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(54) **MULTIFUNCTION KEY ASSEMBLY**
MULTIFUNKTIONS-SCHLÜSSELBAUGRUPPE
ENSEMBLE TOUCHE MULTIFONCTION

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(73) Proprietors:
• **Iscar Ltd.**
24959 Tefen (IL)
• **Hecht, Gil**
22443 Nahariya (IL)

(72) Inventor: **HECHT, Gil**
22443 Nahariya (IL)

(74) Representative: **Vossius & Partner**
Siebertstraße 4
81675 München (DE)

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Description**FIELD OF THE INVENTION**

[0001] The present invention relates to a multifunction key assembly for an electronic device.

BACKGROUND OF THE INVENTION

[0002] There is considerable demand for the miniaturization of electronic devices in general and for cellular telephones in particular. On the other hand, there is increasing demand for electronic devices that include more and more features. Invariably, these demands result in a reduction in the display area, that is, the size of the display screen, or of the viewable area. A major reason for this being the necessity of maintaining a conventional keypad matrix arrangement for inputting data. Although the size and the spacing of the buttons that form a conventional keypad matrix arrangement are constantly being reduced as a result of miniaturization, there is a limit to their reduction. Moreover, with small buttons, or closely spaced buttons, there is a high likelihood of accidentally depressing an unintended button which is adjacent an intended button, or even simultaneously depressing two adjacent buttons thereby providing false input data. Moreover, since the buttons are depressed one by one for each input data, speed of operation is limited.

[0003] U.S. Patent No. 6,441,753 discloses a multifunction key assembly for electronic devices. The multifunction key assembly has a button member having an upper contoured surface defining nine key regions, which in a preferred embodiment, are arranged in a manner consistent with the one through nine keys of a conventional telephone keypad with the central key region representing the five key of a telephone keypad and each perimeter key region represents the remaining keys. However, unlike the conventional keypad matrix the zero, asterisk and pound sign keys are missing. An auxiliary button may be representative of the zero key. Alternatively, each key region may serve multiple functions. For example, the five key region may operate as a conventional zero key upon a double-click. This option is suggested, but its implementation is not described. Whatever the case, the numeral zero cannot be entered through the principal mode of operation and therefore every time a zero that has to be entered will disrupt the smooth flow of data input.

[0004] It is an object of the present invention to provide an improved multifunction key assembly for inputting data to an electronic device and an improved method for inputting data to an electronic device.

[0005] This object is attained with the subject matter in accordance with the respective claims.

SUMMARY OF THE INVENTION

[0006] In accordance with the present invention there

is preferably provided a multifunction key assembly comprising:

two major switches, a first-major switch, a second-major switch, and four first-minor switches, all of the switches being electrically connected to each other; a single key cap mechanically coupled to the two major switches, the single key cap being capable of selectively activating any one of the four first-minor switches and of selectively activating the two major switches either separately or simultaneously, together with any one of the first-minor switches, whereby a total of twelve possible distinct output signals can be outputted from the multifunction key assembly, four distinct output signals being obtained when the first-major switch is activated together with any one of the four first-minor switches, four further distinct output signals being obtained when the second-major switch is activated together with any one of the four first-minor switches, and four yet further distinct output signals being obtained when the first and second-major switches are simultaneously activated together with any one of the four first-minor switches.

[0007] The multifunction key assembly may be located external to, located in, or partially located in, an electronic device and the output signals may be used as input data to the electronic device. Generally, the output signals will be electric signals, which may be transformed into other types of signals.

[0008] In accordance with a preferred embodiment, the key cap is activated by moving it from a major non-active position to a major active position, the key cap being moveable from the major non-active position to the major active position by vertically depressing at least a portion of the key cap, wherein in the major non-active position both major switches are in an electrically off-state and wherein in a major active position at least one of the major switches is in an electrically on-state, there being a total of three major active positions, a first-major active position corresponding to one of the major switches being in an electrically on-state, a second-major active position corresponding to the other one of the major switches being in an electrically on-state and a third major active position corresponding to the two major switches being simultaneously in an electrically on-state.

[0009] It will be appreciated that depressing at least a portion of the key cap defines a direction, which direction is referred to herein as the vertical direction.

[0010] Further in accordance with a preferred embodiment, the key cap is horizontally displaceable in two mutually perpendicular directions to any one of four minor active positions.

[0011] Typically, the two mutually perpendicular directions are termed North-South and East-West and the four minor active positions are, in clockwise direction, North, East, South and West. The two mutually perpendicular directions are coplanar and perpendicular to the vertical

direction in which the at least a portion of the key cap is depressed.

[0012] Yet further in accordance with a preferred embodiment, for each combination of a given minor active position and a particular major active position of the key cap, a specific distinct output signal of the twelve possible distinct output signals is outputted by the multifunction key assembly.

[0013] Still yet further in accordance with a preferred embodiment, each of the four first-minor switches comprises a minor base and a minor stem extending therefrom, each major switch comprises a major base and a major stem extending therefrom and the keycap is coupled to the major stem of each major switch.

[0014] In accordance with a first preferred embodiment, the key cap has a centrally located rod extending from a lower surface thereof and passing between the four first-minor switches, and a given minor active position of the four minor active positions is obtained by the rod urging the minor stem of a given first-minor switch of the four first-minor switches towards its minor base until its electrical state is changed from an off-state to an on-state, thereby activating the given first-minor switch.

[0015] In accordance with another preferred embodiment, the multifunction key assembly further comprises a first guide member having two throughgoing guide grooves perpendicular to each other forming a cross-shaped aperture, through which the rod passes, the first guide member being located between the key cap and the four first-minor switches.

[0016] In accordance with a second preferred embodiment, the multifunction key assembly further comprises four second-minor switches electrically connected to each other and to all the other switches, wherein the major stem of the first-major switch passes between the four first-minor switches, the major stem of the second-major switch passes between the four second-minor switches, the key cap (28) is horizontally displaceable in two mutually perpendicular directions (L1, L2, H1, H2) to any one of four minor active positions, and a given minor active position of the four minor active positions is obtained by the major stem of the first-major switch urging the minor stem of a given first-minor switch of the four first-minor switches towards its minor base until its electrical state is changed from an off-state to an on-state, thereby activating the given first-minor switch, and by the stem of the second-major switch urging the minor stem of a given second-minor switch of the four second-minor switches towards its minor base until its electrical state is changed from an off-state to an on-state, thereby activating the given second-minor switch.

[0017] In accordance with yet another preferred embodiment, the multifunction key assembly further comprises exactly two guide members, each guide member having two throughgoing guide grooves perpendicular to each other forming a cross-shaped aperture, wherein the major stem of the first-major switch passes through the cross shaped aperture of a first of the guide members

and the major stem of the second-major switch passes through the cross shaped aperture of a second of the guide members, the first guide member being located between the key cap and the four first-minor switches, and the second guide member being located between the key cap and the four second-minor switches.

[0018] Preferably, there are exactly two major switches that are electrically connected to each other.

[0019] There is also provided in accordance with the present invention a method for providing one of twelve distinct output signals, preferably comprising the steps of:

- (a) providing a multifunction key assembly comprising exactly two major switches and exactly four first-minor switches electrically connected to the two major switches and to each other and a single key cap mechanically coupled to the two major switches;
- (b) vertically displacing the key cap from a major non-active position to a major active position by depressing at least a portion of the key cap, wherein in the major non-active position both major switches are in an electrically off-state and wherein in an active position at least one of the major switches is in an electrically on-state; and
- (c) horizontally displacing the key cap from a minor non-active position to a minor active position by displacing the key cap in one of two mutually perpendicular directions to one of four minor active positions, wherein in the minor non-active position all four first-minor switches are in an electrically off-state and wherein in a minor active position one of the first-minor switches is in an electrically on-state, thereby providing the one of the twelve distinct output signals.

[0020] The order of carrying out the steps of the method does not have to be in accordance with the order given above. For example, if desired, step (c) can be carried out before step (b).

[0021] In accordance with a preferred embodiment, the method comprises the further step of:

- (d) providing exactly four second-minor switches electrically connected to the two major switches and to the four first-minor switches, wherein in a minor active position one of the second-minor switches is in an electrically on-state.

[0022] There is further provided in accordance with the present invention a cellular telephone comprising:

- a casing having a plurality of surfaces;
- a display screen; and
- a multifunction key assembly comprising:
 - two major switches and four first-minor switches electrically connected to the two major switches and to each other;
 - a single key cap mechanically coupled to the two

major switches, the single key cap being capable of selectively activating each one of the four first-minor switches and of selectively activating the two major switches either separately or simultaneously, together with any one of the first-minor switches, whereby a total of twelve possible distinct output signals can be outputted from the multifunction key assembly.

[0023] If desired, the display screen is located on a front surface of the casing and the key cap is located on a side surface of the casing.

[0024] The present invention provides the following preferred advantages over conventional technologies:

1. It facilitates the miniaturization of electronic devices in general and cellular telephones in particular;
2. It enables the use of larger display screens;
3. The multifunction key is operated by a single key cap;
4. The single key cap may be operated by the thumb of one hand of an operator;
5. The single key cap is simple to operate. Twelve distinct output signals can be obtained by displacing the key cap horizontally in two mutually perpendicular directions (North - South, East - West) in combination with depressing the key cap at three different regions thereof.

[0025] Other advantages of the present invention are readily apparent to those skilled in the art from the following figures, description, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] For a better understanding of the present invention and to show how the same may be carried out in practice, reference will now be made to the accompanying drawings, in which:

Fig. 1 is a perspective view of a typical cellular telephone with a multifunction key assembly according to the present invention;

Fig. 2 is a top perspective view of a multifunction key assembly module according to the present invention;

Fig. 3 is a partially exploded top perspective view of the multifunction key assembly module of Fig. 2, in accordance with a first embodiment of the present invention;

Fig. 4 is a fully exploded view of the multifunction key assembly module of Fig. 3;

Fig. 5 is a partially exploded top perspective view of the multifunction key assembly module of Fig. 2, in accordance with a second embodiment of the

present invention;

Fig. 6 is a fully exploded view of the multifunction key assembly module of Fig. 5;

Fig. 7 is a top view of the multifunction key assembly module of Fig. 2 with key cap in a major non-active position;

Fig. 8 is a top view of the multifunction key assembly module of Fig. 2, in accordance with the first embodiment, with key cap removed, showing where the major stem of the key cap would be located (dashed line) if the key cap was not removed;

Fig. 9 is a top view of the multifunction key assembly module of Fig. 2, in accordance with the second embodiment, with key cap removed;

Fig. 10A is a side view of the multifunction key assembly module of Fig. 2 with key cap in a major non-active position;

Fig. 10B is a side view of the multifunction key assembly module of Fig. 2 with key cap in a first-major active position;

Fig. 10C is a side view of the multifunction key assembly module of Fig. 2 with key cap in a second-major active position;

Fig. 10D is a side view of the multifunction key assembly module of Fig. 2 with key cap in a third-major active position;

Fig. 11 is an illustrative view of one possible arrangement of the electrical wiring of the multifunction key assembly in accordance with the first embodiment;

Fig. 12 is an illustrative view of one possible arrangement of the electrical wiring of the multifunction key assembly in accordance with the second embodiment;

DETAILED DESCRIPTION OF THE INVENTION

[0027] Attention is drawn to Fig. 1 showing a typical electronic device **20** in accordance with the present invention. A non-binding example of such an electronic device **20** as illustrated in Fig. 1 is a cellular telephone. The electronic device **20** comprises a casing **22**, a display screen **24** on a front surface **25** of the casing **22**, a multifunction key assembly **26** in accordance with the present invention having a key cap **28**, a loudspeaker **30**, an earphone **32**, a microphone **34** and auxiliary keys **36**. Noticeably missing is the conventional keypad for inputting data to the electronic device **20**. Moreover, the multifunction key assembly **26** of the present invention is much smaller than the conventional keypad and therefore may be positioned within the electronic device **20** in such a manner that the key cap **28** is located on a side surface **37** of the casing **22** of the electronic device **20**, thereby freeing the great majority of space of the front surface **25** for the display screen **24**, as shown in Fig. 1.

[0028] The multifunction key assembly **26** can be incorporated in the electronic device **20** as an integral part thereof, or it may be manufactured as a separate module and conveniently inserted and removed therefrom as re-

quired. The multifunction key assembly **26** in the form of a module is shown in Fig. 2. For convenience of illustration only, the multifunction key assembly **26** in the form of a module will be described. This has no limiting effect on the description of the multifunction key assembly **26**, but merely serves to restrict the description to the members of the multifunction key assembly **26**, thereby excluding from the description members of the electronic device **20** which are not relevant to the invention. The multifunction key assembly **26** in the form of a module has a housing **38**, within which all the members of the multifunction key assembly **26** are located, apart from the key cap **28**. It will be appreciated that if the multifunction key assembly **26** is not a separate module but is incorporated in the electronic device **20** as an integral part thereof, then the housing **38** of the multifunction key assembly **26** may be a part of the casing **22** of the electronic device **20**.

[0029] With reference to Figs. 3 and 4, the multifunction key assembly **26** in accordance with a first embodiment of the present invention, comprises two major switches **40**, which will be referred to individually as first and second-major switches **40'**, **40''**, four first-minor switches **42'**, which will be referred to individually as first, second, third and fourth first-minor switches **42'a**, **42'b**, **42'c**, **42'd** and a first guide member **44'**. Both the major and first-minor switches **40**, **42'** are electrical switches and may be push button switches. Each major switch **40** has a major stem **46** extending from a major base **48** and each first-minor switch **42'** has a minor stem **50** extending from a minor base **52**. The major stem **46** of each major switch **40** has a longitudinal axis **A**, defining a longitudinal direction of the major switch **40**. Extending from the major base **48** of each major switch **40** are two electrically conducting major leads **54**. Similarly, extending from the minor base **52** of each first-minor switch **40** are two electrically conducting minor leads **56**.

[0030] The key cap **28** has opposing upper and lower surfaces **58**, **60** and has a generally elongated oval or elliptical shape having a long dimension **D** defining a longitudinal axis **L** of the key cap **28**. Two push knobs **62** (**62'**, **62''**) project from the upper surface **58** of the key cap **28** at ends of the key cap **28**, that is, at extremities of the long dimension **D** of the key cap **28**. In addition, two opposing elongated projections **64** project from the upper surface **58**, extending adjacent long edges **66** of the key cap **28** on opposite sides of the longitudinal axis **L**. The end of each major stem **46** distal the major base **48** is retained in a corresponding bore (not seen) in the lower surface **60** of the key cap **28**, thereby mechanically connecting the key cap **28** to the major switches **40**.

[0031] The first guide member **44'** has two throughgoing guide grooves **68**, **70** perpendicular to each other forming a cross-shaped aperture **72**. One of the guide grooves **68** is aligned with the longitudinal axis **L** of the key cap **28** and will be referred to herein as the longitudinal guide groove. The other guide groove **70** is perpendicular to the longitudinal axis **L** of the key cap **28** and

will be referred to herein as the transverse guide groove. The key cap **28** has a centrally located rod **74** extending from its lower surface **60** in a direction generally parallel to the major stems **46** and generally perpendicular to the minor stems **50**. The first guide member **44'** is located between the first-minor switches **42'** and the key cap **28**, with the rod **74** of the key cap **28** passing through the cross-shaped aperture **72** of the first guide member **44'** and between all four of the first-minor switches **42'**.

[0032] Attention is now drawn to Figs. 5 and 6. The multifunction key assembly **26** in accordance with the second embodiment of the present invention, comprises two major switches **40** (**40'**, **40''**), four first-minor switches **42'** (**42'a**, **42'b**, **42'c**, **42'd**), four similar or identical second-minor switches **42''** (**42''a**, **42''b**, **42''c**, **42''d**) and first and second guide members **44'**, **44''**. Unlike the first embodiment, in accordance with the second embodiment the key cap **28** is not provided with a rod. The first guide member **44'** is located between the first-minor switches **42'** and the key cap **28**, with the major stem **46** of the first-major switch **40'** passing between all four of the first-minor switches **42'** and through the cross-shaped aperture **72** of the first guide member **44'**. Similarly, the second guide member **44''** is located between the second-minor switches **42''** and the key cap **28**, with the major stem **46** of the second-major switch **40''** passing between all four of the second-minor switches **42''** and through the cross-shaped aperture **72** of the second guide member **44''**. As with the first embodiment, the end of each major stem **46** distal the major base **48** is retained in a corresponding bore (not seen) in the lower surface **60** of the key cap **28**, thereby mechanically connecting the key cap **28** to the major switches **40'**, **40''**.

[0033] The key cap **28** can be moved in various directions by applying an external force to it. In general, an external force is applied to the key cap **28** by an operator placing a thumb on the upper surface **60** of the key cap **28**, or on one of the push knobs **62'**, **62''** and then either depressing the key cap **28** and displacing it "vertically" by applying a force to the key cap **28** in the longitudinal direction of the major switches **40'**, **40''**, or displacing the key cap **28** "horizontally" by applying a force to the key cap **28** in a direction perpendicular to the longitudinal direction of the major switches **40'**, **40''**. In addition, both vertical and horizontal forces can be applied simultaneously. The major stems **46** are preferably resilient to allow sufficient horizontal displacement of the key cap **28**.

[0034] Attention is now referred additionally to Figs. 7 to 9 and Figs. 10A to 10D. If no vertical force is applied to the key cap **28**, then the key cap **28** is said to be in a non-major active state (Fig. 10A). If no external force at all is applied to the key cap **28**, then the key cap **28** is un-displaced horizontally (Figs. 7 to 9) and un-displaced vertically (Fig. 10A) and is said to be in its rest position. Since the rod **74** is affixed to the key cap **28** and therefore with the key cap **28** removed the rod **74** is not in the housing, it is shown by a dashed line in Fig. 8, representing where the rod **74** would be positioned if the key cap

28 was not removed. In the first embodiment, the rod 74 is constrained to move horizontally in the guide grooves 68, 70 (Fig. 8), and in the second embodiment, the major stems 46 are constrained to move horizontally in the guide grooves 68, 70 (Fig. 9). Therefore, horizontal displacement of the key cap 28 is constrained to longitudinal and transverse movement, corresponding to movement of the rod 74 (first embodiment) or the major stems 46 (second embodiment) in the longitudinal and transverse guide grooves 68, 70, in the longitudinal and transverse directions L1, L2 and H1, H2 respectively. In other words, the key cap 28 can be displaced horizontally in two mutually perpendicular directions to four horizontal displacement directions L1, L2, H1, H2.

[0035] When the key cap 28 is displaced vertically by depressing it, it is displaced from its rest position, or from a major non-active position, (Fig. 10A), to a "major active position". There are precisely three major active positions. A first-major active position (Fig. 10B) is obtained by displacing a first end of the key cap 28 vertically, that is, by depressing the first of the push knobs 62' so that only the major stem 46 of the first-major switch 40' is displaced vertically as it is urged towards its major base 48 thereby changing the electrical state of the first-major switch 40' from an off-state (electrically non-conducting) to an on-state (electrically conducting). A second-major active position (Fig. 10C) is obtained by displacing a second end of the key cap 28 vertically, that is, by depressing the second push knob 62" so that only the major stem 46 of the second-major switch 40" is displaced vertically as it is urged towards its major base 48 thereby changing the electrical state of the of the second-major switch 40" from an off-state to an on-state. A third major active position (Fig. 10D) is obtained by displacing the whole of the key cap 28 vertically, that is, by depressing the upper surface 60 of the key cap 28 at a location between the two push knobs 62', 62" so that both major stems 46 are displaced vertically thereby changing the electrical state of both major switches 40', 40" from an off-state to an on-state. In other words, a "major active position" of the key cap 28 is defined as an on-state of at least one of the major switches 40', 40".

[0036] After the key cap 28 has been moved to a given major active position by depressing it vertically, an output signal can be obtained by moving the key cap 28 to a particular "minor active position". A "minor active position" is defined herein as an on-state (electrically conducting) of at least one of the minor switches 42' (42'a, 42'b, 42'c, 42'd), 42" (421'a, 421'b, 421'c, 421'd). This is achieved by displacing the key cap 28 horizontally either longitudinally or transversely so that force is applied to the minor stem 50 of a particular minor switch 42', 42" urging it towards its minor base 52 until its electrical state is changed from an off-state (electrically non-conducting) to an on-state (electrically conducting). In the first embodiment, it is the rod 74 of the key cap 28 that applies force to the minor stem 50 of a particular first-minor switch 42'. In the second embodiment, it is the stem 46 of the

first-major switch 40' that applies force to the minor stem 50 of a particular first-minor switch 42' and the stem 46 of the second-major switch 40" that applies force to the minor stem 50 of a particular second-minor switch 42".

[0037] A distinct output signal is obtained for each combination of a given major active position and a particular minor active position. The elongated projections 64 serve to prevent the operator's thumb from slipping when displacing the key cap 28 horizontally or when the operator's thumb is at a location between the two push knobs 62. Since there are three major active positions (Fig. 10B, Fig. 10C and Fig. 10D) and four minor active positions, corresponding to the four horizontal displacement directions L1, L2, H1, H2 of the key cap and the ensuing activation of a particular minor switch 42', 42", a total of twelve distinct output signals can be obtained. The four horizontal displacement directions L1, L2, H1, H2, of the key cap 28 and the ensuing activation of a particular minor switch 42', 42", define first, second, third and fourth minor active positions of the key cap 28.

[0038] As a non-binding example, one could choose these twelve distinct output signals to represent the 10 numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, 0 and the functions "clear" and "back space". Which particular combinations of major active positions and minor active positions are used to represent these twelve outputs is a matter of choice. As a non-binding example, the four output signals for the numerals 1, 2, 3 and 4, defining a first set of outputs, may be obtained using the first-major active position (Fig. 10B) along with the first, second, third and fourth minor active positions, respectively; the four output signals for the numerals 5, 6, 7 and 8, defining a second set of outputs, may be obtained using the second-major active position (Fig. 10C) along with the first, second, third and fourth minor active positions, respectively; and the four output signals for the two numerals 9, 0, and the two functions "clear" and "back space", defining a third set of outputs, may be obtained using the third major active position (Fig. 10D) along with the first, second, third and fourth minor active positions, respectively.

[0039] Reference is now made to Fig. 11 showing an illustrative view of one possible arrangement for the electrical wiring of the multifunction key assembly 26 in accordance with the first embodiment that will enable the multifunction key assembly 26 to provide the output signals mentioned above. The two major switches 40', 40" and the four first-minor switches 42' (42'a, 42'b, 42'c, 42'd) are electrically connected to each other, with one of the electrically conducting major leads 54 of each major switch 40', 40" and one of the electrically conducting minor leads 56 of each first-minor switch 40' being electrically common, and the other electrically conducting major lead 54 of each major switch 40', 40" and the other electrically conducting minor lead 56 of each first-minor switch 40' being electrically common and grounded.

[0040] For illustrative purposes, the output signals for the first, second, third and fourth minor active positions, are denoted by (I), (II), (III) and (IV), respectively, and

the output signals for the first and second-major active positions are denoted by (IXb) and (IXc), respectively. With this notation, in accordance with the example given above, the output signal for the numeral 1, from the first set of outputs, is given symbolically by the combination (IXb) + (I), that is, the first push knob 62' is depressed, so that the first-major switch 40' is in an on-state, as shown in Fig. 10B and the key cap 28 is in the first-minor active position. Similarly, the output signal for the numeral 5, from the second set of outputs, is given symbolically by the combination (IXc) + (I), that is, the second push knob 62" is depressed, so that second-major switch 40" is in an on-state, as shown in Fig. 10C and the key cap 28 is in the first-minor active position. In order to obtain an output signal from the third set of output signals, both major switches 40', 40" have to be in an on-state, that is, both push knobs 62 have to be depressed, as shown in Fig. 10D. For example the output signal for the numeral 9 is given symbolically by the combination (IXb) + (IXc) + (I).

[0041] In order to output other signals, such as letters of the alphabet, the key cap 28 may be "double-clicked" before it is displaced in the manner described above. Alternatively, one or more of the auxiliary keys 36 may be actuated. Therefore, a large amount of information such as numerals, letters, symbols, functions, etc. can be outputted from the multifunction key assembly 26.

[0042] Reference is now made to Fig. 12 showing an illustrative view of one possible arrangement for the electrical wiring of the multifunction key assembly 26 in accordance with the second embodiment that will enable the multifunction key assembly 26 to provide the same output signals as those obtained for the first embodiment. The two major switches 40', 40", the four first-minor switches 42' (42'a, 42'b, 42'c, 42'd) and the four second-minor switches 42" (42"a, 42"b, 42"c, 42"d) are electrically connected to each other, with one of the electrically conducting major leads 54 of each major switch 40', 40" and one of the electrically conducting minor leads 56 of each first-minor switch 42' and each second-minor switch 42" being electrically common, and the other electrically conducting major lead 54 of each major switch 40', 40" and the other electrically conducting minor lead 56 of each first-minor switch 40 and each second-minor switch 42" being electrically common and grounded.

[0043] The twelve distinct output signals are obtained from the multifunction key assembly 26 of the second embodiment, by applying the same set of operations to the key cap 28 as described for the first embodiment. For example, the output signal for the numeral 1, from the first set of outputs, is given symbolically by the combination (IXb) + (I), that is, the first push knob 62' is depressed, so that the first-major switch 40' is in an on-state, as shown in Fig. 10B and the key cap 28 is in the first-minor active position. As described above, the only difference between the first and second embodiments being that in the first embodiment, it is the rod 74 of the key cap 28 that applies force to the minor stem 50 of a particular

first-minor switch 42' to obtain a particular minor active position of the key cap 28. Whereas, in the second embodiment, it is the stem 46 of the first-major switch 40' that applies force to the minor stem 50 of a particular first-minor switch 42' and the stem 46 of the second-major switch 40" that applies force to the minor stem 50 of a particular second-minor switch 42" to obtain a particular minor active position of the key cap 28.

[0044] Although the present invention has been described to a certain degree of particularity, it should be understood that various alterations and modifications could be made without departing from the scope of the invention as hereinafter claimed. In particular, the present invention has been described with reference to a cellular telephone. However, it will be appreciated that the present invention is also amenable to other like electronic devices.

20 Claims

1. A multifunction key assembly (26) comprising:

two major switches, a first-major switch (40'), a second-major switch (40"), and four first-minor switches (42'a, 42'b, 42'c, 42'd), all of the switches being electrically connected to each other; a single key cap (28) mechanically coupled to the two major switches (40', 40"), the single key cap (28) being capable of selectively activating any one of the four first-minor switches (42'a, 42'b, 42'c, 42'd) and of selectively activating the two major switches (40', 40") either separately or simultaneously, together with any one of the first-minor switches (42'a, 42'b, 42'c, 42'd), whereby a total of twelve possible distinct output signals can be outputted from the multifunction key assembly (26), four distinct output signals being obtained when the first-major switch (40') is activated together with any one of the four first-minor switches (42'a, 42'b, 42'c, 42'd), four further distinct output signals being obtained when the second-major switch (40") is activated together with any one of the four first-minor switches (42'a, 42'b, 42'c, 42'd), and four yet further distinct output signals being obtained when the first and second-major switches (40', 40") are simultaneously activated together with any one of the four first-minor switches (42'a, 42'b, 42'c, 42'd).

2. The multifunction key assembly (26) according to claim 1, wherein the key cap (28) is activated by moving it from a major non-active position to a major active position, the key cap being moveable from the major non-active position to the major active position by vertically depressing at least a portion of the key cap (28), wherein in the major non-active position

- both major switches (40', 40'') are in an electrically off-state and wherein in a major active position at least one of the major switches (40', 40'') is in an electrically on-state, there being a total of three major active positions, a first-major active position corresponding to one of the major switches (40', 40'') being in an electrically on-state, a second-major active position corresponding to the other one of the major switches (40', 40'') being in an electrically on-state and a third major active position corresponding to the two major switches (40', 40'') being simultaneously in an electrically on-state.
3. The multifunction key assembly (26) according to claim 2, wherein the key cap (28) is horizontally displaceable in two mutually perpendicular directions (L1, L2, H1, H2) to any one of four minor active positions.
 4. The multifunction key assembly (26) according to claim 3, wherein for each combination of a given minor active position and a particular major active position of the key cap (28), a specific distinct output signal of the twelve possible distinct output signals is outputted by the multifunction key assembly (26).
 5. The multifunction key assembly (26) according to claim 1, wherein each of the four first-minor switches (42'a, 42'b, 42'c, 42'd) comprises a minor base (52) and a minor stem (50) extending therefrom, each major switch (40', 40'') comprises a major base (48) and a major stem (46) extending therefrom and the keycap (28) is coupled to the major stem (46) of each major switch (40', 40'').
 6. The multifunction key assembly (26) according to claim 5, wherein the key cap (28) has a centrally located rod (74) extending from a lower surface (60) thereof and passing between the four first-minor switches (42'a, 42'b, 42'c, 42'd), and a given minor active position of the four minor active positions is obtained by the rod (74) urging the minor stem (50) a given first-minor switch of the four first-minor switches towards its minor base (52) until its electrical state is changed from an off-state to an on-state, thereby activating the given first-minor switch.
 7. The multifunction key assembly (26) according to claim 6, further comprising a first guide member (44') having two throughgoing guide grooves (68, 70) perpendicular to each other forming a cross-shaped aperture (72), through which the rod (74) passes, the first guide member (44') being located between the key cap (28) and the four first-minor switches.
 8. The multifunction key assembly (26) according to claim 5, further comprising four second-minor switches (42''a, 42''b, 42''c, 42''d) electrically connected to each other and to all the other switches; wherein the major stem (46) of the first-major switch (40') passes between the four first-minor switches (42'a, 42'b, 42'c, 42'd); the major stem (46) of the second-major switch (40'') passes between the four second-minor switches (42''a, 42''b, 42''c, 42''d); the key cap (28) is horizontally displaceable in two mutually perpendicular directions (L1, L2, H1, H2) to any one of four minor active positions; and wherein a given minor active position of the four minor active positions is obtained by the major stem (46) of the first-major switch (40') urging the minor stem (50) of a given first-minor switch of the four first-minor switches (42'a, 42'b, 42'c, 42'd) towards its minor base (52) until its electrical state is changed from an off-state to an on-state, thereby activating the given first-minor switch, and by the major stem of the second-major switch (40'') urging the minor stem (50) of a given second-minor switch of the four second-minor switches (42''a, 42''b, 42''c, 42''d) towards its minor base (52) until its electrical state is changed from an off-state to an on-state, thereby activating the given second-minor switch.
 9. The multifunction key assembly (26) according to claim 8, further comprising exactly two guide members (44', 44''), each guide member having two throughgoing guide grooves (68, 70) perpendicular to each other forming a cross-shaped aperture (72), wherein the major stem (46) of the first-major switch (40') passes through the cross shaped aperture (72) of a first of the guide members (44') and the major stem (46) of the second-major switch (40'') passes through the cross shaped aperture (72) of a second of the guide members (44''), the first guide member being located between the key cap and the four first-minor switches, and the second guide member being located between the key cap and the four second-minor switches.
 10. The multifunction key assembly (26) according to claim 1, wherein there are exactly two major switches (40', 40'') that are electrically connected to each other.
 11. A method for providing one of twelve distinct output signals comprising the steps of:
 - (a) providing a multifunction key assembly (26) comprising exactly two major switches (40', 40'') and exactly four first-minor switches (42'a, 42'b, 42'c, 42'd) electrically connected to the two major switches (40', 40'') and to each other and a single key cap (28) mechanically coupled to the two major switches (40', 40'');
 - (b) vertically displacing the key cap (28) from a major non-active position to a major active position by depressing at least a portion of the key

cap (28), wherein in the major non-active position both major switches (40', 40'') are in an electrically off-state and wherein in an active position at least one of the major switches (40', 40'') is in an electrically on-state; and

(c) horizontally displacing the key cap (28) from a minor non-active position to a minor active position by displacing the key cap in one of two mutually perpendicular directions (L1, L2, H1, H2) to one of four minor active positions, wherein in the minor non-active position all four first-minor switches (42'a, 42'b, 42'c, 42'd) are in an electrically off-state and wherein in a minor active position one of the first-minor switches (42'a, 42'b, 42'c, 42'd) is in an electrically on-state, thereby providing the one of the twelve distinct output signals.

12. The method for providing one of twelve distinct output signals according to claim 11, comprising the further step of:

(d) providing exactly four second-minor switches (42''a, 42''b, 42''c, 42''d) electrically connected to the two major switches (40', 40'') and to the four first-minor switches (42'a, 42'b, 42'c, 42'd), wherein in an minor active position one of the second-minor switches (42''a, 42''b, 42''c, 42''d) is in an electrically on-state.

13. A cellular telephone (20) comprising:

a casing (22) having a plurality of surfaces (25, 37);
 a display screen (24); and
 a multifunction key assembly (26) comprising:
 two major switches (40', 40'') and four first-minor switches (42'a, 42'b, 42'c, 42'd) electrically connected to the two major switches (40', 40'') and to each other;
 a single key cap (28) mechanically coupled to the two major switches (40', 40''), the single key cap (28) being capable of selectively activating each one of the four first-minor switches (42'a, 42'b, 42'c, 42'd) and of selectively activating the two major switches (40', 40'') either separately or simultaneously, together with any one of the first-minor switches (42'a, 42'b, 42'c, 42'd), whereby a total of twelve possible distinct output signals can be outputted from the multifunction key assembly (26).

Patentansprüche

1. Multifunktionstastenanordnung (26) mit:

zwei Hauptschaltern, einem Ersthauptschalter

(40'), einem Zweithauptschalter (40''), und vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd), wobei alle Schalter miteinander elektrisch verbunden sind;

einer einzelnen Tastenkappe (28), die mit den beiden Hauptschaltern (40', 40'') mechanisch gekoppelt ist, wobei die einzelne Tastenkappe (28) in der Lage ist, einen der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) selektiv zu aktivieren und die beiden Hauptschalter (40', 40'') entweder zusammen mit irgendeinem der Erstnebenschalter (42'a, 42'b, 42'c, 42'd) getrennt oder gleichzeitig selektiv zu aktivieren, wodurch insgesamt zwölf mögliche unterschiedliche Ausgangssignale von der Multifunktionstastenanordnung (26) ausgegeben werden können, wobei vier unterschiedliche Ausgangssignale erzeugt werden, wenn der Ersthauptschalter (40') zusammen mit irgendeinem der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) aktiviert wird, weitere vier eindeutige Ausgangssignale erzeugt werden, wenn der Zweithauptschalter (40'') zusammen mit irgendeinem der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) aktiviert wird, und noch vier weitere eindeutige Ausgangssignale erzeugt werden, wenn der Erst- und Zweithauptschalter (40', 40'') zusammen mit irgendeinem der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) gleichzeitig aktiviert werden.

2. Multifunktionstastenanordnung (26) nach Anspruch 1, wobei die Tastenkappe (28) **dadurch** aktiviert wird, dass sie aus einer nicht aktiven Hauptposition in eine aktive Hauptposition bewegt wird, wobei die Tastenkappe aus der nicht aktiven Hauptposition durch vertikales Drücken zumindest eines Abschnitts der Tastenkappe (28) in die aktive Hauptposition bewegbar ist, wobei in der nicht aktiven Hauptposition beide Hauptschalter (40', 40'') in einem elektrischen Aus-Zustand sind und wobei in einer aktiven Hauptposition zumindest einer der Hauptschalter (40', 40'') in einem elektrischen Ein-Zustand ist, wobei insgesamt drei aktive Hauptpositionen vorhanden sind, wobei es einer ersten aktiven Hauptposition gleichkommt, wenn einer der Hauptschalter (40', 40'') in einem elektrischen Ein-Zustand ist, einer zweiten aktiven Hauptposition gleichkommt, wenn der andere der Hauptschalter (40', 40'') in einem elektrischen Ein-Zustand ist, und einer dritten aktiven Hauptposition gleichkommt, wenn die beiden Hauptschalter (40', 40'') gleichzeitig in einem elektrischen Ein-Zustand sind.

3. Multifunktionstastenanordnung (26) nach Anspruch 2, wobei die Tastenkappe (28) in zwei zueinander senkrechten Richtungen (L1, L2, H1, H2) in irgendeine von vier aktiven Nebenpositionen horizontal

verschiebbar ist.

4. Multifunktionstastenanordnung (26) nach Anspruch 3, wobei für jede Kombination einer gegebenen aktiven Nebenposition und einer bestimmten aktiven Hauptposition der Tastenkappe (28) ein spezifisches eindeutiges Ausgangssignal der zwölf möglichen eindeutigen Ausgangssignale durch die Multifunktionstastenanordnung (26) ausgegeben wird. 5
5. Multifunktionstastenanordnung (26) nach Anspruch 1, wobei jeder der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) eine Nebenbasis (52) und einen sich von dieser erstreckenden Nebenschaft (50) aufweist, wobei jeder Hauptschalter (40', 40'') eine Hauptbasis (48) und einen sich von dieser erstreckenden Haupterschaft (46) aufweist, und wobei die Tastenkappe (28) mit dem Haupterschaft (46) jedes Hauptschalters (40', 40'') gekoppelt ist. 10
6. Multifunktionstastenanordnung (26) nach Anspruch 5, wobei die Tastenkappe (28) einen mittig angeordneten Stab (74) hat, der sich von seiner unteren Fläche (60) erstreckt und zwischen den vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd) hindurchreicht, und eine gegebene aktive Nebenposition der vier aktiven Nebenpositionen **dadurch** erreicht wird, dass der Stab (74) den Nebenschaft (50) eines gegebenen Erstnebenschalters der vier Erstnebenschalter in Richtung seiner Nebenbasis (52) drückt, bis sein elektrischer Zustand von einem Aus-Zustand in einen Ein-Zustand geändert wird, wodurch der gegebene Erstnebenschalter aktiviert wird. 15
7. Multifunktionstastenanordnung (26) nach Anspruch 6, ferner mit einem ersten Führungsteil (44') mit zwei durchgehenden Führungsnuten (68, 70), die senkrecht zueinander sind und eine kreuzförmige Öffnung (72) bilden, durch die der Stab (74) reicht, wobei das erste Führungsteil (44') sich zwischen der Tastenkappe (28) und den vier Erstnebenschaltern befindet. 20
8. Multifunktionstastenanordnung (26) nach Anspruch 5, ferner mit vier Zweitnebenschaltem (42''a, 42''b, 42''c, 42''d), die miteinander und mit allen anderen Schaltern elektrisch verbunden sind; wobei der Haupterschaft (46) des Ersthauptschalters (40') zwischen den vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd) hindurchreicht; wobei der Haupterschaft (46) des Zweithauptschalters (40'') zwischen den vier Zweitnebenschaltern (42''a, 42''b, 42''c, 42''d) hindurchreicht; wobei die Tastenkappe (28) in zwei zueinander senkrechten Richtungen (L1, L2, H1, H2) horizontal in irgendeine der vier aktiven Nebenpositionen verschiebbar ist; und wobei eine gegebene aktive Nebenposition der vier aktiven Nebenpositionen **dadurch** erreicht wird, dass der Haupterschaft (46) 25
- des Ersthauptschalters (40') den Nebenschaft (50) eines gegebenen Erstnebenschalters der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) in Richtung seiner Nebenbasis (52) drückt, bis sein elektrischer Zustand von einem Aus-Zustand in einen Ein-Zustand geändert wird, wodurch der gegebene Erstnebenschalter aktiviert wird, und dass der Haupterschaft des Zweithauptschalters (40'') den Nebenschaft (50) eines gegebenen Zweitnebenschalters der vier Zweitnebenschalter (42''a, 42''b, 42''c, 42''d) in Richtung seiner Nebenbasis (52) drückt, bis sein elektrischer Zustand von einem Aus-Zustand in einen Ein-Zustand geändert wird, wodurch der gegebene Zweitnebenschalter aktiviert wird. 30
9. Multifunktionstastenanordnung (26) nach Anspruch 8, ferner mit genau zwei Führungsteilen (44', 44''), wobei jedes Führungsteil zwei durchgehende Führungsnuten (68, 70) hat, die senkrecht zueinander sind und eine kreuzförmige Öffnung (72) bilden, wobei der Haupterschaft (46) des Ersthauptschalters (40') durch die kreuzförmige Öffnung (72) eines ersten der Führungsteile (44') hindurchreicht und der Haupterschaft (46) des Zweithauptschalters (40'') durch die kreuzförmige Öffnung (72) eines zweiten der Führungsteile (44'') hindurchreicht, wobei das erste Führungsteil sich zwischen der Tastenkappe und den vier Erstnebenschaltern befindet und das zweite Führungsteil sich zwischen der Tastenkappe und den vier Zweitnebenschaltem befindet. 35
10. Multifunktionstastenanordnung (26) nach Anspruch 1, wobei genau zwei Hauptschalter (40', 40'') vorhanden sind, die miteinander elektrisch verbunden sind. 40
11. Verfahren zur Bereitstellung eines der zwölf eindeutigen Ausgangssignalen mit den folgenden Schritten: 45
 - (a) Bereitstellen einer Multifunktionstastenanordnung (26) mit genau zwei Hauptschaltern (40', 40'') und genau vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd), die mit den beiden Hauptschaltern (40', 40'') und miteinander elektrisch verbunden sind, und einer einzelnen Tastenkappe (28), die mit den beiden Hauptschaltern (40', 40'') mechanisch gekoppelt ist; 50
 - (b) vertikales Verschieben der Tastenkappe (28) aus einer nicht aktiven Hauptposition in eine aktive Hauptposition durch Drücken zumindest eines Abschnitts der Tastenkappe (28), wobei in der nicht aktiven Hauptposition beide Hauptschalter (40', 40'') in einem elektrischen Aus-Zustand sind und wobei in einer aktiven Position zumindest einer der Hauptschalter (40', 40'') in einem elektrischen Ein-Zustand ist; und 55
 - (c) horizontales Verschieben der Tastenkappe

(28) aus einer nicht aktiven Nebenposition in eine aktive Nebenposition durch Verschieben der Tastenkappe in einer von zwei zueinander senkrechten Richtungen (L1, L2, H1, H2) in eine der vier aktiven Nebenpositionen, wobei in der nicht aktiven Nebenposition alle vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) in einem elektrischen Aus-Zustand sind und wobei in einer aktiven Nebenposition einer der Erstnebenschalter (42'a, 42'b, 42'c, 42'd) in einem elektrischen Ein-Zustand ist, wodurch das eine der zwölf eindeutigen Ausgangssignale bereitgestellt wird.

12. Verfahren zur Bereitstellung eines der zwölf eindeutigen Ausgangssignalen nach Anspruch 11, mit dem weiteren Schritt:

(d) Bereitstellen von genau vier Zweitnebenschaltern (42"a, 42"b, 42"c, 42"d), die mit den beiden Hauptschaltern (40', 40") und mit den vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd) elektrisch verbunden sind, wobei in einer aktiven Nebenposition einer der Zweitnebenschalter (42"a, 42"b, 42"c, 42"d) in einem elektrischen Ein-Zustand ist.

13. Zellulares Telefon (20) mit:

einem Gehäuse (22) mit mehreren Flächen (25, 37);
 einem Bildschirm (24); und
 einer Multifunktionstastenanordnung (26) mit:
 zwei Hauptschaltern (40', 40") und vier Erstnebenschaltern (42'a, 42'b, 42'c, 42'd), die mit den beiden Hauptschaltern (40', 40") und miteinander elektrisch verbunden sind;
 einer einzelnen Tastenkappe (28), die mit den beiden Hauptschaltern (40', 40") mechanisch gekoppelt ist, wobei die einzelne Tastenkappe (28) in der Lage ist, jeden der vier Erstnebenschalter (42'a, 42'b, 42'c, 42'd) selektiv zu aktivieren und die beiden Hauptschalter (40', 40") zusammen mit irgendeinem der Erstnebenschalter (42'a, 42'b, 42'c, 42'd) entweder getrennt oder gleichzeitig selektiv zu aktivieren, wodurch insgesamt zwölf mögliche eindeutige Ausgangssignale von der Multifunktionstastenanordnung (26) ausgegeben werden können.

Revendications

1. Ensemble de touche multifonction (26) comprenant :

deux commutateurs principaux, un premier commutateur principal (40'), un second commutateur principal (40"), et quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd),

tous les commutateurs étant connectés les uns aux autres de manière électrique ;
 un seul dessus de touche (28) couplé de manière mécanique aux deux commutateurs principaux (40', 40"), le seul dessus de touche (28) étant capable d'actionner de manière sélective n'importe lequel des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) et d'actionner de manière sélective les deux commutateurs principaux (40', 40") séparément ou simultanément, en même temps que n'importe lequel des premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), grâce à quoi un total de douze signaux de sortie distincts possibles peuvent être délivrés en sortie à partir de l'ensemble de touche multifonction (26), quatre signaux de sortie distincts étant obtenus lorsque le premier commutateur principal (40') est actionné en même temps que n'importe lequel des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), quatre autres signaux de sortie distincts étant obtenus lorsque le second commutateur principal (40") est actionné en même temps que n'importe lequel des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), et encore quatre autres signaux de sortie distincts étant obtenus lorsque les premier et second commutateurs principaux (40', 40") sont actionnés simultanément en même temps que n'importe lequel des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd).

2. Ensemble de touche multifonction (26) selon la revendication 1, dans lequel le dessus de touche (28) est activé en le déplaçant depuis une position inactive principale vers une position active principale, le dessus de touche étant mobile à partir de la position inactive principale vers la position active principale en appuyant verticalement sur au moins une partie du dessus de touche (28), dans lequel dans la position inactive principale les deux commutateurs principaux (40', 40") se trouvent dans un état non passant de manière électrique, et dans lequel dans la position active principale au moins l'un des commutateurs principaux (40', 40") se trouve dans un état passant de manière électrique, ce qui correspond à un total de trois positions actives principales, une première position active principale correspondant à l'un des commutateurs principaux (40', 40") qui se trouve dans un état passant de manière électrique, une deuxième position active principale correspondant à l'autre des commutateurs principaux (40', 40") qui se trouve dans un état passant de manière électrique, et une troisième position active principale correspondant aux deux commutateurs principaux (40', 40") qui se trouvent simultanément dans un état passant de manière électrique.

3. Ensemble de touche multifonction (26) selon la revendication 2, dans lequel le dessus de touche (28) peut être déplacé de manière horizontale dans deux directions mutuellement perpendiculaires (L1, L2, H1, H2) vers n'importe laquelle des quatre positions actives secondaires. 5
4. Ensemble de touche multifonction (26) selon la revendication 3, dans lequel pour chaque combinaison d'une position active secondaire donnée et d'une position active principale particulière du dessus de touche (28), un signal de sortie distinct particulier parmi les douze signaux de sortie distincts possibles, est délivré en sortie par l'ensemble de touche multifonction (26). 10 15
5. Ensemble de touche multifonction (26) selon la revendication 1, dans lequel chacun des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) comprend une base secondaire (52) et une tige secondaire (50) qui s'étend à partir de là, chaque commutateur principal (40', 40'') comprend une base principale (48) et une tige principale (46) qui s'étend à partir de là, et le dessus de touche (28) est relié à la tige principale (46) de chaque commutateur principal (40', 40''). 20 25
6. Ensemble de touche multifonction (26) selon la revendication 5, dans lequel le dessus de touche (28) présente une tige située de manière centrale (74) qui s'étend à partir d'une surface inférieure de celui-ci (60) et qui passe entre les quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), et une position active secondaire donnée parmi les quatre positions actives secondaires est obtenue par une poussée de la tige (74) sur la tige secondaire (50) d'un premier commutateur secondaire donné parmi les quatre premiers commutateurs secondaires vers sa base secondaire (52) jusqu'à ce que son état électrique change de l'état non passant vers l'état passant, en actionnant de ce fait le premier commutateur secondaire donné. 30 35 40
7. Ensemble de touche multifonction (26) selon la revendication 6, comprenant en outre un premier élément de guidage (44') qui présente deux rainures de guidage traversantes (68, 70) perpendiculaires l'une à l'autre qui forment une ouverture en forme de croix (72), à travers laquelle la tige (74) passe, le premier élément de guidage (44') étant situé entre le dessus de touche (28) et les quatre premiers commutateurs secondaires. 45 50
8. Ensemble de touche multifonction (26) selon la revendication 5, comprenant en outre quatre seconds commutateurs secondaires (42''a, 42''b, 42''c, 42''d) connectés de manière électrique les uns aux autres et à tous les autres commutateurs ; dans lequel la tige principale (46) du premier commutateur principal (40') passe entre les quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) ; la tige principale (46) du second commutateur principal (40'') passe entre les quatre seconds commutateurs secondaires (42''a, 42''b, 42''c, 42''d) ; le dessus de touche (28) peut être déplacé de manière horizontale dans deux directions mutuellement perpendiculaires (L1, L2, H1, H2) vers n'importe laquelle des quatre positions actives secondaires ; et dans lequel une position active secondaire donnée parmi les quatre positions actives secondaires est obtenue par la poussée de la tige principale (46) du premier commutateur principal (40') sur la tige secondaire (50) d'un premier commutateur secondaire donné parmi les quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) vers sa base secondaire (52) jusqu'à ce que son état électrique change d'un état non passant vers un état passant, en actionnant de ce fait le premier commutateur secondaire donné, et par la poussée de la tige principale du second commutateur principal (40'') sur la tige secondaire (50) d'un second commutateur secondaire donné parmi les quatre seconds commutateurs secondaires (42''a, 42''b, 42''c, 42''d) vers sa base secondaire (52) jusqu'à ce que son état électrique change d'un état non passant vers un état passant, en actionnant de ce fait le second commutateur secondaire donné. 55
9. Ensemble de touche multifonction (26) selon la revendication 8, comprenant en outre exactement deux éléments de guidage (44', 44''), chaque élément de guidage présentant deux rainures de guidage traversantes (68, 70) perpendiculaires l'une à l'autre qui forment une ouverture en forme de croix (72), dans lequel la tige principale (46) du premier commutateur principal (40') passe à travers l'ouverture en forme de croix (72) d'un premier des éléments de guidage (44'), et la tige principale (46) du second commutateur principal (40'') passe à travers l'ouverture en forme de croix (72) d'un second des éléments de guidage (44''), le premier élément de guidage étant situé entre le dessus de touche et les quatre premiers commutateurs secondaires, et le second élément de guidage étant situé entre le dessus de touche et les quatre seconds commutateurs secondaires. 30 35 40 45
10. Ensemble de touche multifonction (26) selon la revendication 1, dans lequel il y a exactement deux commutateurs principaux (40', 40'') qui sont connectés de manière électrique l'un à l'autre. 50
11. Procédé destiné à fournir un signal parmi douze signaux de sortie distincts comprenant les étapes consistant à : 55
- (a) fournir un ensemble de touche multifonction

(26) qui comprend exactement deux commutateurs principaux (40', 40'') et exactement quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) connectés de manière électrique aux deux commutateurs principaux (40', 40'') et les uns aux autres et un seul dessus de touche (28) relié de manière mécanique aux deux commutateurs principaux (40', 40'') ;

(b) déplacer de manière verticale le dessus de touche (28) à partir d'une position inactive principale vers une position active principale en appuyant au moins sur une partie du dessus de touche (28), dans lequel dans la position inactive principale les deux commutateurs principaux (40', 40'') se trouvent dans un état non passant de manière électrique, et dans lequel dans une position active au moins l'un des commutateurs principaux (40', 40'') se trouve dans un état passant de manière électrique ; et

(c) déplacer de manière horizontale le dessus de touche (28) à partir d'une position inactive secondaire vers une position active secondaire en déplaçant le dessus de touche dans l'une de deux directions mutuellement perpendiculaires (L1, L2, H1, H2) vers l'une des quatre positions actives secondaires, dans lequel dans la position inactive secondaire les quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) se trouvent dans un état non passant de manière électrique, et dans lequel dans la position active secondaire l'un des premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) se trouve dans un état passant de manière électrique, en fournissant de ce fait l'un des douze signaux de sortie distincts.

12. Procédé destiné à fournir un signal parmi douze signaux de sortie distincts selon la revendication 11, comprenant l'étape supplémentaire consistant à :

(d) fournir exactement quatre seconds commutateurs secondaires (42''a, 42''b, 42''c, 42''d) connectés de manière électrique aux deux commutateurs principaux (40', 40'') et aux quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), dans lequel dans une position active secondaire l'un des seconds commutateurs secondaires (42''a, 42''b, 42''c, 42''d) se trouve dans un état passant de manière électrique.

13. Téléphone cellulaire (20) comprenant :

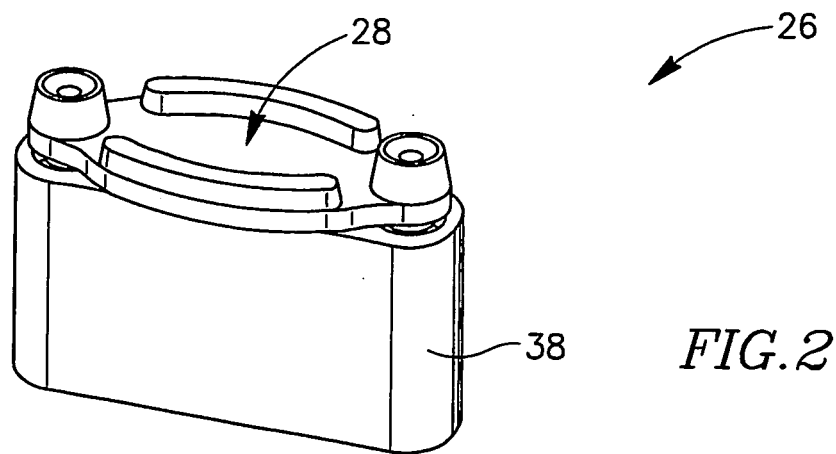
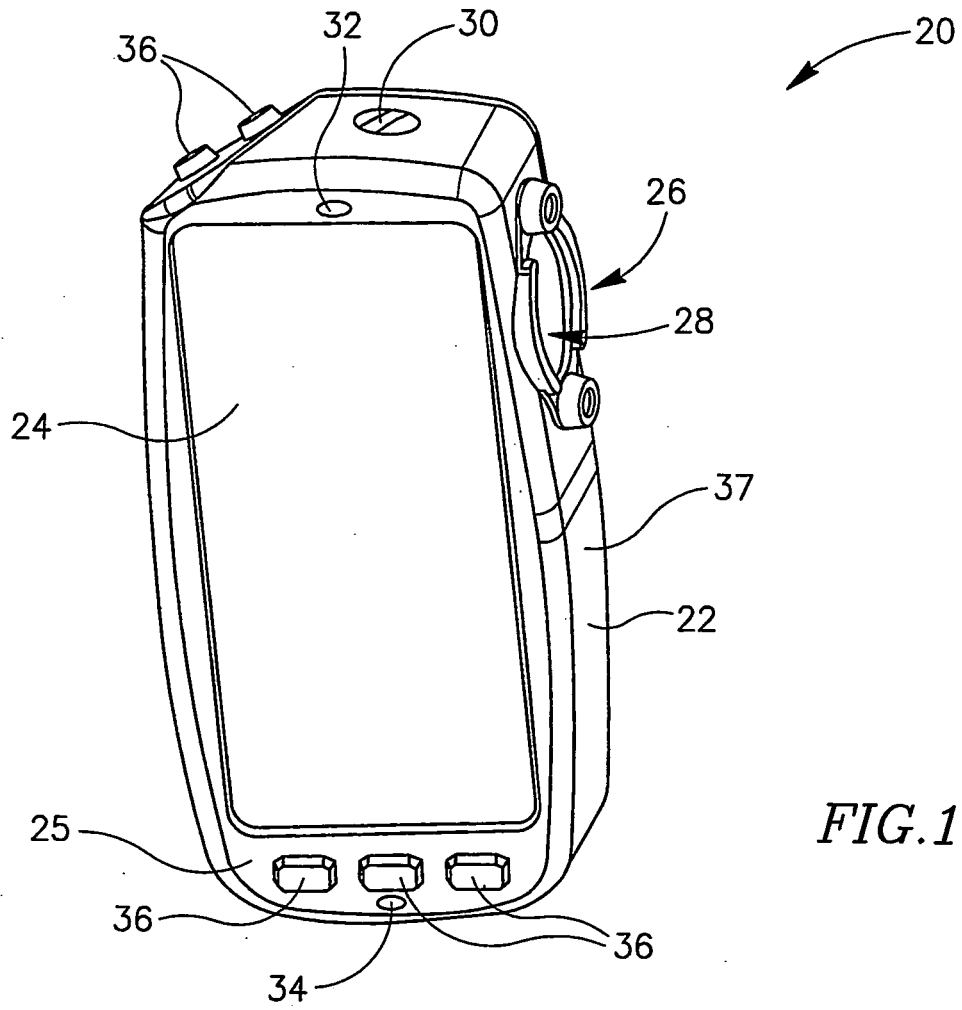
un boîtier (22) qui présente une pluralité de surfaces (25, 37) ;

un écran d'affichage (24) ; et

un ensemble de touche multifonction (26) qui comprend :

deux commutateurs principaux (40', 40'') et quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd) connectés de manière électrique aux deux commutateurs principaux (40', 40'') et les uns aux autres ;

un seul dessus de touche (28) relié de manière mécanique aux deux commutateurs principaux (40', 40''), le seul dessus de touche (28) étant capable d'actionner de manière sélective chacun des quatre premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), et d'actionner de manière sélective les deux commutateurs principaux (40', 40'') séparément ou simultanément, en même temps que n'importe lequel des premiers commutateurs secondaires (42'a, 42'b, 42'c, 42'd), grâce à quoi un total de douze signaux de sortie distincts possibles peuvent être délivrés en sortie à partir de l'ensemble de touche multifonction (26).



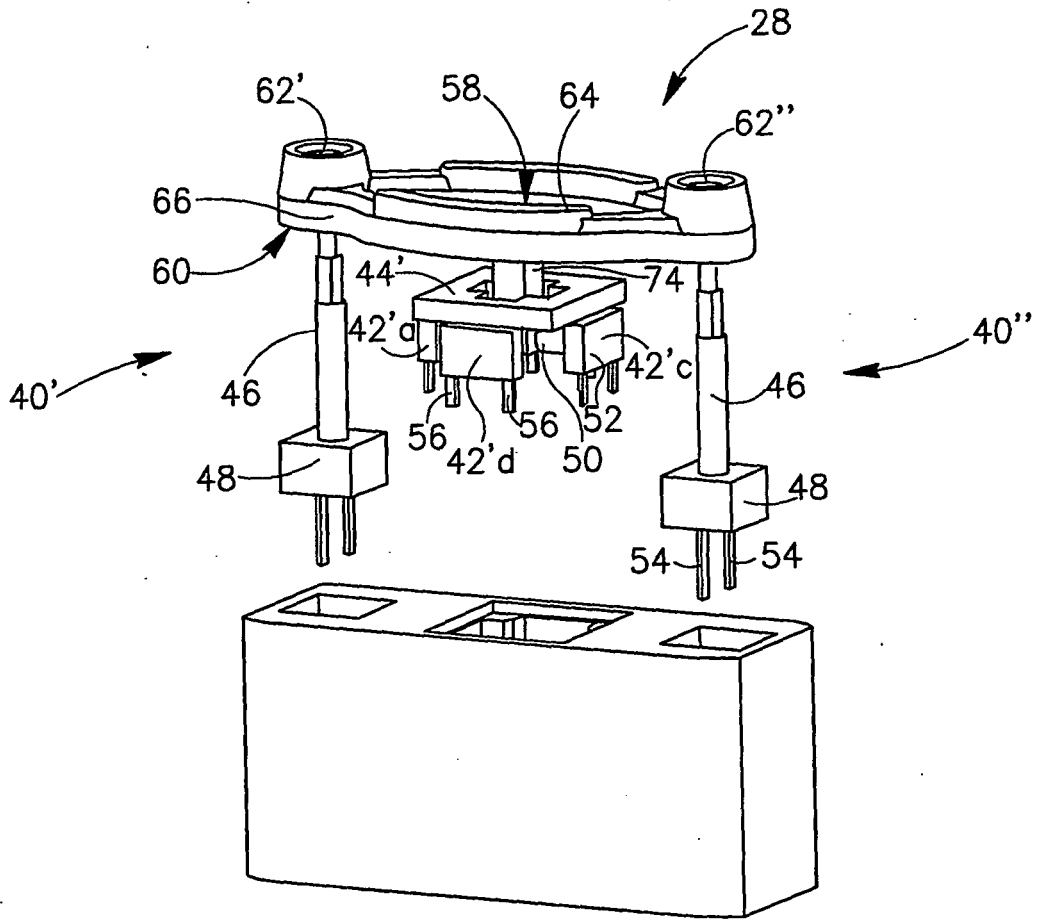


FIG. 3

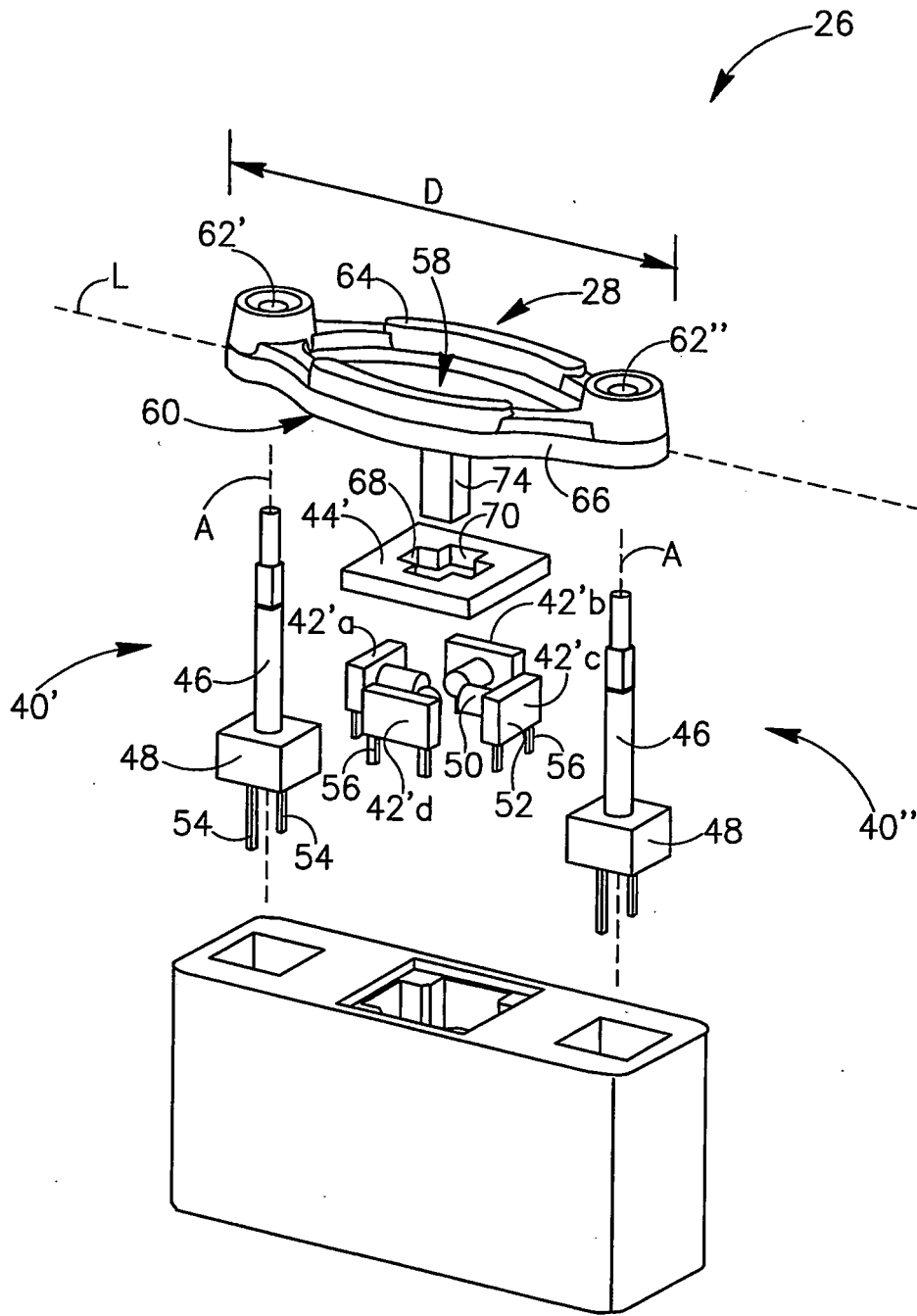


FIG. 4

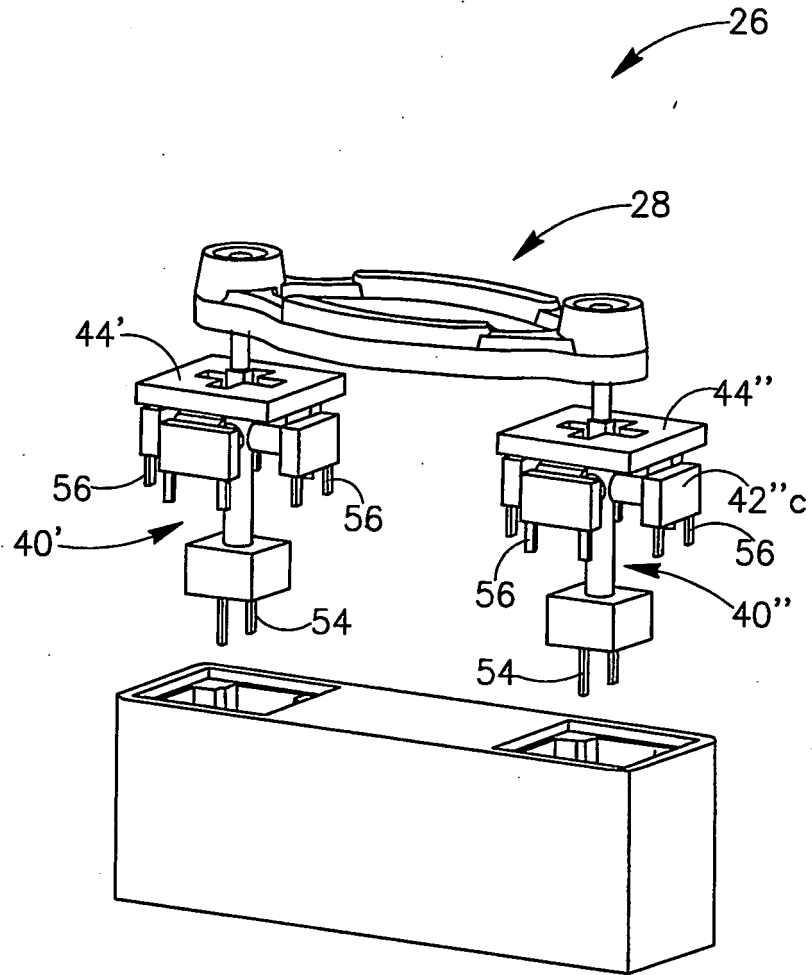


FIG. 5

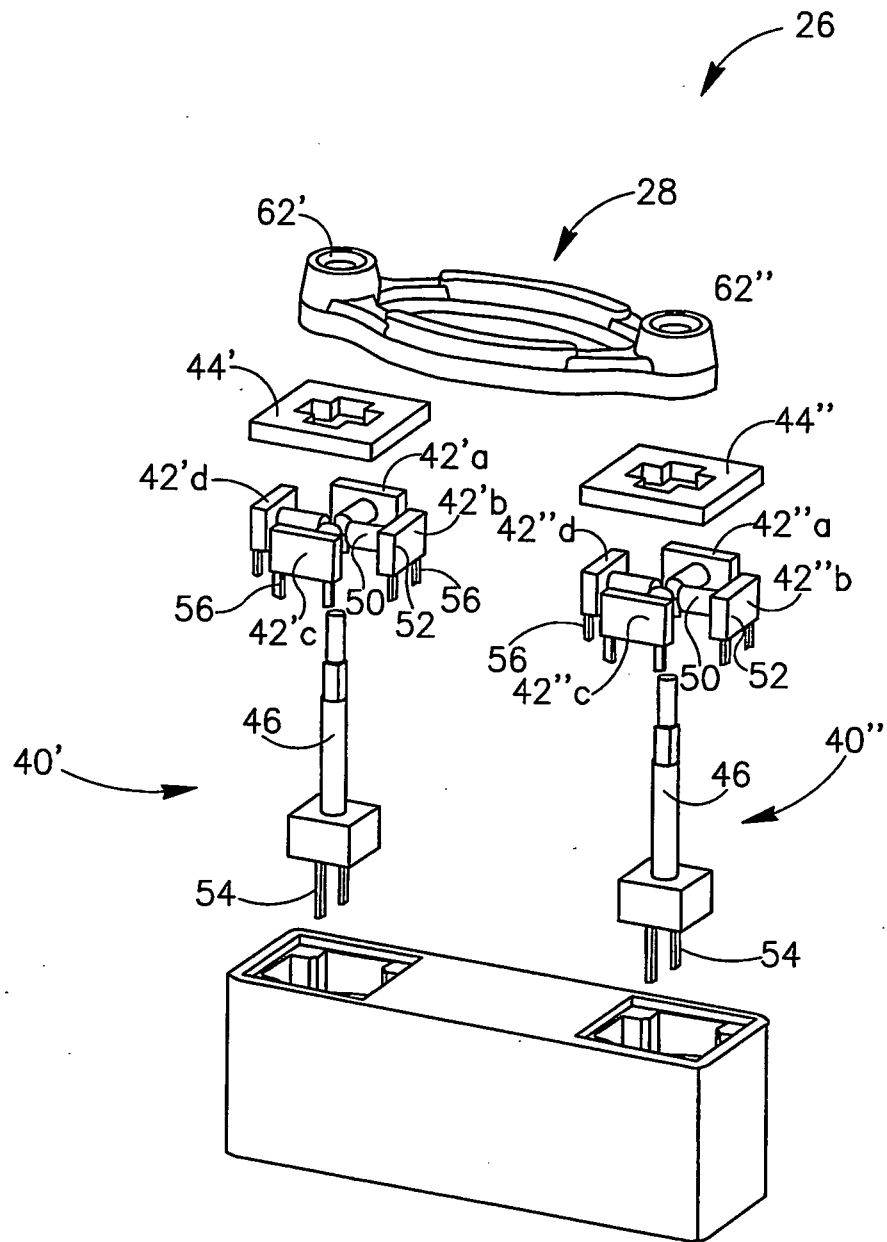


FIG. 6

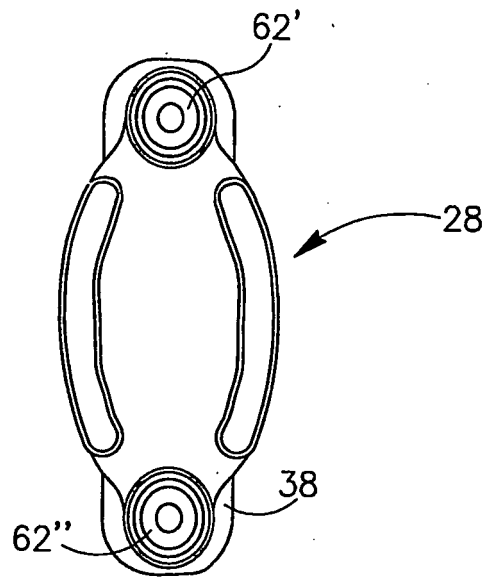


FIG. 7

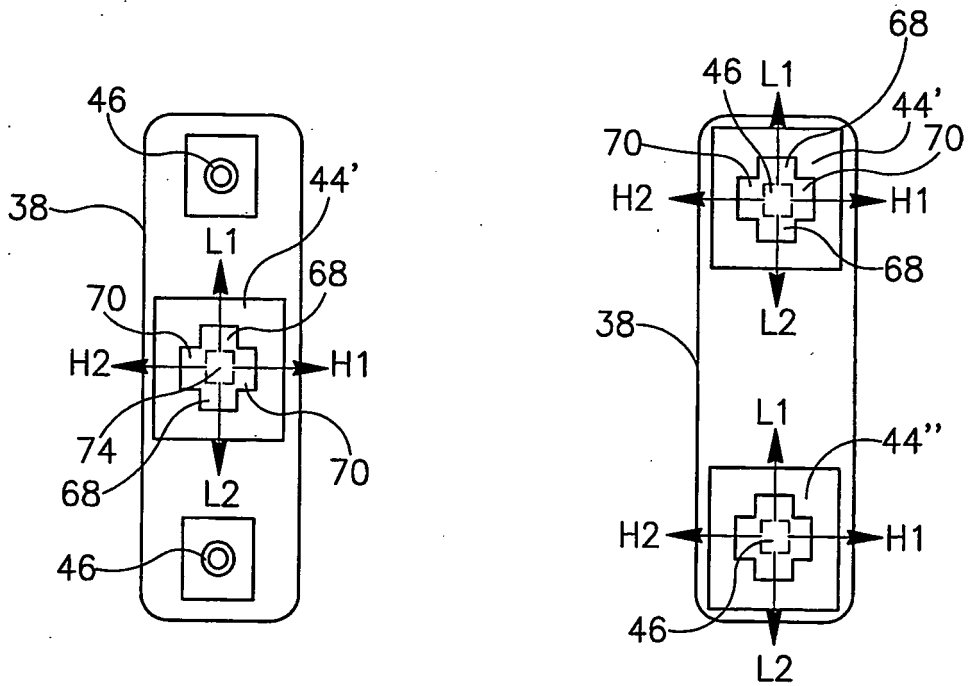


FIG. 8

FIG. 9

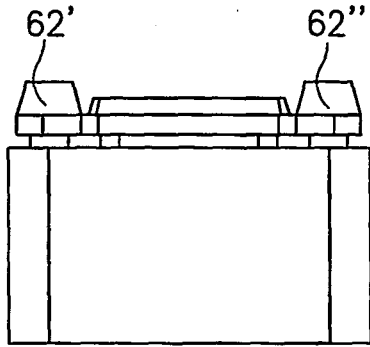


FIG. 10A

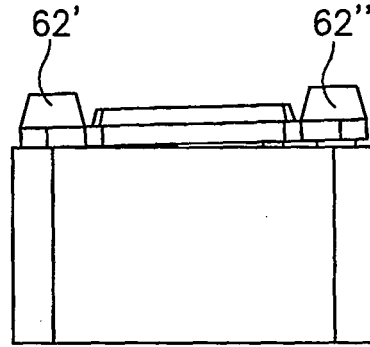


FIG. 10B

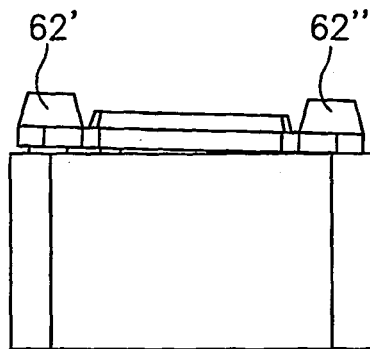


FIG. 10C

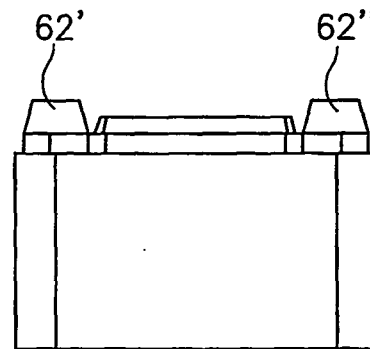


FIG. 10D

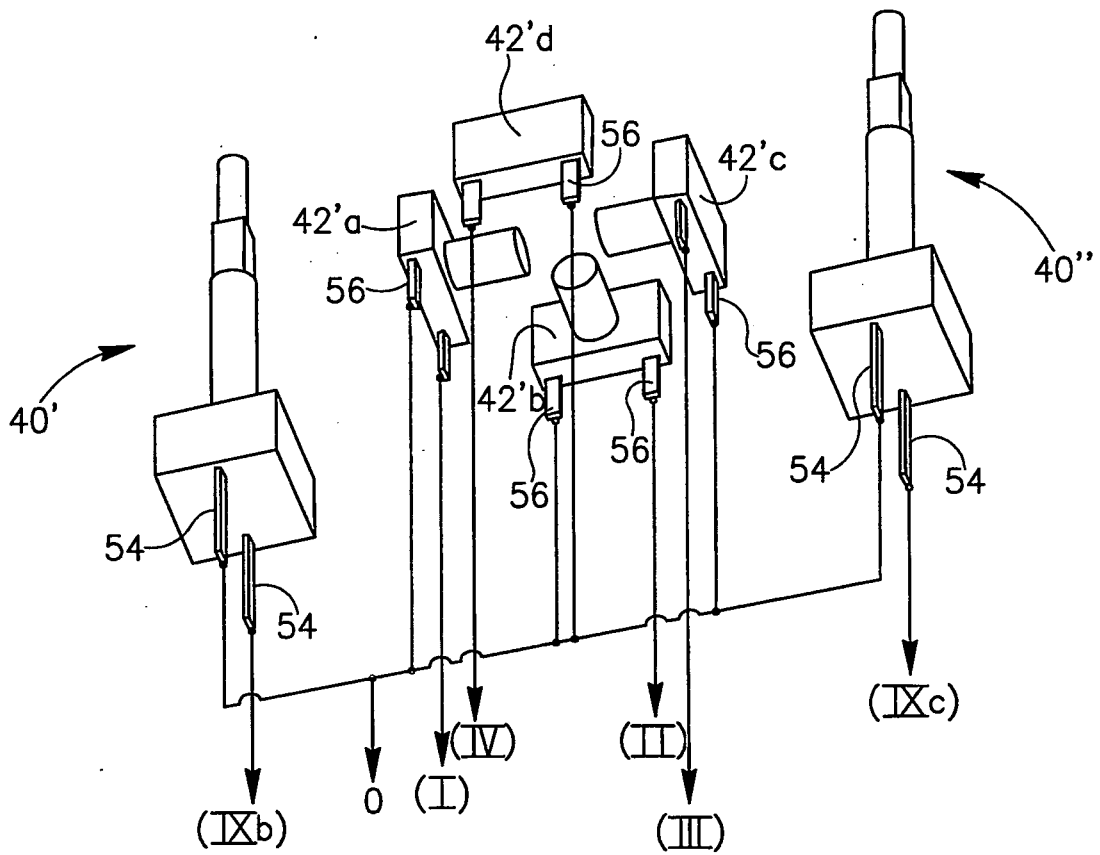


FIG.11

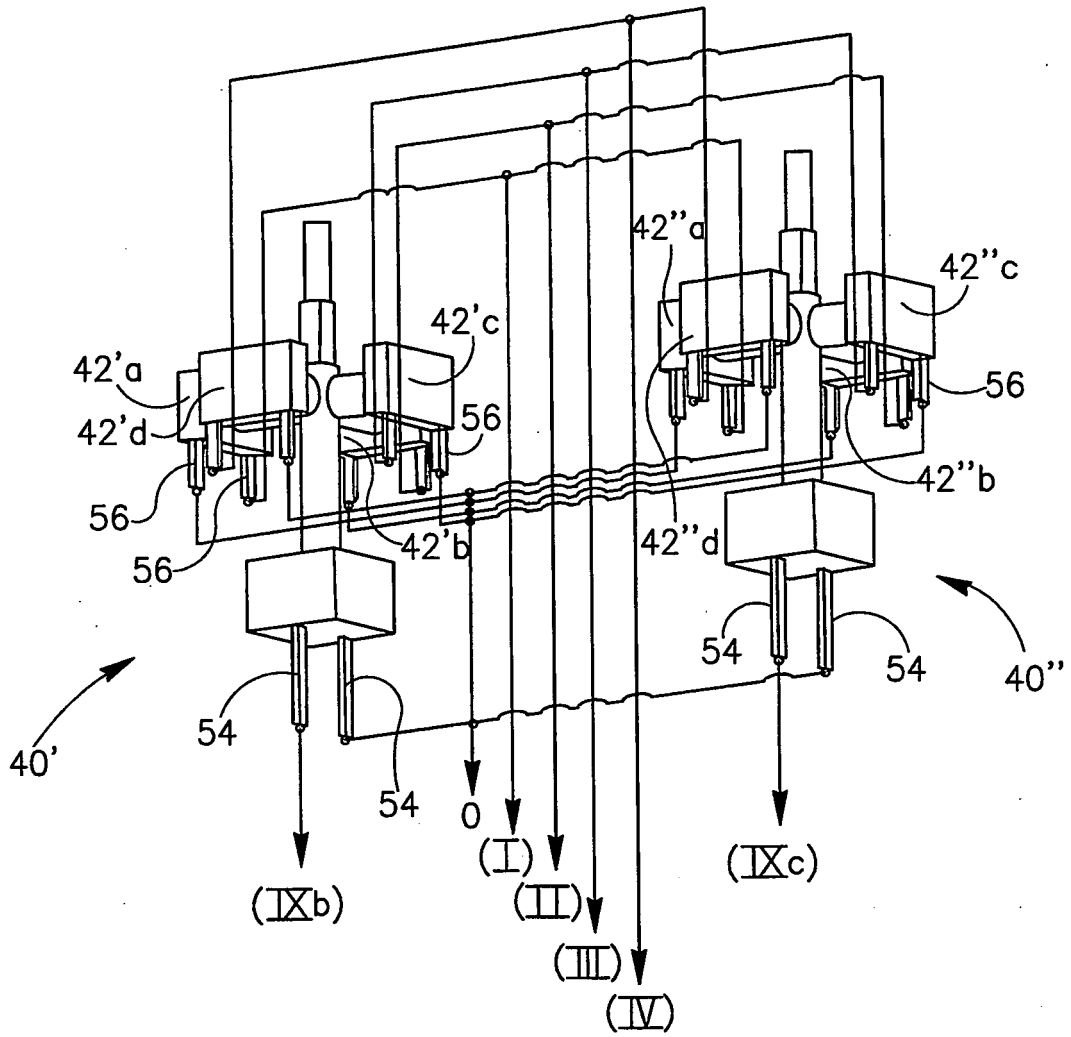


FIG.12

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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