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 [31] **43/49515 and 43/49516**

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 CEC, J, LSR, P, PC)

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[54] **EXPRESSION PEDAL ASSEMBLY FOR AN ELECTRONIC MUSICAL INSTRUMENT PREFERABLY WITH PRESSURE AND/OR LIGHT SENSITIVE SENSORS**  
 7 Claims, 6 Drawing Figs.

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 84/1.24, 84/1.18  
 [51] Int. Cl..... G10c 3/14,  
 G10h 1/02

**ABSTRACT:** An expression pedal assembly involves a pedal capable of being rotated as well as pressed downward flatly, and sensors, preferably a pressure sensitive resistor and/or a photocell, which are operated according to the extent to which the pedal is rotated or pressed downward flatly, so that said sensors cause tone signals to be controlled, thereby to produce desired musical effects.

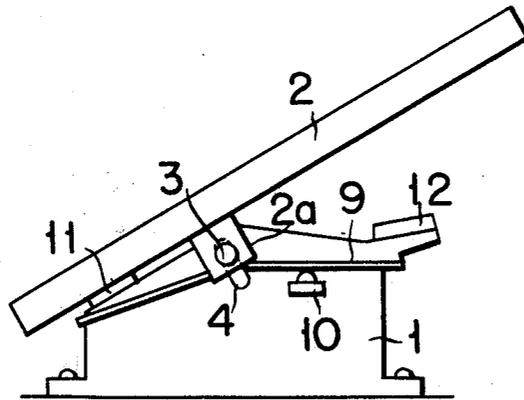


FIG. 1

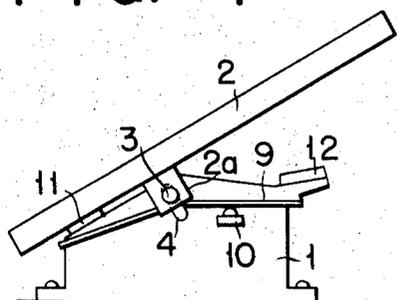


FIG. 4

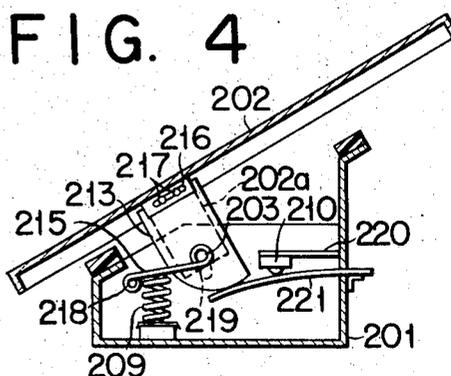


FIG. 2

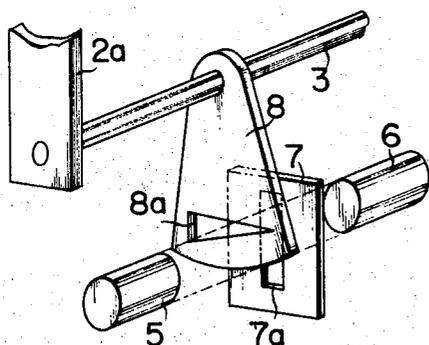


FIG. 5

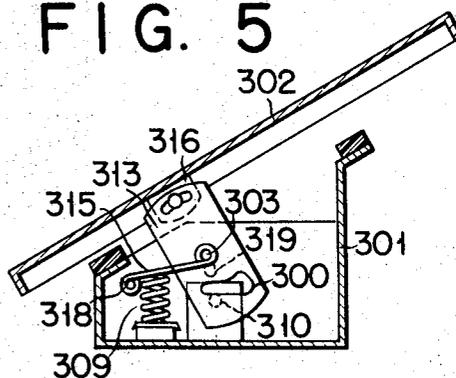
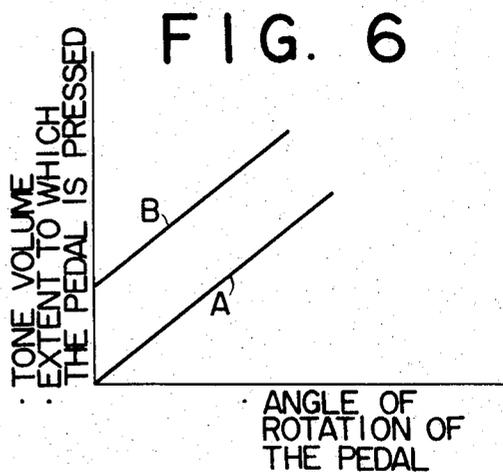
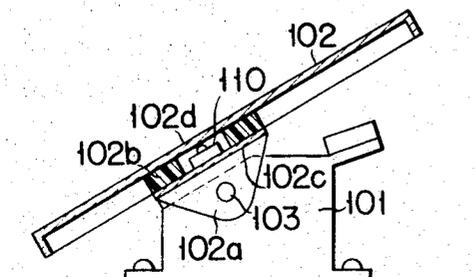


FIG. 3



# EXPRESSION PEDAL ASSEMBLY FOR AN ELECTRONIC MUSICAL INSTRUMENT PREFERABLY WITH PRESSURE AND/OR LIGHT SENSITIVE SENSORS

## BACKGROUND OF THE INVENTION

This invention relates to an expression pedal assembly involved in an electronic musical instrument, and more particularly to an expression pedal assembly adapted to control musical tones so as to produce different musical effects.

The prior art expression pedal assembly involves a pedal or treadle pivoted on a supporting frame so that the tone volume alone is controlled according to the extent to which said pedal rotates about its pivot. However, said pedal assembly is not constituted so as concurrently to control tone signals for producing such a musical effect as tone coloring, vibrato or percussion.

Furthermore, said pedal assembly does not permit the pedal to be quickly controlled so that the tone volume sharply increases. Accordingly said pedal assembly is all the more unsuitable adequately to play a rhythmical tone by the operation of said pedal.

## SUMMARY OF THE INVENTION

An object of this invention is to provide an expression pedal assembly of an electronic musical instrument so improved as individually to add two varying musical effects to musical tones by controlling a common pedal or treadle in different ways.

In this case, one of said musical effects is produced by the rotation of said pedal about its pivot, while the other thereof by pressing said pedal. In the design of the expression pedal assembly of this invention, the former musical effect may be attained by the normal increment of a sound volume, and the latter musical effect by the sharp increment thereof. Secondly, the former musical effect may be attained by the control of a sound volume, and the latter musical effect may be those such as tone coloring, vibrato or percussion. Thirdly, the former musical effect may be attained by the control of amplitude of a vibrato and the latter musical effect by the control of frequency thereof.

In an aspect of this invention, the expression pedal assembly of an electronic musical instrument involves a supporting frame, a pedal or treadle supported by said frame in a manner to be rotated about its pivot and pressed downward flatly, and first and second sensors, the former sensor being operated according to the extent to which the pedal is rotated, and the latter sensor being operated according to the extent to which the pedal is pressed downward flatly, so that each or both sensors cause tone signals to be controlled, thereby to produce musical sounds having a desired effect or effects.

In another aspect of this invention, the expression pedal assembly of an electronic musical instrument involves a supporting frame, a pedal or treadle supported by said frame in a manner to be rotated about its pivot and pressed downward flatly, and a sensor operated according to the extent to which the pedal is rotated and/or pressed downward flatly, so that said sensor causes tone signals to be controlled, thereby to produce musical sounds having a desired effect.

## BRIEF EXPLANATION OF THE DRAWING

FIG. 1 is a side view of an expression pedal assembly embodying this invention;

FIG. 2 is a perspective view of a part of said expression pedal assembly;

FIG. 3 is a side view of another embodiment of said expression pedal assembly of this invention;

FIG. 4 is a side cross-sectional view of a third embodiment of said expression pedal assembly of this invention;

FIG. 5 is a side cross-sectional view of a fourth embodiment of said expression pedal assembly of this invention; and

FIG. 6 is a graph indicating the characteristics of tone volumes varied according to the extent to which the pedal is operated, in connection with the embodiments of FIGS. 4 and 5.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 indicate an expression pedal assembly of this invention which involves a supporting frame 1 formed into a box, a pedal or treadle 2 having bearing plates 2a mounted on both sides of the bottom thereof, a horizontal shaft 3 secured to said bearing plates 2a and a guide aperture 4 formed in said frame 1 in a manner to extend in a direction slightly displaced from a vertical direction. In said aperture 4 is slidably and rotatably disposed said horizontal shaft 3. A photocell 5, the electrical resistance of which varies according to the quantity of light applied thereto and a light source 6 such as a lamp optically facing each other parallel to the axis of said horizontal shaft 3 are disposed in the interior of said frame 1 in a state of optical seal. Between said photocell 5 and light source 6 are interposed a shield plate 7 fixed to the frame 1 and a control plate 8 fixed to the shaft 3. Said shield plate 7 has a rectangular slit 7a extending parallel to the length of said aperture 4 and so positioned in an optical path defined between said photocell and light source as to allow all the flux of light beams to pass therethrough. Said control plate 8 has a wedge-shaped slit 8a spaced from the shaft 3 and extending substantially normal to the radial direction of the shaft 3 in a manner to travel in a direction perpendicular to that in which the light beams pass through the slit 7a. Accordingly, the rotation of the shaft 3 results in the variation of the flux of said light beams passing through the slits 7a and 8a.

Between the forward and rearward ends of the frame 1 is stretched a leaf spring member 9 which urgingly supports the shaft 3 upwardly. A sensor 10 consisting of a piezo-resistance element, the electrical resistance of which varies according to the pressure applied thereto is mounted on the frame 1 and disposed beneath said leaf spring member 9.

Cushion members 11 and 12 are preferably attached to the respective upper forward and rearward portions of the frame 1 so as softly to damp the impact produced when the pedal is inclined to the limits of its rotation.

When the pedal 2 is rotated, the photocell receives the flux of the light beams passing through the superposed area of the slits 7a and 8a according to the extent of the pedal rotation, so that electrical resistance is varied in an electrical circuit to produce a desired musical effect.

When the pedal 2 is pressed or moved downward flatly by sliding the shaft 3 in the aperture 4, the electrical resistance of the sensor 10 is varied according to the magnitude of the pressure with which the leaf spring member 9 pushes down the sensor 10, so as to produce another desired musical effect. For example, the former of said musical effects may be the increment of the tone volumes, while the latter relates to the amplitude of the vibrato or magnitude of the percussion.

FIG. 3 indicates another embodiment of this invention. Said embodiment is characterized by involving a pedal 102 containing a sensor 110 consisting of a piezo-resistance element and a shaft 103 merely journaled to the frame 101. Said pedal 102 includes a base plate 102c, both side edges of which have bearing plates 102a of the same type as that indicated in the first embodiment, and an upper elastically bendable plate 102d facing said sensor 110 mounted on the base plate 102c.

A cushion member 102b made of elastic material such as foamed synthetic resin or rubber surrounds said sensor 110. An optical means (not shown) is provided in association with the shaft 103 similar to that provided in the first-mentioned embodiment.

When the pedal is rotated, the optical means acts so as to vary the flux of the light beams to be transmitted through the optical slits to the photocell thereof. Consequently, a desired musical effect is produced by the tone signals regulated according to the variation of the quantity of light applied to the photocell.

When the pedal is trodden on, the pedal is pressed downward flatly and the plate 102d depresses the sensor 110, with the result that another desired musical effect is produced in accordance with the magnitude of tone signals passing through said sensor.

FIG. 4 indicates an expression pedal assembly of this invention characterized in that one sensor 210 is operated in two different ways by causing a pedal 202 to be pressed or moved downward flatly as well as by the rotation of the pedal. Namely, the pedal 202 has bearing plates 202a to which a horizontal shaft 203 is secured. To the shaft 203 is rotatably fitted a swingable member 213 pivoted by a horizontal shaft 203 and movably connected with a slitted plate 216 attached to the bottom of the pedal 202. Setscrews 217 positioned in the slit of said plate 216 cause the upper end of said swingable member 213 to be fixed to the plate 216. A supporting arm 215 is journaled at one end by the shaft 203 and at the other end by a horizontal pin 218 secured to the side walls of a frame 201 and upwardly urged by the action of a coiled compression spring member 209 which is disposed at the bottom of said frame 201. Both ends of the shaft 203 are slidably inserted into long apertures 219 formed in the side walls of the frame 201. Said apertures extend in a direction slightly displaced from the vertical direction. On the rear wall of the frame 201 are disposed two members 220 and 221 in a manner horizontally to extend from said wall inwardly. To the lower side of the free end of the supporting member 220 is attached the aforementioned sensor 210 facing the upper surface of the spring member 221. Said member 221 consists of elastically bendable material such as copper and presses the sensor 210 upwardly. Said sensor 210, of course, consists of a piezo-resistance element, the electrical resistance of which varies in accordance with the pressure applied thereto. The lower edge of the swingable member 213 is rounded along a curve whose center is spaced from that of the shaft 203.

When the pedal is rotated, the member 221 is bent by being pressed by the curved lower edge of the swingable member 213, so as to reduce the force with which the sensor 210 is pressed. The electrical resistance of the sensor 210 is varied with the extent to which the pedal is rotated, so that a prescribed musical effect, for example, the increase of sound volume is accomplished according to the magnitude of tone signals allowed to pass through the sensor 210.

When the pedal is pressed or moved downward flatly, the shaft 203 is slidably pushed down along the length of the apertures 219, with the supporting arm 215 downwardly urged against the resistance of the spring member 209. Consequently, the member 221 is bent so as to reduce the force with which the sensor 210 is pressed.

FIG. 5 indicates an expression pedal assembly modified from that of FIG. 4. In this fourth embodiment, the sensor 210 of the third embodiment of FIG. 4 if replaced by a photocell 310. A slit 300 is formed in the lower portion of a swingable member 313 so as to apply the flux of the light beams from the light source (bearing no reference numeral) to said photocell 310. By the rotation of the pedal and/or causing it to be

pressed or moved downward flatly, the magnitude of the beam flux is controlled according as the slit faces the photocell wholly or partly. Consequently, electrical resistance is varied in an electrical circuit and a desired musical effect is produced by the tone signals regulated by said photocell.

Since the other parts of this pedal assembly are the same as and act similarly to those indicated in the embodiment of FIG. 4, the detail is not explained. However, said other parts of the pedal assembly are indicated only by the reference numerals, of which the digits in the first and second places are the same as those of the embodiment of FIG. 4, though the digits in the third place are different.

A line A indicated in FIG. 6 shows variations in the tone volume controlled only by the rotation of the pedal of FIG. 4 or 5. A line B indicated in FIG. 6 shows variations in the tone volume controlled by both the rotation of the pedal and flatly pressing downward or movement of the pedal.

We claim:

1. An expression pedal assembly of an electronic musical instrument involving a supporting frame, a pedal or treadle supported by said frame in a manner to be rotated about its pivot and pressed downward flatly, and first and second sensors, the former sensor being operated according to the extent to which the pedal is rotated, and the latter sensor being operated according to the extent to which the pedal is pressed downward flatly, so that either or both sensors cause tone signals to be controlled, thereby to produce musical sounds having a desired effect or effects.

2. The expression pedal assembly claimed in claim 1 in which the first sensor consists of optical means and the second sensor consists of a piezo-resistance element.

3. The expression pedal assembly claimed in claim 1 in which the pedal comprises a base plate, an upper bendable plate elastically supported on said base plate, and the second sensor mounted on said base plate, whereby the sensor can be pressed by the pedal.

4. The expression pedal assembly claimed in claim 1 in which the second sensor is operated by the action of a spring member for supportingly urging the pedal upwardly.

5. An expression pedal assembly of an electronic musical instrument involving a supporting frame, a pedal or treadle supported by said frame in a manner to be rotated about its pivot and pressed downward flatly, and a sensor operated according to the extent to which the pedal is rotated and/or pressed downward flatly, so that said sensor causes tone signals to be controlled, thereby to produce musical sounds having a desired effect.

6. The expression pedal assembly claimed in claim 5 in which the sensor consists of a piezo-resistance element.

7. The expression pedal assembly claimed in claim 5 in which the sensor consists of optical means.

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