(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 October 2009 (01.10.2009)

PCT

(10) International Publication Number
WO 2009/119947 A1

(51) International Patent Classification:
G06F 3/02 (2006.01)

(21) International Application Number:
PCT/KR2008/004297

(22) International Filing Date:
23 July 2008 (23.07.2008)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2008-0028453 27 March 2008 (27.03.2008) KR

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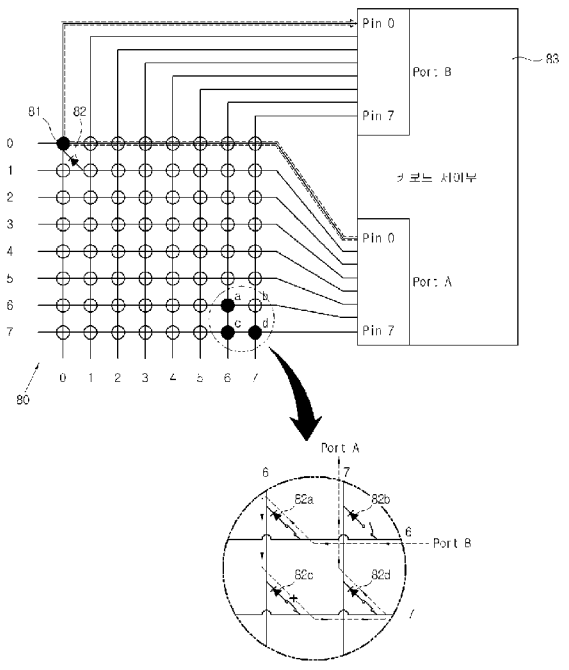
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI

[Continued on next page]

(54) Title: KEYBOARD FOR DETECTING A NUMBER OF KEYS INPUTTED CONCURRENTLY AND METHOD THEREOF

[Fig. 4]



(57) Abstract: The present invention relates to a keyboard for detecting a number of keys inputted con¬ currently and a method thereof, and can provide a keyboard at a low cost which makes it possible to simultaneously input a plurality of keys by providing a membrane keyboard including a membrane film unit that includes a pair of membrane films where a keyboard matrix is formed and a plurality of ports connected with the keyboard matrix, a plurality of rectifier cells that is connected with the ports of the membrane film unit, and a keyboard control unit that dis¬ criminates keys inputted by a user by outputting key-input detecting signals to the keyboard matrix of the membrane film unit and detecting signals correspondingly inputted through the rectifier cells, and a method of controlling the keyboard.

WO 2009/119947 A1

(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Description

KEYBOARD FOR DETECTING A NUMBER OF KEYS INPUTTED CONCURRENTLY AND METHOD THEREOF

Technical Field

[1] The present invention relates to a keyboard for detecting a number of keys inputted concurrently and a method thereof, particularly a membrane keyboard using a plurality of rectifier cells to prevent a ghost key phenomenon and a method of controlling the membrane keyboard.

Background Art

[2] A keyboard implies a device relating to electronic products, such as a computer, which allows a user to input programs or data by pressing keys corresponding to desired characters to send signals.

[3] Keyboards fall into capacitive keyboards and hard contact keyboards, in accordance to the methods detecting key-pressing or transmitting electric current. The capacitive keyboard detects key-pressing by measuring the amount of electric charge flowing through a circuit connected under keys when the keys are pressed. The hard contact keyboard detects key-pressing, according to whether electric current flows, while two metals under keys contact or not contact.

[4] On the other hand, keyboards fall into membrane keyboards, mechanical keyboards, foam type keyboards, and rubber dome keyboards, according to the way of pressing the keys. Most keyboards that recently come into wide use at low cost are membrane type keyboards. Dividing according to the way of electric current supply, the membrane type, foam type, and rubber dome type keyboards correspond to hard contact keyboards.

[5] The mechanical type was primarily used to imply one of the mechanical types, which is a counterpart of an electronic type, but is used to imply a spring type in recent years. According to the mechanical type, as a key is pressed, a metal plate of the key contacts to a lower plate and two non-connected metal circuits are connected, thereby generating an electric current signal. The key is returned by force of a spring. The mechanical type is characterized by making a sound every time a key is pressed, such that there are many people who prefer this type because of the rhythm of when keys are pressed. However, metals having good conductivity, such as gold, are used for the contact points of the contact surfaces and it is required to dispose a micro-switch for each key, and as a result, it is expensive.

[6] On the contrary, the membrane keyboard is provided with an elastic film, which is called a membrane, under the keys, and as the key presses the film, the two sheets

under the membrane film are contacted and an electric signal is generated. The membrane type keyboard does not need a micro-switch for each key like the mechanical type, such that it can be mass produced at a low cost. There are methods for producing a membrane, one of which is to insert one rubber for each key and the other is to produce the entire keyboard of one rubber plate and making concavities and convexities at a portion where a key is pressed. However, most membrane keyboards that are recently produced are formed of one rubber plate because the method that produces a membrane of one rubber plate is inexpensive.

[7] FIG. 1 is a diagram simply illustrating a matrix structure of a common keyboard.

[8] In particular, FIG. 1 simply shows only a keyboard control unit 10 and a matrix 20 in a common keyboard.

[9] The matrix 20 shown in FIG. 1 is a circuit for the keyboards providing sixty four keys, which may be composed of eight rows connected to an output port 11 (Port A) of the keyboard control unit 10 and eight columns connected to an input port 12 (Port B) of the keyboard control unit 10.

[10] The uppermost row of the eight rows in the keyboard matrix 20 corresponds to the 0-row and the lowermost row corresponds to the 7-row. Similarly, the leftmost column of the eight columns in the keyboard matrix 20 corresponds to the 0-column and the rightmost column corresponds to the 7-column. Further, a switch contact point where an m-row and an n-column cross each other is referred to as an (m,n) switch contact point.

[11] As a user presses a keyboard, the row and column circuits passing the switch contact point corresponding to the pressed keyboard are connected and electric current starts to flow. For example, when the switch point 21 corresponding to the point (0,0) is pressed, the 0-row and 0-column in the keyboard matrix 20 are connected as shown in FIG. 1. With the connection, a closed circuit passing the Pin 0, 0-row of the Port A 11, switch contact point (0,0), 0-column, and Pin 0 of the Port B 12 is created.

[12] The keyboard control unit 10 sequentially outputs signals to the pins (0 to 7) of the output port 11 (Port A). Further, the keyboard control unit 10 determines which pin of the pins in the input port 12 (Port B) detects a signal according to the signal output. This operation is described hereafter through an example.

[13] When the switch contact point 21 of the point (0,0) in the keyboard matrix 20 is pressed as in the embodiment shown in FIG. 1, the keyboard control unit 10 that has outputted a signal to the zeroth output pin (Pin 0 of Port A(11)) detects a signal through the zeroth input pin (Pin 0 of Port B (12)). On the other hand, the keyboard control unit 10 cannot detect a signal for combinations of the other output pins and input pins. The keyboard control unit 10 detects when the switch contact point 21 of the point (0,0) is pressed, by using the result of detecting signal.

[14] The keyboard control unit 10 performs the same key-detecting mechanism as described above, even if a plurality of keys is simultaneously pressed. For example, when a signal is transmitted to the zeroth output pin (Pin 0 of Port A (11)) and the signal is detected at the first and second input pins (Pin 1, 2 of Port B (12)), the keyboard control unit 10 recognizes that the keys of the point (0,1) and (0,2) are pressed.

[15] In another example, when the seventh input pin (Pin 7 of Port B (12)) reacts to the zeroth output pin (Pin 0 of Port A (11)) and the zeroth input pin (Pin 0 of Port B (12)) reacts to the seventh output pin (Pin 7 of Port A (11)), the keyboard control unit 10 recognizes that the switch contact points of the points (0,7) and (7,0) are pressed.

[16] FIG. 2 is a view illustrating a ghost key phenomenon that is generated in common keyboards.

[17] A general method of detecting key-input in a keyboard was explained with reference to FIG. 1. However, there are some cases in which connection of undesired circuits is detected when a plurality of keys is simultaneously pressed, such that key-input is not normally recognized. These cases will be explained in more detail under assumption of when the dark keys of the keyboard shown in FIG. 2, that is, the switch contact points 22, 23, 24 are simultaneously pressed.

[18] When the output port of the keyboard control unit 10 outputs a signal through the 2-row, electric current flows through the three pressed switch contact points 22, 23, 24, a signal is detected at the input pin corresponding to the 5-column, in addition to the 3-column. Consequently, the keyboard control unit 10 recognizes that the switch contact point 25, which are indicated by a check mark 'X' is also pressed. The key corresponding to the point 25 is called a 'ghost key' and the phenomenon that generates the ghost key is called a ghost key phenomenon.

[19] When a ghost key phenomenon is generated by simultaneously pressing a plurality of keys, the keyboard transmits an error code to a PC and neglects all of the present input keys. Having received the error code, the PC only beeps.

[20] A keyboard that can recognize all of the input keys when three or more keys are simultaneously pressed is called an n-key roll over keyboard. However, there is a problem in that n-key roll over keyboards that are on the market now all correspond to mechanical keyboards and is very expensive.

Disclosure of Invention

Technical Problem

[21] Embodiments of the present invention help overcome the drawbacks in the related art and it is an object of the invention to provide a keyboard that can prevent a ghost key phenomenon and detect a number of keys inputted concurrently at a low cost by

providing a plurality of rectifier cells to a keyboard using a membrane, and a method of controlling the keyboard.

Technical Solution

[22] A membrane keyboard for simultaneously inputting a plurality of keys according to an aspect of the present invention includes: a membrane film unit that includes a pair of membrane films where a keyboard matrix is formed and a plurality of ports connected with the keyboard matrix; a plurality of rectifier cells that is connected with the ports of the membrane film unit; and a keyboard control unit that discriminates keys inputted by a user by outputting key-input detecting signals to the keyboard matrix of the membrane film unit and detecting signals correspondingly inputted through the rectifier cells.

[23] In this configuration, the ports of the membrane film unit may be independently connected with switch contact points corresponding to each key of the keyboard matrix of the membrane film unit.

[24] Further, it is preferable that the rectifier cells are diodes disposed between the keyboard control unit and the membrane port. In this configuration, the keyboard control unit may include an output port that outputs a key-input detecting signal to the keyboard matrix, and an input port that receives the signal transmitted from the keyboard matrix, in which it is preferable that the diode has a positive direction from the output port of the keyboard control unit to the input port of the keyboard control unit.

[25] A keyboard for simultaneously inputting a plurality of keys according to another aspect of the present invention includes: a keyboard matrix that includes a plurality of switch contact points; diodes that are provided for each switch contact point of the keyboard matrix; and a keyboard control unit that discriminates keys inputted by a user by outputting key-input detecting signals to the keyboard matrix and detecting signals correspondingly transmitted through the rectifier cells.

[26] The keyboard control unit may include an output port that outputs a key-input detecting signal to the keyboard matrix and an input port that receives the signal transmitted from the keyboard matrix. In this configuration, it is preferable that the diode has a positive direction from the output port of the keyboard control unit to the input port of the keyboard control unit.

Advantageous Effects

[27] As described above, when using a keyboard for detecting a number of keys inputted concurrently and a method of controlling the keyboard, it is possible to provide a user, such as a game user, with a keyboard that makes it possible to simultaneously input a plurality of keys at a low cost, because it is possible to prevent a ghost key

phenomenon by providing a plurality of rectifier cells to a membrane keyboard.

Brief Description of Drawings

[28] FIG. 1 is a view simply showing a matrix structure of a common keyboard.

[29] FIG. 2 is a view illustrating a ghost key phenomenon that is generated in common keyboards.

[30] FIG. 3 is a view showing the structure of a membrane keyboard according to an embodiment of the present invention.

[31] FIG. 4 is a view illustrating the pattern configuration of a membrane film unit according to another embodiment of the present invention.

[32] FIG. 5 is a view illustrating the configuration of a membrane keyboard film unit according to another embodiment of the present invention.

[33] FIG. 6 is a view illustrating the configuration of a membrane keyboard film unit according to another embodiment of the present invention.

[34] <Reference Numerals>

[35] 30: Membrane 40: Upper circuit Film

[36] 50: Insulating film 60: Lower Circuit Film

[37] 70: Cover 80: Matrix

[38] 81: Switch Contact Point 82: Diode

[39] 83: Keyboard Control Unit 90: Membrane Film Unit

[40] 91: Switch Contact Point 92: Membrane Film Unit Port

[41] 100: PCB substrate 101: Keyboard Control unit

[42] 102: PCB substrate Port 103: Diode

Best Mode for Carrying out the Invention

[43] A membrane keyboard, which makes it possible to input a plurality of keys at the same time, according to an embodiment of the present invention includes a membrane film unit that includes a pair of membrane films where a keyboard matrix is formed and a plurality of ports connected with the keyboard matrix, a plurality of rectifier cells connected to the ports of the membrane film unit, and a keyboard control unit that outputs key-input detecting signals to the keyboard matrix of the membrane film unit, detects signals correspondingly inputted through the rectifier cells, and discriminates keys inputted by a user.

Mode for the Invention

[44] A keyboard for detecting a number of keys inputted concurrently and a method of controlling the keyboard according to the present invention are described hereafter in detail with reference to the accompanying drawings.

[45] FIG. 3 is a view showing the structure of a membrane keyboard according to an embodiment of the present invention.

[46] The keyboard shown in FIG. 3 may be composed of a membrane 30, an upper circuit film 40, an insulating film 50, a lower circuit film 60, and a cover 70. It should be understood that the keyboard according to the present invention includes a keyboard control unit connected with the upper circuit film 40 and the lower circuit film 60.

[47] The cover 70 made of plastic is disposed at the lowermost layer of the keyboard and the lower circuit film 60 is disposed thereon according to the embodiment shown in FIG. 3. The upper circuit film 40 is disposed on the lower circuit film 60 and the insulating film 50 performs insulation between the lower circuit film 60 and the upper circuit film 40. Further, the membrane 30 providing elasticity of the keyboard is disposed at the uppermost layer.

[48] In this configuration, the upper circuit film 40 and the lower circuit film 60 are provided with circuit patterns according to the configurations of switch contact points of the keyboard. The insulating film 50 prevents connection (short) between the upper circuit film 40 and the lower circuit film 60.

[49] The upper circuit film 40 and the lower circuit film 60 are separated by the insulating film 50, such that electric current does not flow therebetween. Further, the insulating film 50 is disposed where the switch contact points are provided, such that electric current can flow.

[50] In detail, when the switch contact point is not pressed, the membrane 30 maintains a dome shape and the upper circuit film 40 and the lower circuit film 60 are separated, such that electric current does not flow.

[51] However, as a user presses the key, the membrane 30 presses the upper circuit film 40. The pressed upper circuit film 40 is connected with the lower circuit film 60 through a region where the insulating film 50 is not provided, and as a result, electric current flows. The keyboard can recognize the key stroke of the user by detecting the electric current.

[52] In general, substantially similar circuit patterns are formed on the upper circuit film 40 and the lower circuit film 60. The upper circuit film 40 and the lower circuit film 60 are referred to as the membrane film unit in the present invention.

[53] The keyboard according to the present invention can prevent a ghost key phenomenon by the rectifier cells, such as diodes, provided to the membrane film unit. The configuration in which the upper circuit film 40 and the lower circuit film 60 are provided with diodes to prevent the ghost key phenomenon is described hereafter with reference to FIGS. 4 to 6.

[54] FIG. 4 is a view showing the circuit pattern configuration of a membrane film unit according to another embodiment of the present invention.

[55] Similar to common keyboards, the membrane film unit shown in FIG. 4 includes a matrix circuit pattern 80 including m rows and n columns. The matrix shown in FIG. 4

is an 8?8 matrix.

[56] Although the matrix 80 shown in FIG. 4 is an 8?8 matrix, it should be understood that the numbers of rows and columns of the matrix 80 of the present invention can be changed.

[57] Similarly, the point where a row and a column cross is a switch contact point 81 and a hole is formed through the insulating film 50 where the switch contact point 81 is provided, such that the upper circuit film 40 can contact with the lower circuit film 60 by key stroke of a user.

[58] Further, it can be seen from the matrix shown in FIG. 4 that diodes 82, unlike common keyboards, are disposed at predetermined positions for the switch contact points 81. The diodes 82 are elements for preventing backflow of electric current that is the main cause of the ghost key phenomenon.

[59] In the direction of the diode 82, the positive direction is the direction from the output port (High) of the corresponding row where the diode 82 is disposed to the input port (Low) of the corresponding column. It should be understood that those skilled in the art can achieve various configurations of the diode 82.

[60] For example, the diode direction shown in FIG. 4 is for when all matrixes are basically at 0V and High (5V) is inputted into one row when a key is scanned. If all the matrixes are basically at 5V and Low (0V) is inputted to one raw when a key is scanned, the diode direction is reversed. Further, the diode performs the positive-directional operation in this case.

[61] Further, although inexpensive diodes are selected in the present invention to provide an inexpensive keyboard, use of rectifier cells that operate similar to the diodes can be considered.

[62] Mechanism preventing the ghost key phenomenon by using the rectifier cells, such as the diodes 82 shown in FIG. 4 is explained in detail. It is assumed in FIG. 4 that the dark switches a, b, c in the matrix are pressed.

[63] Unlike common keyboards, a signal outputted to the sixth row from the output port (Port A) of the keyboard control unit 83 is not transmitted to the input port (Port A) through the seventh column because a diode 82c is disposed.

[64] Consequently, since there is no input through the seventh column with respect to the output of the sixth row, the keyboard control unit 83 recognizes that the switch b is not pressed. That is, it is possible to prevent the ghost key phenomenon.

[65] However, it is difficult to achieve the diode 82 in the upper circuit film 40 and the lower circuit film 60. Further, there is a problem in that the keyboard is very expensive, even if the diode 82 is achieved in the upper circuit film 40 and the lower circuit film 60.

[66] FIG. 5 is a view illustrating the configuration of a membrane keyboard according to

another embodiment.

[67] Holes are formed through the insulating film 50 at the dotted portions of the membrane film unit 90 in FIG. 5, that is, where switch contact points 91 are disposed, such that the upper circuit film 40 can contact with the lower circuit film 60, when a key stroke is generated.

[68] Further, the membrane film unit 90 can be combined with the cover 70 by fasteners, such as bolts 94. The positions of the bolts 94 can be variously changed according to the external appearance of the keyboard, such as height, width, and thickness.

[69] The switch contact points 91 of the membrane film unit 90 according to the present invention are connected with ports 92 that function as interfaces with a PCB substrate 100 where a keyboard control unit 101 is provided.

[70] Fasteners, such as bolts 93, may be used for connection of the ports 92 of the membrane film 90 with the ports 102 of the PCB substrate 100. The positions of the bolts 93 in FIG. 5 can be changed, and in particular, it is preferable that the bolts 93 are disposed between the pins of the port. The connection of the ports 92 of the membrane film unit 90 with the ports 102 of the PCB substrate is not substantially different from the methods in the related art and the detailed description is not provided.

[71] The switch contact points 91 of the membrane film unit 90 according to the present invention are connected with the ports 92 of the membrane film unit 90. Although four switch contact points 91 are connected with the ports 92 of the membrane film unit 90 in FIG. 5, all of the switch contact points 91 are connected with the ports 92 of the membrane film unit 90 to prevent the ghost key phenomenon.

[72] The port 102 of the PCB substrate connected with the ports 92 of the membrane film unit is connected with predetermined rectifier cells to prevent the ghost key phenomenon. Diodes 103 are also used as the rectifier cells in this embodiment. Further, the rectifier cells, such as diodes, are provided to prevent the ghost key phenomenon that may be generated when a plurality of keys are simultaneously pressed.

[73] The keyboard control unit 101 may include an output port (Port A) that outputs a key-input detecting signal and an input port (Port B) that receives a signal transmitted from the keyboard matrix. Further, the bit numbers of the output port (Port A) and the input port (Port B) can be changed.

[74] The function and structure of the diodes of the embodiment shown in FIG. 5 are described hereafter in detail.

[75] The diodes shown in FIG. 5 prevent a key-input detecting signal outputted from the output port (Port A) from being transmitted to the input port according to the switch contact point that is not pressed by a user.

[76] Further, in the connecting direction of the diodes 103 shown in FIG. 5, the positive

direction is generally set to as the direction from the output port (Port A) of the keyboard control unit 100 to the input port of the keyboard control unit 100.

[77] The ports 92 of the membrane film unit and the ports 102 of the PCB substrate are basically variable according to the number of switch contact points for preventing the ghost key phenomenon. Further, since the rectifier cells, such as the diodes 103, are connected with the ports 102 of the PCB substrate, the diodes 103 are variable according to the number of switch contact points of the keyboard for preventing the ghost key phenomenon.

[78] The circuits passing through the rectifier cells, such as the diodes 103, are converged into a predetermined group and the converged circuit 104 is connected to the input port (Port B) of the keyboard control unit 101.

[79] It can be seen from FIG. 5 of the present invention that four diode circuits 103 are converged into one circuit 104 and connected to the keyboard control unit 101. In this configuration, the number of converged circuits can be changed according to the number of input/output ports of the keyboard control unit 101.

[80] FIG. 6 is a view illustrating the configuration of a membrane keyboard according to another embodiment of the present invention.

[81] The ports 112 of a membrane keyboards shown in FIG. 6 are arranged in a different way from the ports 92 of the membrane keyboard shown in FIG. 5. Explaining again the ports of the membrane keyboard film unit shown in FIG. 5, N ports were arranged at the same intervals in a line.

[82] In contrast, the ports 112 of the membrane keyboard film unit shown in FIG. 6 include two groups of first and second ports composed of m ports, and a third port group composed of n ports. Further, the third port group may be divided into a, b, and c sub-port groups.

[83] Since ports 122 of a PCB substrate 120 should be engaged with the ports 112 of the membrane film unit 110, the shape and arrangement of the ports 122 of the PCB substrate 120 shown in FIG. 6 are the same as the shape and arrangement of the ports 112 of the membrane film unit 110 shown in FIG. 6.

[84] Further, since the other components, such as bolts 113, 114, a keyboard control unit 121, diodes 123, have substantially the same function as the components of the membrane keyboard described in connection with FIG. 5, the detailed description is not provided.

[85] By dividing into the first, second, and third port groups and dividing one port group into a plurality of sub-port groups as described above, a manufacturer of the keyboard can make the circuit patterns of the membrane film unit into desired shapes. By forming a plurality of port groups as described above, it is possible to achieve a simple circuit of the membrane keyboard film unit, and it is possible to achieve a stable

keyboard from the circuit having a simple configuration.

[86] Although the present invention was described with reference to representative embodiments in the above, it should be understood that the above embodiments can be changed in various ways by those skilled in the art without departing from the spirit of the present invention. Therefore, the scope of the present invention should not be limited to the above embodiments and should be construed as the following claims and the equivalent of the claims.

Claims

[1] A membrane keyboard for simultaneously inputting a plurality of keys, the membrane keyboard comprising:
a membrane film unit that includes a pair of membrane films where a keyboard matrix is formed and a plurality of ports connected with the keyboard matrix;
a plurality of rectifier cells that is connected with the ports of the membrane film unit; and
a keyboard control unit that discriminates keys inputted by a user by outputting key-input detecting signals to the keyboard matrix of the membrane film unit and detecting signals correspondingly inputted through the rectifier cells.

[2] The membrane keyboard according to claim 1, wherein the ports of the membrane film unit are independently connected with switch contact points corresponding to each key of the keyboard matrix of the membrane film unit.

[3] The membrane keyboard according to claim 1, wherein the rectifier cells are diodes disposed between the keyboard control unit and the membrane port.

[4] The membrane keyboard according to claim 3, wherein the keyboard control unit includes:
an output port that outputs a key-input detecting signal to the keyboard matrix; and
an input port that receives the signal transmitted from the keyboard matrix.

[5] The membrane keyboard according to claim 4, wherein the diode has a positive direction from the output port of the keyboard control unit to the input port of the keyboard control unit.

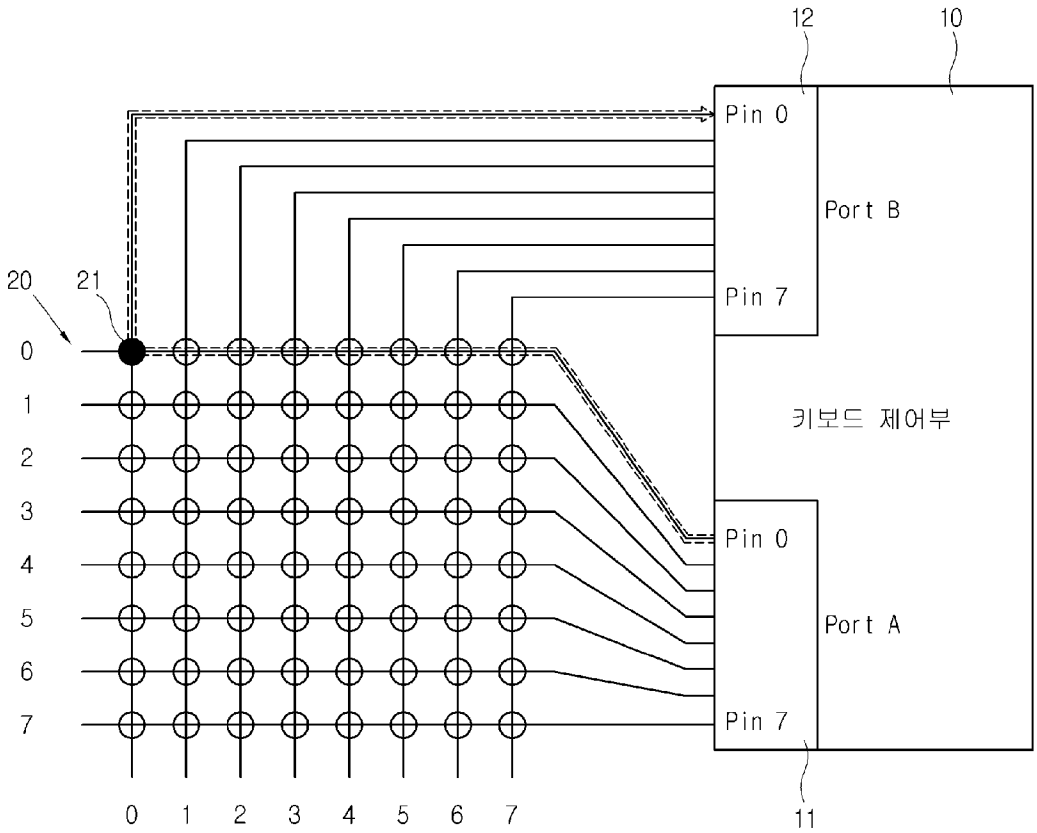
[6] A keyboard for simultaneously inputting a plurality of keys, the keyboard includes:
a keyboard matrix that includes a plurality of switch contact points;
diodes that are provided for each switch contact point of the keyboard matrix; and
a keyboard control unit that discriminates keys inputted by a user by outputting key-input detecting signals to the keyboard matrix and detecting signals correspondingly transmitted through the rectifier cells.

[7] The keyboard for simultaneously inputting a plurality of keys according to claim 6, wherein the keyboard control unit includes:
an output port that outputs a key-input detecting signal to the keyboard matrix; and
an input port that receives the signal transmitted from the keyboard matrix.

[8] The keyboard for simultaneously inputting a plurality of keys according to claim

7, wherein the diode has a positive direction from the output port of the keyboard control unit to the input port of the keyboard control unit.

[Fig. 1]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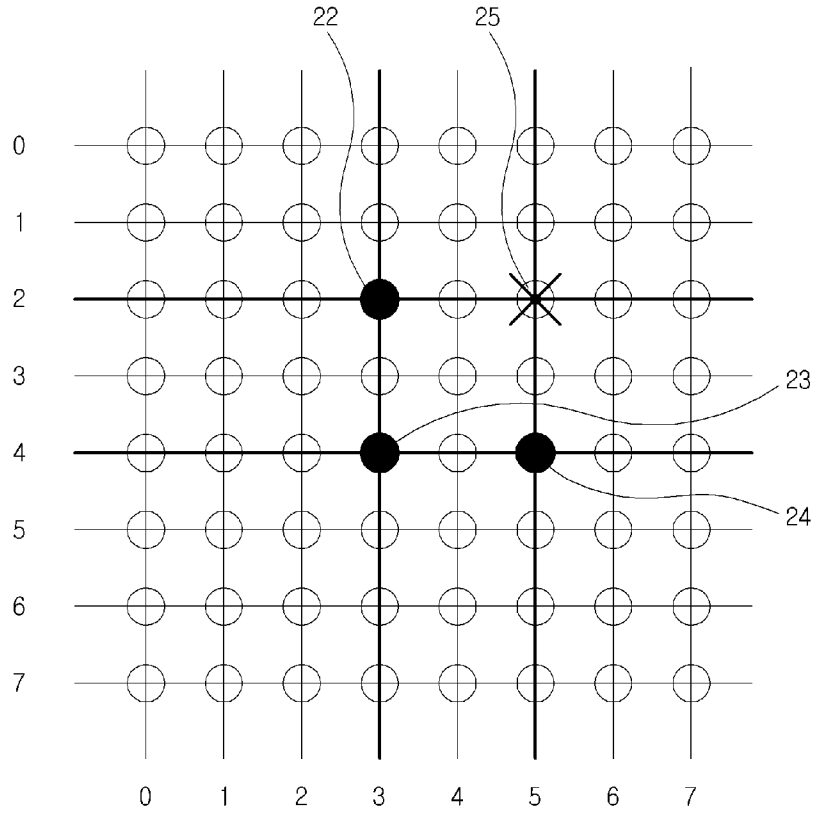
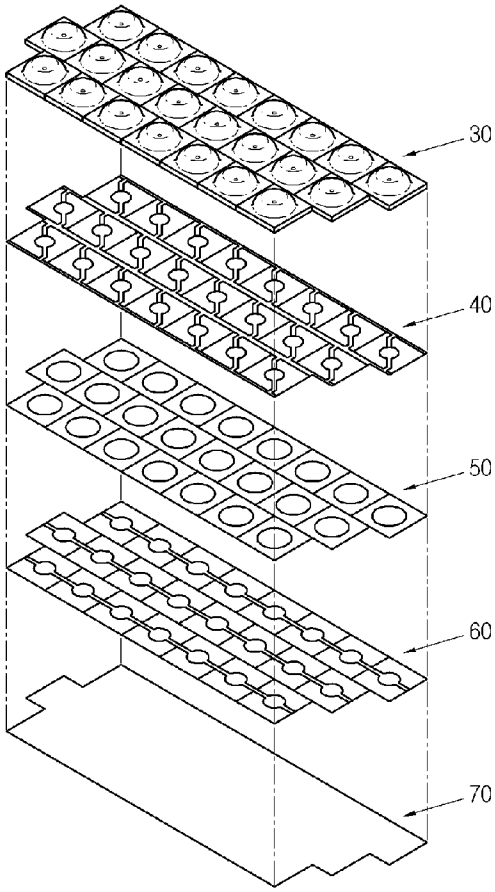
10
Pin 0
Port B
Pin 7
20
21
0
1
2
3
4
5
6
7
키보드 제어부
Pin 0
Port A
Pin 7
0 1 2 3 4 5 6 7
11

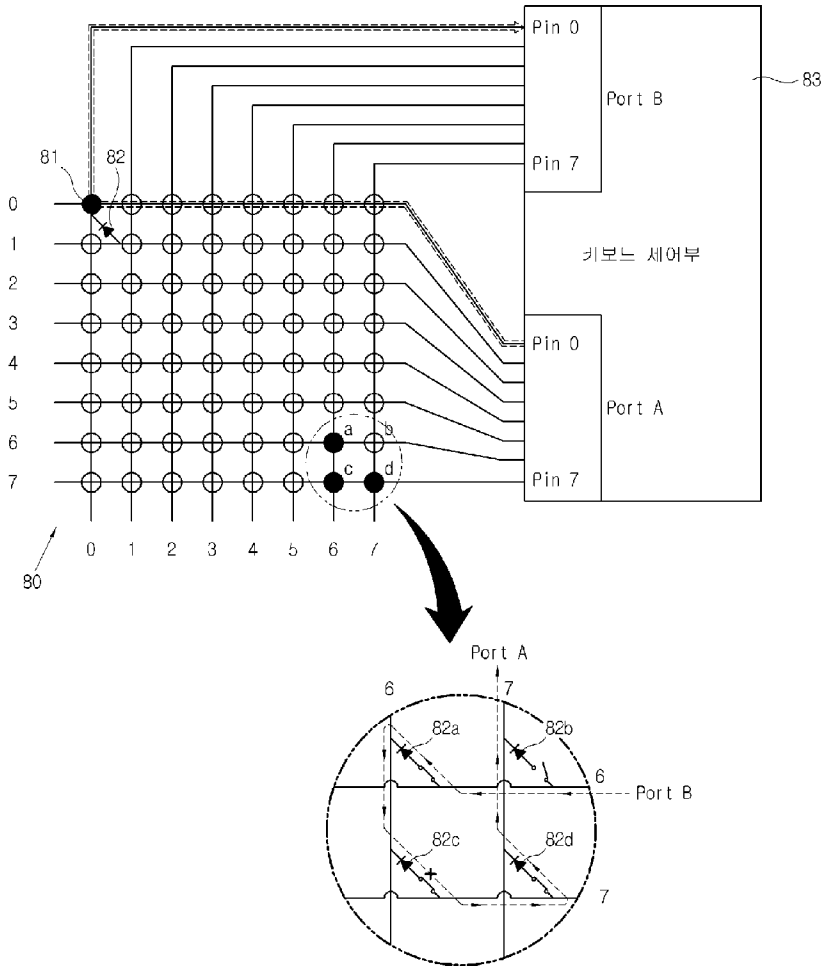
[Fig. 2]



[Fig. 3]



[Fig. 4]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Port B
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81
82
0
1
2
3
4
5
6
7
키보드 제어부
Pin 0
Port A
Pin 7
a
b
c
d
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6
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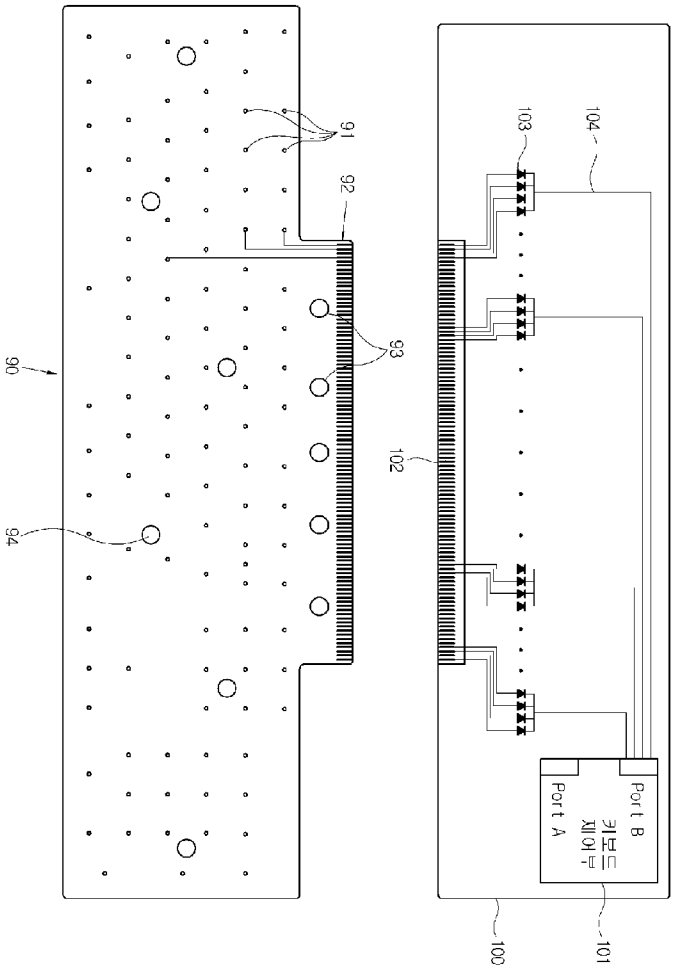
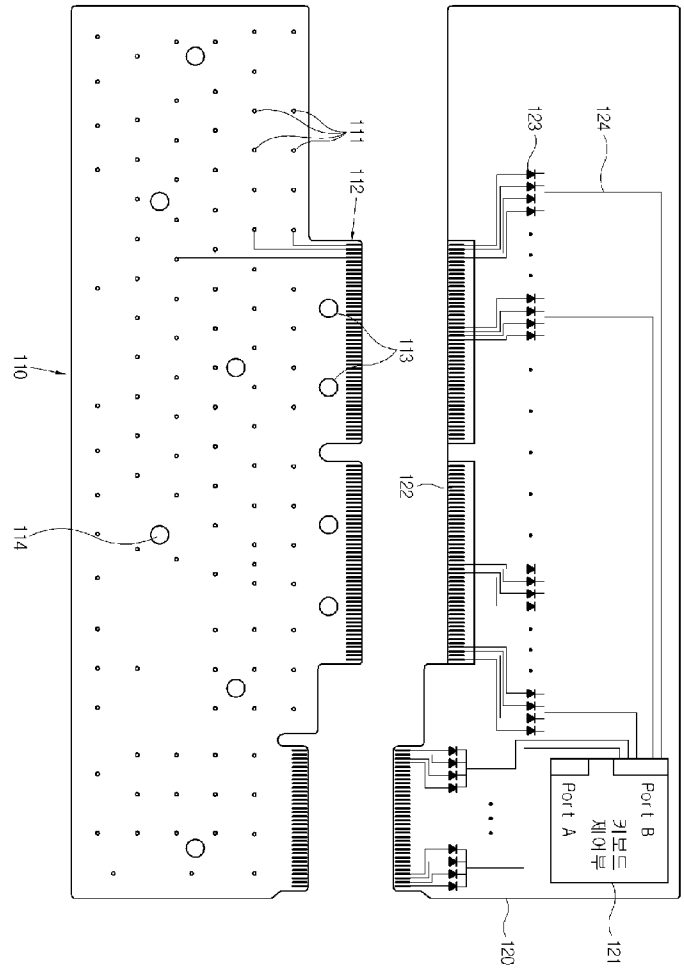
82b
6
Port B
82c
82d
7

[Fig. 5]



[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/004297

A. CLASSIFICATION OF SUBJECT MATTER

G06F 3/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8: H03M, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility Models and applications for Utility Models since 1975
Japanese Utility Models and applications for Utility Models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS(KIPO internal) : 'keyboard', 'rollover', 'diode'

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 60-181911 A (ALPS ELECTRIC CO., LTD.) 17 September 1985 See the abstract, figures 1-2, discussion of the related art and claim 1.	1-8
A	JP 06-161627 A (NEC CORP.) 10 June 1994 See the abstract, figures 8-9, paragraphs [0003] - [0006] and claims 1-5.	1-8
A	JP 06-124155 A (NEC CORP.) 06 May 1994 See the abstract, figures 8-9, paragraphs [0003] - [0006] and claims 1-4.	1-8
A	JP 08-328719 A (NEC CORP.) 13 December 1996 See the abstract, figure 6, paragraphs [0003] - [0009 and claims 1-2.	1-8
A	JP 02-310714 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 26 December 1990 See the abstract, figures 8-9 and discussion of the related art.	1-8
A	JP 63-055617 A (CANON KABUSHIKI KAISHA) 10 March 1988 See the abstract, figure 6 and discussion of the related art.	1-8
A	JP 62-278624 A (ALPS ELECTRIC CO., LTD.) 03 December 1987 See the abstract, figures 2-5 and discussion of the related art.	1-8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 DECEMBER 2008 (19.12.2008)	**19 DECEMBER 2008 (19.12.2008)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/004297

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 60-181911 A	17.09.1985	None	
JP 06-161627 A	10.06.1994	None	
JP 06-124155 A	06.05.1994	JP 2819968 B2	05.11.1998
JP 08-328719 A	13.12.1996	None	
JP 02-310714 A	26.12.1990	None	
JP 63-055617 A	10.03.1988	None	
JP 62-278624 A	03.12.1987	None	