July 21, 1936. V. A. PFEIL 2,048,515

MUSICAL INSTRUMENT

Filed April 28, 1933 2 Sheets-Sheet 1

Fig. 1.

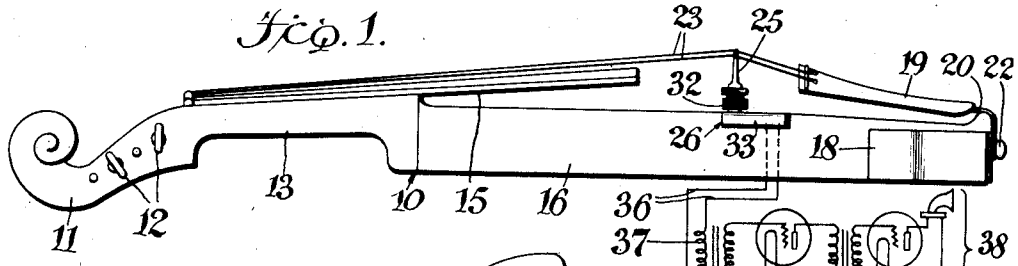


Fig. 2.

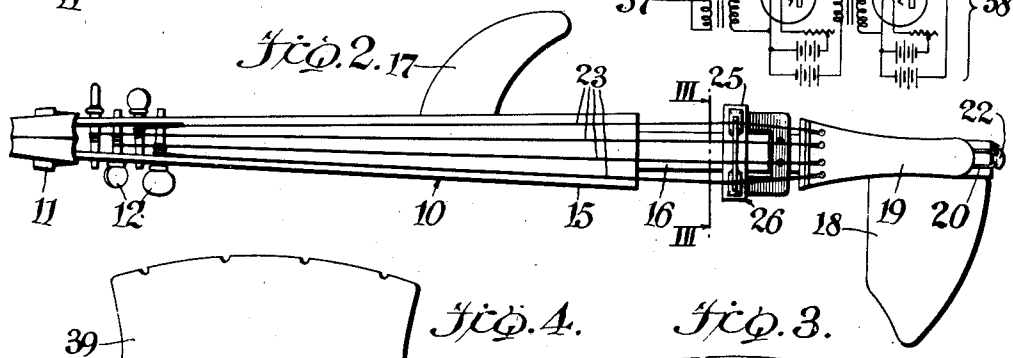


Fig. 4.

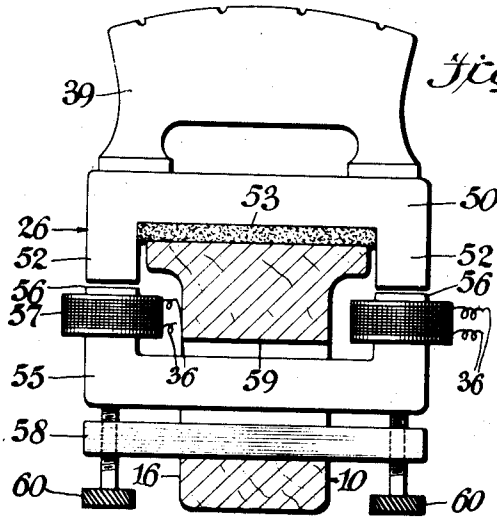


Fig. 3.

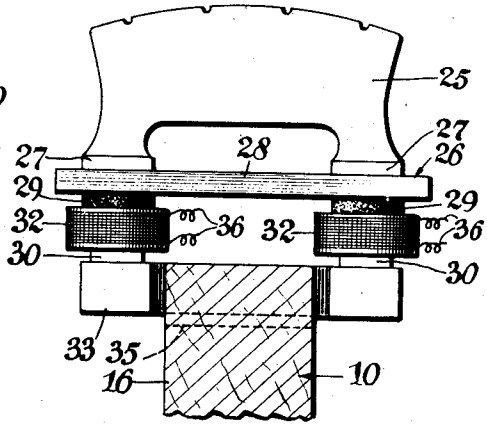


Fig. 5.

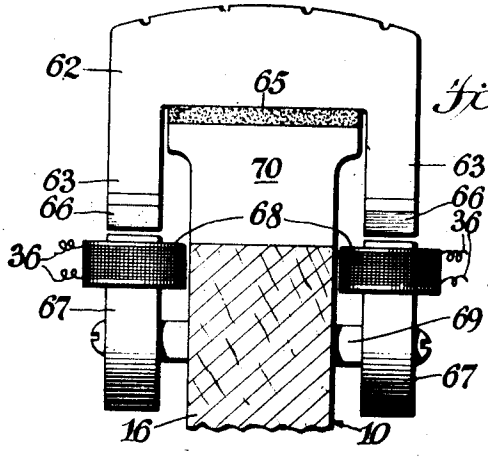
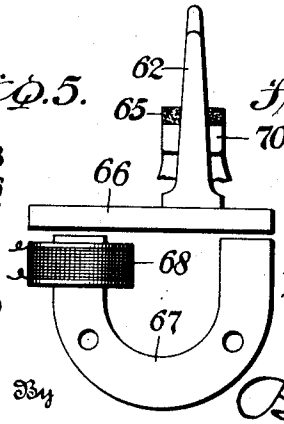


Fig. 6.



Inventor
Victor A. Pfeil

By Beau & Brooks.
Attorneys

July 21, 1936. V. A. PFEIL 2,048,515

MUSICAL INSTRUMENT

Filed April 28, 1933 2 Sheets-Sheet 2

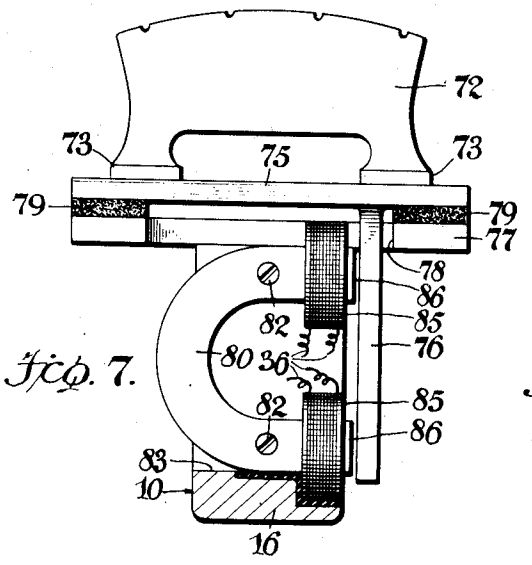


Fig. 7.

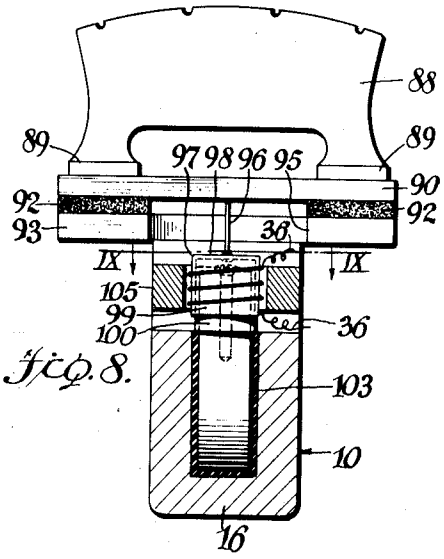


Fig. 8.

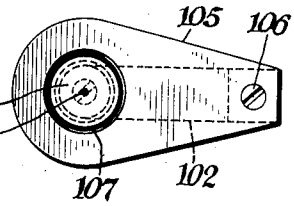


Fig. 9.

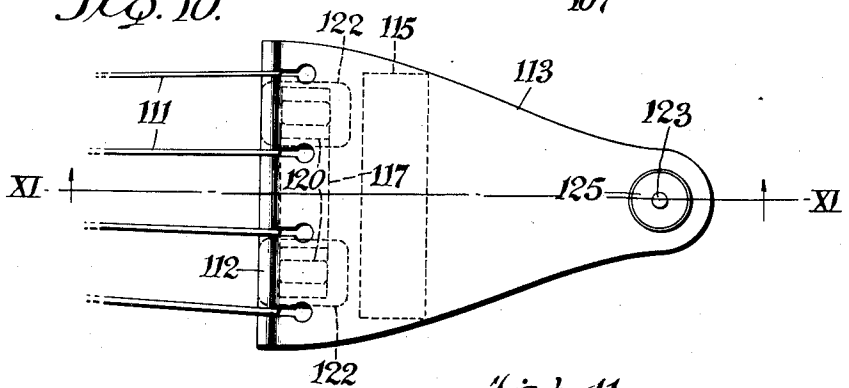


Fig. 10.

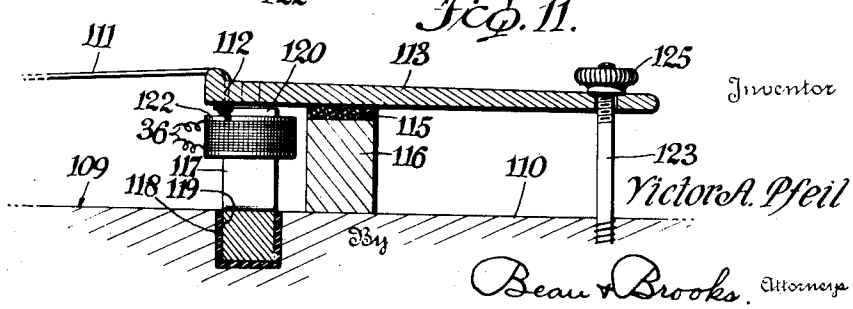


Fig. 11.

Inventor

Victor A. Pfeil

By

Beau & Brooks. Attorneys

Patented July 21, 1936 2,048,515

UNITED STATES PATENT OFFICE

2,048,515

MUSICAL INSTRUMENT

Victor A. Pfeil, Orange, N. J., assignor to Creszentia A. Pfeil, West Orange, N. J.

Application April 28, 1933, Serial No. 668,451

6 Claims. (Cl. 84—1)

This invention relates to stringed instruments and it has particular relation to a stringed musical instrument combined with transforming and amplifying mechanism installed in conjunction therewith.

The invention contemplates the provision of a stringed instrument simulating any well known type which is played manually and is designed for directly producing a pulsating electric current for transformation and amplification into sound energy in the form of musical notes of the instrument at a remote point.

In one embodiment of the invention a special construction of musical instrument is provided and in which a stick of wood, or other suitable material, is employed for mounting a conventional finger board, together with a special bridge construction for receiving strings stretched thereover. The bridge is mounted for oscillatory or vibratory movement with respect to the stick in order that it may operate and cooperate with an electric system constructed to reproduce the sound corresponding to the vibrations of the strings and bridge. The invention includes special construction of bridges for stringed instruments differing materially in construction and method of installation from conventional bridges of ordinary musical instruments.

In referring to means for producing a magnetic field, it is to be understood that electromagnetic devices are intended to include magneto electric devices. That is, electrical energy can be induced through an electric circuit in which electromagnetic means is incorporated for varying a magnetic field according to vibrations of an armature, or a permanent magnet and coil can be used in which the field of the magnet or winding of the coil is provided with an armature vibrated by vibrations of the musical instrument string to create the desired electric pulsations.

In arranging the elements of the instrument embodying the invention, a bridge and transforming device are mounted upon a suitable supporting portion of the instrument, and an armature composed of soft iron is mounted in conjunction with the bridge and transforming device in such manner that the vibrations of the strings of the instrument create direct and proportionate vibrations in the armature which, in turn, develop a pulsating electric current in the transforming device whose wave form is analogous to that of the note or sound produced. The pulsating current is amplified to any desired volume and quality and again transformed into audible sound waves similar in pitch and quality to the original sound produced by the strings. More than one amplifying device can be applied in the structure disclosed.

In the drawings:

Fig. 1 is a side elevation of an instrument, together with a diagram of an electric circuit associated therewith;

Fig. 2 is a plan of the instrument;

Fig. 3 is a cross section taken substantially along the line III—III of Fig. 2;

Fig. 4 is a cross section similar to Fig. 3 and illustrating another form and arrangement of the bridge and electromagnet connection;

Fig. 5 is a cross section similar to Fig. 3 illustrating another form of bridge and electro-magnet connection;

Fig. 6 is a side elevation of the structure shown in Fig. 5;

Fig. 7 is a cross section similar to Fig. 3 and illustrating still another form of bridge and electro-magnet connection;

Fig. 8 is a cross section similar to Fig. 3 illustrating another form of bridge and electro-magnet;

Fig. 9 is a plan of the structure as viewed from the plane indicated by the line IX—IX of Fig. 8;

Fig. 10 is a fragmentary plan of a combined tail piece and electrical transmitting device; and

Fig. 11 is a longitudinal section taken substantially along the line XI—XI of Fig. 10.

Referring to Figs. 1, 2, and 3, a musical instrument 10 is provided somewhat similar to an ordinary violin in that it includes a scroll 11, string securing and tensioning pegs 12, and a neck 13 upon which a finger board 15 is mounted. In this structure the entire body portion or resonator box, usually included in a musical instrument of this general type, is omitted and a suitably turned and finished stick 16 of wood or insulating material is substituted therefor. In fact, the stick 16 is substantially a continuation of and is approximately the same size as the neck. In order to facilitate the manipulation of the fingers along the finger board and to provide for proper resting of the instrument beneath a person's chin, a lateral hand rest 17 is rigidly mounted upon the stick adjacent the neck, and a lateral chin rest 18 is rigidly mounted upon the rear or inner end of the stick.

A conventional violin tail piece 19 having a loop 20 fitting over a button 22 at the end of the stick supports the rear ends of the strings 23 while the strings are connected for adjustment upon the pegs 12 at the outer end of the neck.

While this description refers to the manner in which the instrument such as the violin is assembled with respect to the strings, it is of course possible to apply the same principle of construction to various other types of stringed instruments.

The strings 23 are supported between the end of the finger board 15 and the tail piece 19 by means of a bridge 25 which constitutes a part of a device 26 for transmitting vibrations of the strings into electrical energy having the same vibration or wave characteristics as those of the strings. Since the vibrations of the strings 23 are transmitted through the bridge 25, the latter constitutes a vibratory or oscillatory member. This bridge has its feet 27 supported upon opposite spaced portions of an armature structure 28 in the form of a bar, end portions of which are carried upon blocks of yieldable or resilient material 29, such as rubber or rubber compound, mounted axially upon the outer ends or poles 30 of electro-magnets 32. The poles are rigidly secured upon outer end portions of the legs of a U-shaped permanent magnet 33, and suitable insulating material rigidly carries the magnet 33 upon the stick. It is of course to be understood that only one of the magnets 32 may be used, or that one of them can be omitted, although a more perfectly balanced arrangement is provided by using two as shown in the drawing.

Suitable insulated electric conductors 36 connected to the electro-magnet, lead to a transformer 37, and the secondary terminals of the transformer 37 are, in turn, connected to an electric amplifying system 38 including well known devices such as electron tubes, audio transformers, batteries, and a loud speaker, all of which are represented diagrammatically in Fig. 1. It is to be understood that other well known constructions of amplifying systems can be incorporated in conjunction with the instrument described above.

In the operation of the arrangement described, a musician plays the instrument by fingering the strings and vibrating them by means of a bow or otherwise. These strings are thus vibrated transversely and the vibrations produced are transmitted to, and cause proportionate vibration of, the bridge. From the bridge the vibration is imparted directly to the armature 28, and accordingly, there is generated, by means of the magnetic field of the magnet, a pulsating electric current having a wave form similar to the wave form of the note or sound produced by vibrating the strings. This pulsating electric current is amplified through the electric transforming and amplifying system 37—38, and is finally transformed into an audible note or sound which is a true reproduction of the note as originally set up by the vibration of the strings 23. Since it is possible to vary the volume and tone of the vibration sounds from the strings, the quality of sounds emitted from the amplifying mechanism can be regulated so as to present music commensurate in tone quality with that produced by the finest musical instruments.

It has been observed that the quality and timbre of a note reproduced and amplified by means of an electric circuit depends to a certain extent upon the freedom of vibration of the body producing or emitting the original note. According to this invention such freedom of vibration is secured by means of the resilient supports 29 for the bridge. If the bridge were not so resiliently mounted, then the period of vibration of the armature would necessarily be reduced, and hence, the extent of vibration of the armature itself would be so reduced.

It is known that the quality of music emitted by violin depends largely upon the character and age of the wood of which the resonator box is composed. New violins do not produce the better quality of music because the wood is not of proper character, but tends to set up higher harmonic vibrations which to the ear are inharmonious with the fundamental. In the kind of instrument described herein the resonator box is not used, thus preventing the development of undesirable harmonies. This instrument produces only weak sounds resulting wholly from the vibrations of the strings while the music to be produced is transmitted to the amplifier in the form of vibration directly from the bridge and armature. Thus, the amplifier produces or presents the music of the instrument in the desired manner.

In the construction shown in Figs. 4 to 9, somewhat different arrangements of elements are included for producing results like those described above, in that an instrument 10 is constructed generally in the same manner as the instrument 10 of Fig. 1, but the mounting and elements of the transmitting devices corresponding to the device 26 of Fig. 1 are different in arrangement and construction, and hence, the features thereof are designated by different reference characters.

According to Fig. 4, a bridge 39 is mounted upon suitable armature structure 50 in the form of a yoke having depending legs 52 and a resilient pad or block 53 supports the yoke along its intermediate portion upon the stick 16. A permanent magnet 55 is formed with upwardly extending legs 56 in slightly spaced end to end relation to the legs 52 of the yoke. In this construction the permanent magnet is integral with the pole 56 of the electro-magnet. A bar 58 of insulating material, or having insulating material between magnet 55 and the stick 16, is secured upon the lower wall of a slot 59 formed transversely in the stick. In order to secure proper adjustment of the magnet a pair of thumb screws 60 are screw threaded through opposite end portions of the bar 58 and into opposite marginal portions of the magnet 55. The operation of this arrangement is substantially the same as that described above, although finer adjustment can be obtained by manipulating the thumb screws 60. The connection of the insulated electric conductors 36 from the electro-magnet to the amplifying system 37—38, is the same in both cases.

Referring to Figs. 5 and 6, a bridge 62 is provided with downwardly extending legs 63 straddling the stick 16 and having a block of resilient material 65 supporting the bridge along its lower portion upon the upper surface of the stick. Each leg 63 of the bridge is provided with armature structure 66 rigidly secured thereto and projecting lengthwise of the stick in spaced relation thereto. As best shown in Fig. 6, the structure 66 on each side of the stick is secured nearer one of its ends than the other to the bridge. If desirable, the bridge can be considered a part of the armature structure.

A permanent magnet 67 of U-shape having one leg thereof formed into an electro-magnet 68 is secured on each side of the stick 16, and the end portion of the armature structure 66 on each side of the stick is slightly spaced from adjacent ends of the magnet 67. Suitable securing devices 69 of insulating material rigidly secure the magnets

to the stick. The vibrations of the bridge are transmitted directly through the resilient material 65 and transmitted from the armature structure to the electro-magnet whence they are electrically conducted through the insulated conductors 36 to the transforming and amplifying apparatus 37—38. If desirable the stick may be formed in such manner as to provide a raised support 70, or this member can be formed separately and secured to the stick 16. In this kind of arrangement separate transforming and amplifying apparatus is applicable for connection to each electro-magnet 68.

In Fig. 7 a bridge 72 has its legs 73 secured directly to suitable armature structure in the form of a bar 75 which has a depending arm 76 disposed substantially at right angles thereto. A supporting plate 77 incorporated in the stick 16 and having a central recess 78, is provided at its opposite ends with resilient blocks 79 which support opposite ends of the armature bar 75 thereon. It will be observed that the contiguous ends of the bar and plate project outwardly beyond the edges of the supporting stick 16, and that the angular armature arm 76 extends from the armature bar between the blocks 79, through the recess 78, and in spaced relation down the side of the stick. A permanent magnet 80 of U-shape is rigidly mounted and insulated, as indicated at 82, upon the stick in a recess or cut-a-way portion 83 formed therein. Electro-magnets 85 are built upon the legs 86 of the U-shaped magnets, and these legs are slightly spaced in parallel relation to the armature arm 76. The insulated conductors 36 are connected to the electro-magnets 85 and to the transforming and amplifying system 37—38 as described above.

Figs. 8 and 9 illustrate another form of the invention wherein a bridge 88 is supported by its legs 89 upon opposite end portions of armature structure including a bar 90 that is carried by blocks of resilient material 92 upon the opposite ends of a supporting plate 93. Contiguous ends of the bar and plate extend laterally beyond the opposite sides of the stick 16 and the plate is secured upon the upper surface of the stick.

A recess 95 is formed centrally in the plate 93, and a rod or pin 96 extends rigidly and downwardly from the central portion of the bar to provide a link from the bar to a metallic inverted cup 97 of substantially cylindrical form that has its upper end wall 98 secured rigidly to the lower end of the rod 96. A low impedance sound coil 99 carried on the cup, has its convolutions spaced, and secured about the outer cylindrical cup wall. The rod 96 and cup 97 constitute portions of the armature structure. This cup is disposed over a cylindrical head or pole 100 of a permanent magnet 102 in such manner that the outer wall and end of the cylindrical head remain slightly spaced from the inside walls of the cup. The magnet 102 is U-shape in form and is partially embedded in insulating material 103 secured in the stick 16 to maintain the magnet firmly fixed therein.

The end of the magnet 102 opposite the head 100 is provided with a rigid extension 105 in plate form having a suitable connection 106 to the body portion of the magnet. This plate flares toward the head and is formed with an opening 107 through which the head 100 and cup 97 are so disposed as to be slightly spaced from the wall of the opening. The electric conductors 36 are connected to the coil 99 and to the transforming and amplifying system 37—38 in such manner as to transmit and amplify the vibrations of the strings in the same manner as that described with respect to Figs. 1 and 2.

Referring to Figs. 10 and 11, an instrument 109 is substantially the same in general construction as that shown in Fig. 1, but in this case a body or stick 110 is not provided with a bridge of the type previously described. On the other hand, strings 111 are stretched directly from a transverse portion 112, which serves as a substitute for a bridge and is incorporated in a tail piece 113, to a neck and pegs (not shown) like those shown in Figs. 1 and 2. In this form of the invention the tail piece 113 is composed of metal for the additional purpose of serving as an armature structure, and is supported intermediately upon a resilient block 115 carried upon a raised support 116 that is secured to the stick 110.

A permanent magnet 117, U-shape in form, is partially embedded in insulating material 118 carried rigidly in a recess 119 in the stick. Legs 120 of the magnet extend upwardly to provide poles for an electro-magnet 122. The ends of the legs 120 are spaced slightly from the lower surface of the armature tail piece adjacent one end of the latter. The other end of the tail piece is provided with an adjusting pin 123 extending loosely therethrough and secured rigidly in the stick 110. A suitable nut 125 screw threaded upon the upper end of the pin impinges upon the upper surface of the tail piece and serves to adjust the latter nearer or farther from the ends of the magnet legs 120. It is of course to be understood that the taut strings 112 always tend to pivot the tail piece about the resilient block against the nut 125. The wires 36 are connected to the electro-magnet 122 and to the transforming and amplifying system 37—38 in the same manner as that described with reference to the other figures.

Since the operation of the construction shown in Figs. 1, 2, and 3 has been explained in detail it is apparent that the other somewhat analogous structures disclosed in Figs. 4 to 11, inclusive, function in substantially the same general manner. However, it should be noted that, in the arrangement shown in Figs. 8 and 9, including the low impedance sound coil, the physical vibrations transmitted from the bridge vibrate the cup, and that by using this method, in which a relatively few coils are employed, it is found that fidelity of tone is exceptionally satisfactory.

Although several forms of the invention have been shown and described in detail it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What is claimed is:

1. In a stringed instrument, a solid body of bar form, a plurality of strings tensioned across portions of the body, yieldable means carried upon said body, a vibration transmitting device carried by the body of the instrument, said device including an oscillatory member supporting portions of the tensioned strings, an electro-magnetic mechanism including a pair of electro-magnets disposed adjacent said member and having poles to form magnetic fields, armature structure included in said device and confined directly between said yieldable means and said oscillatory member to restrict the armature to vibrations corresponding to those transmitted from said oscillatory member thereto, said armature structure having portions extending into both magnetic

fields of the poles, said armature structure being vibratory upon said yieldable means in response to the vibrations of said strings and member to vary the field of the electro-magnetic poles, and means for connecting said device to a vibration transforming and amplifying mechanism.

2. In a stringed instrument, a solid body of bar form, a plurality of strings tensioned across portions of the body, a vibration transmitting device carried by the body, said device including a structure for supporting portions of the tensioned strings, said structure having a resilient mounting supporting it directly upon said body portion and including armature portions straddling the body, an electro-magnetic device carried by the body and arranged adjacent the armature portions whereby vibrations of the strings are transmitted through said structure to the magnetic field and the magnetic field is varied by the vibration of the armature therein, and means for connecting said device to a vibration transforming and amplifying mechanism.

3. In a stringed instrument, a solid body of bar form, an armature having a resilient mounting supporting it directly upon the body, a bridge having its base portions seated directly upon the armature for support thereon, a plurality of strings tensioned across said bridge from one portion of the body to another, said armature having an extension arm, an electro-magnetic device carried by the body and having portions arranged adjacent the extension arm of the armature to provide for vibration of said arm in the magnetic field of said device whereby vibrations of the strings are transmitted into electric pulsating current of the same wave form as the wave form of the vibrations of the strings.

4. In a stringed musical instrument, a solid body of bar form, armature structure having resilient mounting supporting it upon the body, a bridge having its base portion seated upon the armature structure for support thereon, a plurality of strings tensioned across said bridge and from one portion of the body to another, a cup-like structure depending from the armature and having metallic conductors coiled thereon to provide portions of an electro-magnetic device, and a permanent magnet having a portion extending into the cup-like structure, said armature being responsive to vibrations of the strings to vibrate said cup-like structure about the portion of the magnet disposed therein and thereby to vary the magnetic field of the electro-magnetic device.

5. In a stringed musical instrument, a solid body of bar form, armature structure having resilient mounting supporting it upon the body, a bridge having its base portions seated upon the armature structure for support thereon, a plurality of strings tensioned across said bridge and from one portion of the body to another, a cup-like device incorporated in said armature structure and having a low impedance coil disposed thereon to provide elements of an electro-magnetic mechanism, a permanent magnet having a portion extending into the cup-like device, said armature structure being responsive to vibrations of the strings to vibrate said cup-like device about portions of the magnet therein to vary the magnetic field of the electro-magnetic mechanism, and means connected to said low impedance coil for transforming and amplifying vibrations transmitted to the electro-magnetic mechanism.

6. In a stringed instrument, a solid body of bar form, a string tensioned across a portion of the body, a vibration transmitting device carried by the body of the instrument; said transmitting device including an oscillatory string contacting member for supporting a portion of the tensioned string, an electrically influenced magnetic mechanism having poles providing a magnetic field, resilient means carried directly upon said body, armature structure incorporated with said member and confined directly between said resilient means and said string contacting member against vibration other than that transmitted directly from the string and string contacting member thereto, coacting parts of said armature structure and member extending at least to opposite edges of the body of the instrument, said armature structure having portions disposed in the magnetic field of said mechanism and being vibratory in response to the vibration of the string to vary the field of said magnetic mechanism.

VICTOR A. PFEIL.