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Honegger

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[54] **LADDER-LIKE ELECTRONIC MUSICAL INSTRUMENT**

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[52] **U.S. Cl.** **84/1.01**

[51] **Int. Cl.** **G10h 1/00**

[58] **Field of Search** ..... 84/1.01, 1.08, 423, 84/427, 428, 432, 433, 439, 442, 470; 35/5; 200/85 R; 272/60; 273/1 E

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Primary Examiner—Richard B. Wilkinson
Assistant Examiner—Stanley J. Witkowski

[57] **ABSTRACT**

Electronic music instrument with separate tone generators which are assigned to the various tones and which are energizable by contact switches or proximity switches. Geometric-type elements are arranged in a regular assembly departing from a keyboard. The elements are designed and arranged in a manner encouraging the use of the sense of touch. Each element is assigned to a particular tone and capable of triggering said contact switches or proximity switches, respectively. The elements may have the form of the rungs of a ladder, or the steps of a stairway, or of mosaic components of a flooring.

3 Claims, 4 Drawing Figures

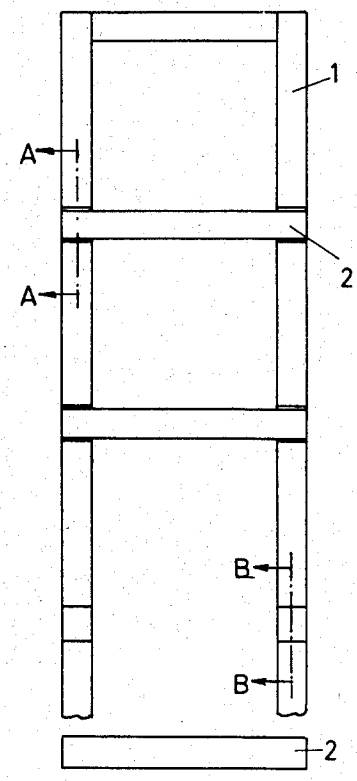


FIG.1

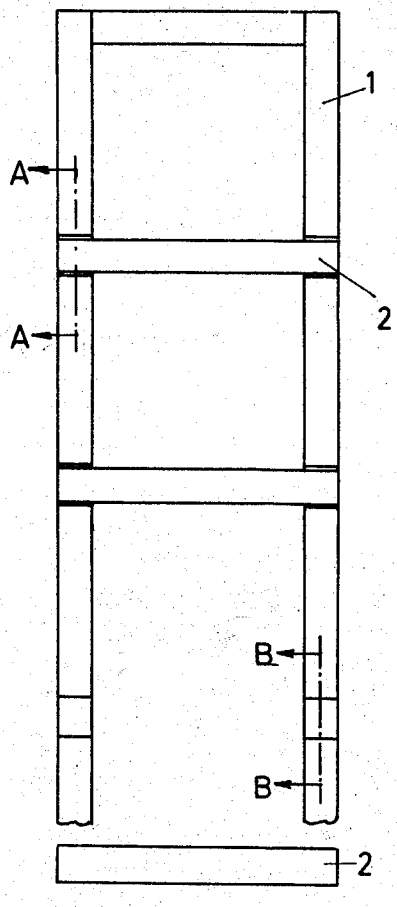


FIG.2

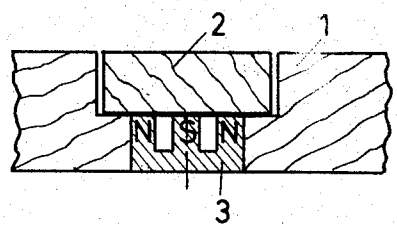


FIG.3

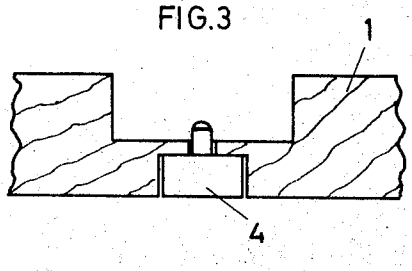
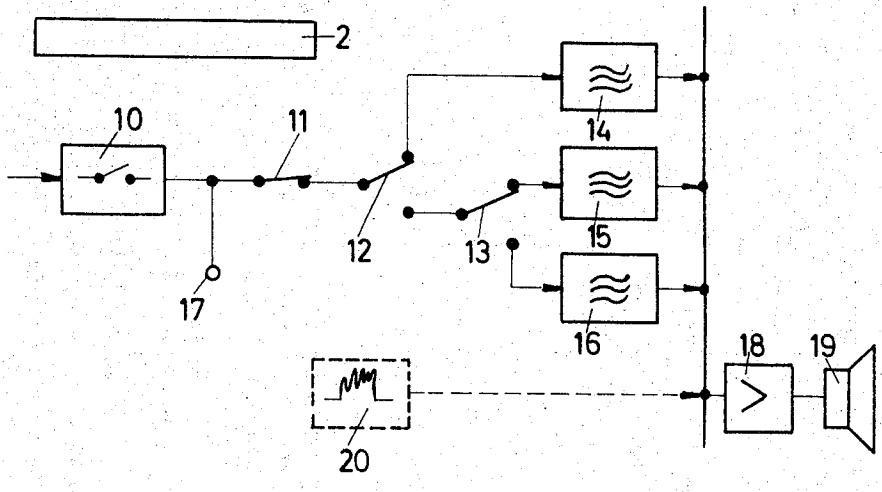


FIG.4



LADDER-LIKE ELECTRONIC MUSICAL INSTRUMENT

My copending patent application, Ser. No. 190,160, filed on Oct. 18, 1971, discloses an electronic music instrument in particular a sounding music board for music instruction, comprising conductor bars which are arranged below a writing surface, more particularly below and between the staff lines, and which are each assigned to a tone and connected to switching means for the purpose of energizing tone generators assigned to the various tones. The switching means in conjunction with the conductor bars have the form of capacitive proximity switches. Although such a music board is eminently suitable as a device for music instruction, its use is confined to cases in which the system of notation is already known to the students or is to be learnt by means of such a board.

For small children below school age, however, such a board is of little use. Nor does it appreciably help in musically accompanied rhythmics.

It is an object of the present invention to provide an electronic music instrument suitable for the music education of small children as well as for the performance of musically accompanied rhythmics.

According to one aspect of the invention the electronic instrument comprises separate tone generators which assigned to the various tones and which are energizable by contact switches or proximity switches, and it further comprises a regular assembly which consists of equal geometrical elements and which departs from a keyboard and whose elements are designed in a manner encouraging the use of the sense of touch and are each assigned to a particular tone and capable of triggering said contact switches or proximity switches.

It is thus possible to construct the assembly in various forms which are eminently suitable for music instruction and permit an astonishing learning performance to be achieved, even with small children.

In an especially advantageous version, the elements may be designed as the rungs of a ladder or as steps of a stairway. Instead, they may have the form of mosaic components of a flooring. In all cases, the simple geometrical form of the assembly emphasizes the relation between distances perceivable by the touch and the tone level differences, so that even the fundamentals of harmonics can be learnt with ease. Where the assembly takes a walkable form, such as stair or floor surfacings, the rhythmic instruction goes along with music instruction.

Another aspect of the invention consists in using the electronic music instrument in conjunction with a sound and/or picture storage device as an aid to music instruction. This presents entirely new perspectives for music instruction, notably in conjunction with audio-visual instruction methods.

Several embodiments of the invention are now to be described by way of example with reference to the accompanying drawings, in which

FIG. 1 shows a ladder with removable rungs which when touched or pressed trip the particular tones;

FIG. 2 shows a section along line A—A in FIG. 1;

FIG. 3 shows a section along line B—B in FIG. 1;

FIG. 4 shows the block diagram of the electric circuitry of an embodiment.

In the embodiment shown in FIG. 1, the ladder comprises a ladder frame 1 and several rungs 2. The rungs

are removable from the ladder frame and re-attachable thereto, and permanent magnets may perform the function of holders. FIG. 2 shows in section the fastening of a rung to the frame by means of a permanent magnet 3 which, in a preferred version, has the form of a pot magnet. Such magnets can be arranged on both sides of the ladder frame, so that the rungs are relatively firmly fastened to the frame. The ladder frame 1 is preferably made of wood or some other electrically non-conductive material, while the rungs 2 may be made of ferromagnetic material, for instance. Where permanent magnets are arranged on both sides of the ladder frame, at least one of each pair of magnets can be electrically connected to the input of a succeeding proximity switch. The rungs 2 then act as electrodes which when touched develop an input signal in the proximity switch owing to the person's body capacity increasing the effect of the space field, so that the particular tone generator is switched on.

Instead of proximity switches, it is possible to use direct contact switches. FIG. 3 shows an especially simple version in which a simple pressure switch 4 is imbedded in the ladder frame 1. The pressure switch may be designed in such a manner that slight pressure on the rung closes the actuating contact and thus energizes the particular tone generator. Instead of using a pressure switch, it is of course possible to employ some other type of switch, such as a magnetic switch or a reed relay. Again, it is also possible to use inductive or optoelectric switches.

FIG. 4 shows a block diagram representing the electric circuitry of the music instrument for one full tone with its upper and lower half-tones. The switching means comprise a proximity or contact switch 10 whose input is actuated by an element as described above, such as a ladder rung, and whose output acts by various manual switches 11, 12 and 13 to select a tone generator 14 for the full tone or one of two tone generators 15 and 16 for the lower and upper half-tones, respectively. The switch 11 serves to cut off all three tone generators, while the change-over switch 12 is designed alternatively to connect the full-tone generator 14 or either of the two half-tone generators. The change-over switch 13 serves to select the half-tone generator 15 or 16 required. Of course, such change-over switches can be dispensed with if the instrument is designed for one tonalty only.

Fitted into the line between the switch 10 and the tone generators is a terminal 17 designed for the connection together with other generators, such as generators of different tonality, or for the connection of another electronic music instrument, such as an organ. The terminal 17 can also be used to switch a signal lamp for tone indication, preferably with different colours identifying the various tones.

All tone generators are connected by a common busbar to an amplifier 18 which is followed by a speaker 19. The tone generators may be either known separate analogue generators or known digital devices operating by harmonic synthesis. To refine the sound pattern, it is possible to include a noise generator 20 which is designed for a specific noise spectrum and which superimposes an adjustable percentage of desirable distortion on the generally sinusoidal signal of the tone generators. The said noise generator can be used to simulate the wind effect of flutes or other wind instruments, for instance. The sound pattern thus produced is more

pleasing than that of the plain sinusoidal signal of the tone generators.

Instead of having the ladder shown in FIG. **1**, it is possible to arrange steps designed to trigger the switch **10**, as shown in FIG. **4**. In this case again, the switch may be designed in a variety of manners, the simplest version here being that of a resilient step acting on a pressure switch. Instead, the step may be fixed, but made of electrically conductive material or coated with such a material so as to form an interception electrode for an electronic proximity switch. When a person treads on the step, the space signal received by the proximity switch is appreciably amplified by the increase in electrode surface due to the person's body capacity, so that the switch is triggered which energizes the particular tone generator.

Finally it is also possible to arrange floor tiles in a specific pattern with suitable switches and electrodes capable of triggering proximity switches.

While the first two embodiments mentioned are mainly suited for the music instruction of small children, the third embodiment, in which various tone generators selected by the switches **12** and **13** according to the tone desired are energized by a person stepping on various floor tiles is preferably intended for ballet or rhythmic instruction. However, the feature common to all embodiments is that their simple and regular geometrical form encourages the touching of the various elements or the stepping thereon, so that various tones and even melodies can be sounded according to the selection of the elements.

Such an instrumnt is eminently suitable as an aid to audiovisual instruction and programmed courses using sound and/or picture storage devices. Within an expanded instruction system, it is also possible to connect such instruments to computer-assisted programmed teaching devices.

Of course, the choice of the geometrical form in which the elements are arranged is not confined to the embodiments described.

The form most suitable from the teaching aspect can be chosen according to the exact purpose or the age of the persons to be instructed.

To assist learning capacity, the elements can be colour-coded, preferably with different colours identifying different tones.

What is claimed is:

1. An electronic musical instrument in the form of a ladder-like structure comprising, in combination, a pair of side members produced from electrically non-conductive material, said side members being provided with substantially uniformly spaced securing means disposed in transversely aligned pairs; a removable rung received in each pair of said securing means, said rung being produced from ferro-magnetic material and at least one of each pair of spaced securing means including a magnet retaining the associated rung in mounted position; a plurality of tone generators, each of which is assigned to a different tone, at least one tone generator being provided for each rung; and separate electrical switch means associated with each rung and having electrical connection with an associated tone generator whereby said tone generator is switched on responsive to a signal received from its associated rung.

2. An electrical musical instrument as set forth in claim **1** including a amplifier and a speaker, all of the tone generators being electrically connected to the amplifier through a common busbar and the musical tones produced are audible through said speaker.

3. An electronic musical instrument as set forth in claim **1** wherein said electrical switch means are capacitive proximity switches.

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