Dec. 4, 1962 J. J. KELLEY, JR 3,066,567

MAGNETIC PICK-UP FOR STEEL STRING INSTRUMENTS

Filed Feb. 10, 1960 2 Sheets-Sheet 1

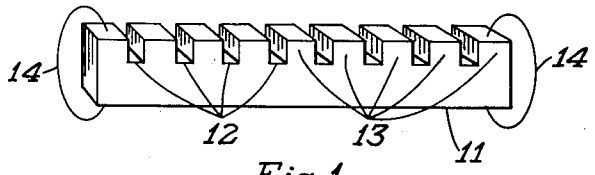

Fig 1

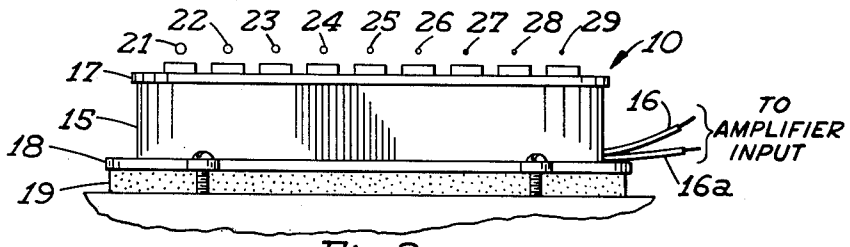

Fig 2

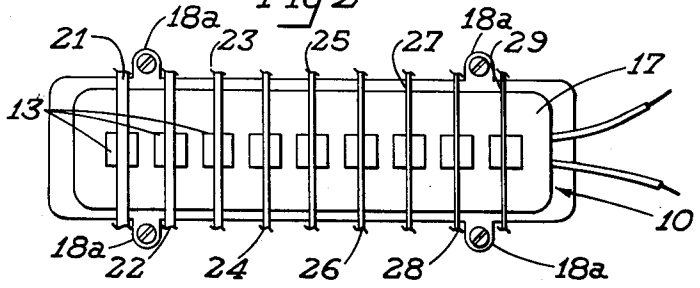

Fig 3

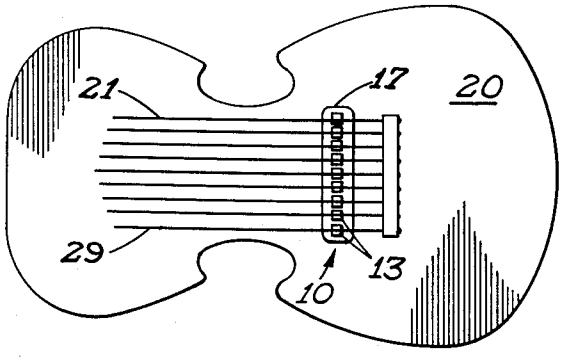

Fig 4

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MAGNETIC PICK-UP FOR STEEL STRING INSTRUMENTS

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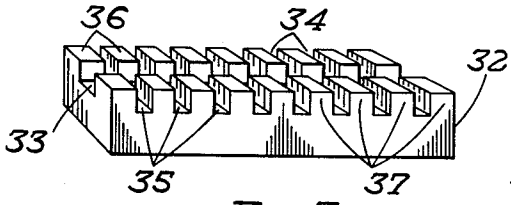

Fig 5

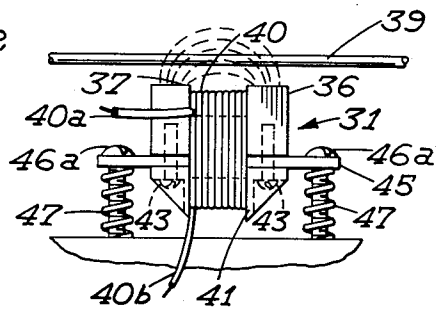

Fig 6

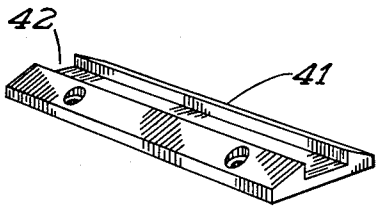

Fig 8

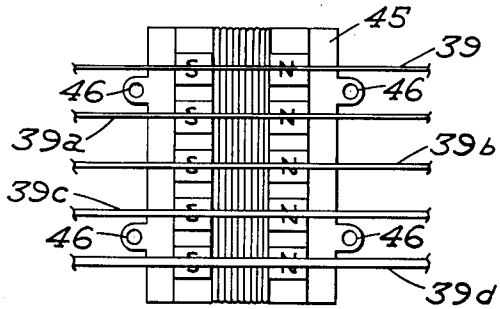

Fig 7

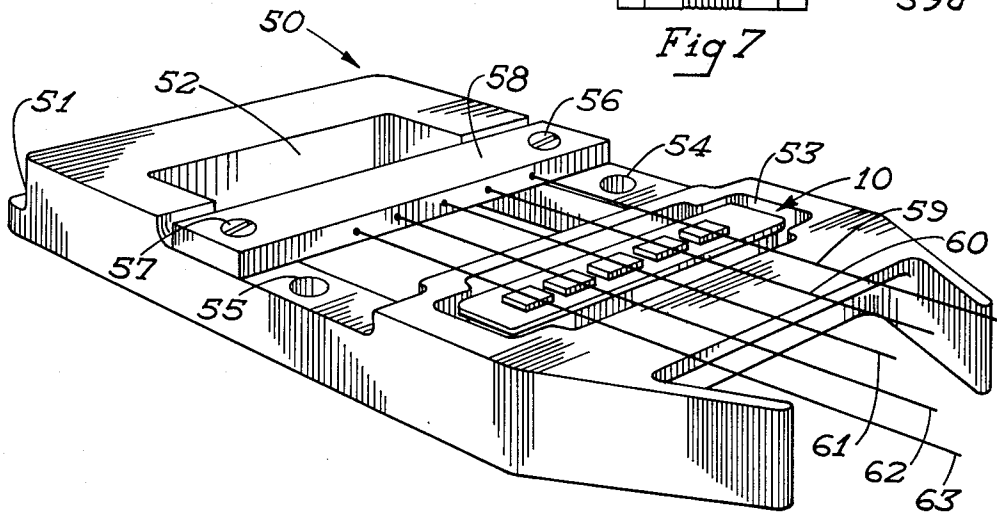

Fig 9

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MAGNETIC PICK-UP FOR STEEL STRING INSTRUMENTS

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4 Claims. (Cl. 84—1.16)

The present invention relates generally to an improved pick-up for string instruments employing a plurality of parallelly disposed strings, and more particularly to an improved pick-up of the type described which is particularly adapted to deliver strong output signals, the design of which is readily adaptable for use with a plurality of different instruments.

Apparatus designed for this particular purpose have been and are being currently widely used, the pick-up being employed to provide a suitable electrical signal which may be amplified and reproduced as desired at a higher volume or energy level. Depending upon the type of pick-up utilized, the particular design thereof may render the unit unduly cumbersome for use in connection with a given instrument, or the design, if magnetically unsound, may tend to provide such a weak or limited electrical signal that pick-up and subsequent true amplification are particularly difficult to achieve. For example, if the device is only capable of generating weak signals and if the pick-up leads are unduly long, losses may occur or noises may be generated which render subsequent amplification unrealistic and noisy. These problems are readily overcome by the apparatus of the present invention.

According to the present invention, a permanent magnet is provided having a large unitary mass, and being particularly adapted to deliver a particularly strong electrical signal. The various tones from the individual strings of the musical instrument may accordingly be picked up, transmitted to a suitable amplifier over reasonably long leads, and subsequently amplified as desired. Because of the nature of the pick-up, the reproduction is substantially free from noise, and is accordingly realistic in nature. The device employs a properly poled magnetic body having a suitable coil wrapped therearound, and further provides alternate pedestals and grooves, the pedestals being particularly adapted for use as a specific area for pick-up for a given instrument string.

It is accordingly an object of the present invention to provide an improved magnetic pick-up for stringed musical instruments, the magnetic body being unitary and having a relatively large mass for providing the necessary lines of flux.

It is another object of the present invention to provide an improved magnetic pick-up for stringed musical instruments wherein a unitary magnetic body is employed which utilizes a pick-up face comprising a plurality of alternate pedestals and grooves, each pedestal being arranged as a specific pick-up zone for a given instrument string.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings in which:

FIG. 1 is a perspective view of the magnetic body utilized in connection with the preferred embodiment of the present invention;

FIG. 2 is a side view of a preferred embodiment of the pick-up apparatus of the present invention;

FIG. 3 is a top plan view of the apparatus of the present invention, showing the pedestal faces thereof;

FIG. 4 is a top plan view of the apparatus of the

present invention shown on a reduced scale in combination with a suitable stringed musical instrument;

FIG. 5 is a perspective view of a magnetic body utilized in connection with a somewhat modified version of the present invention;

FIG. 6 is an end view of the finished apparatus prepared in accordance with the somewhat modified embodiment of the present invention as set forth in FIG. 5;

FIG. 7 is a top plan view of the device shown in FIG. 6;

FIG. 8 is a coil guide arranged to be used in combination with the apparatus illustrated in FIGS. 5–7; and,

FIG. 9 is a perspective view of a mounting plate which is adapted to retain the various forms of the present invention, and which is further arranged to retain the strings of a musical instrument therein.

According to the preferred embodiment of the present invention, the pick-up apparatus generally designated **10** is provided with a magnetic body or mass **11** having a plurality of spaced grooves **12—12** arranged along a major face thereof, the spaces between the grooves forming a plurality of pedestal members **13—13**. The magnetic body is permanently polarized across the thickness dimension thereof, thereby rendering each pedestal in effect a pole-face for a specific string. The flux lines **14—14** are utilized to illustrate this polarization arrangement. The pick-up member **10** is further provided with a plurality of turns of a conductor **15** wrapped around the shank of the body **11** thereby forming a suitable coil therearound. A pair of insulated lead members **16** and **16A** are arranged to conduct the signal generated in the device to a suitable amplifier arrangement (not shown). In this connection, for a normal pick-up number 43 copper magnetic wire may be employed. In order to obtain suitable results, the total coil resistance of between 4,000 and 11,000 ohms is desired, this value depending, among other things, upon the input impedance of the amplifier employed. If a total resistance of about 10,000 ohms is desired, about 9,000 turns will provide the desired resistance value in a magnetic body having a length of 3¼ inches, a width of ¼ inch and a depth of ¾ inch. Of course, the various amplifiers and the like employed in connection with this device may dictate the desired resistance value in the finished device, however the selection of the proper values is considered to be within ordinary skill in the art. In order to properly confine the wire, insulating shields **17** and **18** are provided at the top surface and bottom surface respectively of the pick-up member.

Reference is made to FIG. 4 of the drawings wherein the pick-up device is shown arranged in combination with a suitable musical instrument. The instrument generally designated **20** is provided with a plurality of strings respectively numbered **21** through **29**, these strings being preferably made from a material such as iron, steel, or the like which is magnetic in nature. The individual vibrating strings upon being struck, plucked or the like will vibrate in accordance with a frequency as determined by the length and tension thereof, this frequency of vibration in the tensioned magnetic string being generated as a signal in the magnetic pick-up. The generated signal is then conducted out through the conductors **16** and **16A**. As is conventional in apparatus of this type, if several strings are set into vibration simultaneously the resultant vibrational signal will accordingly be picked up and suitably amplified.

In order to affix the pick-up member **10** to a suitable musical instrument, mounting plate **18** is provided with a plurality of mounting holes **18A—18A**. Furthermore, a resilient member **19** is arranged to be interposed be-

tween the face of the musical instrument upon which the pick-up is mounted and the mounting base **18**. Accordingly, the pick-up **10** is received in substantially vibration-free relationship on a mounting surface. In addition, it is possible to utilize the resilient member which may be, for example, sponge rubber or the like, to dispose the various pole faces either more closely to or more remote from the individual vibrating strings **21–29** inclusive. In this connection, the operator merely applies more tightening force to one pair of mounting screws than to the other. Accordingly, the desired spacing between the pole face and the individual vibrating strings may be obtained.

Inasmuch as the magnetic member is unitary, there is no problem due to loss of magnetic coupling between the various components of the magnetic body. Accordingly, for an apparatus of this size, the unitary member provides for an unusually strong output signal from the device. Furthermore, the polarization of the magnetic body is arranged across the thickness or depth dimension, thereby rendering each pedestal a pole-face. The strength of the magnetic field or the flux density is accordingly substantially constant from one pedestal to the other along the length of the pick-up. The electrical signal generated by any given string vibrating at a given distance from the face of the pick-up will be expected to be substantially constant. Therefore, the advantages of this arrangement are significant over that of a device employing, for example, one leg of a horseshoe magnet as the magnetic body unit.

Referring now to the embodiment shown in FIGS. 5–8, the pick-up apparatus generally designated **31** includes a modified form of magnetic body **32** which is a form of a horseshoe magnet. The magnet **32** includes a longitudinal groove **33** and a plurality of transverse grooves **34—34** and **35—35**. The grooves **34—34** separate the alternate pedestals **36—36** while the grooves **35—35** separate alternate pedestals **37—37**. Each transverse pair of pedestals **36—37** are arranged to function as a pick-up for an individual string **39** which is arranged directly above each magnet couple **36—37**. In this connection, the magnetic body **32** is unitary in its structure and hence it is not necessary to provide for magnetic coupling between a pair of separate bodies. This arrangement enables a greater signal to be generated in the apparatus and hence problems of noise and the like are not expected to be encountered. The assembly is further provided with a magnetic coil **40** which is similar to the coil **15** disclosed hereinabove, coil **40** being along the longitudinal groove **33** and along the corresponding or mating groove **42** of the plastic coil guide **41**. As was stated previously, the device will include as many turns as are deemed essential for the purpose and application of the device. The coil guide **41** is attached to the magnetic body **32** by means of a suitable arrangement of screws **43** and tapped holes. Intervening between the coil guide **41** and the body **32** is a mounting plate **45**. The mounting plate **45** has a plurality of mounting holes **46—46** which are adapted to receive screws **46A—46A** therethrough. Resilient members **47—47** are arranged to be received on the shank of the mounting screws **46A—46A**, and hence the pick-up may be disposed as desired relative to the strings **39**, **39A**, **39B**, **39C** and **39D**. It will be appreciated that it may be desirable in some instances to have string **39D** more closely spaced to the poleface of the pick-up than **39**, for example.

Therefore, in operation, the individual strings, such as string **39**, may be struck, plucked or the like and the vibration thereof will be picked up as a signal generated in the coil **40** of the device. This signal is carried to an appropriate amplifier along the conductors **40A** and **40B**. Because of the physical arrangement of the magnet, it is possible to pick up a signal generated due to the vibration of a string, for example **39**, even though this vibration may be of extremely low magnitude. Inasmuch as the lines of flux run between the pole faces along the upper surface of the unit and inasmuch as the lines of flux also are carried around the body of the magnet, a substantial number of flux lines are affected by the vibration of any string. Of course, any given string affects only the flux pattern in the poles which are next adjacent thereto.

The pick-up retaining apparatus generally designated **50** includes a body portion **51** having a hollow or central cut away portion **52** along with a depression cavity **53**. A pair of mounting holes **54** and **55** are arranged to accommodate suitable screws or the like (not shown) for mounting the retainer **50** on a suitable instrument body. Tap holes **56** and **57** are provided in order that string retaining bar **58** is provided for retaining the ends of the various instrument strings, for example the strings **59**, **60**, **61**, **62** and **63** therein. Either of the modifications of the pick-up apparatus may be received in the cavity **53** and thereby have the pole faces immediately adjacent to the vibrating strings, such as the strings **59–63** inclusive. For purposes of clarity, a pick-up apparatus **10** is shown disposed within the cavity **53** and in operative relationship to the various strings **59–63** inclusive. Regarding the retainer **50**, it is possible with this device to prepare an instrument without the need for having a particular form or configuration. It is essential, however, that suitable mounting means be provided on the instrument for receiving the member **50**, such as, for example, by screws, bolts, or the like through the holes **54** and **55**.

It will be appreciated that various modifications of the present invention may be prepared without departing from the spirit and scope of the present invention. Thus, the specific examples given herein are for purposes of illustration only and are not to be construed as a limitation upon the coverage to which the present invention is entitled.

I claim:

1. In a device for transducing the vibrations of a plurality of independently vibratory parallelly disposed strings into electrical impulses; a unitary magnetic body permanently polarized along a mode between a first and a second pole face thereof, said magnetic body having a plurality of turns of a conductor forming a coil around a central shank portion thereof between said pole faces, at least one transverse groove being formed along said first pole face to define alternate pedestals and grooves therealong, the face of each of said pedestals being arranged to be disposed adjacent one side only of said vibratory parallel strings.

2. In a device for transducing the vibrations of a plurality of independent, magnetic, vibratory parallelly disposed strings of a musical instrument into electrical impulses; a unitary magnetic body permanently polarized along a mode between a first and a second pole face thereof so as to define a flux path therebetween, said magnetic body having a plurality of turns of a conductor forming a coil around a central shank portion thereof between said pole faces, a plurality of transverse grooves being formed along said first pole face to define alternate pedestals and grooves therealong, the face of each of said pedestals being arranged to be disposed adjacent one side only of said vibratory parallel strings, said strings being disposed in said flux path.

3. In a device for transducing the vibrations of a plurality of independent, magnetic, vibratory parallelly disposed strings of a musical instrument into electrical impulses; a unitary magnetic body permanently polarized along a mode between a first and a second pole face thereof, said magnetic body having a plurality of turns of a conductor forming a coil around a central shank portion thereof, a plurality of transverse grooves formed along said first pole face to define alternate pedestals and grooves therealong, the face of each of said pedestals being arranged to be disposed adjacent one side only of said vibratory parallel strings and modulate the flux path

existing between said first pole face and said second pole face.

4. A magnetic variable reluctance pick-up arranged for use in combination with a musical instrument having a plurality of independently suspended vibratory parallelly disposed strings and comprising: a unitary magnetic body permanently polarized in a mode between a first and a second pole face thereof, said magnetic body having a plurality of turns of a conductor forming a coil around a central shank portion thereof, a plurality of transverse grooves being formed along said first pole face to define

alternate pedestals and grooves therealong, the face of each of said pedestals being arranged to be disposed adjacent one side only of said vibratory parallel strings.

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