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Lace

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(54) **SENSOR ASSEMBLY FOR STRINGED MUSICAL INSTRUMENTS**

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(51) **Int. Cl.**[7] **G10H 3/14**
(52) **U.S. Cl.** **84/727**
(58) **Field of Search** 84/726–728

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(57) **ABSTRACT**

A sensor assembly for a stringed musical instrument having a plurality of movable strings includes at least one blade adapted to be disposed adjacent the strings and at least one magnet disposed adjacent the at least one blade to generate a magnetic field through the at least one blade. The sensor assembly includes a primary winding disposed adjacent the at least one blade to create a primary current from a disruption in the magnetic field by the moveable strings. The primary current creates a primary electromagnetic flux. The sensor assembly also includes at least one secondary winding spaced from the primary winding and being magnetically coupled to the primary winding. The at least one secondary winding transforms the primary electromagnetic flux into a secondary current adapted to be passed out the stringed musical instrument.

19 Claims, 5 Drawing Sheets

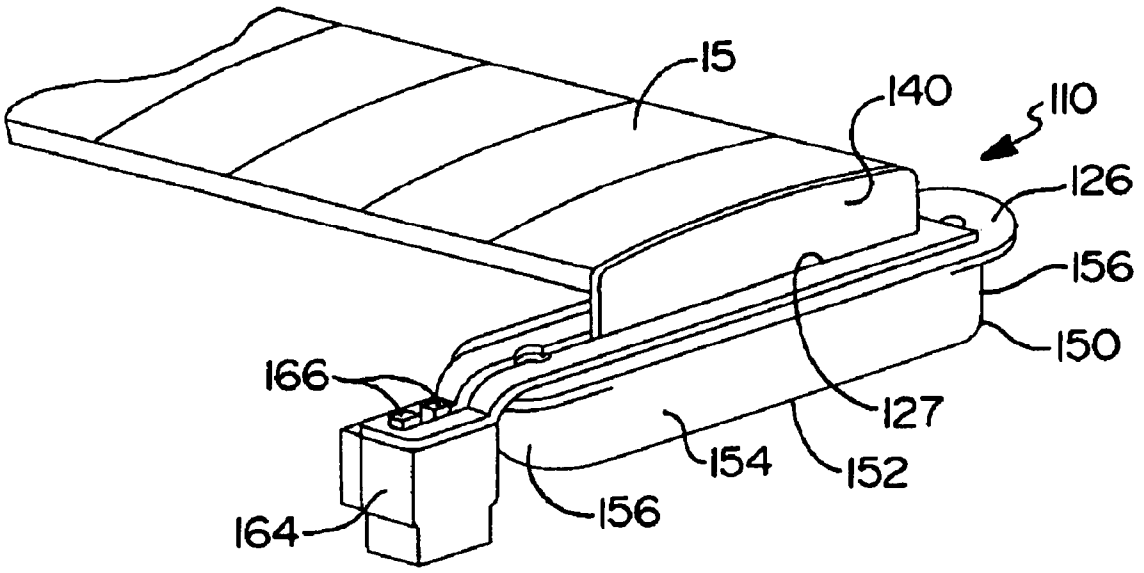

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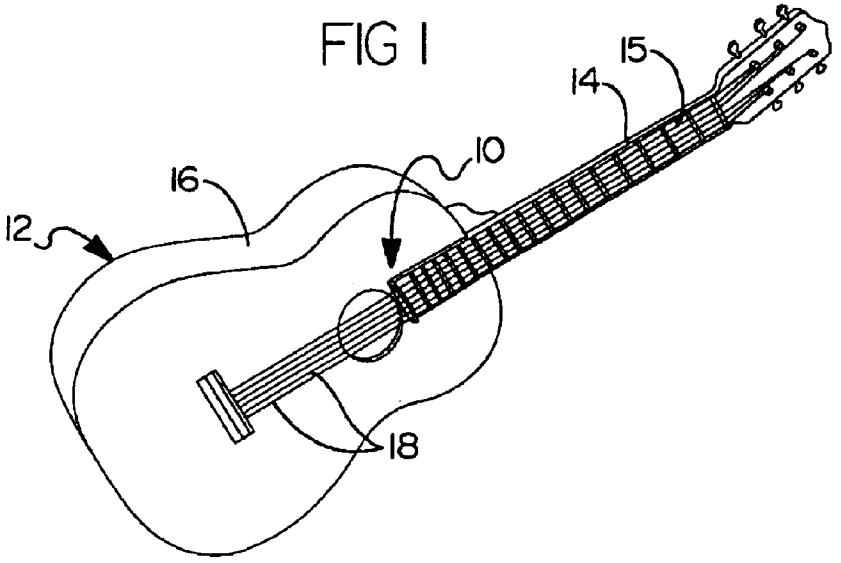
FIG 1



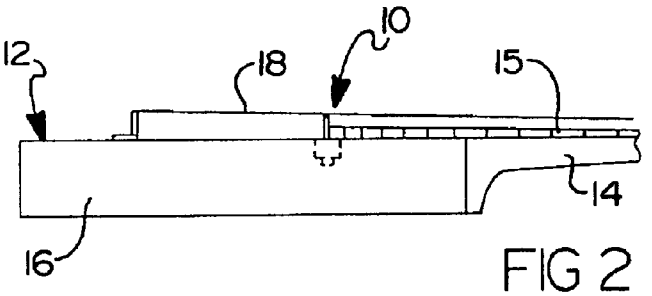


FIG 2

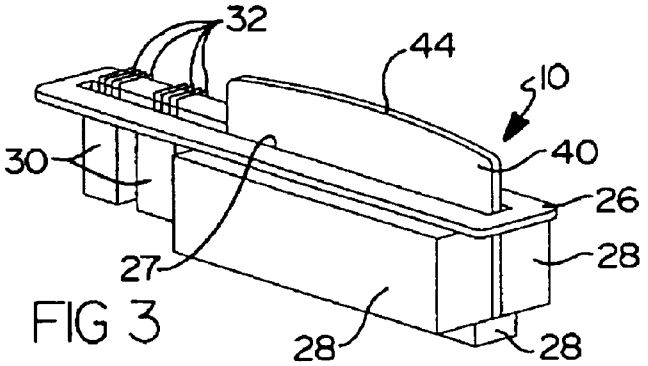


FIG 3

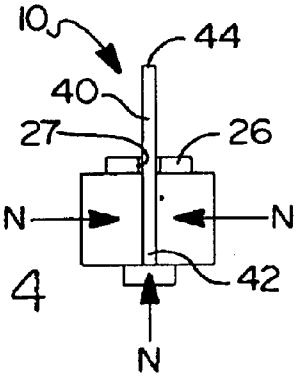


FIG 4

FIG 5

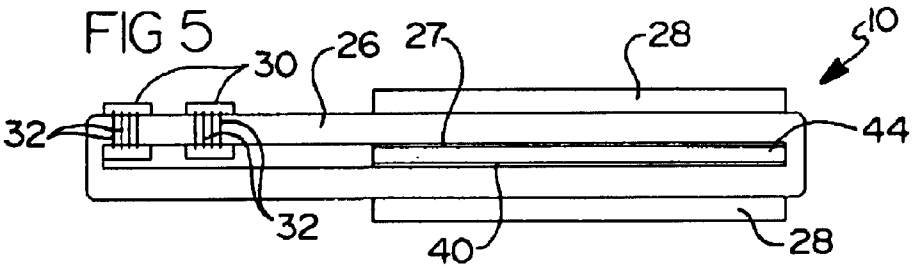


FIG 6

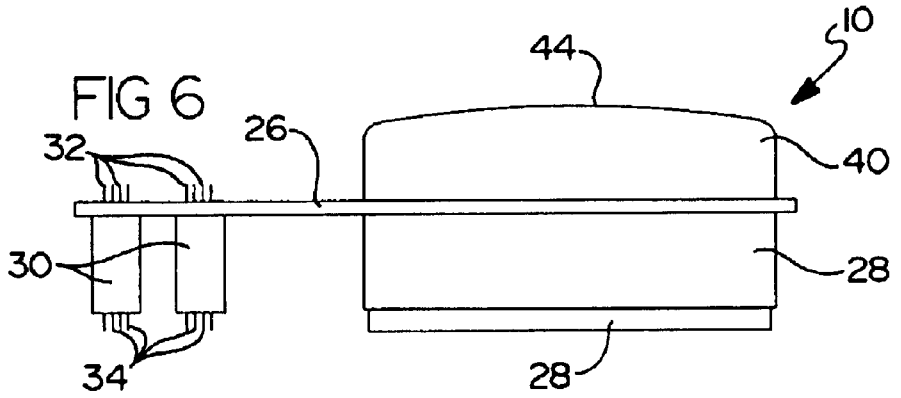


FIG 7

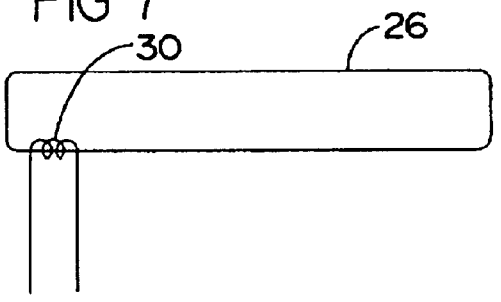
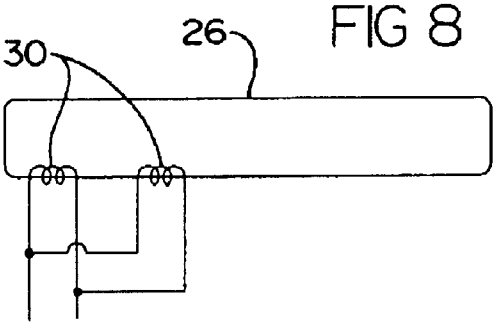


FIG 8



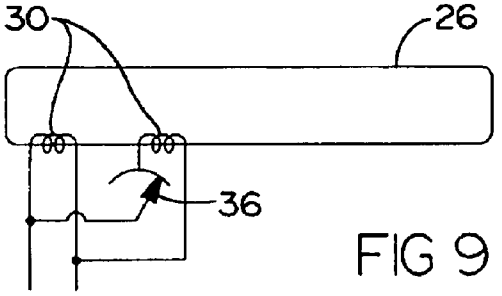


FIG 9

FIG 10

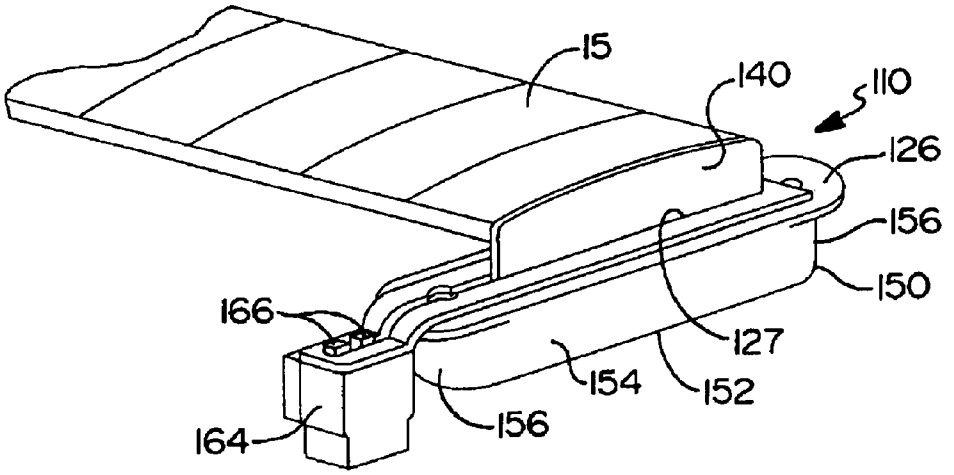
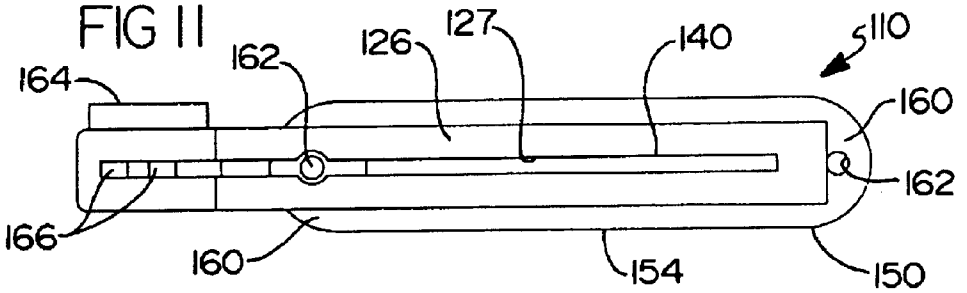


FIG 11



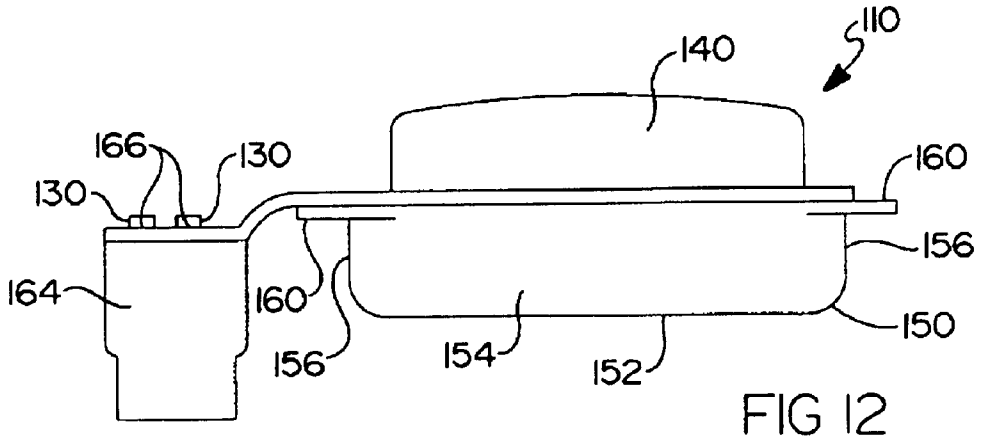


FIG 12

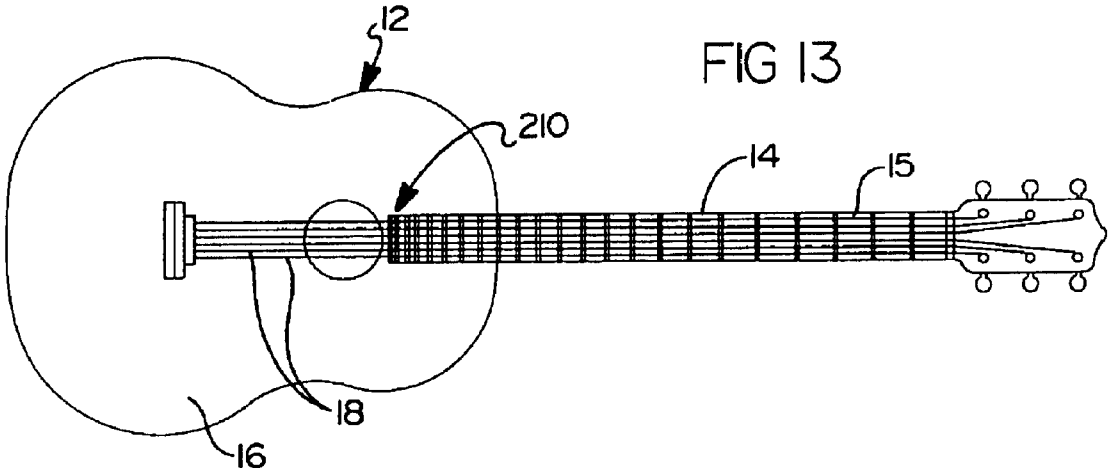


FIG 13

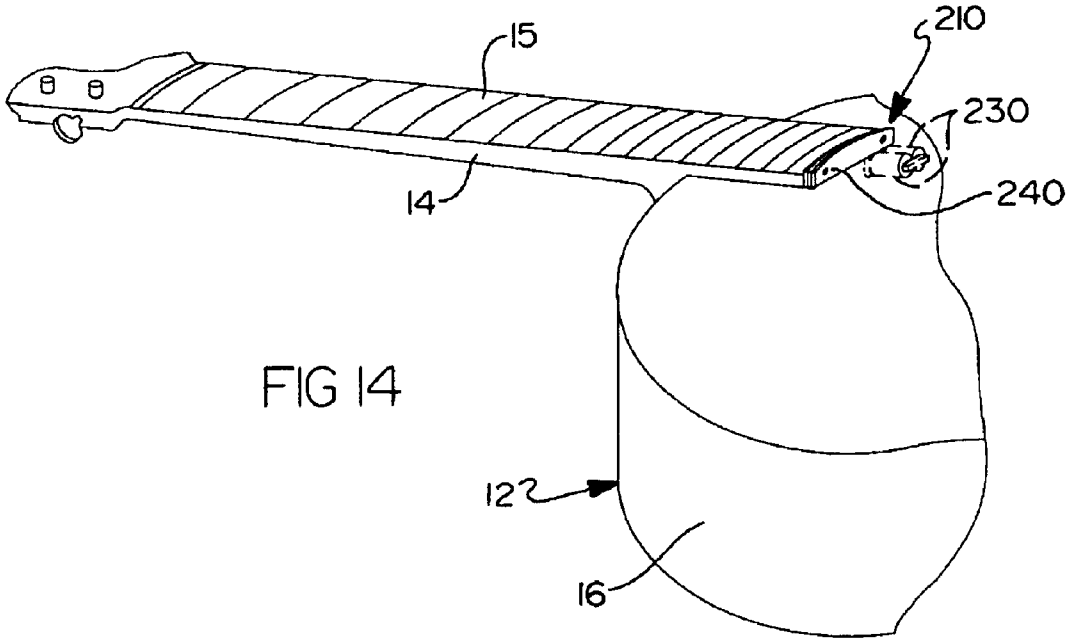
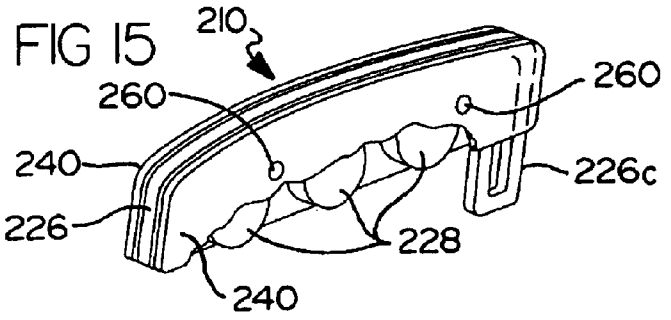


FIG 14

FIG 15



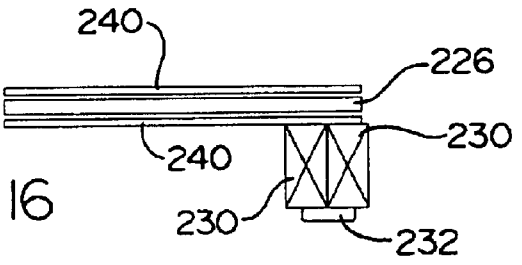


FIG 16

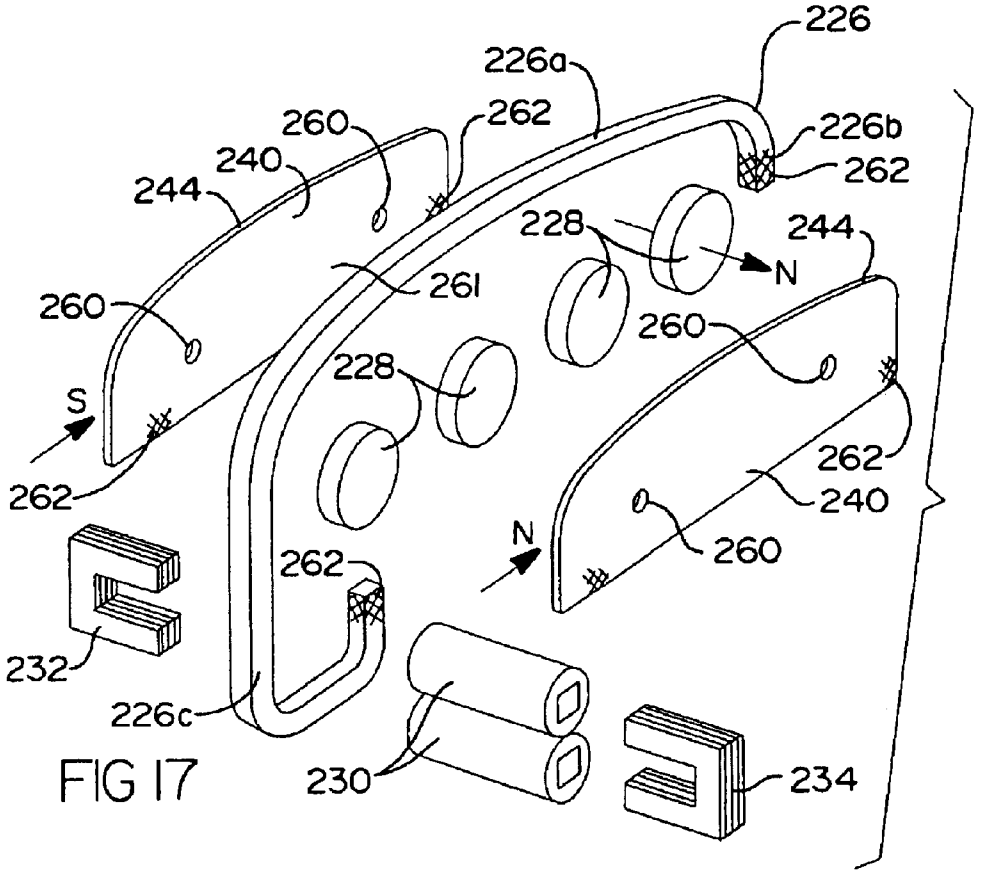


FIG 17

SENSOR ASSEMBLY FOR STRINGED MUSICAL INSTRUMENTS

CROSS-REFERENCE TO RELATED APPLICATION(S)

The present invention claims the priority date of copending U.S. Provisional Patent Application Serial No. 60/262,218, filed Jan. 17, 2001.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to musical instruments and, more particularly, to a sensor assembly for use with stringed musical instruments.

2. Description of the Related Art

Generally, stringed musical instruments such as electric guitars have electromagnetic sensors or pick-ups for sensing mechanical vibrations of the strings and converting such into electrical signals. The electrical signals from the electromagnetic sensors are amplified and modified and, ultimately, reconverted into acoustical energy to produce music and the like.

U.S. Pat. Nos. 5,501,900 and 5,438,157, issued to Lace, discloses an acoustic electromagnetic sensor assembly and mounting assembly for a stringed musical instrument. In that patent, the sensor assembly has a mounting assembly which fits in a sound hole of the stringed musical instrument. These electromagnetic sensors have a high visual impact when mounted on a stringed musical instrument such as an acoustic guitar. Further, these electromagnetic sensors typically have a tone and output that has a single value.

It is desirable to provide a sensor assembly that has less of a visual impact. It is also desirable to provide a sensor assembly with more variations in tone and output. Therefore, there is a need in the art to provide a sensor assembly, which meets these desires.

SUMMARY OF THE INVENTION

It is, therefore, one object of the present invention to provide a sensor assembly for a stringed musical instrument.

It is another object of the present invention to provide an electromagnetic sensor for an acoustic stringed musical instrument that has a low visual impact.

It is a further object of the present invention to provide an electromagnetic sensor for an acoustic stringed musical instrument that provides flexibility in tone and output of the sensor.

To achieve the foregoing objects, the present invention is a sensor assembly for a stringed musical instrument having a plurality of movable strings. The sensor assembly includes at least one blade adapted to be disposed adjacent the strings and at least one magnet disposed adjacent the at least one blade to generate a magnetic field through the at least one blade. The sensor assembly includes a primary winding disposed adjacent the at least one blade to create a primary current from a disruption in the magnetic field by the moveable strings. The primary current creates a primary electromagnetic flux. The sensor assembly also includes at least one secondary winding spaced from the primary winding and being magnetically coupled to the primary winding. The at least one secondary winding transforms the primary electromagnetic flux into a secondary current adapted to be passed out the stringed musical instrument.

One advantage of the present invention is that a new sensor assembly is provided for a stringed musical instrument. Another advantage of the present invention is that a sensor assembly is provided for a stringed musical instrument, which has low impact visually on the instrument or is virtually invisible on the instrument. A further advantage of the present invention is that the sensor assembly provides flexibility in the tone and output of the sensor. Yet a further advantage of the present invention is that the sensor assembly is quieter via making a primary winding humbucking. Still a further advantage of the present invention is that the sensor assembly uses neodymium magnets to decrease the packaging size, making the assembly smaller, and more versatile in mounting. Another advantage of the present invention is that the sensor assembly has at least one blade to aesthetically blend into the neck of the stringed musical instrument such as a guitar. Yet another advantage of the present invention is that the sensor assembly has full humbucking primary and secondary windings. Still another advantage of the present invention is that the sensor assembly has greater sensitivity with a primary winding at the top of the blade. A further advantage of the present invention is that the sensor assembly is non-visually distracting and blends in with the end of the neck or can be in neck.

Other objects, features, and advantages of the present invention will be readily appreciated, as the same becomes better understood, after reading the subsequent description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a sensor assembly, according to the present invention, illustrated in operational relationship with a stringed musical instrument.

FIG. **2** is a side elevational view of the sensor assembly and stringed musical instrument of FIG. **1**.

FIG. **3** is a perspective view of the sensor assembly of FIG. **1**.

FIG. **4** is a side elevational view of the sensor assembly of FIG. **1**.

FIG. **5** is a plan view of the sensor assembly of FIG. **1**.

FIG. **6** is a front view of the sensor assembly of FIG. **1**.

FIG. **7** is a schematic view of a single secondary winding for the sensor assembly of FIG. **1**.

FIG. **8** is a schematic view of a dual secondary winding in parallel for the sensor assembly of FIG. **1**.

FIG. **9** is a schematic view of a dual secondary winding with a potentiometer for the sensor assembly of FIG. **1**.

FIG. **10** is a perspective view of another embodiment, according to the present invention, of the sensor assembly of FIG. **1** illustrated in operational relationship with a stringed musical instrument.

FIG. **11** is a plan view of the sensor assembly of FIG. **10**.

FIG. **12** is a front view of the sensor assembly of FIG. **10**.

FIG. **13** is a plan view of yet another embodiment, according to the present invention, of the sensor assembly of FIG. **1** illustrated in operational relationship with a stringed musical instrument.

FIG. **14** is a partial perspective view of the sensor assembly and stringed musical instrument of FIG. **13** illustrated with the strings removed.

FIG. **15** is a perspective view of the sensor assembly of FIG. **13** illustrated with the secondary windings removed.

FIG. **16** is a plan view of the sensor assembly of FIG. **13**.

FIG. **17** is an exploded perspective view of the sensor assembly of FIG. **13**.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring to the drawings and, in particular, to FIGS. **1** and **2**, one embodiment of a sensor assembly **10**, according

to the present invention, is illustrated in operational relationship with a stringed musical instrument, such as a guitar, generally indicated at **12**. The guitar **12** is of the acoustical type having a neck portion **14** with a fingerboard **15**, a body portion **16**, and a plurality of strings **18** extending along the neck and body portions **14** and **16**, respectively. The sensor assembly **10** is disposed beneath the strings **18** and mounted to the body portion **16** adjacent to or in the fingerboard **15** in a manner to be described. Although the sensor assembly **10** is illustrated with a guitar **12**, it should be appreciated by those skilled in the art that any suitable type of stringed musical instrument may be enhanced by the sensor assembly **10**. It should further be appreciated that the sensor assembly **10** may be used with either an electric type of stringed musical instrument **12**.

The sensor assembly **10** may include a case (not shown) extending longitudinally and having a general "U" shape cross-section. The case has a generally planar base wall and a pair of generally planar side walls substantially parallel to each other and connected by generally arcuate shaped corner walls to the base wall to form a longitudinal channel. Preferably, the longitudinal channel has a lateral width greater than a height thereof. The case is fabricated from a single piece of ferromagnetic material such as an iron-based steel. The case may be secured by suitable means such as fasteners (not shown) to the fingerboard **15** as illustrated in FIG. **2**.

Referring to FIGS. **2** through **6**, the sensor assembly **10** includes a primary winding **26** made from a conductive material. Preferably, the primary winding **26** is made of a conductive material such as copper. The primary winding **26** is preferably a solid piece of copper made as a single layer stamping or multilaminate construction. It should be appreciated that the primary winding **26** may be made of any suitable conductive material.

The primary winding **26** has a configuration that acts as a one-turn receiver. In one embodiment, the primary winding **26** has a generally rectangular shape with a slot **27** extending therethrough. The primary winding **26** has a predetermined length. Preferably, the primary winding **26** extends to encompass all of the moveable strings **18**. It should be appreciated that the primary winding **26** may be configured to have other suitable shapes other than the rectangular shape. It should also be appreciated that the primary winding **26** may be a plurality of windings.

The sensor assembly **10** also includes at least one, preferably a plurality of magnets **28** disposed adjacent the primary winding **26** to provide a magnetic flux field to the strings **18**. The magnets **28** are secured to the interior surface of the case by suitable means such as an adhesive bonding agent. The magnets **28** are a permanent magnet strip and is made of a flexible permanent magnet material such as PLASTIFORM® which is commercially available from Arnold Engineering, Marango, Ill. The magnets **28** extend longitudinally and are generally rectangular in shape. It should be appreciated that the magnets **28** are orientated in a manner to be described.

The sensor assembly **10** also includes at least one, preferably a plurality of secondary windings **30** adjacent to the primary winding **26**. In one embodiment, the secondary windings **30** extend generally perpendicular to the primary winding **26**. The secondary windings **30** are coils of a conductive wire such as copper wrapped around core elements **32,34** to be described. It should be appreciated that the secondary windings **30** can be either single or multiple coils connected in series or parallel.

The secondary windings **30** are susceptible to electromagnetic flux transferred by the core elements **32** to be described from the primary winding **26**. The secondary windings **30** transform the primary electromagnetic flux into a secondary current. More specifically, the primary winding **26** and the secondary windings **30** and the core elements **32,34** act together as a transformer which transforms the primary current into the secondary current. The secondary current is passed through an output port (not shown) to electronics subsequent to the sensor assembly **10**. Although the primary winding **26** is shown to be a separate circuit than that of the secondary windings **30**, the secondary windings **30** may in an alternative embodiment (not shown) be connected in series to the primary winding **26** at a common point to create an autotransformer. It should be appreciated that possible electronic components, which may be operatively connected to the output port include receivers, synthesizers, amplifiers, speakers, and the like.

The secondary windings **30** are shorter in length than the predetermined length of the primary winding **26**. The secondary windings **30** include a first core element **32**, which extends through one end of the secondary windings **30** and a second core element **34**, which extends through the other end of the secondary windings **30**. In one embodiment, the first and second core elements **32,34**, which are "U" shaped in appearance, extend into the secondary windings **30** from each end and telescopingly engage. The core elements **32,34** are made from laminations of a high permeable magnetic material such as steel. It should be appreciated that the sensor assembly **10** may have a single secondary winding **30** as illustrated in FIG. **7** or multiple secondary windings **30** as illustrated in FIGS. **3** through **6** that can be combined in different ways to create a variety of tones. It should also be appreciated that the multiple secondary windings **30** may be in configured in a dual parallel arrangement as illustrated in FIG. **8** or with a potentiometer **36** as illustrated in FIG. **9**. It should further be appreciated that the use of multiple secondary windings **30** provides flexibility in the tone and output of the sensor assembly **10**. It should be still further appreciated that the multiple secondary windings **30** can be a variety of values and can be used with an elongated primary winding **26** to allow flexibility in the design and placement of the sensor assembly **10**.

The sensor assembly **10** further includes a blade **40** extending through the slot **27** in the primary winding **26**. The blade **40** acts as a core piece to conduct the magnetic field and to provide a flux connection to the strings **18**. The blade **40** is fabricated from a ferromagnetic material such as cold rolled steel. The blade **40** is a thin plate made of steel or other such material that is susceptible to a magnetic field. The blade **40** includes a base end **42** and a distal end **44**. The base end **42** is disposed adjacent the magnets **28** and may be fixedly secured to the magnets **28** via any suitable securing device, such as an adhesive epoxy. The distal end **44** is a sharp edge, which receives the movable strings **18** thereon. The distal end **44** is curvilinear allowing it to blend in with the curvature of the fingerboard **15** and apply equal flux on each of the movable strings **18** so that each of the movable strings **18** affects the magnetic field from the blade **40** equally. It should be appreciated by those skilled in the art that the curvilinear shape of the distal end **44** might vary depending on the type of stringed musical instrument **12** used. It should also be appreciated by those skilled in the art that the distal end **44** may even be straight for such instruments as acoustic violins, banjos, ukuleles, and the like wherein the strings all are set in a single plane.

Referring to FIGS. **10** through **12**, another embodiment, according to the present invention, of the sensor assembly **10**

is shown. Like parts of the sensor assembly **10** have like reference numerals increased by one hundred (100). In this embodiment, the sensor assembly **110** includes a case or cover **150** extending longitudinally and having a general "U" shape cross-section. The cover **150** has a generally planar base wall **152** and a pair of generally planar side walls **154** substantially parallel to each other and connected by generally arcuate shaped corner walls **156** to the base wall to form a longitudinal channel **158**. Preferably, the longitudinal channel **158** has a lateral width greater than a height thereof. The cover **150** has a flange **160** extending outwardly at each corner wall **156** and generally perpendicular thereto. The flange **160** has an aperture **162** extending therethrough to allow a fastener (not shown) to extend through the aperture **162** and slot **127** of the primary winding **126** and secure the cover **150** to the body portion **16** of the stringed musical instrument **12**. The cover **150** is fabricated from a single piece of material such as plastic or an iron based steel and forms a cup to contain the magnets **128**, primary winding **126**, and blade **140**.

The sensor assembly **110** also has a case **164** for the secondary windings **130**. The case **164** is disposed about the secondary windings **130** and secured thereto by suitable means. The core piece **132** may have a projection **166** to extend through the slot **127** to secure the secondary winding **130** to the primary winding **126**. It should also be appreciated that the primary winding **126** may have a portion disposed below a plane of a remainder thereof to which the secondary windings **130** are attached.

Referring to FIGS. **13** through **17**, yet another embodiment, according to the present invention, of the sensor assembly **10** is shown. Like parts of the sensor assembly **10** have like reference numerals increased by two hundred (200). In this embodiment, the sensor assembly **210** includes a primary winding **226** having a configuration that acts as a one-turn receiver. In this embodiment, the primary winding **226** has a base **226***a* extending transversely to encompass all of the moveable strings **18**. The primary winding **226** also has a first end **226***b* extending generally perpendicular to the base **226***a* and a second end **226***c* extending generally perpendicular to the base **226***a*. The second end **226***c* has a generally "J" shape for a function to be described. The primary winding **226** is made from a non-ferrous, conductive material. Preferably, the primary winding **26** is made of a conductive material such as copper. It should be appreciated that the first end **226***b* and second end **226***c* do not contact each other and that the primary winding **226** is not a closed loop, but an open loop.

The sensor assembly **210** also includes at least one, preferably a plurality of magnets **228** disposed adjacent the primary winding **226** to provide a magnetic flux field to the strings **18**. The magnets **228** are secured between and to a pair of blades to be described by suitable means such as an adhesive bonding agent. The magnets **228** are made of a permanent magnet material such as Neodymium, which is commercially available. The magnets **228** are spaced longitudinally and are generally circular in shape. It should be appreciated that the magnets **228** are orientated in a manner to be described. It should also be appreciated that the magnets **228** may be made of other types of magnetic material.

The sensor assembly **210** also includes at least one, preferably a plurality of secondary windings **230** adjacent to the primary winding **226**. In one embodiment, the secondary windings **230** extend generally perpendicular to the primary winding **226**. The secondary windings **230** are coils of a conductive wire such as copper wrapped around core elements **232,234**.

The secondary windings **230** are susceptible to electromagnetic flux transferred by the core elements **232** from the primary winding **226**. The secondary windings **230** transform the primary electromagnetic flux into a secondary current. More specifically, the primary winding **226** and the secondary windings **230** and the core elements **232,234** act together as a transformer which transforms the primary current into the secondary current. The secondary current is passed through an output port (not shown) to electronics subsequent to the sensor assembly **210**. It should be appreciated that possible electronic components, which may be operatively connected to the output port include receivers, synthesizers, amplifiers, speakers, and the like.

The secondary windings **230** are shorter in length than the predetermined length of the primary winding **226**. The secondary windings **230** include a first core element **232**, which extends through one end of the secondary windings **230** and a second core element **234**, which extends through the other end of the secondary windings **230**. In one embodiment, the first and second core elements **232,234**, which are "U" shaped in appearance, extend into the secondary windings **230** from each end and telescopingly engage. Each of the core elements **232,234** is made from a plurality of laminations, preferably four, of a high permeable magnetic material such as steel. It should be appreciated that the sensor assembly **210** has a pair of secondary windings **230** that act as dual humbucking secondaries. It should also be appreciated that the secondary windings **230** may be spaced farther from the primary winding **226** as illustrated in FIG. **14**.

The sensor assembly **210** further includes a plurality, preferably a pair, of blades **240** disposed on the sides of the primary winding **226** such that the primary winding **226** is disposed therebetween. The blades **240** act as a core piece to conduct the magnetic field and to provide a flux connection to the strings **18**. The blades **240** are fabricated from a ferromagnetic material such as cold rolled steel. The blades **240** are a thin plate made of steel or other such material that is susceptible to a magnetic field. The blade **240** includes at least one, preferably a plurality of apertures **260** extending therethrough for a function to be described. One of the blades **240** is disposed adjacent the magnets **28** and the blade **240** may be fixedly secured to the magnets **28** via any suitable securing device, such as an adhesive epoxy. The other one of the blades **240** has an inner surface **261** that is electrically insulated from the magnets **228**. That blade **240** disposed on one side of the primary winding **226** and the other blade **240** is disposed on the other side of the primary winding **226** and the primary winding **226** and blades **240** are electrically secured together by suitable means such as soldering at a plurality of locations **262**. The blades **240** have a distal end **244** that is curvilinear allowing it to blend in with the curvature of the fingerboard **15** and apply equal flux on each of the movable strings **18** so that each of the movable strings **18** affects the magnetic field from the blades **240** equally. It should be appreciated by those skilled in the art that the curvilinear shape of the distal end **244** might vary depending on the type of stringed musical instrument **12** used. It should also be appreciated by those skilled in the art that the distal end **244** may even be straight for such instruments as acoustic violins, banjos, ukuleles, and the like wherein the strings all are set in a single plane. It should further be appreciated that one of the blades **240** is magnetic north and the other blade is magnetic south. It should still further be appreciated that the sensor assembly **210** may be mounted to the end of the neck **14** by suitable means such as fasteners (not shown) extending through the apertures **260** in the blades **240** and into the neck **14**.

The present invention has been described in an illustrative manner. It is to be understood that the terminology, which has been used, is intended to be in the nature of words of description rather than of limitation.

Many modifications and variations of the present invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A sensor assembly for a stringed musical instrument having a plurality of movable strings comprising:

at least one blade adapted to be disposed below the movable strings and adapted to be either one of disposed at an end of a neck and disposed in the neck of the stringed musical instrument;

at least one magnet disposed adjacent said at least one blade to generate a magnetic field through said at least one blade;

a primary winding disposed adjacent said at least one blade to create a primary current from a disruption in the magnetic field by the movable strings, the primary current creating a primary electromagnetic flux; and

at least one secondary winding spaced from said primary winding and being magnetically coupled to said primary winding, said at least one secondary winding transforming the primary electromagnetic flux into a secondary current adapted to pass out the stringed musical instrument.

2. A sensor assembly as set forth in claim **1** wherein said at least one blade extends through a slot in said primary winding.

3. A sensor assembly as set forth in claim **1** wherein said at least one blade is a thin plate fabricated from a ferromagnetic material that is susceptible to a magnetic field.

4. A sensor assembly as set forth in claim **1** wherein said at least one blade is fabricated from cold-rolled steel.

5. A sensor assembly as set forth in claim **1** wherein said at least one blade is electrically connected to one side of said primary winding.

6. A sensor assembly as set forth in claim **1** including a plurality of blades, said primary winding being disposed between said blades and electrically connected thereto.

7. A sensor assembly as set forth in claim **1** wherein said blade includes a base end and a distal end, said base end being disposed adjacent said at least one magnet and said distal end being disposed adjacent the movable strings.

8. A sensor assembly as set forth in claim **7** wherein said base is fixedly secured to said at least one magnet.

9. A sensor assembly as set forth in claim **7** wherein said distal end is curvilinear.

10. A sensor assembly as set forth in claim **1** wherein said primary winding is a closed loop.

11. A sensor assembly as set forth in claim **1** wherein said primary winding is an open loop.

12. A sensor assembly as set forth in claim **1** wherein said primary winding has a generally rectangular shape of a pre-determined length and a slot extending through said primary winding through which said at least one blade extends.

13. A sensor assembly as set forth in claim **1** wherein said at least one magnet includes a plurality of magnets.

14. A sensor assembly as set forth in claim **1** wherein said at least one magnet is generally rectangular and extends substantially longitudinally.

15. A sensor assembly as set forth in claim **1** wherein said at least one magnet is generally circular in shape.

16. A sensor assembly for a stringed musical instrument having a plurality of movable strings comprising:

at least one blade adapted to be disposed adjacent the movable strings;

at least one magnet disposed adjacent said at least one blade to generate a magnetic field through said at least one blade;

a primary winding disposed adjacent said at least one blade to create a primary current from a disruption in the magnetic field by the movable strings, the primary current creating a primary electromagnetic flux;

at least one secondary winding spaced from said primary winding and being magnetically coupled to said primary winding, said at least one secondary winding transforming the primary electromagnetic flux into a secondary current adapted to pass out the stringed musical instrument; and

a first core element extending through one end of said at least one secondary winding and a second core element extending through the other end of said at least one secondary winding, said first and second core elements adapted to receive the electromagnetic flux from said primary winding and transform the electromagnetic flux into the secondary current.

17. A sensor assembly for a stringed musical instrument having a plurality of movable strings comprising:

at least one blade adapted to be disposed adjacent the movable strings;

at least one magnet disposed adjacent said at least one blade to generate a magnetic field through said at least one blade;

a primary winding disposed adjacent said at least one blade to create a primary current from a disruption in the magnetic field by the movable strings, the primary current creating a primary electromagnetic flux;

at least one secondary winding spaced from said primary winding and being magnetically coupled to said primary winding, said at least one secondary winding transforming the primary electromagnetic flux into a secondary current adapted to pass out the stringed musical instrument;

a first core element extending through one end of said at least one secondary winding and a second core element extending through the other end of said at least one secondary winding; and

wherein said first and second core elements are substantially "U" shaped and are adapted to telescopingly engage each other.

18. A sensor assembly for a stringed musical instrument having a plurality of movable strings comprising:

a blade disposed adjacent the plurality of movable strings and adapted to provide a flux connection to the plurality of movable strings;

at least one magnet adapted to generate a magnetic field through and conducted by said blade, the plurality of movable strings adapted to disrupt the magnetic field;

a primary winding disposed adjacent said at least one magnet and adapted to create a primary current from a disruption in the magnetic field by the plurality of movable strings, the primary current creating a primary electromagnetic flux;

at least one secondary winding spaced from and magnetically coupled by a plurality of high magnetic permeability metal laminate core elements to said primary winding, said at least one secondary winding adapted to transform the primary electromagnetic flux into a secondary current adapted to pass out the instrument;

a case that extends longitudinally, has a generally "U" shaped cross-section defining a substantially longitudinal channel, defines an interior surface of said case, and is fabricated from a single piece of ferromagnetic material and adapted to secure said at least one magnet to said interior surface; and

a cover disposed about and secured to said at least one secondary winding.

19. A sensor assembly for a stringed musical instrument having a plurality of movable strings comprising:

a plurality of blades adapted to be disposed below the movable strings and adapted to be either one of disposed at an end of a neck and disposed in the neck of the stringed musical instrument;

a plurality of magnets disposed between said blade to generate a magnetic field though said blades;

a primary winding disposed between said blades and electrically connected thereto to create a primary current from a disruption in the magnetic field by the movable strings, the primary current creating a primary electromagnetic flux; and

a plurality of secondary winding spaced from said primary winding and being magnetically coupled to said primary winding, said secondary windings transforming said primary electromagnetic flux into a secondary current adapted to pass out the stringed musical instrument.

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