United States Patent

[11] **3,598,890**

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[33] **Japan**
[31] **43/53404**

[54] **ELECTRONIC MUSICAL INSTRUMENT WITH MAGNETO-SENSITIVE ELEMENTS AND MOVABLE PERMANENT MAGNET PROVIDING GLISSANDO**

10 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **84/1.17,** 84/1.24, 335/206
[51] **Int. Cl.** **G10h 1/02,** G10c 3/20
[50] **Field of Search** ..... 84/1.01, 1.04, 1.09, 1.1, 1.14, 1.15, 1.17, 1.24, 1.26, DIG. 7, DIG. 8, DIG. 23; 335/206

[56] **References Cited**

UNITED STATES PATENTS

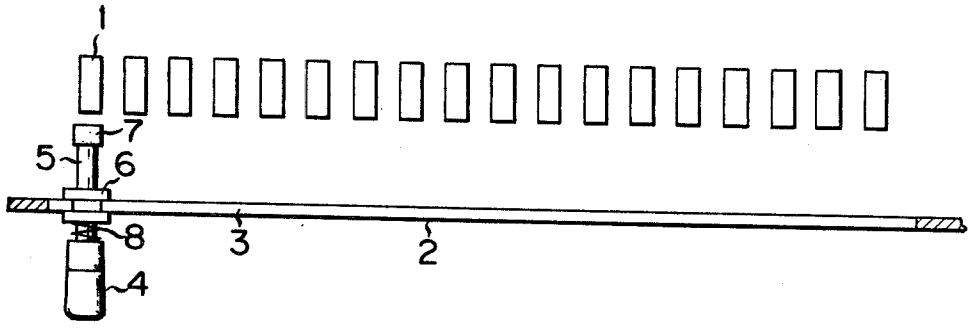
3,524,375	8/1970	Hopping	84/1.26 X
3,533,029	10/1970	Steinbach et al.	335/206
3,546,353	12/1970	Jenny	84/1.01
3,353,030	11/1967	Michel	84/1.01 X

OTHER REFERENCES

D. E. Eastwood, " Selector Switch," IBM Technical Disclosure Bulletin, Vol. 8 No. 8, January 1966, p. 1034

Primary Examiner—D. F. Duggan
Assistant Examiner—Stanley J. Witkowski
Attorney—Flynn and Frishauf

ABSTRACT: A device producing a glissando effect includes a plurality of magneto-sensitive elements arranged in a row in accordance with the respective notes of a musical scale. A permanent magnet is movable along the row of magneto-sensitive elements so as to energize the corresponding elements by its displacement to produce musical notes, the movement of the magnet being controllable at the control panel of the electronic musical instrument.



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SHEET 1 OF 3

FIG. 1

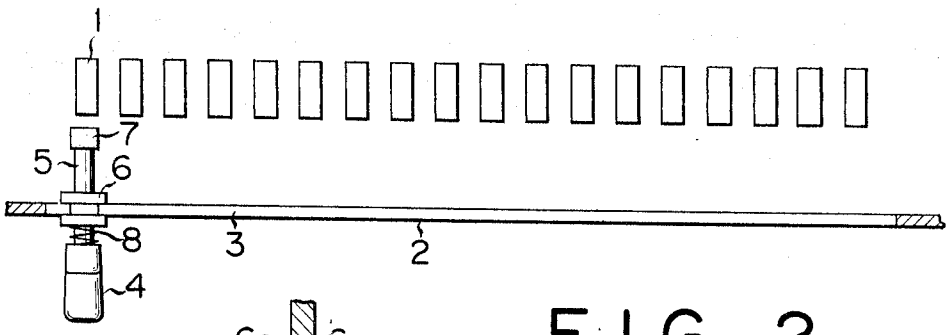


FIG. 2

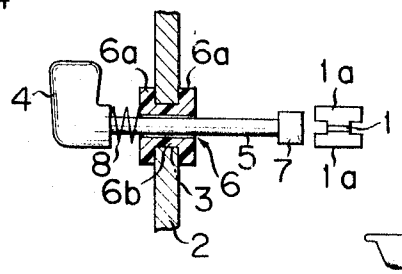
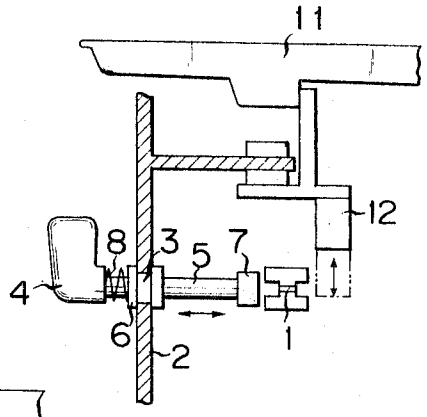


FIG. 3



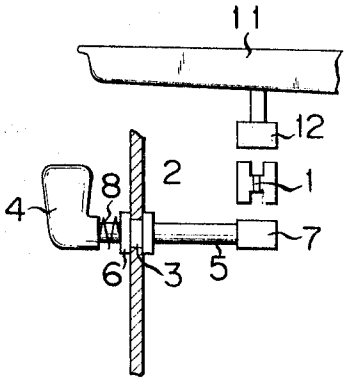


FIG. 4

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Attys

FIG. 5

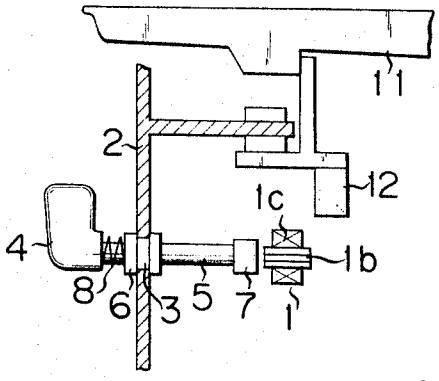


FIG. 6

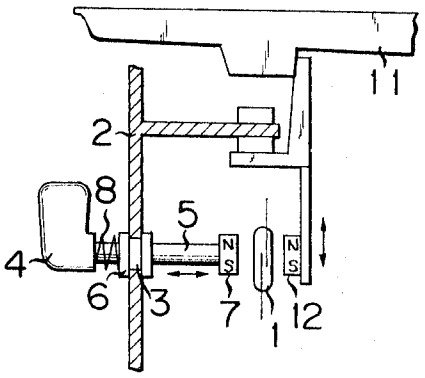
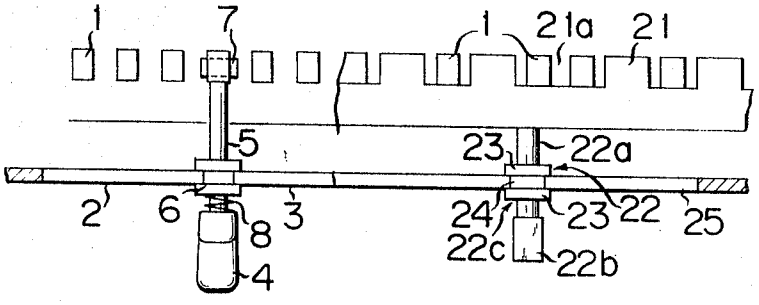


FIG. 7



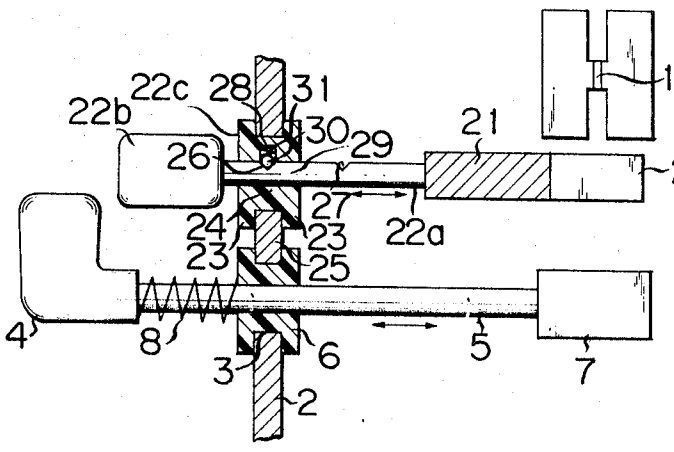


FIG. 8

FIG. 9

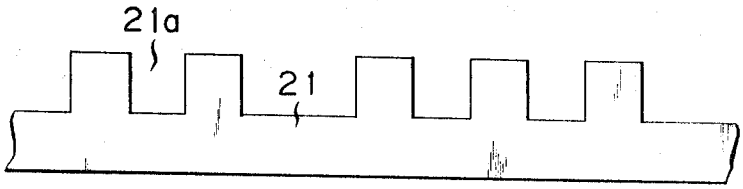


FIG. 10

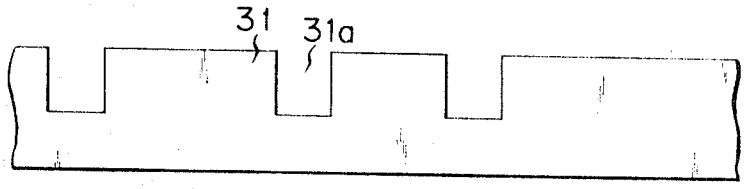


FIG. 11

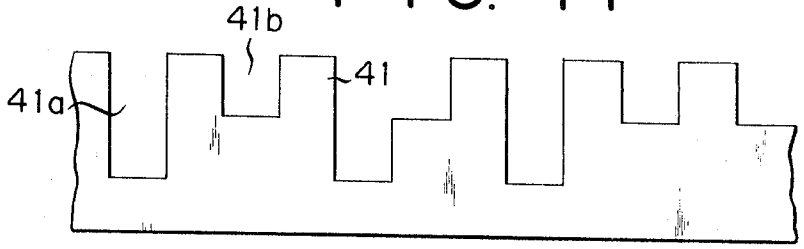
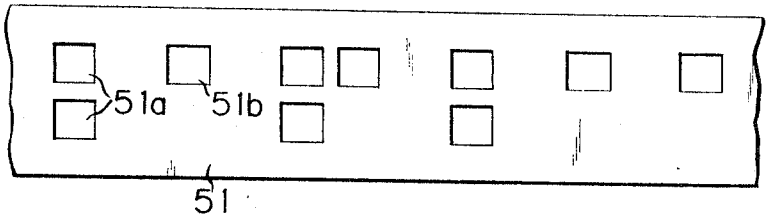


FIG. 12



ELECTRONIC MUSICAL INSTRUMENT WITH MAGNETO-SENSITIVE ELEMENTS AND MOVABLE PERMANENT MAGNET PROVIDING GLISSANDO

BACKGROUND OF THE INVENTION

This invention relates to a device for producing a glissando effect for an electronic musical instrument.

The prior art electronic musical instrument can perform a glissando effect only by producing tones in rapid succession on the keyboard. Essentially, however, the conventional glissando performance is nothing but an imitation type and yet requires the same advanced techniques as are used in the similar performance of a piano. Moreover, the electronic musical instrument of a general type involves a plurality of mechanical switching devices arranged in accordance with the respective key members, with the result that such glissando performance unavoidably results in great click noises.

An object of this invention is to provide a device for producing a glissando effect for an electronic musical instrument so improved as to permit an easy, smooth and exact operation without use of key members.

Another object of this invention is to provide a device for producing a glissando effect for an electronic musical instrument so improved as to permit an easy, smooth and exact operation without generating click noises.

SUMMARY OF THE INVENTION

According to one aspect of this invention, a device for producing a glissando effect comprises a plurality of magneto-sensitive elements arranged in a row in accordance with a prescribed order of musical notes, each of the elements being magnetically controlled to make the corresponding tone to sound when energized. A permanent magnet is movable along the arrangement of elements so as to energize elements by its displacement, and a controller is connected with the permanent magnet which is operable on the control panel of the electronic musical instrument.

According to another aspect of this invention, the electronic musical instrument comprises a combination of a key assembly and a device for producing a glissando effect, wherein the above-mentioned magneto-sensitive elements are also used as keying switch devices equipped in accordance with the respective key members.

BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a plan view of a device for producing a glissando effect embodying this invention;

FIG. 2 is a cross-sectional side view of said device;

FIG. 3 is a cross-sectional side view of a combination of a key assembly and a device for producing a glissando effect embodying this invention;

FIG. 4 is a cross-sectional side view of a combination mechanism modified from that of FIG. 3;

FIG. 5 is a cross-sectional side view of a combination mechanism further modified from that of FIG. 3;

FIG. 6 is a cross-sectional side view of a combination mechanism still further modified from that of FIG. 3;

FIG. 7 is a plan view of a device for producing a glissando effect further embodying this invention;

FIG. 8 is a cross-sectional side view of said device of FIG. 7;

FIG. 9 is an enlarged plan view of a shielding plate involved in the device of FIGS. 7 and 8;

FIG. 10 is an enlarged plan view of a shielding plate modified from that of FIG. 9;

FIG. 11 is an enlarged plan view of a shielding plate further modified from that of FIG. 9; and

FIG. 12 is an enlarged plan view of a shielding plate still further modified from that of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 indicates a plurality of magneto-sensitive elements or sensors 1, for example, consisting of magneto-sensitive diodes such as SMD SONY brand "(SONY MAGNETO-DIODE") having a pair of yokes 1*a*. Said sensors 1 are arranged in a row in accordance with the respective notes of a chromatic musical scale. In front of the arrangement of said sensors 1 is vertically disposed a control panel 2 having a longitudinally extending slit 3. At the front side of said control panel 2 is disposed a handle or knob 4 movable along said slit 3. Said handle 4 is provided with a connecting rod 5 which penetrates a guide piece 6 and extends to the backside of said control panel 2. Said guide piece 6 has a pair of flanges 6*a* formed at the ends and its middle portion 6*b* slidably inserted into said slit 3. To the end of said connecting rod 5 is fixedly secured a movable permanent magnet 7 is a manner to face the arrangement of said sensors 1. Between the rear end of said handle 4 and the front end of said guide piece 6 is interposed a coiled compression spring member 8 loosely surrounding the connecting rod 5.

For the glissando performance, the handle 4 is pushed toward the control panel 2 against the resistance of the spring member 8, and displaced along said slit 3 by the sliding of the guide piece therethrough, so that the permanent magnet 7 energizes the corresponding sensors in turn by displacement with its access to the sensor effected by the pushing of the tablet, with the result that tone generators (not shown) corresponding to the respective sensors 1 give forth tone signals in turn in accordance with the order in which notes are arranged in the chromatic scale. This is because the electrical resistance of the magneto-sensitive diode varies with the extent to which said sensor 1 is conducted into the magnetic field of the magnet 7, so that said sensor is actuated as a key switch element for each tone generator.

In this embodiment, the magneto-sensitive elements or sensors may be arranged in accordance with the respective notes of any other musical scale, for instance, a diatonic musical scale. Furthermore, said sensor may consist of a mechanical switching element such as a reed switch, provided undesirable click noises can be avoided by any suitable means, or said noises do not pose any difficulties.

FIG. 3 indicates a combination of a key assembly and a device for producing a glissando effect. The device for producing a glissando effect described hereinafter involves the same parts as indicated in the first-mentioned embodiment, so that the explanation of said parts is not detailed but merely illustrated in the figure. Said key assembly is provided with a plurality of key members 11 arranged in a row in accordance with the respective sensors 1 and each having a permanent magnet 12. When the key member 11 is pushed down, said permanent magnet 12 descends and closely faces the opposite side of said sensor 1 to that line along which the magnet 7 travels. As a result, said sensors 1 can also be used as keying switch devices equipped in accordance with the respective key members 11.

Though the magnets 7 and 12 of FIG. 3 are positioned at the front and rear sides of the arrangement of the sensors 1, the magnets 7 and 12 according to another embodiment as illustrated in FIG. 4 are positioned particularly at the upper and lower sides thereof. The magnets 12 in these cases are adapted to energize the corresponding sensors by their access thereto.

The sensor 1 illustrated in FIG. 5 consists of a core 1*b* and an induction coil 1*c* surrounding said core 1*b*. The device for producing a glissando effect, involving said induction coil and core, does not require means for moving the magnet 7 forward so as to keep the sensor free from the effect of the magnet when said sensor is not used for the glissando performance. This is because each of said sensors is energized only when the magnet 7 is quickly displaced along the arrangement of said sensors.

An embodiment illustrated in FIG. 6 includes a sensor consisting of a reed switch element instead of those indicated in the above-mentioned embodiments.

It will often be required in practice that a glissando be performed in accordance with the order in which tones are arranged in a diatonic musical scale, though the device of this invention is provided with a plurality of sensors arranged in corresponding relationship to the respective notes of a chromatic musical scale.

To meet the aforementioned requirement, a further improved device is described hereinafter.

Such device, another embodiment of this invention, is illustrated in FIGS. 7 and 8. The device is provided with a shield plate 21 consisting of a magnetic material such as iron, which effectively prevents the sensors from being inconveniently influenced by the magnetic field, into which said sensor would be conducted without said shield plate, and means 22 for controlling said shield plate 21. Since the other parts of said device are of the same type as already described in one of the aforesaid embodiments, said parts are not detailed but merely illustrated.

Said shield plate 21 has notches 21*a* formed at the rear edge thereof in a manner to match those selected from the sensors associated with the respective notes of a chromatic musical scale, whose scale positions are so defined as to correspond to the respective notes of a major musical scale. Said shield plate 21 is horizontally held by a suitable means (not shown) in a manner to be movable in longitudinal and transverse directions. The controlling means 22 consists of an operating rod 22*a*, a handle or knob 22*b* attached to the front end of said rod 22*a*, and a guide piece 22*c* which the operating rod 22*a* slidably penetrates. Said guide piece 22*c* has a pair of flanges 23, the middle portion 24 of said guide piece being slidably inserted into a slit 25 formed in the control panel 2 separately from the slit 3. Said slit 25 has a sufficient length to permit the guide piece to be moved therethrough, so that each notch 21*a* may be shifted in the lengthwise direction of the shield plate 21 within the range of a space defined by sensors having a number constituting one octave.

Said operating rod 22*a* has two cup-shaped depressions 26 and 27 linearly formed in the lengthwise direction thereof. The guide piece 22*c* has a cylindrical cavity 28 extending inwardly from a through bore 29 for allowing the rod 22*a* to slide therethrough in a perpendicular direction to the axis of said through bore.

In the cavity 28 is positioned a stop ball 30 which is urged towards the through bore by a coil spring member 31.

When a glissando is performed using a chromatic musical scale, the handle 22*b* is pulled until the ball 30 is fitted into the rear depression 27, so that the shield plate 21 is shifted forward to be removed from an area intervening between the sensors 1 and travel line of the magnet 7. Under this condition, the handle 4 is operated as already detailed for the glissando performance.

When a glissando is performed by using a major musical scale, the handle 22*b* is pushed until the ball 30 is fitted into the forward depression 26 so as to shift the shield plate 21 rearward, with the result that the arrangement of the notches 21*a* is positioned between the sensors 1 and travel line of the magnet 7. Consequently, the sensors only corresponding to the notches 21*a* are energized when the handle 4 is operated, thereby to perform a glissando in a major musical scale selected from those whose performance is effected by the adoption of necessary keys according to the way in which the starting tone "do" is chosen. Such selection of the key of major scale, i.e. transposition of the key of musical scale is carried out by shifting the shield plate 21 in its lengthwise direction in such a manner that a multiple of one full pitch defined by two adjacent sensors can be covered each time.

FIG. 10 indicates a shield plate 31 modified from that mentioned above. Shield plate 31 has notches 31*a* formed at the rear edge thereof in accordance with the sensors corresponding to the respective notes of a major chord.

If necessary, a shield plate separate from those mentioned above may be used for a glissando performance by a minor chord.

FIG. 11 indicates a shield plate 41 modified from those mentioned above. Shield plate 41 has deep notches 41*a* formed at the rear edge thereof in corresponding relationship to the respective notes of a major chord, and a shallow notches 41*b* formed at the same edge in corresponding relationship to the remaining notes arrived at by excluding notes of the major chord from those of the major musical scale.

A shield plate 51 finally illustrated in FIG. 12 has apertures 51*a* and 51*b* formed in two rows in the longitudinal direction. Said apertures 51*a* and 51*b* act exactly as do the notches 41*a* and 41*b* of FIG. 11.

What I claim is:

1. A device producing a glissando effect comprising:
   - a plurality of magneto-sensitive elements arranged in a row in accordance with a prescribed order of musical notes;
   - means including a plurality of keys arranged in accordance with said prescribed order and a plurality of magnets coupled to said keys for magnetically controlling respective magneto-sensitive elements to produce corresponding musical notes:
   - a control structure including a controller slidably supported thereon, and including means for moving said controller along said row of magneto-sensitive elements; and
   - a magnet connected to said controller and being movable with the sliding movement of said controller in successively confronting relationship with each of said magneto-sensitive elements, such that said magnet energizes said magneto-sensitive elements to produce corresponding musical notes.

2. A device as claimed in claim 1 wherein said control structure further comprises a shield plate removably positioned between said magneto-sensitive elements and said magnet and having openings or notches formed therein, said openings or notches being arranged in registration with selected ones of said magneto-sensitive elements, said magnet energizing only said selected magneto-sensitive elements.

3. A device as claimed in claim 2 wherein said shield plate is made of magnetic material.

4. A device as claimed in claim 2 wherein said control structure includes means for moving said shield plate in the direction of said row of magneto-sensitive elements.

5. A device as claimed in claim 1 wherein said magneto-sensitive elements are magneto-resistors, the electrical resistance of which varies in accordance with the intensity of magnetic field applied thereto.

6. A device as claimed in claim 1 wherein said magneto-sensitive elements are induction coils.

7. A device as claimed in claim 1 wherein said magneto-sensitive elements are reed switches.

8. An electronic musical instrument producing a glissando effect comprising in combination:
   - a plurality of keys arranged in a row in accordance with a prescribed order of musical notes;
   - a plurality of first magnets respectively coupled to said keys;
   - a plurality of magneto-sensitive elements arranged in a row in corresponding relationship with said keys, each of said magneto-sensitive elements being magnetically controlled to produce a corresponding musical note, said magneto-sensitive elements being selectively controlled by said first magnets;
   - a control structure including:
     - a control panel disposed in parallel with said row of magneto-sensitive elements; and
     - a controller slidably supported on said control panel, said controller having a handle for moving said controller along said row of magneto-sensitive elements; and
     - a second magnet connected to said controller, said second magnet being movable with the sliding movement of said controller in successively confronting relationship with each of said magneto-sensitive elements, such that said second magnet energizes said magneto-sensitive elements in turn to produce musical notes.

9. An electronic musical instrument as claimed in claim 8 wherein said control structure further comprises a shield plate removably positioned between said magneto-sensitive elements and said second magnet and having openings or notches formed therein, said openings or notches being arranged in registration with selected ones of said magneto-sensitive elements, said second magnet energizing only said selected magneto-sensitive elements.

10. An electronic musical instrument as claimed in claim 9 wherein said control structure includes means for moving said shield plate in the direction of said row of magneto-sensitive elements.