Nov. 11, 1941. C. W. RUSSELL 2,262,335

MUSICAL INSTRUMENT

Filed July 21, 1939 3 Sheets-Sheet 1

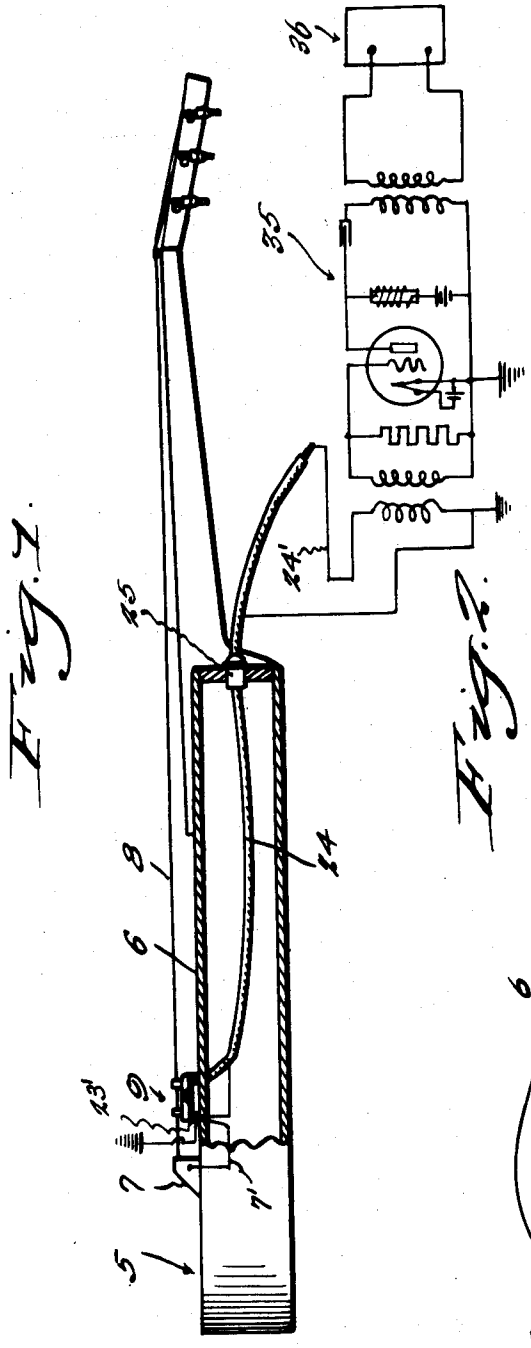


Fig. 1.

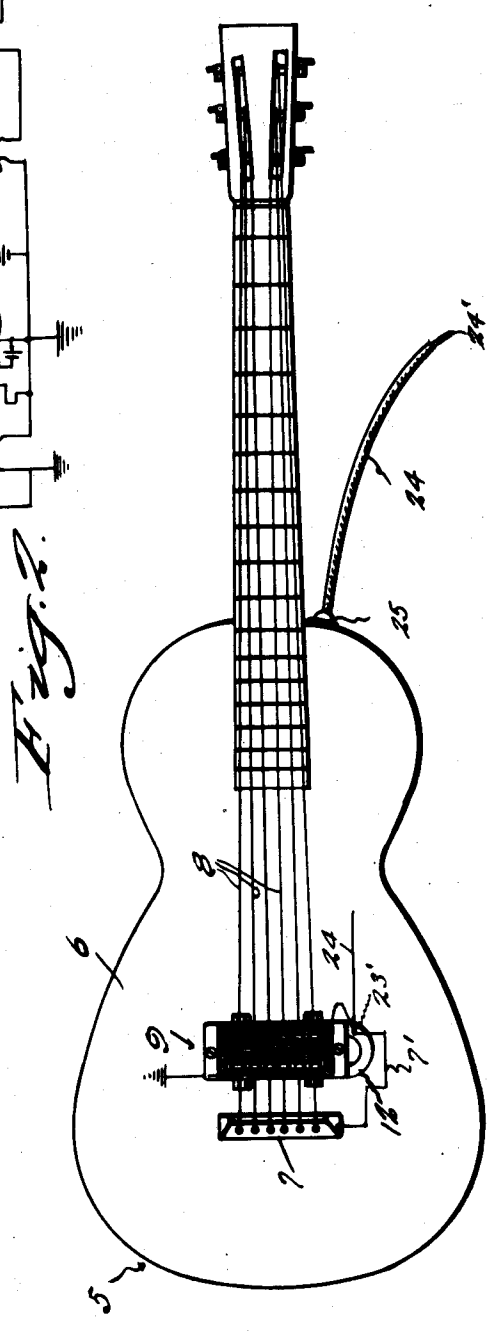


Fig. 2.

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MUSICAL INSTRUMENT

Filed July 21, 1939 3 Sheets-Sheet 2

Fig. 6.

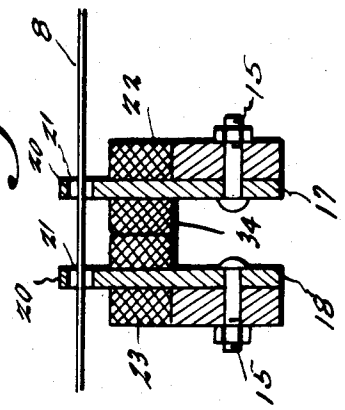


Fig. 5.

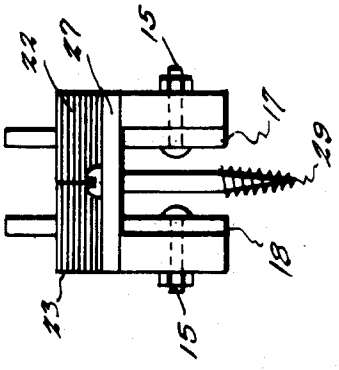


Fig. 3.

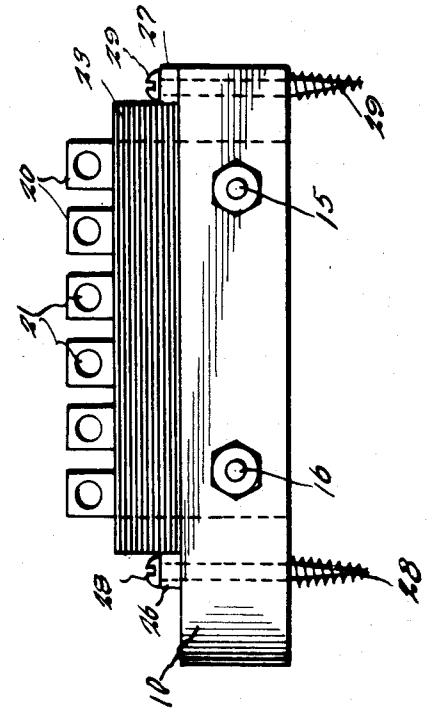


Fig. 7.

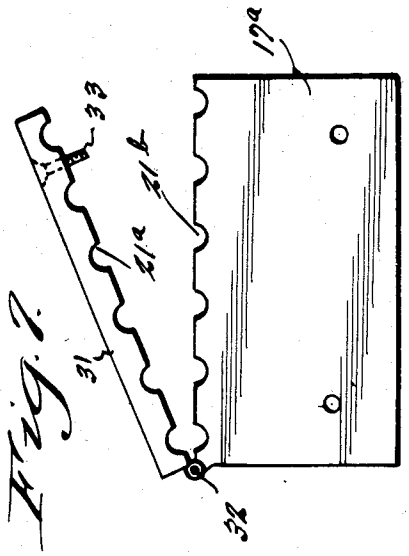
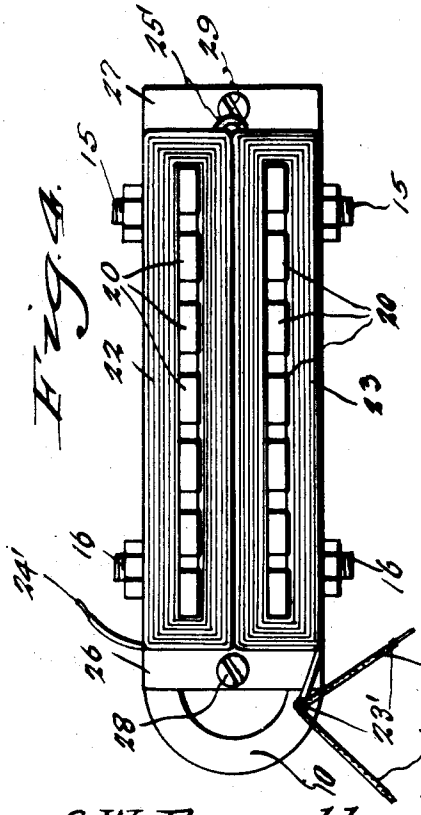


Fig. 4.



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MUSICAL INSTRUMENT

Filed July 21, 1939 3 Sheets-Sheet 3

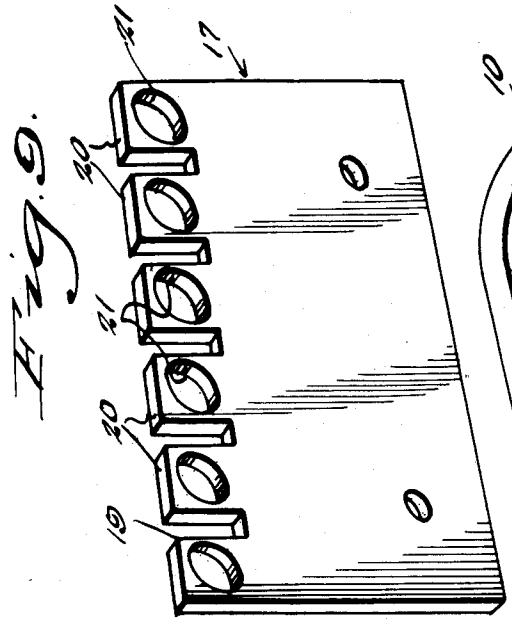


Fig. 9.

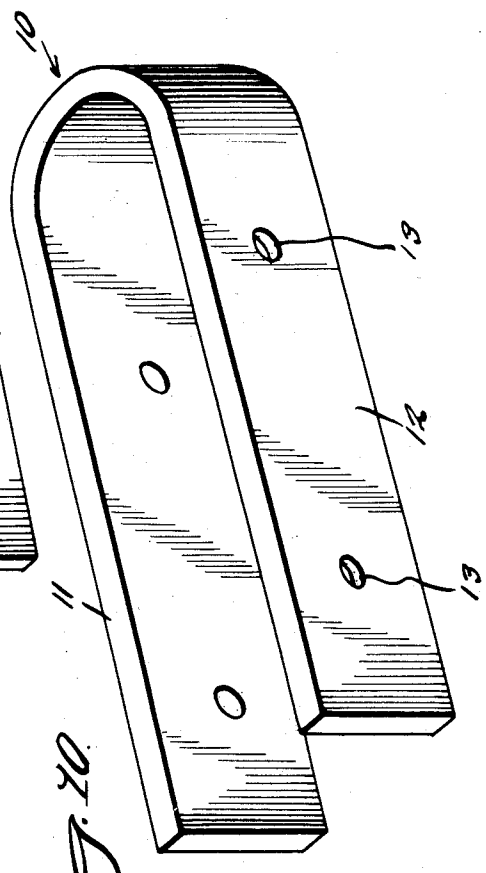


Fig. 10.

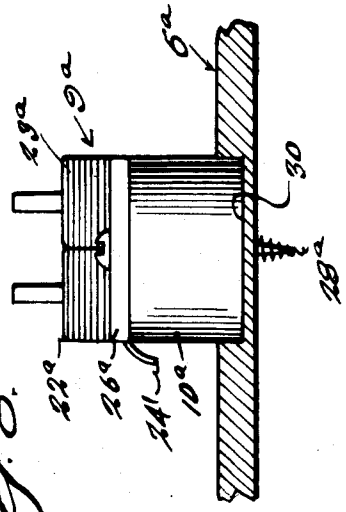


Fig. 8.

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UNITED STATES PATENT OFFICE

2,262,335

MUSICAL INSTRUMENT

Clarence W. Russell, Longton, Kans.

Application July 21, 1939, Serial No. 285,773

6 Claims. (Cl. 84—1.15)

My invention relates generally to stringed musical instruments, and particularly to instruments of this type which involve an inductive electrical pick-up unit arranged to operate a reproduction device at a distance from the instrument, and an important object of my invention is to provide arrangements of this type whose operation is characterized by absence of tone distortion and by uniformity in tone volume, and wherein accurate reproduction of the music evolved by vibrating the different strings of the instrument in the course of playing upon the same is assured.

Another important object of my invention is to provide arrangements of the character stated above wherein the pick-up unit associated with the strings of the instrument is devised to enable the reproduction unit to reproduce equal volume regardless of the difference in diameter, vibration frequency, and amplitude of the string or strings, and regardless of the different planes in which the string or strings are vibrated.

Other important objects and advantages of my invention will be apparent from a reading of the following description taken in connection with the drawings wherein for purposes of illustration I have shown preferred embodiments of my invention.

In the drawings:

Figure 1 is a longitudinal sectional and side elevational view of a stringed musical instrument showing the incorporation therein of a pick-up and amplifying unit in accordance with the present invention.

Figure 2 is a top plan view of Figure 1.

Figure 3 is an enlarged side elevational view of the pick-up unit removed from the instrument.

Figure 4 is a top plan view of Figure 3.

Figure 5 is a right hand end elevational view of Figure 3.

Figure 6 is a transverse vertical sectional view taken through the pick-up unit alongside of one of the strings of the instrument and showing the strings centered in the corresponding openings of the pole pieces.

Figure 7 is a side elevational view of an alternate form of pole piece.

Figure 8 is a left hand end elevational view of a pick-up unit showing the same mounted in a depression in the sounding board of the instrument instead of flush therewith as in the embodiment illustrated in Figure 1.

Figure 9 is a perspective view of one of the pole pieces of the embodiment shown in Figures 3 to 6, inclusive.

Figure 10 is a perspective view of the permanent magnet of the pick-up unit.

Referring in detail to the drawings, the numeral 5 generally designates a suitably illustrative type of stringed musical instrument such as a guitar, the same having the sounding board 6, the bridge 7, and the steel strings 8 strung from the bridge, the sounding board being devoid of the usual sound opening. Located inwardly of the bridge 7 and in a position functionally related to that of the usual sound hole is the pick-up unit 9.

The pick-up unit 9 comprises a U-shaped permanent magnet 10 formed of flat rectangular cross section steel with the straight legs 11 and 12 thereof each formed with a pair of assembling bolt holes 13, 14 through which the assembling bolts 15, 16 pass. The respective assembling bolts pass also through respective pole plates 17, 18 which are thereby clamped directly against the inner surfaces of the respective magnet legs.

The pole plates 17, 18 each comprise, as shown in Figure 9, a generally rectangular magnetically permeable plate having its upper edge castellated by the presence of slots 19 defining individual pole-pieces 20 corresponding in number to the number of magnetically permeable steel strings 8 possessed by the instrument. Each pole-piece is formed with a circular opening 21 through which the corresponding string passes, each particular opening 21 being positioned so that while the corresponding string passing therethrough is at rest the string will lie exactly in the axial center of the opening thereby providing for equalized magnetic cooperation between the steel string and the pole-piece no matter in what direction or plane the string may be vibrating, since in this arrangement the string cuts equally as many lines of force in any direction of vibration and while vibrating freely will approach the opposite sides of the opening at equally spaced distances therefrom.

The sizes of the openings 21 are not all the same, but these openings are gauged as to size or diameter so that their strings will not touch their sides when vibrated and so that the magnetic effect of each steel string on the corresponding pole-pieces of the permanent magnet is the same regardless of the diameter of the strings and the amplitude and frequency of their vibration. In this way equalized volume reproduction is assured for the different strings by the reproduction device (not shown) which the pick-up unit is to control through the medium of a suitable amplifying means such as that shown.

As shown in the drawings each pole-plate is mounted to its leg of the permanent magnet 10 with its lower edge substantially flush with the lower edge of the magnet and with the upper part of the pole-plates projecting above the magnet and surrounded below the pole-pieces with horizontally wound coils 22, 23, respectively, which have one end grounded to the magnet at 23' and the remaining end 24' led out of the instrument by an insulated conduit 24 passing under the sounding board and out through a convenient opening in the side wall of the instrument protected by a grommet 25. The coils are connected as indicated at 25' in series aiding relation producing in effect one coil having one end thereof grounded to the magnet. A dielectric spacer 34 traversed by the wood screws 28, 29 may be used between the pole-plates.

On the upper edges of the legs of the magnet at the opposite ends of the coils 22, 23 are non-magnetic bars 26, 27 each centrally traversed by the respective wood screws 28, 29 which anchor the pick-up unit operatively in place on the sounding board 6, either on the top surface of the sounding board as shown in Figure 1 or in an accommodating depression 30 formed in the top of the sounding board, the latter arrangement being called for in the case of an instrument having low-lying strings. Assembled as described the paired castellations on the opposed pole-pieces having their similarly sized openings 21 axially aligned with the corresponding strings 8. The bight of the permanent magnet is preferably placed adjacent the small or treble strings of the instrument.

A form of pole-plate 17a shown in Figure 7 of the drawings permits installation and removal of the pick-up unit on the instrument without removing the strings thereof. This pole-plate 17a has a portion of its upper edge cut off to provide the hinged bar 31 which has the hinge connection 32 to one end of the plate, and the lower edge of this bar is formed with the required member and sizes of semi-circular openings 21a to complement similar openings 21b formed in the upper edge of the plate. A clamping screw 33 carried by the bar 31 is arranged to be turned into the upper edge of the said plate to lock the bar 31 in place, after the strings 8 have been positioned in the openings. The pole-plates 17a may be substituted for the pole-plates 17 and 18 where desired.

The coil of the pick-up unit 9, the steel strings 8, the frame of the pick-up unit, and the chassis of the amplifier, generally designated 35, have a common ground. That is to say, the shield 24 over the amplifier lead 24', which is electrically and mechanically connected to the chassis of the amplifier 35, is electrically connected to the magnet of the pick-up unit which is connected to one end of the series aiding coils, and also connected to the steel strings 8 by connection with the steel bridge 7 over which the strings 8 rest. This grounding arrangement is made to keep stray induction and noise frequencies away from the pick-up unit. The amplifier operates a suitable reproducer 36 such as a loudspeaker.

The lead 24' is covered by and insulated from a flexible metal shield 24, which shield is the ground lead to the amplifier and attached to the amplifier chassis at one end. The remaining end of the lead 24 is connected to the frame of the pick-up unit at 23'. The metal bridge 7 to which the strings 8 are attached is connected by a suitable electrical conductor to the point 23'.

Although I have shown and described herein preferred embodiments of my invention, it is to be definitely understood that I do not desire to limit the application of the invention thereto, and any change or changes may be made in the materials, and in the structure and arrangement of the parts, within the spirit of the invention and the scope of the subjoined claims.

Having described the invention, what is claimed as new is:

1. An electrical pick-up unit of the character described, said unit comprising a U-shaped permanent magnet having substantially straight legs, a pole piece secured to the inner side of and projecting beyond one edge of each leg, a longitudinally wound coil on the projecting part of each pole piece, each projecting part comprising a magnetically permeable bar hinged at one end of the upper edge of the body of the projecting part, the lower edge of said bar and the said upper edge being formed with complementary semi-circular apertures, to define string accommodating openings while the bar is in closed position.

2. In a musical instrument having magnetizable vibratory strings arranged in side by side relation, an electrical pick-up unit, said unit comprising a permanent magnet characterized by pole-plates arranged across and longitudinally spaced along the strings, each pole-plates having thereon portions formed with string accommodating holes, the holes in the said portions being axially aligned and arranged to receive the corresponding strings in concentrically spaced arrangement while the strings are at rest, the said holes being circular and proportioned in diameter in accordance with the size and amplitude of vibration of the individual strings.

3. In a musical instrument having magnetizable vibratory strings arranged in side by side relation, an electrical pick-up unit, said unit comprising a permanent magnet characterized by pole-plates arranged across and longitudinally spaced along the strings, each pole-plates having thereon portions formed with string accommodating holes, the holes in the said portions being axially aligned and arranged to receive the corresponding strings in concentrically spaced arrangement while the strings are at rest, the said holes being circular and proportioned in diameter in accordance with the size and amplitude of vibration of the individual strings and connected inductive windings on said portions.

4. In a musical instrument, a plurality of magnetizable strings arranged in side by side spaced relation, an electrical pick-up unit comprising a horse-shoe permanent magnet having two substantially parallelly spaced legs, said legs being substantially equally spaced from one side of said plurality of strings, said legs extending transversely with respect to the length of the strings, individual pole-pieces spaced along each leg of the magnet and corresponding in number to the number of strings, said pole-pieces projecting from the legs of the magnet in the direction of the strings and being aligned in pairs with respect to the individual strings, the pole-pieces of each pair being formed with string accommodating openings whereby each string passes through the openings in two pole-pieces of opposite magnetic polarity.

5. In a musical instrument, a plurality of magnetizable strings arranged in side by side spaced relation, an electrical pick-up unit comprising a

horse-shoe permanent magnet having two substantially parallelly spaced legs, said legs being substantially equally spaced from one side of said plurality of strings, said legs extending transversely with respect to the length of the strings, individual pole-pieces spaced along each leg of the magnet and corresponding in number to the number of strings, said pole-pieces projecting from the legs of the magnet in the direction of the strings and being aligned in pairs with respect to the individual strings, the pole-pieces of each pair being formed with string accommodating openings whereby each string passes through the openings in two pole-pieces of opposite magnetic polarity, the openings in the paired pole-pieces being circular and concentric with respect to the string extending therethrough while the string is at rest, the diameters of the openings being proportioned to the diameter of the strings and the amplitude of their vibrations.

6. In a musical instrument a plurality of magnetizable strings arranged in side by side spaced relation, an electrical pick-up unit comprising a horse-shoe permanent magnet having two substantially parallely spaced legs, said legs being substantially equally spaced from one side of said plurality of strings, said legs extending transversely with respect to the length of the strings, individual pole-pieces spaced along each leg of the magnet and corresponding in number to the number of strings, said pole-pieces projecting from the legs of the magnet in the direction of the strings and being aligned in pairs with respect to the individual strings, the pole-pieces of each pair being formed with string accommodating openings whereby each string passes through the openings in two pole-pieces of opposite magnetic polarity, a magnetizable pole-plate secured to each leg of the magnet and structurally and magnetically connecting the corresponding pole-pieces to the legs of the magnet, and a coil wound around each of said pole-plates between the related pole-pieces and the related magnet leg.

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