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ELECTRICAL MUSICAL INSTRUMENT

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FIG. 1.

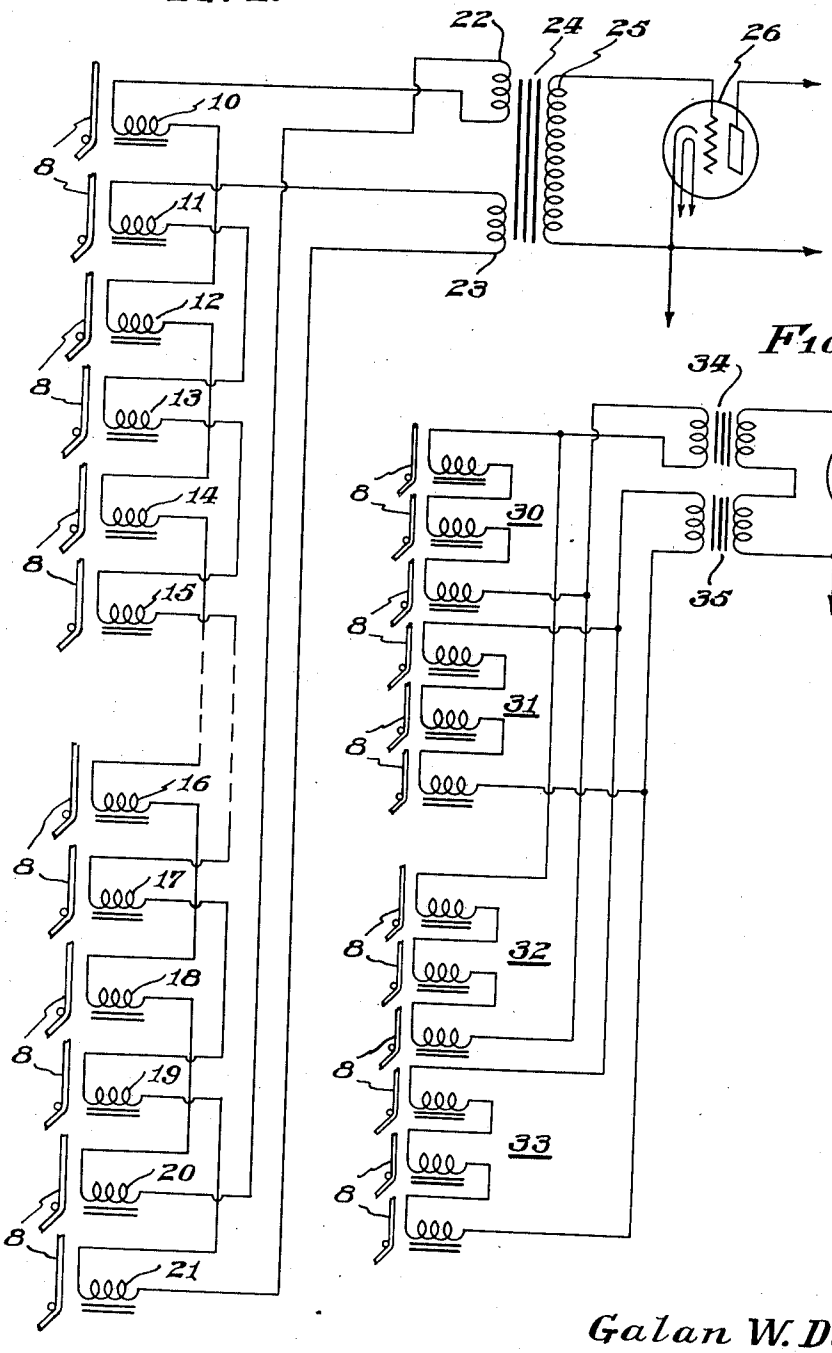


FIG. 2.

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ELECTRICAL MUSICAL INSTRUMENT

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This invention relates to electric musical instruments and more particularly to instruments of the piano type, although the invention is sufficiently broad to be applicable to electric organs and analogous apparatus.

In the construction of the electric pianos having pick-ups adjacent strings for each note, there is a tendency for the pickups to be affected by extraneous electrical impulses. When electromagnetic pickups are used, stray magnetic fields may be picked up, as, for example, from power transformers, thereby producing a hum. Likewise, in the case of electrostatic pickups, electrostatic fields are picked up, producing either hum or clicks and similar objectionable noises.

In order to avoid these objectionable effects it has heretofore been proposed to connect alternate pickups in opposite phase. In the case of electromagnetic pickups, this may be accomplished in either of two ways, either by reversing the direction of the winding or of its connections on alternate pickups, or by reversing the polarity of the polarizing magnets. If the polarity of the polarizing magnets is reversed, there is a tendency toward interference between the opposed magnetic fields in adjacent strings or groups of strings corresponding to the several notes, and this, in turn, produces a lack of uniformity of response of the instrument to the several notes. If the pickup windings are wound in opposite directions, or if they are oppositely connected, the lack of uniformity is very serious in assembling the apparatus. In the case of oppositely wound coils, extreme care must be exercised to be sure that the coils are properly located and, in the case of opposite connections, corresponding care must be taken to be sure that the connections are reversed on the alternate coils. In either case, an error in a single coil may throw the instrument badly out of balance and require a careful checking of the connection or polarity of every coil in the instrument to locate the trouble.

In a piano constructed in accordance with my invention, alternate pickups are connected together and are connected in exactly similar fashion to one transformer winding, while the intermediate pickups are likewise connected together in the same manner as the first group and are connected in reverse fashion to a second transformer winding. This arrangement causes any stray currents arising in the pickups to be cancelled in the transformer and, at the same time, permits identical construction and connection of all the pickups, thereby simplifying construction and assembly. In an alternative form of the invention, the pickups may be connected together in groups, there being the same number of pickups in each group and then alternate groups may be connected together to one transformer winding while the intermediate groups are connected together and in a reverse manner to the other transformer winding. The analogous method of connection may be followed in the case of electrostatic pickups.

One object of my invention is to provide an improved electric musical instrument.

Another object of my invention is to provide an improved electric piano which is free from extraneous noises.

Another object of my invention is to provide an improved method of connecting the pickups in an electric musical instrument to the output circuit.

Another object of my invention is to provide an improved electric piano which is inexpensive to fabricate and simple to assemble.

Other and incidental objects of my invention will be apparent to those skilled in the art from a reading of the following specification and an inspection of the accompanying drawing in which

Figure 1 is a schematic wiring diagram of one form of the invention, and

Figure 2 is a schematic wiring diagram of a second form of the invention.

Referring first to Fig. 1, the sound producing vibrators, whether they be strings, tuning forks or other equivalent members, are indicated generally at 8. These vibrators may be provided with any usual or appropriate mechanisms for setting them into vibration such as a piano action or the like, or they may be vibrated by striking them with hammers, as in a xylophone; or they may be the tone wheels or other equivalent elements of an electric organ, this portion of the construction per se forming no part of my invention.

The several pickups corresponding to the sequence of notes are indicated at 10 to 21, inclusive, and are placed in appropriate relation to the sound producing members so as to convert the vibrations thereof into electrical impulses. The even numbered pickups, such as 10, 12, 14, 16, 18 and 20, are connected together as shown, in this case being connected in series, and are connected to the transformer primary winding 22. The odd numbered pickups 11, 13, 15, 17, 19 and 21 are likewise connected in series and are connected to the transformer primary winding 23, but in the reverse direction to the connection of the even numbered pickups to the winding 22.

It will be apparent that either of these connections may be made in the reverse direction or the transformer winding may be correspondingly made. It will, likewise, be apparent that, instead of connecting the groups of pickups in series, they may be connected in parallel, although the series connection is somewhat more convenient for low impedance pickups.

Since each note affects only one pickup, the input to the transformer 24, and likewise the output therefrom, will not be affected by the reverse connection of the other pickups. If, however, a stray field should affect, for example, the pickups 10 and 11, the stray impulses would reach the transformer windings 22 and 23 in opposition and would cancel out, thereby producing no output in the transformer secondary 25 which is connected to the amplifier 26.

Since the stray magnetic field ordinarily affects quite a number of pickups in its vicinity, I find that the modification of the invention shown in Fig. 2 is quite satisfactory. In this case, a group of pickups 30 are connected together, and these are connected to a spaced group of pickups 32 which are similarly connected together, and these two groups are connected to the primary winding of the transformer 34. Likewise, the pickups 31 are connected together and are connected to the group of pickups 33 which are likewise connected together, and these groups of pickups are connected to the transformer 35. It will be noticed that the transformers 34 and 35 have their secondaries connected in series, thereby producing the same effect as the single transformer 24 in Fig. 1. It will be apparent that any stray magnetic field affecting the groups of pickups 30 and 31 will be cancelled out due to the reverse connections of the transformer primaries. Likewise, if the field affects only the adjacent pickups of the two groups, the same cancelling effect will be obtained.

The transformers 34 and 35 are connected to the amplifier 36 in the same manner as the transformer 24 is connected to the amplifier 26.

It will be apparent to those skilled in the art that my invention may be applied as readily to electrostatic pickups as to electromagnetic pickups, which has heretofore been difficult. All the electrostatic pickups in an electric musical instrument are ordinarily supplied with a polarizing voltage of the same sign, thereby making their connection in opposite phase difficult, if not impossible. By the use of my invention, the polarizing voltage on all the pickups may be of the same sign, but the alternate pickups may be connected to separate transformer windings in identically the same manner as with the inductive pickups shown and with a corresponding result.

It will also be apparent that I may substitute other equivalent transducing means for the transformer 24 or for the pair of transformers 34, 35, as, for example, appropriate vacuum tubes may be inserted instead of or in addition to the transformer, or known types of capacitance-resistance coupling may be substituted.

Having now described my invention, I claim:

1. An electrical musical instrument including a plurality of note producing means, a plurality of pickup means each only in cooperative relation with means for producing one note, an output circuit, a circuit connecting alternate pickup means to said output circuit in one sense, and a second circuit connecting the remaining pickup means to said output circuit in the opposite sense.

2. An electrical musical instrument including a plurality of note producing means, a plurality of groups of pickups each pickup only in cooperative relation with means for producing one note, means connecting alternate groups of said pickups to an output circuit in one sense, and additional means connecting the remaining groups of pickups to said output circuits in the opposite sense.

3. An electrical musical instrument including a plurality of note producing means, a plurality of pickup means each only in cooperative relation with means for producing one note, an output circuit, coupling means connecting alternate pickup means to said output circuit in one sense, and a second coupling means connecting the remaining pickup means to said output circuit in the opposite sense.

4. An electrical musical instrument including a plurality of note producing means, a plurality of groups of pickups each pickup only in cooperative relation with means for producing one note, coupling means connecting alternate groups of said pickups to an output circuit in one sense, and additional coupling means connecting the remaining groups of pickups to said output circuit in the opposite sense.

5. An electrical musical instrument including a plurality of note producing means, a plurality of pickup means each only in cooperative relation with means for producing one note, an output circuit, transducing means connecting alternate pickup means to said output circuit in one sense, and a second transducing means connecting the remaining pickup means to said output circuit in the opposite sense.

6. Apparatus of the class described including an output transformer, a plurality of pickups each only in cooperative relation with means for producing one note connected to a primary winding of said transformer, and a second similar group of pickups each only in cooperative relation with means for producing one note located between said first notes connected in the opposite sense to a second primary winding of the transformer.

7. Apparatus of the class described comprising a group of pickups each only in cooperative relation with means for producing one note inductively connected in one sense to an output circuit, and a second similar group of pickups each only in cooperative relation with means for producing one note inductively connected in the opposite sense to said output circuit.

8. Apparatus of the class described including an output transformer, a plurality of pickups each only in cooperative relation with means for producing one note connected to a primary winding of said transformer, and a second similar group of pickups each only in cooperative relation with means for producing one note connected in the opposite sense to a second primary winding of the transformer.

9. An electrical musical instrument including a plurality of note producing means, a plurality of pickup means each only in cooperative relation with means for producing one note, an output circuit, coupling means connecting alternate pickup means corresponding to alternate notes to said output circuit in one sense, and a second coupling means connecting the remaining pickup means corresponding to the intervening notes to said output circuit in the opposite sense.

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