July 13, 1954 R. KELLER 2,683,388

PICKUP DEVICE FOR STRINGED INSTRUMENTS

Filed April 12, 1952

Fig. 1.

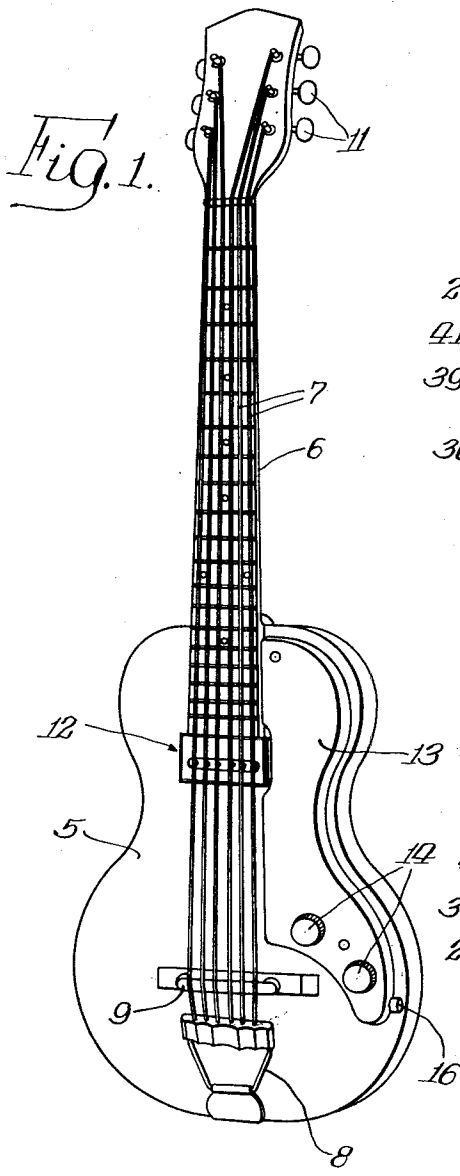


Fig. 2.

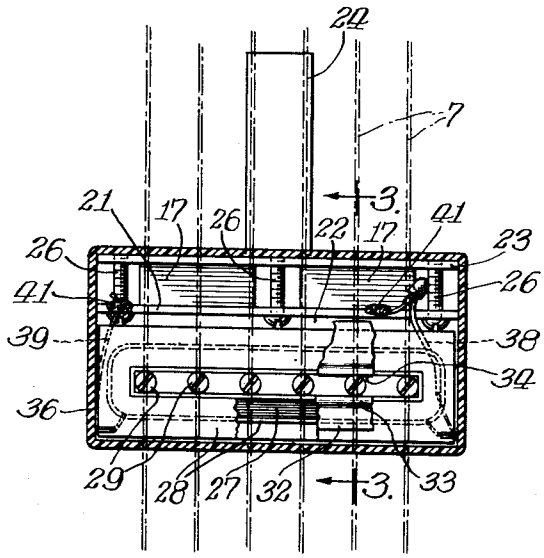
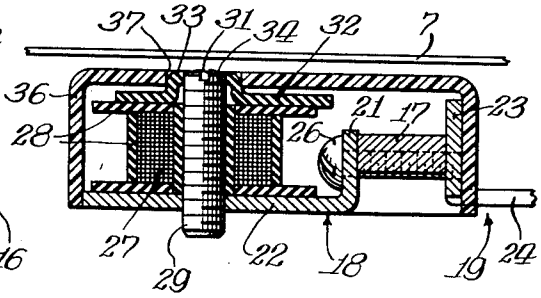


Fig. 3.



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PICKUP DEVICE FOR STRINGED INSTRUMENTS

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The invention relates to pickup devices for stringed musical instruments, and its general object is to provide a novel pickup device which is highly sensitive to the vibrations of the associated strings, which picks up not only the fundamental note of each string but also the harmonics or overtones to a high degree, and which faithfully responds to the string vibrations.

More specifically, an object of the invention is to provide a pickup device which establishes a magnetic field extending for a substantial distance along each string, with the magnetic lines of force lying substantially parallel to the strings for the major portion of said distance.

Another important object is to provide a magnetic pickup device which is inexpensively and easily manufactured and which may be readily adapted for different numbers of strings and different string spacings.

Other objects and advantages of the invention will become apparent from the subsequent detailed description taken in conjunction with the accompanying drawing wherein:

Fig. 1 is a perspective view of an electric Spanish guitar embodying the pickup device of the present invention;

Fig. 2 is an enlarged plan view of the pickup device with the cover portion broken away; and

Fig. 3 is a sectional view of the pickup device as seen along the line 3—3 of Fig. 2.

Referring first to Fig. 1, my invention is illustrated in conjunction with an electric Spanish guitar of the hard body type having a non-vibrating body portion 5 and a neck portion 6 provided with the usual fingerboard and having a plurality of strings 7 tensioned thereover. The strings 7 are secured at one end of the body 5 by an anchoring device 8 and extend over a bridge 9 and thence along the neck 6 to a plurality of tuning keys 11 provided at the end of the neck. A pickup device 12, which constitutes the subject matter of the present invention, is mounted adjacent the inner end of the neck 6 in the space between the strings 7 and the body portion 5. The instrument is also provided with a suitable handrest 13 as well as a pair of readily accessible tone and volume controls 14. It will be understood that the pickup device 12 is connected in circuit with the controls 14 which are in turn connected through a suitable attachment 16 with an amplifier and speaker unit, not shown.

Referring to Figs. 2 and 3, the construction of the pickup device 12 will now be described in detail. This unit consists of a plurality of rectangular block-shaped or bar magnets 17 disposed

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in spaced relation and longitudinal alignment between a pair of pole pieces, indicated generally at 18 and 19, the latter being formed from a metal such as iron or steel having a high magnetic permeability. The pole piece 18 is generally L-shaped with a short vertical leg or flange 21 and a longer horizontal leg or plate 22. The pole piece 19 comprises an upright flat strip 23, and an elongated horizontal member 24 extends integrally from the strip 23 for mounting the pickup device on the body of the instrument. The magnets 17 are retained in unitary assembled relation with the pole pieces 18 and 19 by means of a plurality of screws 26 extending between the vertical portions 21 and 23 of the pole pieces for clamping the magnets flatwise therebetween. It will be understood that the screws 26 are made of non-magnetic material such as brass to avoid shorting the magnetic circuit. Although two bar magnets 17 are shown in the present embodiment of the invention and three non-magnetic screws 26 are utilized in alternating relation with the magnets 17, the same structural features may be applied in the case of a single magnet or an even greater number of magnets. In addition, the pole pieces may be easily fabricated to any desired width to meet the requirements of a particular installation since no special dies are required.

An elongated coil 27 is mounted on the horizontal portion 22 of the pole piece 18 with its axis upright, the coil 27 being enclosed and protected in the usual manner by insulating core and end sheets, as indicated at 28. A plurality of upright adjusting screws 29 are mounted in suitable threaded apertures in the horizontal portion 22 of the pole piece 18. These screws 29 extend upwardly through the elongated central opening of the coil 27 and are provided with slots 31 in their upper ends for adjusting the axial height thereof. As will be clearly seen from Fig. 2 of the drawing, a screw 29 is provided for each of the strings 7 and is disposed immediately thereunder so that by adjustment of the screw 29 the magnitude of the air gap between the upper end of the screw and the corresponding string 7 can be readily controlled. A protective plate 32 of insulating material is disposed over the top of the coil 27 and has a raised portion 33 provided with a plurality of apertures 34 for receiving the upper ends of the screws 29. A suitable protective cover 36, which may be of plastic or the like, is detachably fitted over the entire unit for enclosing and protecting the same, the top portion of the cover 36 being slotted,

as at 37, to accommodate the raised portion 33 of the insulator 32. Thus, when the unit completely assembled with the cover 36 in position thereon, it will be apparent that the upper slotted ends of the adjusting screws 29 are readily accessible for independent adjustment. As seen from Fig. 2, a lead 38 from one terminal of the coil winding extends from the unit and is connected in circuit in the usual manner with the amplifier and speaker and with the controls 14. A lead 39 at the opposite terminal of the coil winding completes the electrical circuit through soldered connections, as at 41, with the upright leg 21 of the pole piece 18.

The bar magnets 17 are so arranged that their respective poles are at the elongated sides of the magnets adjacent the pole pieces, and the pickup unit is mounted below the strings 7 so that a line between the two poles of each magnet extends substantially parallel to the strings. The pole piece 18 with its elongated leg 22 constitutes in effect and extension beyond the corresponding poles of the magnets 17 such that the magnetic field is extended or elongated substantially beyond the normal pole-to-pole distance of the magnets. Consequently, the lines of force of the magnetic field extend substantially paralliel to the strings 7 over a substantial portion of the length of the strings. Moreover, the arrangement of the bar magnets 17 with their pole pieces 18 and 19 constitutes in effect a horseshoe magnet pattern with the respective legs or poles extending upwardly toward the strings. Thus, the upright strip 23 extending above the magnets 17 constitutes one leg of the horseshoe magnet pattern and the upright adjusting screws 29 function as the opposite leg. In this manner, the strings 7 are disposed directly in the magnetic field and are coextensive with the longitudinally extending lines of force. It will be understood that the strings 7 are of magnetic metal and thus constitute a portion of the magnetic circuit. As the strings 7 vibrate in the magnetic field the reluctance of the field is thereby varied and an induced electrical current having all the characteristics of the sound producing vibrations of the strings is created in coil 27 in the manner well known in this art.

The improved pickup unit constituting the present invention possesses a number of important advantages both from the point of view of performance and also from a structural viewpoint. With respect to performance of the pickup unit, the most important advantage stems from the elongated or extended character of the magnetic field and the generally parallel relation of the magnetic lines of force with the instrument strings as compared with the perpendicular relation between the magnetic field and the strings which is common in many currently used pickup devices.

In my device the magnetic metal strings 7 are disposed directly in the linear dimension of the flux path and the strings therefore function as a "return" in the magnetic circuit between the upright strip 23 and the tips of the adjusting screws 29. As a result, a wide area of the magnetic pattern is efficiently activated by the moving strings whereby to produce substantially greater and more effective variations in the reluctance of the magnetic field. Because of the relatively great effective string length disposed in the flux path, my device provides a relatively wide pickup pattern which covers the constantly changing string vibration nodal points in a highly effective manner. Consequently, the use of a pickup device of the present character produces substantial improvements in the tone color of the instrument due to the capturing of additional overtones or harmonics which are not ordinarily reproduced when the pickup point is limited to a single point or relatively restricted area on the strings. It will be apparent that by varying the effective length of the pole piece 18 and the location of the coil 27 and adjusting screws 29 thereon, I can obtain considerable variation in the effective pickup area longitudinally of the strings. Thus, within reasonable limits, my pickup device is able to capture overtones to a very high degree as compared with the devices heretofore known.

Another important performance factor in the present invention resides in the fact that there is a desirable flux concentration at the tips of the adjusting screws 29 because of the fact that the screws are in effect one pole of a horseshoe magnet, as hereinbefore described. It is also known that with respect to a horseshoe magnet the most effective position for the pickup coils is surrounding the tips of the magnet poles. Consequently, the arrangement in my device is such that the coil 27 can be readily mounted immediately adjacent the tips of the screws 29.

From a production or manufacturing viewpoint, the present invention possesses additional significant advantages. In the first place, the unit is quite powerful and provide highly desirable performance characteristics as described above, yet the overall dimensions are relatively small and it is possible to employ a limited magnet mass. This compactness of construction while retaining highly effective performance is an especially useful feature in connection with certain types of electrical stringed instruments. For example, in the Spanish guitar one of the most effective pickup areas is directly at the end of the fingerboard, and the present invention provides a pickup device that can be readily fitted into this limited area and at the same time provide full power at the point required.

It will also be apparent that my device is quite simple to manufacture and assemble. The invention permits the use of standard bar stock magnets which are substantially less expensive than horseshoe magnets. The simplicity of the assembled relation of the parts wherein the magnets are held in clamped relation between the pole pieces further contributes to the economy of the device from a manufacturing viewpoint.

The basic principles of my device are such that the unit can be readily adapted for use on instruments of varying size, e. g. those containing from 4 to 12 strings. As hereinbefore mentioned, the number of individual bar magnets, the dimensions of the pole pieces, and the size of the pickup coil are easily changed to accommodate the requirements of any particular installation. Moreover, with any given unit it is a simple matter to use coils of varying size for the purpose of altering the power of the device.

Although the invention has been described in connection with a particular structural embodiment, it will be understood that various modifications and alternative constructions may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a stringed instrument having a plurality of steel strings and bridge means supporting the strings and determining the effective length thereof, a pickup device mounted adjacent the

strings and spaced from said bridge means intermediate the effective length of the strings, said pickup device comprising a block-shaped magnet positioned such that an axial line through its poles extends substantially parallel to the strings, a first pole piece comprising a plate having one face abutting one pole of the magnet and extending toward the strings so that one edge of the plate extends transversely of the strings and is laterally spaced from the strings, a second pole piece comprising an L-shaped plate with one leg of the L having its face abutting the other pole of the magnet, the other leg of the L extending substantially parallel to the strings from the side of said one leg which is remote from the strings, and coil means mounted on the face of said other leg and extending toward the strings but laterally spaced therefrom.

2. In a stringed instrument having a plurality of steel strings and bridge means supporting the strings and determining the effective lengths thereof, a pickup device mounted under the strings and spaced from said bridge means intermediate the effective length of the strings, said pickup device comprising a block-shaped magnet positioned such that an axial line through its poles extends substantially parallel to the strings, a first pole piece comprising a plate having one face abutting one pole of the magnet and extending edgewise toward the strings with its upper edge spaced from the strings, a second pole piece comprising an L-shaped plate with one leg of the L having its face abutting the other pole of the magnet, the other leg of the L extending substantially parallel to the strings from the lower edge of said one leg, a coil mounted on the upper face of said other leg and extending transversely of the strings, and a plurality of core members, one for each string, mounted in said other leg and extending upwardly through said coil toward but in spaced relation to said strings.

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