 and a connecting portion 40 which is substantially parallel to the axis of cylinder 34 (Fig. 5). Each of arms 39 has the end thereof secured to an end of cylinder 34, and each extends in a substantially radial direction with respect to the axis of cylinder 34, and also flares outwardly with respect to the other arm. Depending from connection portion 40, preferably from the center thereof, is a strut or link 42, and rotation of cylinder 34 in response to the bowing of one or more of the strings produces a substantially vertical vibration of link 42. Affixed to the end of link 42 as by being integrally formed therewith is the vertex of a conically shaped element 44. Lever 38 may be formed of a strip of Phosphor bronze and cylinder 34 of steel whereby said lever may be secured to said cylinder by being soldered thereto. Cylinder 32 may also be formed of steel or of any other suitable metal such as Duralumin or a plastic. Link 42 and element 44 may be formed of Duralumin, in which case said link is secured to connection portion 40 by a suitable adhesive such as a nitrocellulose cement.

As the principal sound-producing unit of the instrument, there is provided a cone speaker 46 which comprises a generally cone-shaped diaphragm 48 whose upper end is secured as by adhesion to the lower edge of element 44, a nitrocellulose adhesive being suitable for this purpose. Diaphragm 48 is of any conventional construction, being formed, for example, of a stiff paper composition. The lower base end of diaphragm 48 is secured to a rim 50 of the same general shape as said base, said rim being of a suitably rigid supporting material such as wood, plastic or metal, and being preferably attached as by a nitrocellulose adhesive to the lower peripheral portion 52 of said diaphragm. Portion 52 is an integral extension of the diaphragm and is provided with suitable corrugations or other extensible portions which permit of relatively free vibration of the diaphragm in response to the vertical vibration applied to the vertex portion thereof through link 42. Cone speaker 46 may be of any conventional shape, but preferably the base thereof is symmetrical about a longitudinal axis, and this axis of symmetry is located beneath and substantially parallel to support 10. Preferably speaker 48 has an oval shape.

To mount the cone speaker unit and to permit the foregoing vibration-transmitting mechanism which actuates said speaker unit to be operatively connected thereto, support 10 is provided with an aperture 54 (Fig. 4) whose walls preferably flare outwardly from the upper to the lower end, the angle of flare being such as will adapt said aperture to receive the upper vertex end of elements 44 and of the diaphragm 48 without having the walls thereof contact the diaphragm or link 42, 44 during operation thereof. To mount rim 50 of said speaker unit, a plurality of arms 56 (Fig. 3) extend downwardly and angularly from support 10, being secured to said support or, as shown, being integrally formed therewith. Said arms are secured to rim 50 to support the same and provide in conjunction with the recessed lower portion of support 10 a space for receiving diaphragm 48. One of said arms 56 serves to mount bracket 26.

In a preferred form of the violinlike construc-

tion described hereinabove, cylinders 32 and 34 are formed of tubing having an outer diameter of approximately .19 inch and the length of lever arm 38, i. e., the distance from the center of cylinder 34 to the vertical longitudinal axis of link 42, is approximately .44 inch. The effective lever arm ratio of the linkage which transmits the motion of the bridge 28 to the diaphragm 18 is thus approximately 2.4, so that the amplitude of a vibration of the bridge is magnified roughly 2.4 times. For optimum performance, this lever arm ratio is greater than 1 and is preferably between 2 and 3.

Although the shape of diaphragm 48, as shown, is that of a segment of a cone generated by a straight line having one end fixed and the other moving in an oval path, it is within the scope of the invention to use diaphragms of other shapes as, for example, those generated by a curved instead of a straight line, or by a line moving in a circular or a polygonal instead of an oval path. It is to be understood that the term "cone-shaped diaphragm" as used herein includes diaphragms of these various shapes.

The instrument may be muted by changing the position of cylindrical member 32, so that its axis instead of being parallel to the axis of cylinder 34 and perpendicular to the lateral movement of bridge 28, becomes inclined to the axis of said cylinder 34. The more closely the cylinder axis approaches parallelism with the direction of movement of bridge 28, the greater is the muting effect.

A novel modification of the bridge means of the invention, as well as of the mechanism for transmitting the lateral vibration of said bridge to a sound-producing speaker unit to actuate the same, are shown in Figs. 6 and 7. As shown, said bridge means comprise a suspending member 60 in the form of an inverted U whose arms are secured to the main supporting member 62 of the instrument as by screws 63 and whose central curved portion extends transversely of the instrument at a point which is above the desired location for the bridge. A plurality of bores preferably equal in number to the number of strings and located approximately above the strings are provided in the curved portion of member 60, each bore being threaded and having threaded therein a set screw 64 and each set screw having an axial passage therein. Arcuate bridge member 68 is suspended by member 60 by means of a suitable filament suspending means, for example, a single filament 70 of metal wire or nylon which is knotted at one end to prevent the same from passing through the passage in one of the end set screws and which has the free end thereof extending through said passage in said set screw to and through a recess 72 in bridge member 68 and back again through the passage in said set screw. The filament extends down again in a loop through each successive passage of the other set screws and is looped each time through a recess 72 in the bridge member. The free end of the filament is then knotted. In this manner, the filament 70 is caused to extend through each of the set screws to suspend the bridge member 68 at four points. Each of the four recesses 72 in the bridge member through which the filament 70 is looped may have one of the strings 73 of the instrument threaded therethrough to support the same. As a result of this mounting, bridge member 68 is freely suspended for arcuate lateral movement in response to the bowing of each of the strings. The strings apply a downward com-

ponent to the bridge member, maintaining filament 70 taut. To effect slight adjustments in the position of the bridge member, one or both end set screws 64 may have its position adjusted in support 60.

To transmit the lateral movement of bridge member 68 to a link 74 which is connected to the vertex of a suitable cone speaker unit 76 for actuating the same, there is provided a lever 78. Lever 78 may be formed of a suitable metal such, for example, as spring steel, and may be V-shaped with the vertex thereof secured as, for example, by means of an adhesive to link 74. The ends of the arms thereof are held under tension between bridge member 68 and the upper surface of support 62, and are preferably provided with angularly extending portions 78a which fit into a pair of grooves 77 and 79. Groove 79 is provided in the lower edge of bridge 68 adjacent one end thereof. Groove 77 may be formed in the upper surface of support 62, but as shown is formed in the head of a metallic insert 81 which is rigidly held as by a force fit in said support 62. Lateral movement of bridge 68 causes lever 78 to pivot about the vertex of groove 77 and produces a substantially vertical movement of link 74 operating the diaphragm of speaker unit 76. It is to be understood that the mounting and construction of the speaker unit 76 is like that of speaker unit 46 of the embodiment of Figs. 1 to 5.

By providing a bridge suspension of this type, it becomes possible to use bridge members of minimum weight and mass, thereby reducing inertia effects to a minimum.

In another modification of the invention, a plurality of bridges, motion-transmitting linkages and speaker units may be employed, and one such modification is shown in Figs. 8 and 9 wherein two cone speakers 80 and 82 are mounted in spaced, substantially concentric relationship on a supporting member 84. Each of speakers 80 and 82 has the diaphragm thereof actuated by a separate link 86 and 88, respectively. Speaker unit 80 whose diaphragm is the outer diaphragm is provided adjacent its vertex with a suitable aperture 90 through which link 88 extends. Link 88 is shown substantially parallel to link 86 and adapted for vibration in a direction substantially parallel to the vibration direction of link 86, but it is to be understood that link 88 may extend at an angle to link 86 and may be adapted to vibrate in a direction substantially parallel to its axis. Links 86 and 88, in turn, are connected to the ends of levers 92 and 94, respectively, said levers being of the same general construction as, for example, lever 38 of the embodiment of Figs. 1 through 5, the other ends of each of said levers 92 and 94 being connected to cylindrical members 96 and 98, respectively, which cylindrical members in turn support the base portions of a pair of bridges 100 and 102, respectively. Bridge 100 is provided with a pair of notches to support two of the strings 101 and bridge 102 is provided with two more notches to support the other two strings 101 of the instrument. The inner adjacent ends of said bridge portions have their lower surfaces 104 and 106, respectively, elevated a substantial distance above the surfaces thereof which engage cylinders 96 and 98 and these elevated surfaces 104 and 106 rest on cylindrical members 108 and 110, respectively, which cylindrical members provide a second support for each bridge. These cylindrical members rest on the upper surface of a supporting platform 112 which extends over levers 92 and 94 and rigidly secured to support-

ing member 84. Cylinders 96 and 98 ride on the bottom wall of said groove and levers 92 and 94 pivot between the side walls thereof.

In the form shown, inner diaphragm 82a of cone speaker unit 82 is the larger and is preferably provided with a plurality of perforations 114 in order to minimize the impedance effects of its presence upon diaphragm 80a of speaker unit 80. To mount speaker unit 82, support 84 is provided with a pair of depending arms 116 whose ends engage and are secured, as by adhesion, to rim 82b of said speaker unit 82. Each of arms 116 is preferably provided adjacent its upper end with an inward projection which provides a shoulder 118 to which the rim 80b of speaker unit 80 is affixed.

Preferred results are obtained by having smaller cone 80 actuated by the bridge which supports the E and A strings and by having unit 82 actuated by the bridge which supports the D and G strings, and this preferred arrangement is illustrated in the drawings. Similarly, it has been determined that most satisfactory results with the foregoing arrangement are obtained if lever 94 which actuates diaphragm 80a has a lever ratio less than the lever ratio of lever 92 which actuates the larger and heavier diaphragm 82a. Preferably, lever 94 has a lever ratio between one and two, and lever 92 has a lever ratio over two.

Although in the above-described embodiment there are shown two bridges and two speaker units, and each bridge supports two of the strings, it will be readily appreciated that one of said bridges may support but one string while the other supports three of the strings, or that there may be provided a greater number of bridges and speaker units, for example, a bridge and the speaker unit for each of the strings.

It will be noted that in each of the foregoing embodiments of the invention the bridge member is mounted for relatively free lateral movement and its lateral movement is not appreciably inhibited by the lever arm linkage which connects said bridge member to the diaphragm of the speaker unit. In each instance the lever arm is capable of a rocking movement relative to the bridge member so that the vibration of the lever arm is a direct function of the magnitude of lateral movement of the strings which causes the lateral displacement of the bridge member. This results in a high fidelity of tone reproduction.

Although the present invention has been illustrated and described hereinabove as embodied in a bowed string instrument of the violin type, it will now be apparent to those skilled in the art that it may be embodied in other types of string instruments, e. g., instruments like the viola, the cello and the bass violin.

Since certain changes may be made in the above product without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a string instrument comprising supporting means, a plurality of strings mounted tautly on said supporting means, and a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, the combination therewith of sound-producing means comprising a cone-shaped diaphragm mounted on said supporting means with its apex portion

adjacent said bridge member and with its axis substantially perpendicular to the longitudinal axis of said supporting means, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a lever free to move relative to said bridge member and a link extending substantially perpendicularly to the lateral movement of said bridge member connecting said lever to the apex of said cone-shaped diaphragm, lateral movement of said bridge member causing angular movement of said lever and movement of said link along its longitudinal axis to actuate said diaphragm.

2. In a string instrument comprising supporting means, a plurality of strings mounted tautly on said supporting means, and a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, the combination therewith of sound-producing means comprising a cone-shaped diaphragm mounted on said supporting means with its apex portion adjacent said bridge member, and means for mounting said bridge member and for transmitting the movement thereof to said diaphragm, said last-named means comprising a plurality of laterally spaced supports for said bridge member arranged to permit lateral vibration of said bridge member in response to the bowing of said string and including a lever so connected to said bridge member and to said diaphragm as to be moved angularly relative to said bridge member in response to lateral vibration of the latter without appreciably restricting said lateral vibration, said lever actuating said diaphragm when moved angularly, said supporting means having no appreciable sound-producing effect in response to the vibration of said string, and said cone-shaped diaphragm constituting the sole effective sound-producing element of said instrument for converting the vibration of said string to sound.

3. In a string instrument comprising supporting means, a plurality of strings mounted tautly on said supporting means, and a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, the combination therewith of sound-producing means comprising a cone-shaped diaphragm mounted on said supporting means with the apex portion thereof adjacent said bridge member, and means for mounting said bridge member and for transmitting the movement thereof to said diaphragm, said last-named means comprising a plurality of laterally spaced supports for said bridge member arranged to permit lateral vibration of said bridge member in response to the bowing of said string and including a lever so connected to said bridge member and to the apex portion of said diaphragm as to be moved angularly relative to said bridge member in response to lateral vibration of the latter without appreciably restricting said lateral vibration, said lever actuating said diaphragm when moved angularly.

4. In a string instrument comprising supporting means, a plurality of strings mounted tautly on said supporting means, and a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, the combination therewith of sound-producing means comprising a cone-shaped diaphragm having a plane of symmetry and mounted with the plane of symmetry thereof located in substantial coincidence with the longitudinal axis of said sup-

porting means and with the apex portion thereof adjacent said bridge member, and means for mounting said bridge member and for transmitting the movement thereof to said diaphragm, said last-named means comprising a plurality of laterally spaced supports for said bridge member arranged to permit lateral vibration of said bridge member in response to the bowing of said string and including a lever so connected to said bridge member and to the apex portion of said diaphragm as to be moved angularly relative to said bridge member in response to the lateral vibration of the latter without appreciably restricting said lateral vibration, said lever actuating said diaphragm when moved angularly.

5. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut lengthwise of said support, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm having an apex portion adjacent to said bridge member and a base portion, a rim member secured to said base portion, means comprising a pair of depending elements for securing said rim member to said main support, and means for supporting said bridge member and for transmitting the movement thereof to said diaphragm to actuate the latter, said last-named means comprising a plurality of laterally spaced supports for said bridge member arranged to permit lateral vibration of said bridge member in response to the bowing of said string and including a lever so connected to said bridge member and to the apex portion of said diaphragm as to be moved angularly relative to said bridge member in response to the lateral vibration of the latter without appreciably restricting said lateral vibration, said lever actuating said diaphragm when moved angularly, said main support having no appreciable sound-producing effect in response to the vibration of said string, and said cone-shaped diaphragm constituting the sole effective sound-producing element of said instrument for converting the vibration of said string to sound.

6. A string instrument comprising, in combination, supporting means, a plurality of strings mounted tautly on said supporting means, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a V-shaped lever member having the end of one arm of the V in engagement with said bridge member, the end of the other arm of the V in engagement with said supporting means and the apex portion of the V connected to said diaphragm, lateral movement of said bridge member causing a corresponding movement of said lever portion in engagement therewith and producing a rocking movement of said lever about the portion thereof engaging said supporting means whereby a vibration actuating said diaphragm is obtained.

7. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said

strings to hold the same taut lengthwise of said support, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a V-shaped lever having the end of one arm of the V in engagement with said bridge member, the end of the other arm of the V in engagement with said main support and the apex portion of the V connected to said diaphragm, lateral movement of said bridge member causing a corresponding movement of said lever portion in engagement therewith and producing a rocking movement of said lever about the portion thereof engaging said main support whereby a vibration actuating said diaphragm is obtained.

8. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut lengthwise of said support, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm having an apex portion adjacent to said bridge member and a base portion, a rim member secured to said base portion, means for securing said rim member to said main support, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a V-shaped lever member having the end of one arm of the V in engagement with said bridge member, the end of the other arm of the V in engagement with said main support and the apex portion of the V connected to said apex portion of said diaphragm, lateral movement of said bridge member causing a corresponding movement of said lever portion in engagement therewith and producing a rocking movement of said lever about the portion thereof engaging said main support whereby a vibration actuating said diaphragm is obtained.

9. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a plurality of separate members supporting said bridge member, one of said supporting members being cylindrical, said cylindrical member being only in frictional engagement with said bridge member and being rotated by the lateral movement of said bridge member, and an arm connected to said cylindrical member to form a lever therewith and adapted to rock in response to the rotary movement of said cylindrical member, said arm being connected to said diaphragm.

10. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means

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mounted on said support and engaging said strings to hold the same taut lengthwise of said support, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a plurality of separate members supporting said bridge member, one of said members being cylindrical, said cylindrical member being only in frictional engagement with said bridge member and being rotated by the lateral movement of said bridge member, and an arm connected to said cylindrical member to form a lever therewith and adapted to rock in response to the rotary movement of said cylindrical member, said arm being connected to said diaphragm.

11. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut lengthwise of said support, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm having an apex portion adjacent to said bridge member and a base portion, a rim member secured to said base portion, means for securing said rim member to said main support, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a plurality of cylindrical members supporting said bridge member and an arm connected to one of said cylindrical members to form a lever therewith and adapted to rock in response to the rotary movement of said cylindrical member, said arm being connected to said apex portion of said diaphragm.

12. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a lever having a portion thereof in engagement with said bridge member, another portion thereof in engagement with said main support, and a third portion thereof connected to said diaphragm, lateral movement of said bridge member causing a corresponding movement of said lever portion in engagement therewith and producing a rocking movement of said lever about the portion thereof engaging said main support whereby a vibration actuating said diaphragm is obtained, said lever having an effective lever arm ratio in excess of 1, thereby amplifying the motion transmitted from said bridge member to said diaphragm.

13. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge

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member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said last-named means comprising a lever having a portion thereof in engagement with said bridge member, another portion thereof in engagement with said main support, and a third portion thereof connected to said diaphragm, lateral movement of said bridge member causing a corresponding movement of said lever portion in engagement therewith and producing a rocking movement of said lever about the portion thereof engaging said main support whereby a vibration actuating said diaphragm is obtained, said lever amplifying the motion of said bridge member two to three times.

14. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said diaphragm constituting the sole effective means for converting the vibration of said string to sound, said main support having no appreciable sound-producing effect in response to the vibration of said string.

15. A string instrument comprising, in combination a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said diaphragm having a plane of symmetry and being mounted on said support with its plane of symmetry in substantial coincidence with the longitudinal axis of said support.

16. A string instrument comprising, in combination, a main support extending longitudinally of the instrument, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a cone-shaped diaphragm, and means for mounting said bridge member for lateral movement in response to the bowing of said string and for transmitting said lateral movement to said diaphragm to actuate the latter, said diaphragm being oval shaped and being mounted on said support with its axis of symmetry located beneath and substantially parallel to said support.

17. In a hand-held bowed string instrument of the violin type, means secured to said instrument and capable of engaging the body of the instrumentalist to facilitate the handling and playing of the instrument, said means comprising a chin-engaging member, a chest-engag-

ing member located beneath said chin-engaging member, and a downwardly and rearwardly extending element including an arcuate portion so located relative to said chin-engaging and chest-engaging members as to fit behind the neck of the instrumentalist, said chest-engaging member being mounted on said element below said chin-engaging member.

18. In a hand-held bowed string instrument of the violin type, means secured to said instrument and capable of engaging the body of the instrumentalist to facilitate the handling and playing of the instrument, said means comprising a chin-engaging member, a rodlike member extending rearwardly and downwardly relative to said chin-engaging member, said rodlike member comprising a curved portion to the rear of said chin-engaging member for engaging the neck of the instrumentalist and a chest-engaging plate mounted on said rodlike member beneath said chin-engaging member.

19. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portions thereof, sound-producing means comprising a diaphragm, means for supporting said bridge member for movement in response to the bowing of said string, said means comprising a filament-supporting member secured to said main support and filament means comprising at least a single filament mounted on said filament-supporting member and connected to said bridge member to suspend the same for relatively free lateral movement with respect to said filament-supporting member, and means for transmitting the movement of said bridge member to said diaphragm to actuate the latter.

20. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, means for supporting said bridge member for movement in response to the bowing of said string, means for supporting said bridge member for movement in response to the bowing of said string, said means comprising a filament-supporting member secured to said main support with a portion thereof located above said bridge member and filament means comprising at least a single filament mounted on said portion of said filament-supporting member and connected to said bridge member to suspend the same for relatively free lateral movement with respect to said filament-supporting member, and means for transmitting the movement of said bridge member to said diaphragm to actuate the latter.

21. A string instrument comprising, in combination, a main support, a plurality of strings, means mounted on said support and engaging said strings to hold the same taut, a bridge member engaging at least one of said strings intermediate the ends of the taut portion thereof, sound-producing means comprising a diaphragm, means for supporting said bridge member for movement in response to the bowing of said string, means for supporting said bridge member for movement in response to the bowing of said string, said means comprising a filament-supporting member secured to said main support with a portion thereof located above said bridge member and filament means comprising at least a single filament mounted on said portion of said filament-supporting member and connected to said bridge member to suspend the same for relatively free lateral movement with respect to said filament-supporting member, said filament extending from said supporting member in a plurality of spaced loops, each said loop connecting with a different portion of said bridge member, and means for transmitting the movement of said bridge member to said diaphragm to actuate the latter.

22. A string instrument as recited in claim 6 wherein a second bridge member engages another one of said strings, a second diaphragm is mounted on said supporting means, and means are provided for connecting said second bridge member to said second diaphragm whereby the lateral movement of said other string is caused to actuate said second diaphragm.

23. A string instrument as recited in claim 11 wherein a second bridge member engages another one of said strings, a second diaphragm is mounted on said supporting means, and means are provided for connecting said second bridge member to said second diaphragm whereby the lateral movement of said other string is caused to actuate said second diaphragm.

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