May 31, 1960 J. T. KUNZ 2,938,420

PICKUPS FOR ELECTRICAL MUSICAL INSTRUMENT

Filed May 5, 1958

Fig. 1

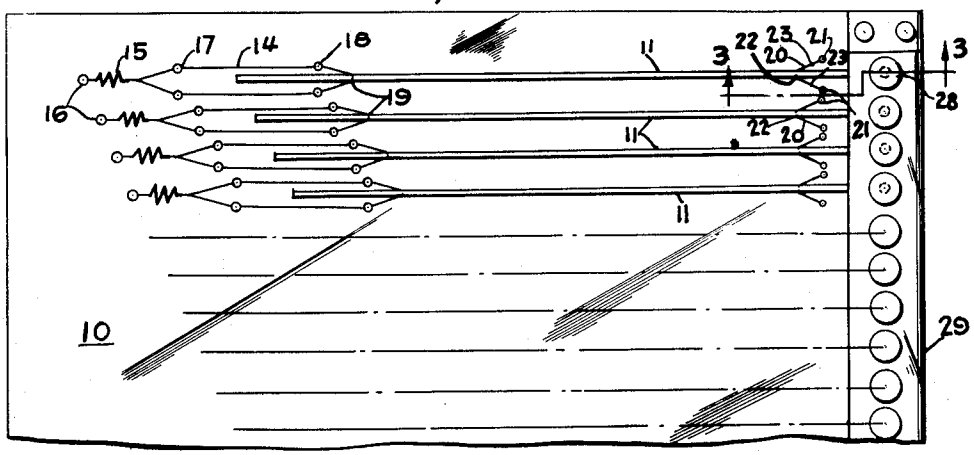


Fig. 3

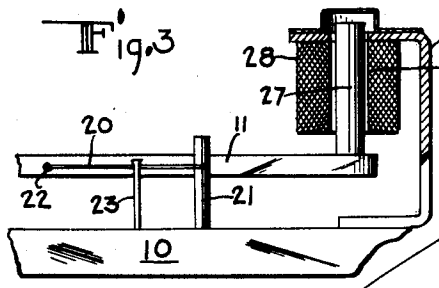


Fig. 2

Fig. 5

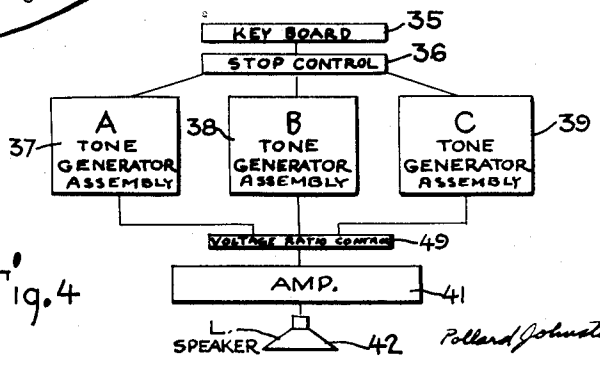


Fig. 4

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PICKUPS FOR ELECTRICAL MUSICAL INSTRUMENT

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4 Claims. (Cl. 84—1.15)

This invention relates to electronic musical instruments and particularly to a transducer means for converting mechanical vibrations into electrical vibrations, especially in bell-like tone instruments.

Various types of tone generators have been used in electric music instruments, such as bars or rods for generating vibrations when struck. Mechanical-electrical pickups or transducers have been used for translating the vibrations, the electrical vibrations being amplified, modified as needed, and then reproduced by a loud speaker so as to provide the desired resultant notes or sound sensations heard by the listener. The instruments involved herein have been found particularly useful for producing bell tones, such as those of a cup-shaped or campaniform bell tone. Various types of transducers have been used in the past, such as those known as the capacitance type and the magnetic reluctance type.

One of the objects of the invention is to provide an efficient transducer which will convert more of the mechanical energy than prior arrangements.

Another object of the invention is to provide a transducer which is relatively insensitive to large variations in position between the armature and pickup coil.

A still further object is to provide a transducer in which there are no electrical connections between the armature and the pickup coil.

In one aspect of the invention, a magnetic armature is arranged to be moved by a vibrator relative to a non-magnetic coil, the magnetic flux of the armature cutting the turns of the coil as it is moved relative thereto. As a result, a signal is produced which can be fed to the voltage ratio and filter circuits of an amplifier, the amplifier in turn being connected to a loud speaker for producing the resultant musical notes. In a preferred form, the armature is placed adjacent the end of the vibrating bar and is mounted so that the axis of the armature will be parallel or substantially parallel to the direction in which the rod vibrates. The magnetic coil is held stationary and the armature moves therein, the armature preferably passing completely through the coil so that the amplitude of the coil induced voltage will be insensitive to armature position within the coil. The armature should be acoustically integral with the rod. The pickup can be used for various purposes such as on fixed-free rods or on free-free rods as described in applicant's copending application Serial No. 733,101 filed May 5, 1958.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

Fig. 1 is a plan view of one form of assembly of tone generators with which the invention can be used.

Fig. 2 is a fragmentary perspective view of one of the tone generators of Fig. 1.

Fig. 3 is a fragmentary enlarged sectional view taken along the lines 3—3 of Fig. 1.

Fig. 4 is a schematic showing of one combination in which the invention can be used.

Fig. 5 is a modified form of the invention.

The transducer can be used with various types of tone generators, but it will be described herein in conjunction with a free-free rod such as described in the aforementioned copending application Serial No. 733,101.

Base 10 has a plurality of rods 11, 11 comprising the tone generators of the assembly. Suspensions for the rods are located adjacent either end so as to exert force along the axis of the rods. Flexible string or thread 14 for each rod can be attached at one end to a spring 15, the other end of the spring being carried by a post 16. Thread 14 is supported freely in guide posts 17, 18 and can be attached to the rod at 19. The opposite end of a rod can be carried by flexible thread 20 fastened to posts 21 and to the rods at 22. Damping pins 23 can be provided for frictionally engaging thread 20 so as to provide the desired low frequency movement damping.

A permanent magnet armature 27 can be fastened to the rods, armature 27 preferably being made acoustically integral with the rod. The armature should be made of a high permeability magnetic material such as that sold under the name "Alnico." Non-magnetic coil 28 can be supported in bracket 29 (Fig. 3) mounted on base 10 of the assembly. The coil has an aperture 30 therethrough for receiving in juxtapositioned relationship, armature 27. The armature preferably is made of such a length that it passes clear through the coil. When such is the case, the amplitude of the coil induced voltage will be insensitive to armature position within the coil.

When the vibrator is struck or activated by a striker, such as 47, the armature will move relative to the non-magnetic coil so that the magnetic flux thereof will cut the turns of wire of the coil and set up a voltage therein in accordance with relative movement therebetween. The only energy required is that needed to cut the lines of force and thus there is no force on the rod or coil. It should also be apparent that the arrangement will be insensitive to relatively large variations between the armature and coil.

As an example of the manner in which the invention can be used in conjunction with a bell carillon or the like, Fig. 4 schematically shows a keyboard at 35 which may have keys for each of the notes of the scale. Connections can be made through the stop control 36 and the various assemblies of tone generators at 37, 38 and 39. Each assembly may have rods and striker means for producing various combinations of partials. The voltage generated from the various pickups can be connected through adjustable filter and voltage circuit means 49 to amplifier 41. Amplifier 41 in turn is connected to loud speaker means 42.

An alternative form of pickup is seen in Fig. 5 wherein rod 11 has armatures 43 and 44 extending from either side thereof through non-magnetic coils 45, 46. The coils can be suitably connected to the amplifier circuits.

It is to be understood that variations may be made in details of construction without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. An electric music instrument tone generator including base means and a vibrator mounted thereon, permanent magnet armature means mounted on said vibrator, said armature means having magnetic flux associated therewith, a non-magnetic electric coil juxtapositioned relative to said armature means and fixedly mounted relative to said base means, circuit means for connecting said coil to said instrument for reproducing of said vibra-

tor therein, and strike means operable to strike said vibrator for setting the same into vibration, the magnetic flux of said armature means moving relative to said coil when said vibrator is set into vibration to generate a voltage in said coil and circuit means in accordance with the frequency and amplitude of movement of said coil means and armature means relative to each other.

2. In an electric music instrument tone generator, the combination including base means and a vibrator, a permanent magnet armature means acoustically integral with said vibrator, said armature means having magnetic flux associated therewith, non-magnetic electric coil means juxtapositioned relative to said armature means, and through which said armature means can move, means fixedly mounting said coil means relative to said base means, and vibrator activating means for setting said vibrator into vibration, the magnetic flux of said armature means moving relative to said coil means to generate a voltage in said coil means and circuit means in accordance with the frequency and amplitude of movement of said coil means and armature means relative to each other.

3. An electric music instrument tone generator including base means and a vibrator, permanent magnet armature means mounted on said vibrator and extending in opposite directions on either side thereof, said armature means having magnetic flux associated therewith, non-magnetic electric coil means on either side of said vibrator and in which said armature means can move, said coil means being fixedly mounted relative to said base means, circuit means for connecting said coil means to said instrument for reproducing vibrations thereof, and striker means actuatable to strike said vibrator for setting the same into vibration, the magnetic flux of said armature moving relative to said coil means when said vibrator is set into vibration to generate voltage in said coil means

and circuit means in accordance with the frequency and amplitude of movement of said coil means and armature means relative to each other.

4. In an electric music instrument tone generator, the combination including base means and a vibrator mounted thereon, a permanent magnet armature means acoustically integral with said vibrator, said armature means having magnetic flux associated therewith, non-magnetic electric coil means having an aperture therethrough and being juxtapositioned relative to said armature means, and through which said armature means can move, said armature means normally extending through said aperture, means fixedly mounting said coil means relative to said base means, and vibrator activating means for setting said vibrator into vibration, the magnetic flux of said armature means moving relative to said coil means to generate a voltage in said coil means and circuit means in accordance with the frequency and amplitude of movement of said coil means and armature means relative to each other.

References Cited in the file of this patent

UNITED STATES PATENTS

788,484	Lyon	Apr. 25, 1905
1,543,124	Ricker	June 23, 1925
2,273,333	Schluter	Feb. 17, 1942
2,301,871	Hanert	Nov. 10, 1942
2,413,062	Miessner	Dec. 24, 1946
2,492,919	Hings	Dec. 27, 1949
2,588,295	Rowe	Mar. 4, 1952
2,606,474	Kunz	Aug. 12, 1952
2,655,069	Marshall	Oct. 13, 1953
2,703,504	Rowe	Mar. 8, 1955
2,754,434	Frank	July 10,1956
2,799,196	Alvarez	July 16, 1957