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STRINGED MUSICAL INSTRUMENT WITH ELECTROMAGNETIC PICKUP ALSO FUNCTIONING AS A BRIDGE

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FIG. 1

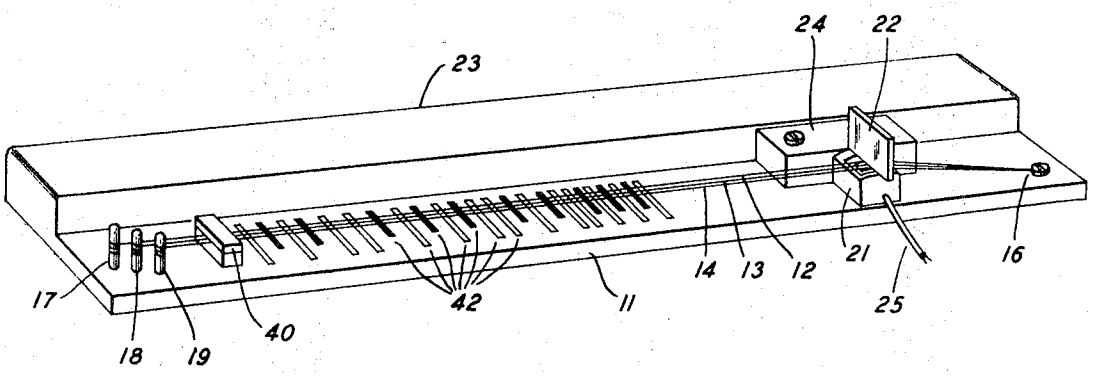
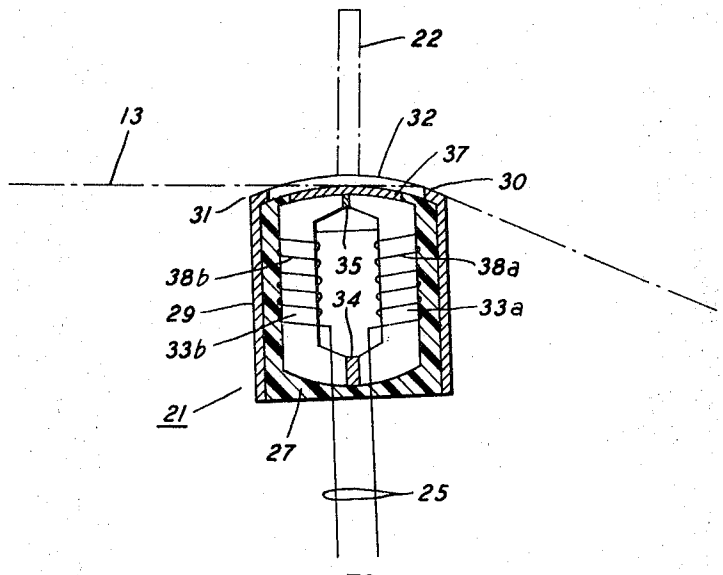


FIG. 2



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STRINGED MUSICAL INSTRUMENT WITH ELECTROMAGNETIC PICKUP ALSO FUNCTIONING AS A BRIDGE

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ABSTRACT OF THE DISCLOSURE

A multi-stringed fretless musical instrument is disclosed in which all strings are simultaneously struck and the very small string vibrations are picked up by a magnetic pick-up which is itself the bridge of the instrument.

BACKGROUND OF THE INVENTION

A great many musical instruments are based upon the vibration of struck, plucked, or bowed strings and many different types of sounds can be obtained. One particular sound of considerable importance, particularly to modern popular music, is that of the struck bass viol. This deep resonant sound provides the rhythm and support for many small instrumental groups.

Unfortunately, a bass viol is a large and cumbersome instrument to carry. Because of the low frequency of the notes the resonating chamber or box becomes quite large in order to provide sufficient volume to amplify the sound. A large number of current instruments, however, do not rely on natural or physical amplification, the initial vibrations of the strings causing a transducer to produce corresponding electrical signals. Merely to remove the air chamber and utilize the electronic amplification instead would not change, however, the general construction and organization of the instrument.

Thus, the instrument would still be quite large having a long neck with frets, multiple strings individually plucked for rhythm sounds, and strings of the same length as in a regular bass viol.

There are known today a number of techniques for coordinating the various parts of a musical instrument. The determining factor is, however, always the ultimate sound. Thus electronic pick-ups have been placed in the frame or support of an instrument or have been mechanically connected to a vibrating bridge member. Similarly piezoelectric materials have been incorporated into bridges. The strings themselves may be plucked individually, together, or put in vibration sympathetically, with one string causing sympathetic vibrations in another as in a viola d'amore. Similarly, the vibrations may be allowed to reflect back from the tuning pins or tensioning members or may be damped. In all cases the ultimate choice of these techniques depends on the desired sound or tonal effects.

It is an object of my invention to provide a small and economical rhythm instrument having a tone similar to a plucked bass viol.

It is a further object of my invention to eliminate the need for a long neck and long strings for such an instrument.

SUMMARY OF THE INVENTION

In accordance with my invention the sounds of a plucked bass viol are attained with an instrument that neither in appearance nor principle of operation is at all similar to the bass viol. Specifically I provide a plurality of strings preferably of a magnetic material such as steel and arranged to be struck simultaneously. In one specific illustrative embodiment I provide three such strings supported closely adjacent each other and tuned an octave apart.

Unlike other stringed instruments wherein the individual

notes are defined by frets on the base or neck of the instrument, the player's fingers pressing the strings against the frets to define the vibration length of the individual string, my instrument is fretless. Also unlike other instruments in which the string is momentarily excited, as by being plucked or struck with an article which is quickly removed, in my invention the instrument is played by striking the strings and having the striking object remain in contact with the strings.

Accordingly, in the playing of my instrument the strings are both excited and their vibration length determined at the same time and by the same act. However, because the strings while vibrating are restrained at their point of contact, only very small vibrations are set up in them, vibrations that I refer to as microvibrations.

In order to detect these vibrations and generate corresponding electrical signals for transmission to appropriate amplification equipment, I provide, in accordance with an aspect of my invention, that the three strings be tensioned over an electromagnetic pick-up which defines the bridge of the instrument. To insure good coupling of these microvibrations I mount a magnet directly above the bridge. In this way the vibrations, while smaller than one would normally expect to be required to utilize in a musical instrument, can be picked up and used for the input to the amplification equipment.

Specifically, in accordance with one illustrative embodiment of my invention, the electromagnetic transducer or head has a core portion of a magnetizable material and a slightly curved upper surface. The transducer is positioned other than perpendicular to the three wires. Thus the wires extend across the transducer surface at a small angle and make contact with the transducer surface directly adjacent the air gap in the transducer or pick-up head, which is the region of maximum sensitivity. The wires do not follow the surface of the transducer but, because of its slightly curved shape, are slightly above the transducer past this point of contact. The wires advantageously bear against the side of the transducer casing, around which they are bent to the anchor pin.

The point of contact of the wires on the transducer is the bridge of my instrument. Further I have found that the particular sound quality I desire requires both the vibration of the wires in air just before the bridge, and above the head, as well as the physical vibration of the wires on the transducer at the bridge point of contact.

The magnet is positioned on the transducer casing so as to be at the bridge point of contact but to be above the wires both where the string vibrates in the air and where the vibrations on the transducer surface are to be picked up by the transducer.

In order to enable the player to play the various notes I advantageously provide markings on the base of the instrument directly below the points on the strings to be struck for those notes. These markings, of course, are not physical ridges, such as as frets, and have no part in the actual generation of the notes.

The three strings are advantageously held by a common anchor pin adjacent the bridge at one end of the instrument and extend to individual tuning pins at the other end. A damping element, such as felt, is positioned on the strings adjacent the tuning pins to absorb the vibrational energy from the point of the contact to the pins. Normally in a stringed instrument the whole string, or the whole string up to the fret, is vibrated and reflections are desirable to add the overtones. With my invention, however, these reflections and the vibrations on the unused portion of the string are not desirable and are damped out. The overtones are instead provided by the multiple string arrangement tuned an octave apart.

It is a feature of my invention that multiple strings be tensioned on a base member and adapted to be played

by striking the strings simultaneously with the striking element remaining in contact with the strings. The striking element thus both initiates the tone and also determines its frequency, the instrument being fretless.

It is another feature of my invention that the electromagnetic transducer is itself the bridge of the instrument. Specifically in accordance with this feature of my invention the wires make contact with the curved surface of the transducer so that the transducer picks up both the air vibrations of the wire above the surface of the transducer and the physical vibrations of the wires on the surface of the transducer.

It is still a further feature of my invention that the resulting instrument, while capable of creating tones similar to those of a plucked bass viol, may be physically quite small, as of the order of only three feet in length.

It is still another feature of my invention that the instrument include three strings placed close enough to each other as to be struck simultaneously, but not so close as to touch each other. Further in accordance with this feature of my invention the three strings are of such dimensions as to be tuned an octave apart.

DRAWING

These and other advantageous objects and features of my invention may be further understood from consideration of the following detailed description and the accompanying drawing, in which:

FIG. 1 is a perspective view of one illustrative embodiment of my invention showing particularly the position of the three strings tensioned across the base member of the instrument; and

FIG. 2 is a simplified sectional view of the bridge of FIG. 1, the bridge being defined by the point of contact of the wires on the electromagnetic transducer surface.

DETAILED DESCRIPTION

Turning now to the drawing, the simplicity, economy, and small size of a musical instrument in accordance with my invention become readily apparent. The instrument includes a base plate **11** of any convenient material; the base plate is advantageously of a hard wood, through other materials might be used. Tensioned across the top of the base plate **11** are three musical strings **12**, **13**, and **14**, preferably of steel so as to energize directly the electromagnetic pick-up provided. I have found, however, that nonmagnetic strings may be used with a helical overwind of a steel wire adjacent the transducer element.

The strings are mounted between a common anchoring pin **16** and individual tuning pins **17**, **18**, **19**. In accordance with aspects of my invention they are mounted sufficiently close together so as to be struck simultaneously, as by the player's finger or a wooden or metal pin, and also mounted sufficiently above the base plate **11** so as not to be pressed against it during striking or playing. This, of course, is in contradistinction to most stringed musical instruments wherein the strings must be pressed against ridges or frets while played to define the length of the vibrating strings.

The base plate **11** may be about three feet long and three inches wide, including a stepped back portion **23**, so that the whole instrument is compact and easily carried; if the back portion **23** were omitted the width could be decreased even to about one inch. The three strings may be of .025, .011, and .008 gauge wire and are advantageously tuned so as to be an octave apart; obviously other size wires could be employed if it is desired to tune the instrument lower or higher.

The strings are stretched across an electromagnetic transducer or pick-up head **21** which is mounted from a support **24**. The transducer **21**, the details of which are depicted in a simplified illustration in FIG. 2, may be an electromagnetic transducer or pick-up head as is itself known in the art, and specifically it may be the type of pick-up head utilized in magnetic recording wherein a magnetic wire or tape is to be transported across the upper surface of the head. In accordance with my invention, however, the head or transducer **21** is itself the bridge of the instrument and the wires **12**, **13**, and **14** contact the upper surface of the head, as seen in FIG. 2, to define the bridge point of contact.

The transducer **21** is mounted from the support **24** so as to be at a slight angle turned towards the tuning pins **17**, **18**, and **19**. The angle may be only of the order of a few degrees so that it can barely be detected except on close inspection. The reason for this tilting of the transducer **21** will become apparent from the subsequent discussion of FIG. 2.

A bar magnet **22** is positioned adjacent the head **21** so as to provide the required magnetic flux. While my instrument will be operative with various positionings of the magnet **22**, I have found that the quality of the bass tones is improved if the magnet is positioned directly above the bridge point of contact of the wires with the transducer. The magnet **22** is positioned on the side case of the transducer **21** and is not in contact either with the upper surface of the transducer itself or the wires. While various magnets may be employed in instruments in accordance with my invention, I have found that a magnetic plastic between two flux guide iron plates is very effective to direct a magnetic field of required intensity through the wires at the bridge point of contact with the transducer surface.

Further, it is to be understood that while the magnet **22** is depicted in FIG. 1 as merely positioned on the transducer, and removable therefrom, it is to be understood that if desired the magnet and transducer may be included within a suitable housing extending from the back step portion **23**. However, to provide a better view of the transducer and wires such a housing has been omitted from the drawing.

Electrical wires **25** extend from the transducer **21** to a pre-amplifier of suitable amplifying equipment, not shown, which may be of any of the many known types available commercially today.

The relationship between the wires and the transducer whereby the bridge is defined and the desired vibrations of the wire are picked up to give the particular bass tones similar to the plucked bass viol can be best seen from FIG. 2. This figure is a sectional view through the transducer **21**; it is to be understood that for purposes of illustrating the principles of my invention I have idealized the illustration of the various parts. Thus in FIG. 2 is more of a schematic illustration than an actual rendering of the physical arrangements. For example, to simplify the drawing the potting compound **27** which holds the transducer core in the casing has been omitted from within the core.

The transducer **21** includes a case **29** having a back upper edge **30**, a front upper edge **31** towards the tuning pins and side edges **32**, of which only the far edge is shown. The side edge **32** is curved so that the magnet **22**, which is positioned on these two side edges **32**, is slightly above the upper surface of the head. Included within the case **29** is the transducer core **33** comprising two members **33***a* and **33***b* which are of a magnetizable material. As is known in the magnetic pick-up art a nonmagnetic spacer **34** is between the core halves **33***a* and **33***b* at one end and a similar spacing shim **35** is between the core halves to define the active gap of the head. The cross-section of the core **33** is advantageously reduced adjacent the active gap defined by shim **35**, as is known in the art. Similarly, as is known in the art, a surface plate **37** is across the end of the core **33** and the shim **35**. This surface plate **37** is curved slightly so that the upper surface of the head is curved.

A coil, comprising series connected sections **38***a* and **38***b*, is wound around the core **33** and connected to the output leads **25**, as is known.

In accordance with my invention the tilting of the

transducer **21** with respect to the strings, of which string **13** is shown in FIG. 2, is such that the string **13** is above the front edge **31** of the casing and then makes contact with the transducer surface **37** at a point directly adjacent the spacing shim **35** defining the air gap in the pick-up head. This point of contact is the bridge of the instrument. However, I have found that to attain the musical tone two effects are involved: the first requires that the strings be free to vibrate in air directly above the head, and the second requires that the strings vibrate on the surface of the head so that there is a direct mechanical transfer of the vibrational energy.

The vibrations resulting when the instrument is played with the striking instrument remaining on the strings to define their lengths are quite small. However, by my unique arrangement of the strings and the transducer as the bridge, these very small vibrations are sufficient to provide the requisite signals in the coil **38**. Further, by providing the pick-up at the bridge, even apart from the bridge being defined by the pick-up, the harmonics are dominant and the harmonic content of the tone remains constant despite the very large difference possible in the effective length of the strings as they are played.

Because of the curvature of the transducer surface **37** the strings make contact with the surface to define the bridge of the instrument but do not remain in contact with the surface **37** after that. Instead the strings bear against the back edge **30** of the case **29** and are bent over that edge to the common anchor **16**.

If the strings vibrate only in the air above the surface of the transducer, so that the edge **30** then defines the bridge, a tone of different timbre is obtained. Similarly, if the strings are directly on the surface so that only the mechanical vibrations are directly transferred, a different tone is obtained.

The instrument is played by the player striking the three strings **12, 13, 14** simultaneously and leaving his striking element, whether his finger, pin, or other suitable implement, against the strings while the note is sounded. Very small or microvibrations are created and transmitted along the strings to the transducer **21** where they are detected and applied to the amplifying equipment. Similar small vibrations are of course transmitted towards the pins **17, 18, 19** but are damped by damping material, such as felt **40**, placed against the strings adjacent the tuning pins.

The note generated will depend on the location along the wire that is struck and suitable indications **42** of these notes may be placed on the base plate **11** directly beneath the strings. I have found that with the dimensions and strings mentioned above a range of approximately two octaves may be readily attained with a very rich sounding bass viol note resulting.

While in the above discussion reference has been made to bass viol tones, it is of course to be understood that the color of the tones will depend on the manner of playing, just as a bass viol may itself be plucked or bowed with different tonal results, and my invention is not to be considered as limited to this one use.

Accordingly, while a specific illustrative embodiment of my invention has been described above, it is to be understood that this is merely illustrative of the principles of my invention and that various modifications may be made by those skilled in the art without departing from the scope and spirit of my invention.

What is claimed is:

1. A musical instrument adapted to be struck with the striking element maintained against the vibrating strings to determine the frequency of the tone as well as to generate the tone, said instrument comprising

a base member,

a plurality of strings, the spacing between the strings being such that they are simultaneously struck during the playing of the instrument, and

electromagnetic transducer means mounted by the base member and across which said strings are tensioned, said strings each being in contact with the upper surface of said transducer means at a point to allow the vibration of the strings on the upper surface of said transducer means to be physically transmitted to the transducer means to affect the output thereof, said points of contact thereby defining the bridge of the instrument, said strings being positioned sufficiently above said base member so as not to be in contact with said base member during playing of the instrument.

2. A musical instrument in accordance with claim **1** wherein the upper surface of said transducer means is curved and said strings vibrate in air above a portion of said surface before the bridge but are in mechanical contact with said transducer surface at the bridge.

3. A musical instrument in accordance with claim **2** wherein said transducer means is tilted so as to be at a slight angle with respect to said strings.

4. A musical instrument in accordance with claim **3** further comprising common anchor means adjacent said transducer means and to which said strings are all attached and individual tuning pins for said strings remote from said transducer means.

5. A musical instrument in accordance with claim **4** wherein said strings are above said transducer upper surface after the bridge and bear against the casing of said transducer means before being connected to said anchor means.

6. A musical instrument in accordance with claim **5** wherein said transducer means includes core means defining an air gap, said strings being in contact with said transducer upper surface adjacent said air gap, and magnet means positioned above said transducer surface directly adjacent said air gap.

7. A musical instrument in accordance with claim **3** wherein said plurality of strings includes three strings of such relative size as to be tuned an octave apart.

8. A musical instrument in accordance with claim **4** further comprising damping means adjacent said tuning pins for damping vibrations along said strings.

9. A musical instrument comprising

a base member,

electromagnetic transducer means mounted by said base member and having an upper surface,

means tensioning a musical string across said transducer surface whereby said transducer means itself defines the bridge of the instrument, said string contacting said transducer surface at a point to allow the vibrations of the string to be physically transmitted to said transducer means,

said transducer upper surface being so positioned with respect to said string that said string vibrates in air above a portion of said surface before the bridge but vibrates on said transducer surface at the bridge, and

magnet means applying magnetic flux to said string and said transducer means at the bridge thus defined.

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