

June 7, 1932.

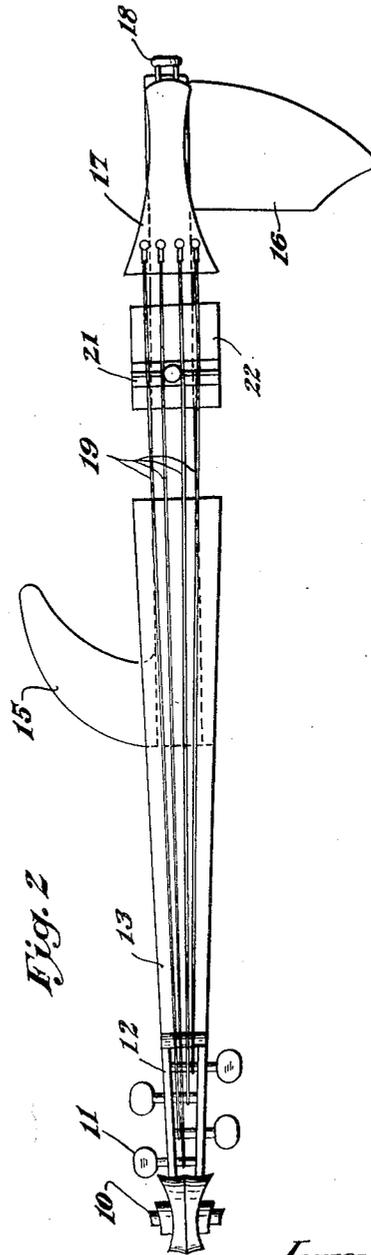
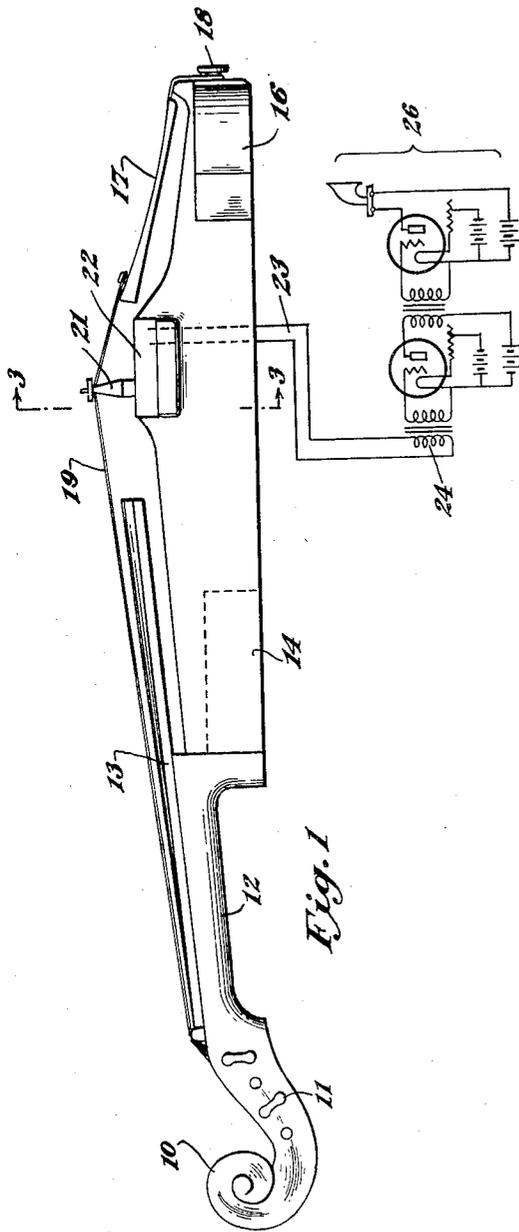
V. A. PFEIL

1,861,717

MUSICAL INSTRUMENT

Filed Oct. 22, 1928

2 Sheets-Sheet 1



Inventor
Victor A. Pfeil
by Barton A. Beauf
Attorney

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2 Sheets-Sheet 2

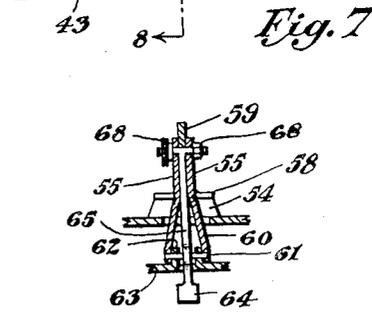
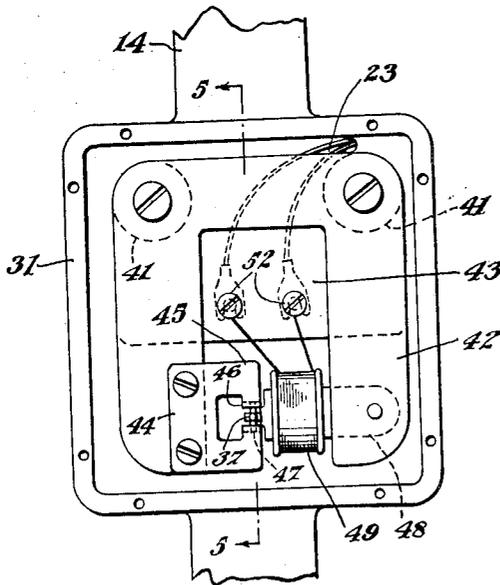
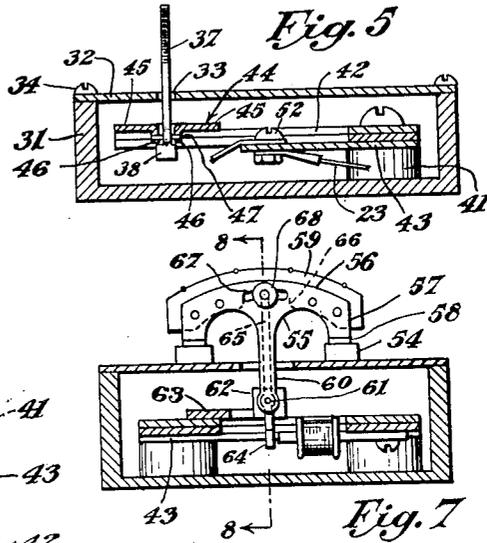
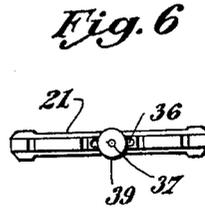
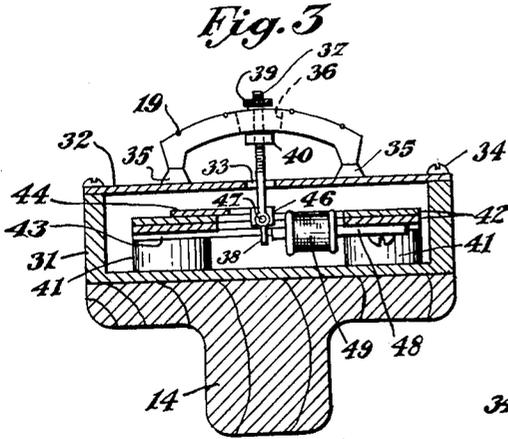


Fig. 4

Fig. 8

Inventor
Victor A. Pfeil
by Barton A. Bean
Attorney

UNITED STATES PATENT OFFICE

VICTOR A. PFEIL, OF BUFFALO, NEW YORK

MUSICAL INSTRUMENT

Application filed October 22, 1928. Serial No. 313,978.

This invention relates to musical instruments and it has particular reference to a stringed instrument having a transforming and amplifying device mounted in part thereon.

The invention contemplates the provision of a stringed musical instrument simulating any well known type, which may be played manually for directly producing a pulsating electric current which may be amplified and transformed into sound energy reproducing the notes of the instrument at a remote point.

The invention comprehends a special construction of musical instrument which essentially produces a new instrument adapted for producing sound vibrations similar to any well known type of musical instrument, in which a stick mounts the usual finger board through the string supporting and tensioning devices including the use of a special bridge construction mounted for free movement relative to the stick so that it may be adapted for operating a suitable electric system constructed to produce the sound corresponding to the vibrations of the strings and the bridge.

The invention includes the provision of a special bridge construction for stringed instruments differing materially in construction and the manner and method of mounting on the instrument from the ordinary type of bridge now in general use.

More specifically, the various objects of the invention are attained by resiliently mounting a string bridge and transforming device on the instrument and positioning an armature between the bridge and transforming device in such manner that the vibration of the strings of the instrument creates a direct and proportionate vibration in the armature, which, in turn, develops a pulsating electric current in the transforming device whose wave form is analogous to that of the note produced. The pulsating current is amplified to any desired volume, and again transformed into audible sound waves similar in pitch and quality to the original sounds produced by the strings.

A typical embodiment of the invention is illustrated in the accompanying drawings, wherein;

Fig. 1 is a side elevational view of the instrument together with a diagram of an associated electric circuit.

Fig. 2 is a plan view of the instrument.

Fig. 3 is a transverse cross sectional view taken on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary plan view of the transforming device with the cover removed.

Fig. 5 is a longitudinal cross sectional view taken along the line 5—5 of Fig. 4.

Fig. 6 is a plan view of a string bridge.

Fig. 7 is an elevation of a different type of string bridge.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 7.

As illustrated in Figs. 1 and 2, the new musical instrument selected for example is similar to an ordinary violin, in that it includes a scroll 10, string securing and tensioning keys 11, and neck 12, upon which is mounted a finger board 13. For a reason subsequently to be explained, however, the usual body portion or resonator box of this type of stringed instrument is omitted, being replaced by a suitably turned and finished stick of wood 14, which need be of no greater width and depth than the neck 12. At one side of the stick 14, and adjacent the junction thereof with the neck, is a support 15 which projects outwardly and serves as a hand rest. At the other end of the stick 14 is a projecting chin rest 16 and a tail piece 17 mounted in the usual manner, together with a button 18 to complete the assembly by means of which a string securing means is provided.

Extending between the scroll 10 and button 18 are a plurality of strings 19, the number and character of which will depend, of course, upon the type of instrument. These strings are supported between the ends of the finger board 13 and tail piece 17 by means of an upstanding member or bridge 21, (best shown in Figs. 3 and 6), which advantageously is constructed and mounted in accordance with the principles hereinafter set forth. Beneath the bridge 21, and advantageously serving as a support therefor, is a device for transforming the vibrations of the strings into electrical energy having the same vibration

or wave characteristics, indicated generally in Figs. 1 and 2 by the reference numeral 22, and shown in detail in Figs. 3, 4 and 5.

A pair of wires 23, so encased as not to interfere with the musician, lead from the energy transforming device 22 to the primary coil of an electrical transformer 24. The secondary terminals of the transformer 24 are in turn connected to an electrical amplifying system including such well known devices as electron tubes, audio transformers, batteries, and a loud speaker, all of which are represented schematically and indicated by the reference numeral 26. It is to be understood that any well known type and construction of amplifying system may be used with this new instrument.

The assemblage of elements for transforming the vibrations generated upon striking the strings 19, into electrical energy, is mounted upon and in a box or housing 31 formed of suitable material, which box is secured to the stick 14. A cover 32 for the box is formed with a transversely extending slot 33, and is secured to the box by means of screws 34. Positioned on either side of the slot 33 is a supporting pad of soft rubber 35, or of other material which is resilient and deformable. The bridge 21 is mounted in the plane of the slot 33 and upon the pads 35, so that when the strings 19 are vibrated, the vibrations are imparted to the bridge to produce oscillations thereof on and between the resilient pads 35. These oscillations are controlled and the movement of the bridge is limited by the pads 35. The mid portion of the bridge 21 is slotted longitudinally at 36 to receive the arm 37 projecting upwardly from armature 38, said arm being fixedly secured in any desired position in the slot by proper adjustment of retaining nuts 39 and 40 threaded thereon. The armature 38 is mounted in the box 31, the arm extending thereon through the slot 33 formed in the cover 32.

Within the box 31, and mounted adjacent one end thereof, is a pair of upright posts 41 which may be formed of suitable insulating material such as ebonite. A permanent magnet 42 consisting of a series of laminations formed into the general shape of the letter U is mounted upon the posts 41 with the poles projecting toward the opposite end of the box. Upon the magnet is positioned a sheet 43 of insulating material, such as fiber. Upon one of the poles of the magnet, and advantageously on the top side thereof, is secured a bracket 44 formed to provide a support for the armature 38. As shown best in Figs. 4 and 5 the bracket 44 is provided with opposed spaced arms 45 which merge into downwardly projecting lugs 46, which are provided with aligned openings to receive a pivot pin 47 extending through and pivotally mounting the armature 38. The armature 38 is formed adjacent its pivoted end as a flat

plate, and is susceptible of rocking or oscillating movement on the pin 47.

Disposed upon the opposite pole of the magnet 42, and advantageously on the lower side thereof, is a pole 48 of an electromagnet 49. The pole 48 is positioned to extend into close proximity to the face of the flat plate portion of armature 38 so as to provide a relatively small space between the poles of the magnet, of which the armature forms one pole, in order to provide a sensitive device. The ends of the coil 49 of the electromagnet terminate in binding posts 52 mounted on insulating sheet 43 to which are also secured the wires 23 leading to the amplifying circuit 26.

Assuming the instrument to be of the character of a violin, the musician first tensions the strings 19 to proper pitch by manipulation of the keys 11. This adjustment of the strings is apt to displace the bridge 21 by rocking it laterally so that the armature 38 secured thereto is not properly spaced from the pole 48 of the electromagnet 49 to secure proper sensitivity and efficient results. To correct the displacement of the armature, the screws 39 and 40 on either side of the bridge 21 are loosened to permit the armature 38 to assume an upright position, which may be regarded as indicative of proper adjustment. The screws 39 and 40 are then turned to contact tightly with the bridge 21, thereby fixedly securing the armature 38 to the bridge. The instrument may then be played in the usual manner, the projecting portions 16 and 15 on the stick 14 serving respectively as a chin rest and hand support.

In operation, the transverse vibrations of the strings 19 generated by bowing the strings, cause a proportionate vibration of the bridge 21 between the resilient pads 35. This vibration of the bridge is directly imparted to the armature 38 which is constrained to rock to and from the pole 48 of the magnet by virtue of the pivot bearings 47. There is accordingly 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 emitted by the bowed strings. This pulsating electric current is amplified through the electrical system 26 and is finally transformed into an audible note or sound which is a true reproduction of the note originally set up by the vibration of the strings 19.

It has been observed that the quality of 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 emitting the original note. In the present invention, such freedom of vibration is obtained by means of the resilient supports 35 which permit of a limited but positive vibration of the bridge as a unit. If the bridge were not so resiliently mounted then the period of vibrations of the armature.

would necessarily be reduced, and hence the extent of vibration of the armature itself. From an actual practice of the invention it has been determined that the structure herein set forth is particularly advantageous since the reproduced notes are of exceptional quality and are true.

It is also well understood that the quality of music emitted by violins depends to a large extent upon the character and age of the wood used in the resonator box. New violins do not produce satisfactory music since the wood is not of the same character, but tends to set up higher harmonic vibrations which to the ear are inharmonic with the fundamental. With the apparatus herein described the box is eliminated, thereby preventing the development of undesirable harmonies. The apparatus produces only weak sounds resulting solely from the vibrations of the strings, while the music to be produced is transmitted to the amplifier in the form of vibrations, directly from the bridge, the amplifier producing the music of the instrument, but since the purpose of the instrument is to produce vibrations which are to be amplified, this feature is not ordinarily of importance.

Another form of bridge construction which may be found desirable for use with this new instrument is illustrated in Figs. 7 and 8 in which resilient pads 54 are provided for engaging and limiting the oscillating movement of the bridge occasioned by the vibrations of the strings. The bridge structure includes a pair of plates 55 of metal or other suitable material which are substantially T-shaped, having the head portions 56 curved as illustrated, and terminating at the ends in depending portions 57 provided with laterally extending feet 58 which rest on the pads 54. A string supporting strip 59 of wood, fibre, or other suitable material having an arcuate upper surface suitably notched to receive the strings is riveted between the plates 55 so as to form a rigid bridge structure.

The stem portion of the plates 55 indicated at 60, depends from the central portion of the head portions 56 and extends through slots formed in the cover of the transforming device, and at the lower ends are provided with aligned openings for receiving the pivot pin 61. This pivot pin is mounted in the upwardly extending ears 62 formed on the armature supporting plate 63 which is carried by the permanent magnet structure in the same manner as illustrated in Fig. 3.

The armature is indicated at 64, which is also pivotally mounted on the pin 61 and extends between the ears 62 and the plate members 55. This armature 64 has an upwardly extending arm 65 terminating in the recessed portion 66 of the string supporting strip 59 having a pair of lateral extensions slidably engaging in slots 67 in the head portions 56

of the plate members 55. These lateral extensions are threaded to receive nuts 68 which may be tightened to rigidly secure the armature to the bridge structure so that the armature will vibrate with the bridge for operating the energy transforming device in a manner heretofore described.

It will be observed that the tensioning of the strings will have a tendency to force the bridge downwardly toward the stick in the structure illustrated in Fig. 3, tending to compress the supporting pads 35. While this construction operates satisfactorily, a more sensitive bridge structure is obtained by the construction shown in Figs. 7 and 8, because the bridge itself is mounted on the pin 61 for pivotal movement and the tension of the strings acting on the bridge is applied to the pin 61 and not to the pads 54. With this construction the bridge has a free rocking movement about the pivot pin 61 controlled and limited by the pads 54, permitting the use of more resilient material for the pads than with the construction shown in Fig. 3.

The bridge structure above described forms a special feature of the present invention and cooperates with the stick structure and string mounting in forming the new musical instrument, in addition to the features of the invention residing in the construction of the instrument as a whole and its combination with a suitable sound producing device.

It will, of course, be understood that various types of magnetic transforming or "pick-up" devices may be mounted upon the instrument, that various forms of electrical amplifying circuits may be employed, and that the various structural features of the invention are susceptible to modification within the scope of the appended claims.

What is claimed is:

1. A stringed musical instrument comprising a plurality of strings, means at either end of the strings for securing the same, means for tensioning the strings, a bridge adapted to contact with the strings intermediate the securing means, an electro-magnetic pick-up disposed beneath the bridge, and an armature mounted upon the bridge and operably associated with said pick-up.

2. A stringed musical instrument comprising a stick having a scroll disposed at one end and a rest at the opposite end thereof, a finger board mounted on the stick adjacent the scroll, a tail piece adjacent the rest, strings extending over the finger board and tail piece and secured at either end of the stick, an energy transforming device mounted upon the stick intermediate the finger board and tail piece, a bridge mounted on the transforming device, said bridge contacting with said strings, said bridge being formed with an elongated aperture therethrough, an armature disposed in said aperture and depending

therefrom into the transforming device and means for adjustably securing the armature to the bridge.

3. In the reproduction and amplification of musical notes emitted by string instruments, the improvement which comprises resiliently mounting a bridge on an electro-magnetic transforming device disposed beneath the strings and an armature suspended from the bridge into the field of the electro-magnetic device.

4. In combination in a musical instrument, a set of tensioned strings operable to produce vibrations, electro-magnetic means sensitive to the vibrations of said strings, and electrical means for operation by said last named means adapted to produce sound waves corresponding to the vibrations impressed thereon.

5. In combination in a musical producing system, a set of tensioned strings operable to produce vibrations electro-magnetic means directly actuated by said strings, and sound producing means operable by said electro-magnetic means for producing sounds corresponding to vibrations of said strings.

6. A stringed musical instrument comprising a plurality of tensioned strings, a support therefor having the ends of the string secured to opposite end portions thereof, an arcuate shaped bridge having opposite ends supported for oscillatory movement relative said support and having a central portion thereof engaging and supporting said strings intermediate the ends, an electro-magnetic device below said bridge having a permanent magnet provided with pole pieces spaced apart to form a gap for a magnetic field, and an armature mounted intermediate its ends for pivotal movement relative to said support and permanent magnet, said armature having one end attached to said bridge and the opposite end extending into the magnetic field between the pole pieces of said device and oscillatable by said bridge for oscillating the end between said pole pieces to vary the magnetic field of said electro-magnetic device.

7. A stringed instrument comprising a plurality of tensioned strings, a support therefor having the ends of the strings secured to opposite end portions thereof, a bridge having opposite end portions supported for oscillatory movement relative said support, said bridge engaging and supporting said strings intermediate the ends, and electro-magnetic device mounted on said support below said bridge having a permanent magnet with spaced end portions, a bracket mounted on one end portion, an armature pivotally mounted in said bracket and having one end connected to said bridge and the opposite end in the magnetic field of said magnet for varying said magnetic field when oscillated by said bridge.

8. A musical instrument of the type de-

scribed comprising a string, an electrical unit having a magnetic field, a member set into vibration by the string, and a vibratory rod connected to said member and lying in said field to alter the flux thereof.

9. A musical instrument of the type described, comprising a string, an electrical unit having a magnetic field, a member set into vibration by the string, a vibratory rod connected to said member and lying in said field to alter the flux thereof, and means to vary the position of the rod independently of the vibratory member.

10. A musical instrument of the type described comprising a string, an electrical unit mounted on said instrument and having a magnetic field, a vibratory armature lying in said field, a vibratory support for said string, and means connecting the armature with the support to transmit vibrations from the latter to the former.

11. A musical instrument of the type described comprising a string, an electrical unit mounted on said instrument and having a magnetic field, a vibratory armature lying in said field, a vibratory support for said string, means connecting the armature with the support to transmit vibrations from the latter to the former, and means to adjust the position of the armature in the field independent of its vibratory movement.

12. A musical instrument of the type described comprising a string, a vibratory bridge supporting said string, a vibratory armature connected to said bridge, an electrical unit on the instrument having a magnetic field in which said armature lies, and means for translating the vibrations of the armature into electrical current variations to be transmitted to an amplifier.

VICTOR A. PFEIL.