CAPACITANCE SENSING FOR PERCUSSION INSTRUMENTS AND METHODS THEREFOR

TECHNICAL FIELD

[0001] The present invention relates generally to musical instruments, and more particularly to electronic percussion instruments and/or percussion input devices.

BACKGROUND OF THE INVENTION

[0002] The detection of percussive events can serve as useful input signals for instruments and systems. For example, conventional electronic percussion systems are know that can be used in place of conventional acoustic percussion instruments. In addition to musical instrument applications, the detection of percussive events can be a desirable feature for controller objects, such as those utilized as gaming inputs to personal computer (PC) based, console based and/or portable gaming systems.

[0003] Conventional electronic pad based percussion systems are known. Many such conventional approaches can rely on piezoelectric sensors that can convert the pressure of a percussive event into an electronic signal. Many such conventional systems only determine when a playing surface is struck, and not where such an event occurs.

[0004] U.S. Pat. No. 4,852,443 by Duncan et al. and issued on Aug. 1, 1989 discloses a capacitive pressure-sensing method and apparatus having a drum-like application. The drum-like application can track changes in capacitance to a pad by measuring a degree of alternate current (AC) current flow.

[0005] A drawback to conventional approaches, like those described above can be the manufacturing costs involved. In addition, such devices can also have an undesirable high degree of complexity when it comes to the manufacturing of systems and devices employing such conventional approaches.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIGS. **1**A and **1**B show a percussion instrument according to a first embodiment of the present invention.

[0007] FIG. **2** shows a percussion instrument according to a second embodiment of the present invention.

[0008] FIG. **3** shows a percussion instrument according to a third embodiment of the present invention.

[0009] FIG. **4** shows a percussion instrument according to a fourth embodiment of the present invention.

[0010] FIG. **5** shows a percussion instrument according to another embodiment of the present invention.

[0011] FIG. **6** shows a percussion instrument according to yet another embodiment of the present invention.

[0012] FIG. **7** is a side cross sectional view showing a materials that can be included in percussion instruments like those shown in FIGS. **5** and **6**.

[0013] FIG. **8** is a diagram showing a sense operation according to one type of capacitance sensing that can be included in the embodiments.

[0014] FIG. **9** is a diagram showing a sense operation according to another type of capacitance sensing that can be included in the embodiments.

[0015] FIGS. **10**A and **10**B are diagrams showing a sense operation according to yet another type of capacitance sensing that can be included in the embodiments.

[0016] FIG. **11**A is a diagram of a capacitance sensor that can be included in the embodiments. FIGS. **11**B to **11**D are diagrams showing wiring arrangements for capacitance sensors according to various embodiments.

[0017] FIG. **12** is a block schematic diagram of a capacitance sensing system that can be included in the embodiments.

[0018] FIG. **13** is a block schematic diagram of another capacitance sensing system that can be included in the embodiments.

[0019] FIG. **14** is a block schematic diagram of yet another capacitance sensing system that can be included in the embodiments.

[0020] FIG. **15** is a flow diagram of a capacitance sense method that can be executed by a capacitance sense system like that shown in FIGS. **12**, **13** and/or **14**.

[0021] FIG. **16** is a block schematic diagram of a capacitance sensor array that can be included in the embodiments.

[0022] FIG. **17**A is a block schematic diagram of a system according to an embodiment.

[0023] FIG. **17**B shows an input indication approach according to an embodiment.

[0024] FIG. **18** shows one approach to reprogramming capacitance sensor grouping.

[0025] FIGS. **19**A to **19**C show examples of capacitance sensor arrays can be reprogrammed into different group configurations.

[0026] FIG. **20** shows another approach to reprogramming capacitance sensor grouping.

[0027] FIGS. **21**A and **21**B show examples of how particular capacitance sensor arrays can be reprogrammed into different group configurations.

[0028] FIGS. **22**A and **22**B show the generation of a sound value according to embodiments.

[0029] FIG. **23** shows the generation of a sound activation value from a capacitance sensor array according to an embodiment.

[0030] FIG. **24** shows a system that includes a display for indicating detected input events of an instrument according to one embodiment.

[0031] FIG. **25** shows the storage of input events with corresponding times of such events, according to one embodiment.

[0032] FIG. **26** is a timing diagram showing the alteration of a previously generated sound value according to an embodiment.

[0033] FIG. **27** shows an encoding circuit that can be included in the embodiments.

[0034] FIG. **28** shows a sound generation circuit according to an embodiment.

[0035] FIG. **29** is a block schematic diagram of a controller according to one embodiment.

[0036] FIGS. **30** to **34** are block schematic diagrams showing various system embodiments.

DETAILED DESCRIPTION

[0037] Various embodiments of the present invention will now be described in detail with reference to a number of drawings. The embodiments show systems, instruments, and processing methods that can be used in the generation of data values in response to percussive events.

[0038] A percussion instrument according to a first embodiment is shown in a top view in FIG. **1**A and a side