Nov. 12, 1935. L. A. LOAR 2,020,842

STRINGED MUSICAL INSTRUMENT

Filed July 31, 1933 3 Sheets-Sheet 1

Fig. 1

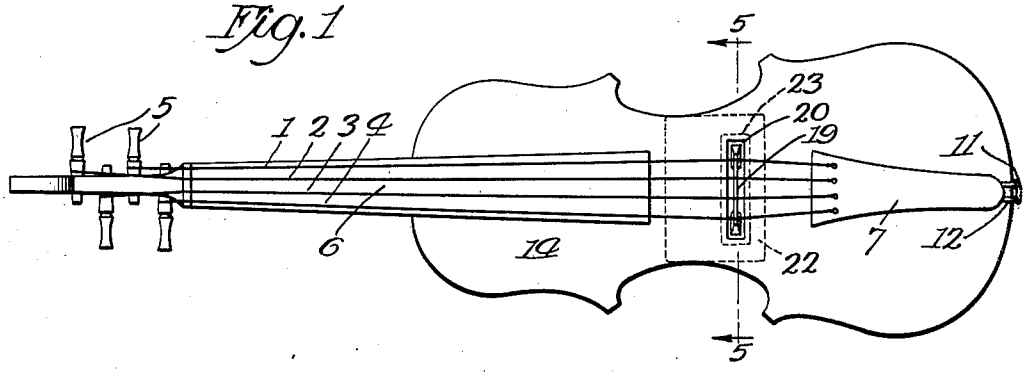


Fig. 2

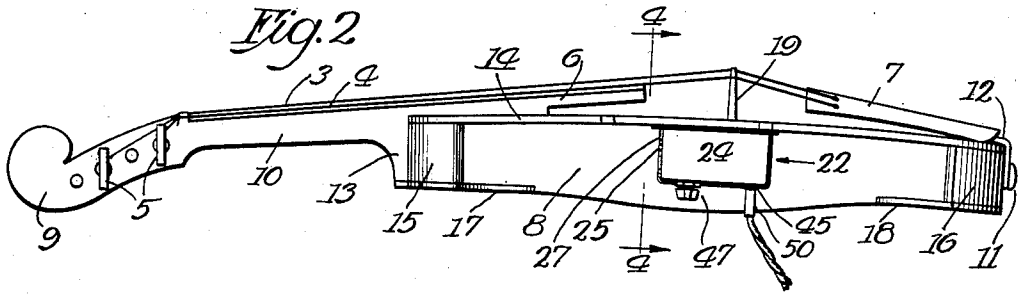


Fig. 3

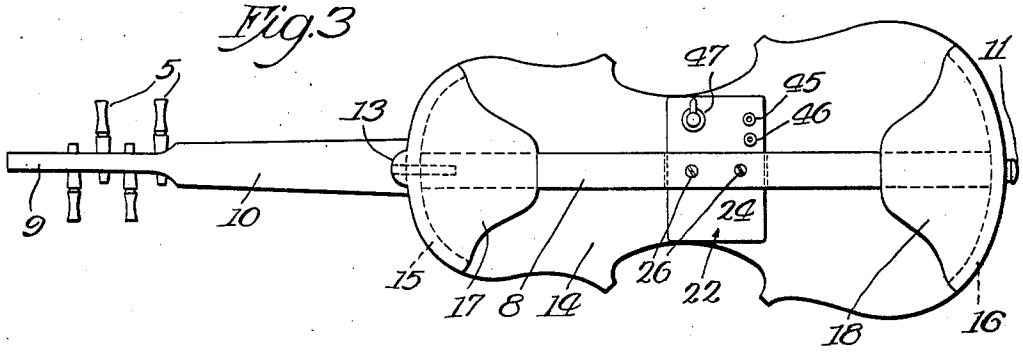
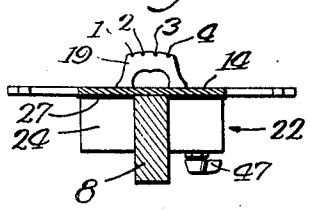


Fig. 4



INVENTOR.
Lloyd A. Loar
BY
J. Clarke Hagey
ATTORNEY.

Nov. 12, 1935. L. A. LOAR 2,020,842

STRINGED MUSICAL INSTRUMENT

Filed July 31, 1933 3 Sheets-Sheet 2

Fig. 5

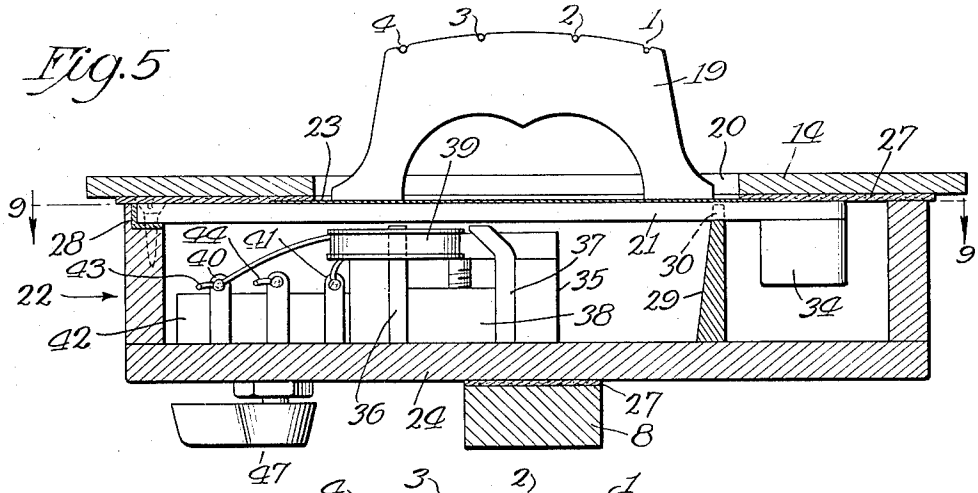


Fig. 6

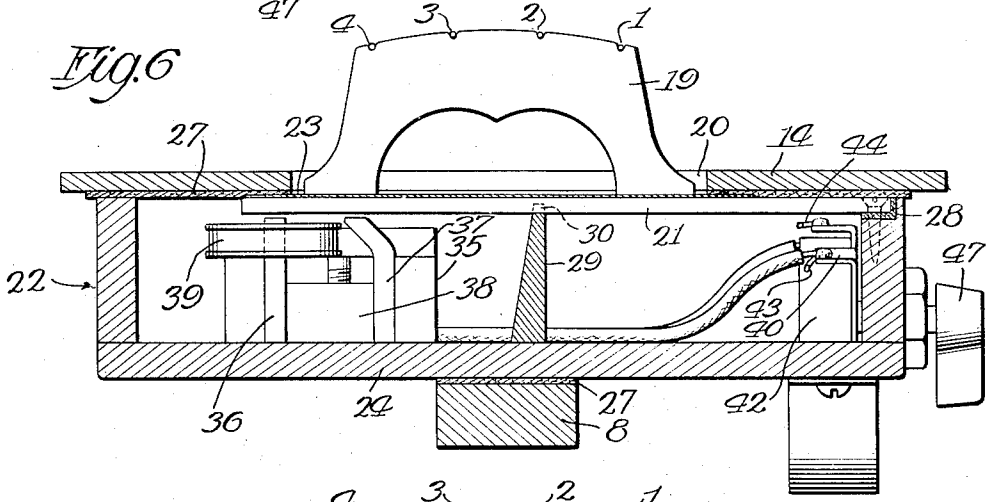
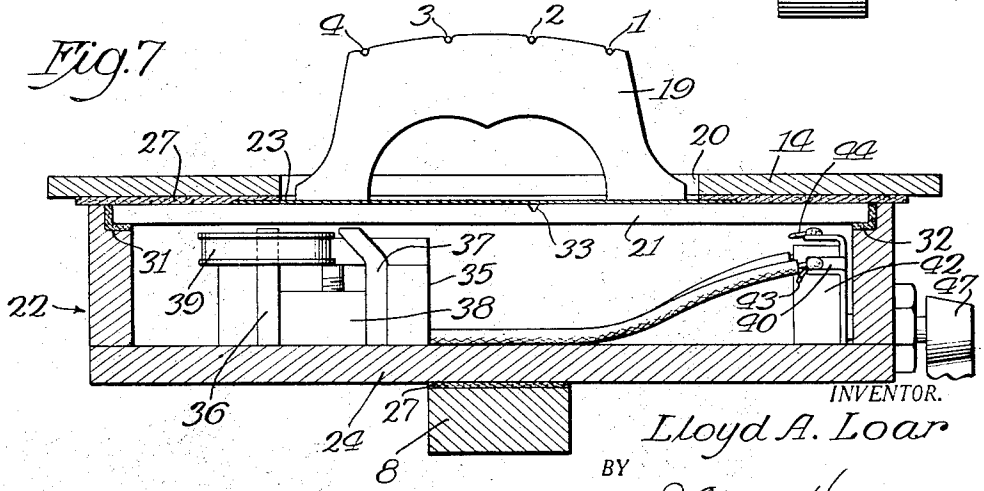


Fig. 7



INVENTOR.
Lloyd A. Loar
BY
J. Clarke Hagey
ATTORNEY.

Nov. 12, 1935. L. A. LOAR 2,020,842

STRINGED MUSICAL INSTRUMENT

Filed July 31, 1933 3 Sheets-Sheet 3

Fig. 8

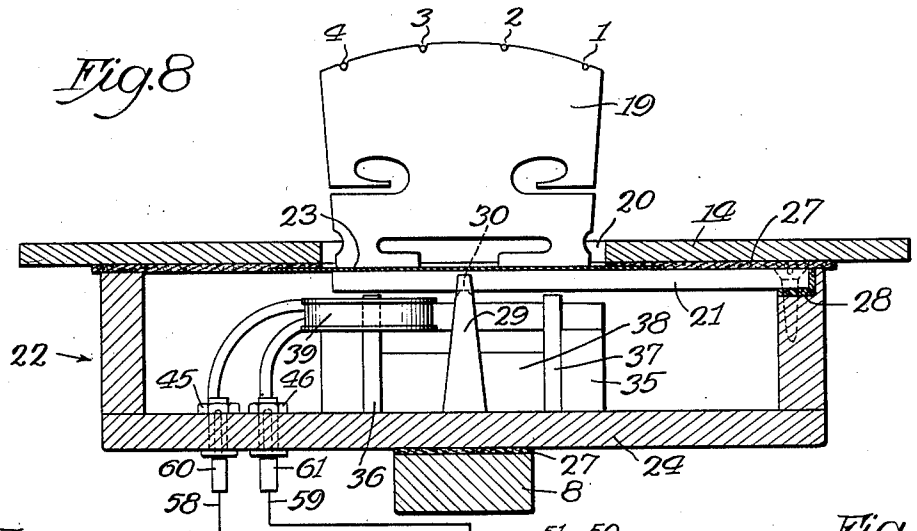


Fig. 9

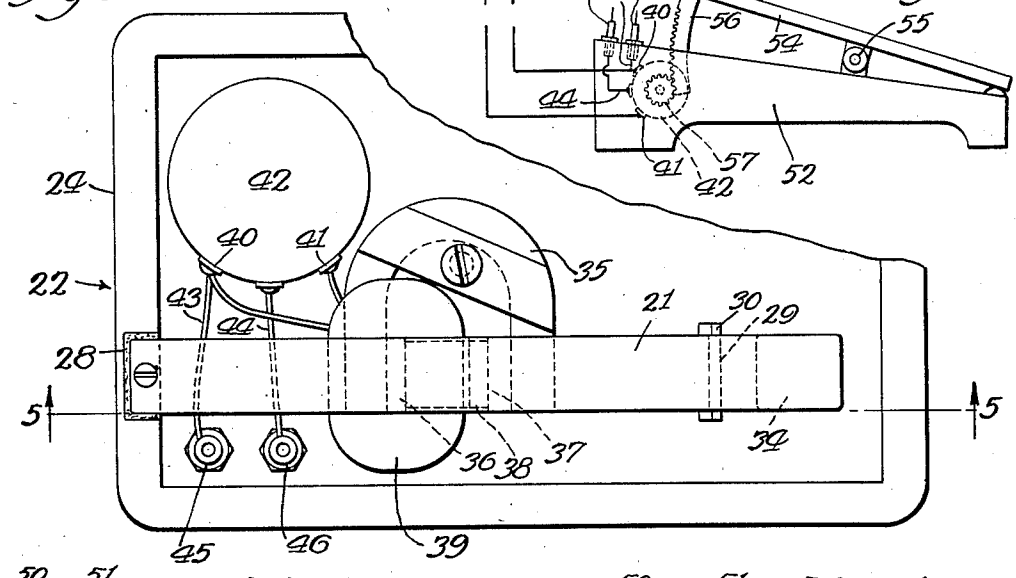


Fig. 12

Fig. 10

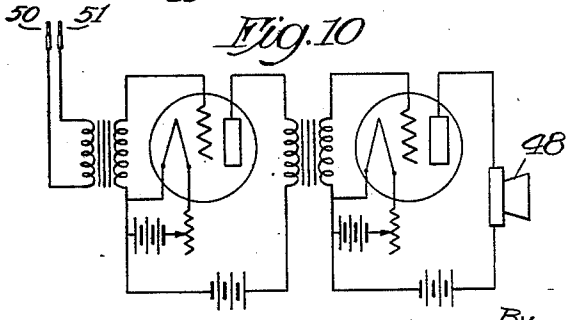
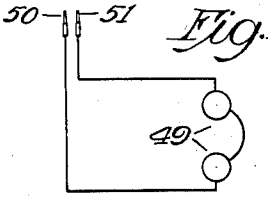


Fig. 11



INVENTOR.
Lloyd A. Loar
By J. Clarke Hagey
ATTORNEY.

Patented Nov. 12, 1935

2,020,842

UNITED STATES PATENT OFFICE

2,020,842

STRINGED MUSICAL INSTRUMENT

Lloyd A. Loar, Kalamazoo, Mich., assignor to Acousti-Lectric Company, Kalamazoo, Mich., a corporation of Michigan

Application July 31, 1933, Serial No. 682,976

14 Claims. (Cl. 84—1)

This invention relates to stringed musical instruments, and more particularly concerns instruments of the bowed and plucked string types, such as, but not limited to, those of the viol, mandolin, guitar, and banjo families.

The principal objects of the invention are to provide stringed instruments of special construction, which are played in the same manner as the various instruments of the types and families mentioned, and preferably simulate them more or less in general appearance, but in which the usual hollow instrument bodies are omitted, or are so changed in construction and so employed as to eliminate certain hereinafter described objectionable characteristics which they would otherwise possess as resonant sound-amplifying chambers, and to provide a novel means, highly sensitive to the finer tonal characteristics of the different instruments, through which desired qualities of the tones produced by the string vibrations may be selected, accurately registered and faithfully reproduced, and adjustably and evenly amplified in volume. Further objects and advantages of the invention will appear from the description to follow.

It is well known that stringed musical instruments, which appear to be exactly alike in details of construction, often vary greatly in their tonal qualifications. This is particularly exemplified in instruments of the viol type, wherein, for example, due to its superior quality of tone, one violin may be valued at thousands of dollars, while its apparent replica may lack such qualifications and have comparatively no value. There has been no way known to definitely determine, in the course of its manufacture, assembly or adjustment, the character or exact timbre of tone an instrument will possess when completed. In the usual and well known forms of stringed instruments already mentioned, the strings are stretched over bridges supported upon the tops or bellies of the respective sound-amplifying chambers forming the bodies of such instruments, and, since these sound-amplifying chambers are of fixed dimensions, they necessarily possess inherent resonant vibratory frequencies, so that they are sympathetically responsive to certain tonal vibrations more than others, and consequently amplify these tones to a greater degree and thereby produce an unevenness in the tonal scales of the respective instruments. In addition to producing unevenness of tonal volume in the scale or range of a single instrument, the employment of an amplifying chamber of fixed dimensions also renders it impossible to obtain the same character of tone from the different strings, or for the different notes of the scale obtained from any one string of the instrument. Character of tone is produced by the combination of tonal partials, and is a composite of such partials, and an amplifying chamber of fixed dimensions is responsive to certain tonal partials more than others, while some are wholly lost or damped, for the same reasons that it is responsive to certain tonal fundamentals more than others. The recognition of these conditions is evident in the employment of different sizes of instruments of the same family, for example, the violin, viola, violoncello, and bass viol, the tonal ranges of the different instruments requiring sound-amplifying chambers of correspondingly different dimensions. This method of apportioning divisions of the musical scale to different instruments is carried out in other families of stringed instruments, and smaller divisions might be made by adding more instruments to each family, but this would not remedy the aforesaid undesirable conditions as they exist in each instrument.

My invention does not contemplate changing the number of instruments comprising a family of instruments, nor does it involve changing the musical range or the desirable characteristic tonal qualifications properly belonging to the different instruments, but it does provide improvements in the quality of tone of the instruments, in the direction in which superior instruments are distinguished as such from their fellows, employing means by which a manufacturer may predetermine and fix preferred tonal qualities in such instruments as standards, and may duplicate such tonal qualities and follow such standards in other such instruments. It also provides for the production of even tonal volume and character throughout the musical scale and tonal range of each instrument, the convenient and exact control of volume amplification, and the production of undistorted tone from an instrument to any intensity desired. I believe I am the first to provide a construction which is designed and serves to correct the undesirable conditions I have mentioned, and/or which possesses the highly desirable features and qualifications indicated.

In the drawings,

Figure 1 is a top plan view of a stringed musical instrument constructed according to my invention;

Figure 2 is a side elevational view of such instrument;

Figure 3 is a bottom plan view thereof;

Figure 4 is a vertical sectional view, taken upon the line 4—4 of Figure 2;

Figure 5 is a vertical sectional view, upon an enlarged scale, taken upon the line 5—5 of Figure 1, and viewing the parts shown in Figure 9 upon the line 5—5 thereof;

Figures 6, 7, and 8 are views similar to Figure 5, illustrating modifications in the construction and arrangement of the parts of the magneto-acoustic unit, forming a part of the present invention;

Figure 9 is a plan view of the magneto-acoustic unit, viewed upon the line and in the direction of the arrows 9—9 of Figure 5;

Figures 10 and 11 are diagrammatic illustrations of conventional forms of sound-reproducing devices which may be connected with the instrument shown and to be described; and

Figure 12 is a side elevational view of a pedal-operated circuit-controlling device which may be employed as a part of my invention.

Although the prevailing methods of constructing and supporting the string-bridges of instruments of the viol family, together with the design and structure of the bodies of such instruments, render them exceptionally responsive to tonal partials, so that the tones of these instruments are much richer in character than those of other classes and families of stringed musical instruments, there are many of the string tone-partials existent in the respective string-bridges which are lost in the flexibility of the bridges and the stiffness of the body-structure of the instruments. Careful measurements have shown that, when permitted, the string-bridges of instruments of the types here concerned register the various directional vibrations of the strings stretched thereover. These vibrations are undulatory and oscillatory, and extend longitudinally, transversely, and perpendicularly of the strings. Consequently, in order to amplify the tones produced by such vibrations of the strings, it is necessary that the bridges be so supported that they may vibrate with and transmit such string movements. By eliminating the usual instrument bodies as sound-amplifying chambers, I avoid their aforesaid uneven amplification of tonal volume and character, and by supporting the string-bridges in the manner I shall describe, I provide for a more accurate registration and faithful reproduction of desired qualities of the tones produced by the string vibrations.

Referring, now, to the construction of the instrument here shown, more particularly in Figures 1 to 4, inclusive, of the drawings, the strings 1 to 4, tuning pegs 5, fingerboard or apron 6, and tail-piece 7 may be those of the standard violin. The bar 8 constitutes the principal frame-member and the back-bone of the instrument. It may be a single solid member extending the full length of the instrument, shaped at one end-part to form the scroll 9 and neck 10 and carrying at the other end the tail-pin or button 11, to which the tail-piece 7 is hitched by the loop 12 in the usual manner, or it may be made separately from and joined or firmly secured to the neck at the shoulder 13 thereof, as indicated in Figure 3. Body-plate 14 is firmly secured upon the upper surface of bar 8 and upon the upper surfaces of the head and tail rib-blocks 15 and 16, respectively, and is formed to resemble in plan the top or belly of a violin. In addition to serving as transverse supports for the end-parts of body-plate 14, head and tail rib-blocks 15 and 16, together with the corresponding back-plates 17 and 18, are firmly secured upon bar 8 and serve to give the proper body-thickness to facilitate the holding and playing of the instrument as a violin, and to provide a secure support for a standard form of chin-rest. If desired, the appearance of the violin may be simulated further, as by completing the rib and back, but such an arrangement, according to my invention, would not serve as an amplifying chamber resonant to the string vibrations, since body-plate 14 and back-plates 17 and 18 are firmly secured throughout their lengths upon bar 8, and body-plate 14 neither supports nor contacts with the string-bridge 19.

An opening 20 is formed in body-plate 14, and string-bridge 19 rests wholly upon and is supported entirely by the paramagnetic metal bar-armature 21 of the magneto-acoustic unit 22, which is in turn carried by bar 8. Bar 8 thus serves as a strut to receive the tension of the strings between tuning-pegs 5 and button 11, and as a support to receive the down-bearing of the strings upon string-bridge 19 and magneto-acoustic unit 22. Opening 20 is preferably covered by some thin flexible dust-excluding material. I have shown a membrane 23 of this character secured upon the under surface of body-plate 14 and extending between the feet of string-bridge 19 and bar-armature 21. Magneto-acoustic unit 22 comprises a tray-like casing 24, which is removably fitted within a recess 25 in bar 8 just beneath body-plate 14 and is held in position by screws 26. Vibration-absorbing or deadening material 27, such as felt or buckskin, is employed in recess 25 and between casing 24 and body-plate 14. Bar-armature 21 is positioned directly beneath opening 20 and, in the arrangements shown in Figures 5, 6, 8 and 9, is supported at one end-part in the recess 28 formed in the upper edge of one side of casing 24, and, at a carefully determined point between its ends, upon a block 29, resting within a recess 30 formed in the upper end-part thereof. Block 29 is firmly secured in proper position upon the bottom of casing 24. In the arrangement shown in Figure 7, bar-armature 21 is supported at its opposite end-parts within recesses 31 and 32 formed in the upper edges of opposite sides of casing 24, and, at a carefully determined point between its ends, is scored transversely with a groove 33. Recesses 28, 30, 31 and 32 are bushed with a noise-preventing material, such as leather or cork.

The metal bar-armature 21 possesses its own vibratory frequency and, unless prevented, would respond more readily to string and string-bridge vibrations of that frequency than to others. The unevenness of tonal volume and character which would result under such circumstances, although much higher in the musical scale, are to be avoided as much as the objectionable characteristics of the amplifying chamber of fixed dimensions already described. In order to prevent this natural frequency vibration of bar-armature 21 being sympathetically contributed to the vibrations of the strings and string-bridge, and in order to reject certain undesired frequency vibrations of the strings and string-bridge which interfere with the production of pure tone, it is divided into two sections, the vibratory frequencies of which are unfriendly to each other. This may be accomplished in several different ways, the preferred method depending, to a considerable extent, upon other factors which have to do with refinements in, and condensing of, the construction, not necessary to mention herein.

In the construction shown in Figures 5 and 9,

block 29 is positioned to support bar-armature 21 outside the treble foot of string-bridge 19, and a weight 34 is secured to the comparatively short free treble end-part of said bar-armature to cooperate with the positioning of said block in damping the natural frequency vibrations of said bar-armature. The vibratory frequency or period of the weighted end-part is unfriendly to that of the main part of the bar-armature and prevents it from sympathetically responding to certain tonal vibrations or frequencies more than to others. A U-shaped permanent magnet 35 is secured in position upon the bottom of casing 24. Pole-pieces 36 and 37 are secured to opposite polar ends of said magnet 35, or are held firmly in position thereagainst, as by block 38 which is wedged therebetween and secured to the bottom of casing 24 to prevent any possible vibration of these parts. Pole-piece 36 extends straight upwardly into close proximity to bar-armature 21 and is surrounded by a wire coil-winding 39. Pole-piece 37 extends upwardly and is bent over to position its upper end in similar close proximity to said bar-armature, as near as practicable to the upper end of pole-piece 36, the purpose being to position the two magnetic poles near each other to be subjected to approximately the same amplitude and frequencies of bar-armature vibrations. The ends of wire coil-winding 39 are connected at 40 and 41 to the variable resistance volume-control unit 42, from which wires 43 and 44 extend respectively to tip-jacks 45 and 46. Volume-control unit 42 is provided with an adjusting knob 47. In this arrangement of the parts of the magneto-acoustic unit shown in Figures 5 and 9, the adjusting shaft of volume-control unit 42 and the tip-jacks 45 and 46 project through the bottom of casing 24 upon the bass side of the instrument. For certain requirements, however, the arrangement of the parts may be turned about, so that the weighted end-section of bar-armature 21 will be near the bass foot of string-bridge 19, and tip-jacks 45 and 46 and adjusting knob 47 will be upon the treble side of the instrument.

In the modification shown in Figure 6, recess 28 is formed in the upper edge of the treble side of casing 24, and block 29 is positioned to support bar-armature 21 inside the treble foot of string-bridge 19, leaving the bass end-section of the bar-armature free, but the natural vibratory frequency of this free bass end-section is controlled by having the natural frequency of the other end-section unfriendly to it.

As already mentioned, in the arrangement shown in Figure 7, the opposite end-parts of bar-armature 21 are supported within recesses 31 and 32 and the bar-armature is scored with a groove 33, instead of being supported between its ends. Groove 33 is so located that the natural vibratory frequencies of the two end-sections of bar-armature 21 are unfriendly to each other.

Figure 8 illustrates an arrangement quite similar to that shown in Figure 6, differing therefrom principally in the closely grouped arrangement of the magneto-electric elements 35 to 39 and block 29 directly beneath string-bridge 19. This arrangement is employed in smaller viol-type instruments, where the narrowness of the instrument at the bridge limits the width of casing 24. Here again, the natural vibratory frequencies of the two end-sections of bar-armature 21 are maintained unfriendly to each other.

In the arrangements of the parts shown in Figures 6 and 7, volume-control unit 42 is positioned so that the adjusting shaft thereof projects through treble side of casing 24, and tip-jacks 45 and 46 are also positioned in said treble side of the casing, this arrangement being desirable in the smaller, but not in the larger, instruments of the viol family, because of the method of holding the different instruments during playing, and in order to permit adjustment of knob 47 and attachment of the electrical connections by the free bow-hand of the player.

While I have shown and described two manually operable arrangements of the volume-control unit 42 upon the instrument, I have found it highly desirable, in many instances, to mount it separately upon a pedal-device, so that it may be operated by the foot of the player, and not interfere with his playing. Such an arrangement is illustrated in Figure 12, where the volume-control unit 42 is shown secured upon the base 52 of the portable pedal-device 53. A heel-and-toe rocking pedal 54 is pivoted at 55 upon base 52 and is operatively connected with the adjusting shaft of the volume-control unit by means of the rack 56 and pinion 57. While the pedal-device 53 is shown as associated with the construction illustrated in Figure 8, it is to be understood that it may be similarly associated and used with any of the other constructions, either in place of or in conjunction with the volume-control units 42 illustrated in the other figures of the drawings. Where the pedal-device is used and the manually operable type is not desired, the ends of wire coil-winding 39 are connected directly to the tip-jacks 45 and 46 (Figures 8 and 9), with which wires 58 and 59 are respectively connected by cord-tips 60 and 61, wires 58 and 59 thus constituting flexible cord extensions of the ends of wire coil-winding 39, connected, as previously described, at 40 and 41 to the variable resistance volume-control unit 42, from which wires 43 and 44 may be connected with the cord-tips 50 and 51 of the loud-speaker circuit of Figure 10 or the head-phones circuit of Figure 11.

Since the particular form of sound-reproducing apparatus used in connection with the instrument herein described does not form a part of this invention, I have illustrated in Figure 10 a conventional circuit diagram of two audio-frequency amplification stages connected with a loud-speaker 48, and, in Figure 11, have indicated a pair of head-phones 49. Either the loud-speaker circuit of Figure 10 or the head-phones circuit of Figure 11 may be connected with the instrument by inserting cord-tips 50 and 51 into tip-jacks 45 and 46 (see Figure 2).

Attention is directed to the fact that, while bar-armature 21 rests within and is held in position by recesses 28, 30, 31 and 32, the free vibration thereof in all directions is not interfered with in any manner. When strings 1 to 4 are tensioned for playing, string-bridge 19 is thereby held down and presses upon bar-armature 21, and, since the string-bridge is wholly supported upon the bar-armature, and the bar-armature is not prevented from vibrating in any direction, the vibrations of said strings directly produce, and are substantially represented in, the periodicity, amplitude, and wave-form of the electric current generated magneto-electrically by the vibrations of bar-armature 21 in the magnetic field in which it is positioned over the permanent magnet pole-pieces 36 and 37.

In all of the arrangements shown, the general operation of the parts is the same, and the fol-

lowing description of such general operation applies equally well to the several constructions.

With either one of the sound-reproducing devices of Figures 10 and 11 connected with the instrument, the operation is as follows: The various directional vibrations of strings 1 to 4 are faithfully transmitted through string-bridge 19 to bar-armature 21 and varies the intensity of the magnetic field existing between pole-pieces 36 and 37. Such variations in the intensity of the magnetic field induces an electric current in wire coil-winding 39 and the circuit of which it forms a part, the periodicity and amplitude of the vibrations being accurately represented in the wave form of the current thus generated. The voltage of this current and, consequently, the strength of the signals received by the sound-reproducing device served thereby, may be adjusted by turning knob 47 or rocking pedal 54 of the variable resistance volume-control unit 42, but this adjustment does not interfere with or distort the wave-form pattern of the electric current, so that, while the player may thus determine the output of the magneto-acoustic unit 22 and thereby control the power of tone delivered by the instrument, he still retains the usual control of relative tonal intensities through powerful or light vibrations of the strings.

In the several arrangements illustrated in Figures 5 to 9, inclusive, the string-bridge 19 is shown and has been described as differently supported by the bar-armature 21. In the arrangement of Figures 5 and 9, where the block 29 is positioned to support bar-armature 21 outside the treble foot of string-bridge 19, it is evident that only one end-section of the bar-armature will be vibrated directly by the string-bridge, since said string-bridge rests wholly upon, and is supported entirely by, said one end-section. In that arrangement, the weighted free end-section of the bar-armature is not sympathetic to the same orders of frequencies as the other end-section which supports the string-bridge. In the other arrangements, the feet of the string-bridge rest and are supported, one upon one end-section and the other upon the other end-section of the bar-armature, and it is evident that the string vibrations are transmitted by the string-bridge to both end-sections of the bar-armature. In Figures 6 and 7, the two pole-pieces of magnet 35 are positioned below one end-section of the bar-armature, while, in Figure 8, one pole-piece 36 of the magnet is located below one end-section, and the other pole-piece 37 is located below the other end-section of the bar-armature. However, in all of the arrangements, neither end-section of the bar-armature can vibrate to vary the magnetic field and effect the generation of E. M. F. in coil-winding 39 without moving the other end-section with it at the same frequency, and, since the two end-sections are not sympathetic to the same orders of frequencies, it is evident that, in practical use, the bar-armature has no inherent frequency to which it may respond too freely.

From the foregoing description, it will be evident that; by different placements of block 29, thus varying the natural frequencies of the two end-sections of bar-armature 21 and their relation to each other; by different placements of block 29 in relation to the space between the feet of string-bridge 19, so that more or less string-pressure is transmitted by the string-bridge to one side or the other of block 29 and to one or the other end-sections of bar-armature 21; by different total lengths of bar-armature 21 and each of its end-sections; by different widths and thicknesses of bar-armature 21; by different degrees of stiffness or elasticity of bar-armature 21; and by varying combinations of these factors; the magneto-acoustic unit can be made responsive to any type or order of audio frequency, and so select from the string vibration-patterns the type and number of tonal partials or components to give the character of tone desired. Thus the unit provides mechanical methods of tone-color control impossible to any other construction. The air-gap between bar-armature 21 and pole-pieces 36 and 37 is determined by the height of block 29. This, as well as the position of the block, is determined and fixed at the time of manufacturing assembly and will not change with use, so it is neither necessary nor desirable that the height or position of block 28 be made adjustable for the player.

The herein described intimate association of the strings 1 to 4 with bar-armature 21, together with the facts that no exterior electric circuit is introduced for modification, and no resonant elements with their inherent vibratory frequencies may interfere are most important features of my invention. The absence of interposed connecting or transmitting elements, such as levers, push-rods, and pivots, between the strings and the magneto-electric unit are important and distinguishing factors in rendering the device peculiarly accurate in registering directional string vibrations, all of which are directly transmitted by the string-bridge to the bar-armature and are represented faithfully in the wave-form electric current generated by the magneto-acoustic unit, subject to the refinements which may be definitely introduced and fixed or built into the instrument by the manufacturer in the ways I have described.

Instruments embodying my invention have many practicable uses. The electrical output of the magneto-acoustic unit 22 is amply sufficient to operate head-phones 49, and there is no opportunity for extraneous sounds to be registered, as would be the case if a modulated power circuit were employed. There is no opportunity here for battery, power-circuit, or static electrical disturbances to interfere or distort. The device is extremely sensitive to string-vibrations, but not to extraneous electrical disturbances, and cannot register sound-chamber echoes and distortions of tone, since there is no sound-chamber or sound-board to produce them. Neither is it unduly sensitive to extraneous noises incidental to the playing of the instrument, such as impact of the fingers on the strings and finger-board, brushing of clothes against the body of the instrument, and noise from the vibrator (bow, pick, or fingers) used to vibrate the strings.

The instrument is particularly useful for practice purposes, the audible tones directly produced thereby being weak and undisturbing to others even in the same room. By using the head-phones, the player may hear all of the qualities of tone produced by his playing, to the exclusion of other sounds. Consequently, a number of instruments may be simultaneously played in the same room, without any of the players being disturbed by the playing of others. The use of mutes upon the regular instruments, and the use of practice dummies, prevents the player from obtaining the true characteristic tone of the instrument, but the use of the instrument herein described causes no distortion of tone, regardless of volume. By using the amplifier and loud-speaker system, the tones of the individual instrument may be ampli-

fied in volume to a degree which the player himself may adjustably determine by means of the adjusting knob 47 or the pedal 54, limited only by the limitations of the amplifying and loud-speaker unit. In this manner, the player may adjust the volume of tone for salon or concert performances to a nicety, without sacrificing or distorting tonal characteristics.

I claim:

1. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory bar forming a part of said means, a string-bridge supported upon said bar, and strings tensioned upon said support and bearing upon said string-bridge; said bar extending lengthwise transversely of said strings.

2. A stringed musical instrument comprising a support, a body-plate secured upon said support and having an aperture therein, magneto-electric circuit-generating means carried upon said support, a vibratory member forming a part of said means positioned directly beneath the aperture in said body-plate, a string-bridge extending through the aperture in said body-plate and resting upon said member, and strings tensioned upon said support and bearing upon said string-bridge.

3. A stringed musical instrument comprising a support, a casing carried upon said support, magneto-electric circuit-generating means located within said casing, a vibratory member forming a part of said means and supported by said casing, a string-bridge supported upon said member, and strings tensioned upon said support and bearing upon said string-bridge.

4. A stringed musical instrument comprising a support, a body-plate secured upon said support and having an aperture therein, a casing carried upon said support, magneto-electric circuit-generating means located within said casing, a vibratory member forming a part of said means and supported by said casing directly beneath the aperture in said body-plate, a string-bridge extending through the aperture in said body-plate and resting upon said member, and strings tensioned upon said support and bearing upon said string-bridge.

5. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory member forming a part of said means, a string-bridge supported upon said member, and strings tensioned upon said support and bearing upon said string-bridge; said member being supported at one end part thereof and at a point along its length.

6. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory bar forming a part of said means, a string-bridge supported upon said bar, and strings tensioned upon said support and bearing upon said string-bridge; said bar extending lengthwise transversely of said strings and being supported at one end part thereof and at a point along its length.

7. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory member forming a part of said means, a string-bridge supported upon said member, and strings tensioned upon said support and bearing upon said string-bridge; said member being supported at one end part thereof and at a point along its length, the location of the last mentioned point of support being positionable below said string-bridge to suppress the inherent vibrations of said member and permit it to be vibrated synchronously with and by said string-bridge.

8. The combination, with the strings and string-bridge of a stringed musical instrument, of a magneto-electric circuit-generating device operated by the vibrations of said strings to produce a wave-form electric current the characteristics of which vary in accordance with the vibrations of said strings, comprising a bi-polar permanent magnet, a closed electric circuit comprising a coil surrounding one polar part of said magnet, and a bar-armature supported for vibration within the magnetic field of said magnet, extending across both poles thereof, and supporting said string-bridge.

9. The combination, with the strings and string-bridge of a stringed musical instrument, of a magneto-electric circuit-generating device operated by the vibrations of said strings to produce an electric current the wave-form characteristics of which are varied by the vibrations of said strings, comprising a bi-polar permanent magnet, a closed electric circuit having a coil positioned within the magnetic field of said magnet, an adjustable current-controlling device included in said circuit, and a bar-armature supported for vibration within the magnetic field of said magnet, extending across both poles thereof, and supporting said string-bridge.

10. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory member forming a part of said means, a string-bridge supported upon said member, and strings tensioned upon said support and bearing upon said string-bridge; said member being supported and operatively divided into two sections, the vibratory frequencies of said sections being non-synchronous to suppress undesired vibrations of said member.

11. A stringed musical instrument comprising a support, a body-plate secured upon said support and having an aperture therein, magneto-electric circuit-generating means carried upon said support, a vibratory armature forming a part of said means and extending transversely of said support directly beneath the aperture in said body-plate, a string-bridge extending through the aperture in said body-plate and wholly supported by said armature, and strings tensioned upon said support and bearing upon said string-bridge.

12. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory armature forming a part of said means, a string-bridge wholly supported by said armature, strings tensioned upon said support and bearing upon said string-bridge, and two armature-supporting blocks operatively dividing said armature into two sections whose natural frequency is such that one is out of phase with the other.

13. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory armature forming a part of said means, a string-bridge wholly supported by said armature, strings tensioned upon said support and bearing upon said string-bridge, and two blocks supporting said armature, one supporting block being at one end of said armature and the other supporting block being positionable along the length of said armature to permit the relative lengths of the two sections into which it operatively divides said armature to be determined to control the rela-

tive frequencies of the two sections of said armature.

14. A stringed musical instrument comprising a support, magneto-electric circuit-generating means carried upon said support, a vibratory member forming a part of said means, a string-bridge wholly supported by said member, strings tensioned upon said support and bearing upon said string-bridge, and two blocks supporting said member, one supporting block being at one end of said member and the other supporting block being positionable along the length of said member to permit the relative lengths of the two sections into which it operatively divides said member to be determined to control the relative frequencies of the two sections of said member, and the location of said positionable supporting block being likewise positionable with relation to the center of the string pressure area transmitted by said string-bridge to said member so that more or less string pressure can be directed to either of the two sections into which the positionable supporting block operatively divides said member.

LLOYD A. LOAR.