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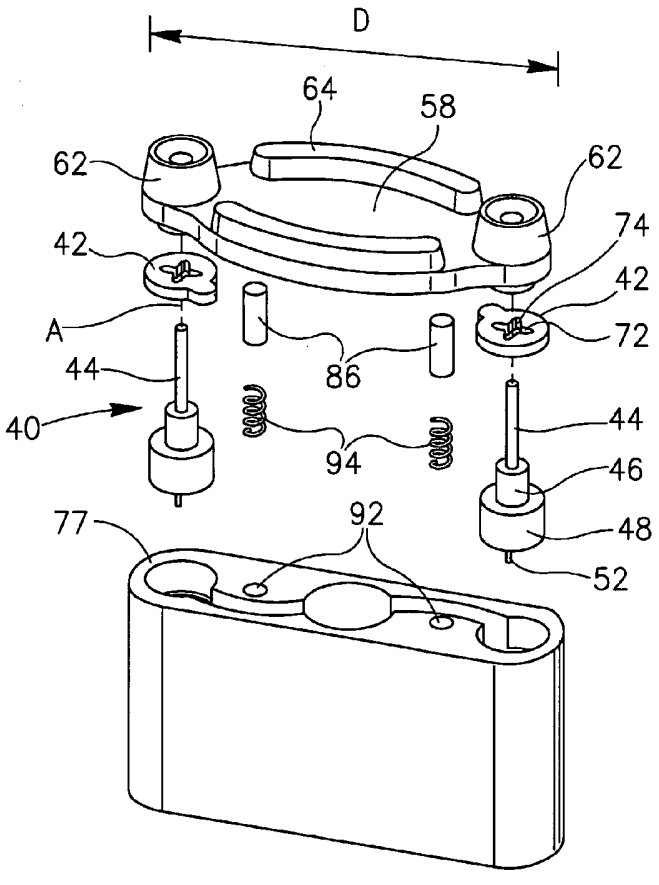


(57) Abstract: A multifunction key assembly for inputting data to an electronic device. The multifunction key assembly has two switches operated by a single key cap. The key cap can be displaced vertically into three active positions and horizontally into four contact positions, giving rise to twelve distinct output data signals for inputting to the electronic device.

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# MULTIFUNCTION KEY ASSEMBLY

## FIELD OF THE INVENTION

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

## BACKGROUND OF THE INVENTION

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.

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.

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.

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

## SUMMARY OF THE INVENTION

In accordance with the present invention there is preferably provided a multifunction key assembly comprising:

two switches electrically connected to each other, each switch being capable of giving rise to exactly four distinct output signals when in an electrically on-state;

a single key cap coupled to the two switches, the single key cap being capable of selectively activating the two switches either separately or simultaneously, whereby a

total of twelve possible distinct output signals can be outputted from the multifunction key assembly, eight distinct output signals being obtained when each of the two switches is activated separately and four distinct output signals when the two switches are activated simultaneously.

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.

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

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

Further in accordance with a preferred embodiment, the key cap is horizontally displaceable in two mutually perpendicular directions to four contact positions. Typically, the two mutually perpendicular directions are termed North-South and East-West and the four contact 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.

Yet further in accordance with a preferred embodiment, for each combination of a given contact position and a particular 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.

In accordance with a first preferred embodiment, each switch comprises a single electrically conducting stem, the keycap being coupled to the stem of each switch.

In accordance with another preferred embodiment, each switch further comprises an electrically non-conducting guide member, the guide member having two throughgoing guide grooves perpendicular to each other forming a cross-shaped aperture.

Typically, each end of the two guide grooves is provided with an electrical contact. Since there are two guide grooves perpendicular to each other forming the cross-shaped aperture, there will be four ends and therefore four electrical contacts. A given contact position is obtained when a part of the at least one of the switches is in electrical abutment with a given electrical contact.

In accordance with one preferred embodiment, the stem of each switch passes through the grooves of an associated guide member and the part of the at least one of the switches which is in electrical abutment with one of four electrical contacts is the stem of the at least one of the switches.

In accordance with a second preferred embodiment, the key cap is coupled to a single centrally located electrically conducting stem.

In accordance with a preferred embodiment, the single stem passes through a single cross-shaped aperture in a single electrically non-conducting guide member, the aperture comprising two throughgoing guide grooves perpendicular to each, with electrical contacts being located at each end of each guide groove, there being in all four electrical contacts, wherein a given contact position is obtained when the stem is in electrical abutment with a given electrical contact.

Preferably, there are exactly two switches that are connected to each other.

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 two switches electrically connected to each other and coupled to a single key cap;

(b) vertically displacing the key cap from a non-active position to an active position by depressing at least a portion of the key cap, wherein in the non-active position both switches are in an electrically off-state and wherein in an active position at least one of the switches is in an electrically on-state; and

(c) horizontally displacing the key cap in one of two mutually perpendicular directions to one of four contact positions, thereby providing the one of the twelve distinct output signals.

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).

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 switches electrically connected to each other, each switch being capable of outputting exactly four distinct output signals when in an electrically on-state;

a single key cap coupled to the two switches, the single key cap being capable of selectively activating the two switches either separately or simultaneously, whereby a total of at least twelve possible distinct output signals can be outputted from the multifunction key assembly, eight distinct output signals being obtained when each of the two switches is activated separately and four distinct output signals when the two switches are activated simultaneously.

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.

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

It facilitates the miniaturization of electronic devices in general and cellular telephones in particular.

It enables the use of larger display screens.

The multifunction key is operated by a single key cap.

The single key cap may be operated by the thumb of one hand of an operator.

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.

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

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 perspective view of a multifunction key assembly module according to the present invention;

**Fig. 3** is a partially exploded view of the multifunction key assembly module of Fig. 2;

**Fig. 4** is a fully exploded view of the multifunction key assembly module of Fig. 2;

**Fig. 5** is a partially sectioned bottom perspective view of the multifunction key assembly module of Fig. 2;

**Fig. 6** is a partially sectioned top perspective view of the multifunction key assembly module of Fig. 2;

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

**Fig. 8** is a top view of the multifunction key assembly module of Fig. 2 with key cap in a non-active position;

**Fig. 9A** is a side view of the multifunction key assembly module of Fig. 2 with key cap in a non-active position;

**Fig. 9B** is a side view of the multifunction key assembly module of Fig. 2 with key cap in a first active position;

**Fig. 9C** is a side view of the multifunction key assembly module of Fig. 2 with key cap in a second active position;

**Fig. 9D** is a side view of the multifunction key assembly module of Fig. 2 with key cap in a third active position;

**Fig. 10** is an illustrative view of one possible arrangement of the electrical wiring of the multifunction key assembly in accordance with the first embodiment;

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

**Fig. 12** is a sectioned top view of the multifunction key assembly module in accordance with the second embodiment;

**Fig. 13** is a top exploded view of the multifunction key assembly module of Fig. 12; and

**Fig. 14** is a bottom exploded view of the multifunction key assembly module of Fig. 12.

## DETAILED DESCRIPTION OF THE INVENTION

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.

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 required. 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 features of the multifunction key assembly **26**, thereby excluding from the description features of the electronic device **20** which are not relevant to the invention.

With reference to Figs. 3 to 6, the multifunction key assembly **26** comprises, in accordance with a first embodiment of the present invention, in addition to the key cap **28**, a housing **38**, two switches **40** and two electrically non-conducting guide members **42**. Each switch **40** comprises an electrically conducting stem **44** having a longitudinal axis **A** defining a longitudinal direction of the switch **40**, a movable guide cylinder **46** in which one end of the stem **44** is retained and a fixed guide cylinder **48** in which the movable guide cylinder **46** is longitudinally

displaceable. Protruding from a lower end **50** of the fixed guide cylinder **48** are two electrically conducting leads **52**. 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** will be a part of the casing **22** of the electronic device **20**.

Each switch **40** and an associated guide member **42** is located in a chamber **54** in the housing **38** having a lower step **56** which abuts the lower end **50** of the fixed guide cylinder **48**, thereby supporting the switch **40** against longitudinal forces applied to the stem **44** by the key cap **28**. 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 buttons **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 stem **44** distal the movable guide cylinder **46** is retained in a bore **68** passing through a cylindrical protrusion **70** protruding from the lower surface **60** of the key cap **28** directly below an opposing push button **62**, thereby mechanically connecting the key cap **28** to the switches **40**.

Each guide member **42** has two throughgoing guide grooves **72**, **74** perpendicular to each other forming a cross-shaped aperture. The guide member **42** is supported in the chamber **54** by an upper step **75** and has a small protrusion **42'** which is located in a recess **76** in the housing **38**, in order to fix the orientation of the guide grooves **72**, **74**. The stem **44** of each switch **40** passes through the guide grooves **72**, **74** of an associated guide member **42** so that the guide member **42** is located between the movable guide cylinder **46** and the key cap **28**. The end of each stem **44** distal the movable guide cylinder **46** protrudes beyond a top surface **77** of the housing **38** and the lower surface **60** of the key cap **28** is adjacent and opposite the top surface. Generally, the top surface **77** is an outer surface of the housing **38** of the multifunction

key assembly module. However, if the multifunction key assembly **26** is incorporated in the electronic device **20** as an integral part thereof, then the top surface will be part of the external surface of the casing **22** of the electronic device **20**.

One of the guide grooves **72** of each guide member **42** is aligned with the longitudinal axis of the key cap **28** and will be referred to herein as the longitudinal guide groove. The other one of the guide grooves **74** of each guide member **42** is perpendicular to the longitudinal axis of the key cap **28** and will be referred to herein as the transverse guide groove. At the ends of the longitudinal and transverse grooves **72, 74** are electrical contacts **78, 80, 82, 84**. Consequently, all in all there are four electrical contacts **78, 80, 82, 84** associated with the guide grooves of each guide member **42**. These will be labeled first, second, third and fourth electrical contacts **78, 80, 82, 84**, as shown in Fig. 7.

As will described in greater detail below, 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 **58** of the key cap **28**, or on one of the push buttons **62** and then either depressing the key cap **28** and displacing it "vertically" by applying a force in the longitudinal direction of the switches **40**, or displacing the key cap **28** "horizontally" by applying a force in a direction perpendicular to the longitudinal direction of the switches **40**. In addition, both vertical and horizontal forces can be applied simultaneously. The stems **44** are preferably resilient to allow sufficient horizontal displacement of the key cap **28**.

If no vertical force is applied to the key cap **28**, then the key cap **28** is said to be in a non-active state. If no external force at all is applied to the key cap **28**, then the key cap **28** is said to be in its rest position.

Since the stems **44** are constrained to move in the guide grooves **72, 74**, the horizontal displacement of the key cap **28** is constrained to move longitudinally and transversely, corresponding to movement of the stems **44** in the longitudinal and transverse guide grooves **72, 74**, respectively. In other words, the key cap **28** can be displaced horizontally in two mutually perpendicular directions.

Two support pins **86** are provided. Although not absolutely necessary, the support pins **86** aid in restoring the key cap **28** to its rest position (Figs. 8 and 9A) after having been displaced and the external force is removed. The support pins **86** have conical protrusions **88** at one end and flat surfaces **90** at the other end. The support pins **86** are located in cavities **92** in the housing **38** and are biased by means of helical springs **94** located in the cavities **92** below the support pins **86** and in contact with the flat surfaces **90**. The conical protrusions **88** are received in conical indents **96** in the lower surface **60** of the key cap **28**.

When the key cap **28** is displaced vertically by depressing it, it is displaced from its rest position, or from a non-active position, (Fig. 9A), to an active position. There are precisely three active positions. A first active position (Fig. 9B) is obtained by displacing a first end of the key cap **28** vertically, that is, by depressing a first of the push buttons **62'** so that only the stem **44** coupled to the first push button **62'** is displaced vertically thereby changing the electrical state of the of the first switch **40'** from an off-state (electrically non-conducting) to an on-state (electrically conducting). A second active position (Fig. 9C) is obtained by displacing a second push button **62''** end of the key cap **28** vertically, that is, by depressing the second push button **62''** so that only the stem **44** coupled to the second push button **62''** is displaced vertically thereby changing the electrical state of the of the second switch **40''** from an off-state to an on-state. A third active position (Fig. 9D) is obtained by displacing the whole of the key cap **28** vertically, that is, by depressing the upper surface **58** of the key cap **28** at a location between the two push buttons **62** so that both stems **44** are displaced vertically thereby changing the electrical state of both switches **62** from an off-state to an on-state.

After the key cap **28** has been moved to a given active position by depressing it vertically, an output signal can be obtained by moving the key cap **28** to a particular contact position. This is achieved by retaining the key cap **28** in the given active position and displacing it horizontally either longitudinally or transversely until the stem **44**, that is, a part of the switch **40**, comes into electrical contact with one of

the four electrical contacts **78**, **80**, **82**, **84** of the guide grooves **72**, **74**. A distinct output signal is obtained for each combination of a given active position and a particular contact position. The elongated projections **64** serve to prevent the operator's thumb from slipping when displacing the key cap **28** horizontally and when the operator's thumb is at a location between the two push buttons **62**.

Since there are three active positions (Fig. 9B, Fig. 9C and Fig. 9D) and four contact positions (corresponding to the first, second, third and fourth electrical contacts, **78**, **80**, **82**, **84**), a total of twelve distinct output signals can be obtained. 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 active positions and contact 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 active position (Fig. 9B) along with the first, second, third and fourth contact 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 active position (Fig. 9C) along with the first, second, third and fourth contact 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 active position (Fig. 9C) along with the first, second, third and fourth contact positions, respectively.

Reference is now made to Fig. 10 showing an illustrative view of one possible arrangement for the electrical wiring of the two switches **40** and their respective guide members **42** that will enable the multifunction key assembly **26** to provide the output signals mentioned above. The stems **44** are electrically common and grounded along with one of the electrically conducting leads **52** of each switch **40**. Also, the first, second, third and fourth electrical contacts **78**, **80**, **82**, **84** of one of the two guide members **42** are electrically common with the first, second, third and fourth electrical contacts **78**, **80**, **82**, **84**, respectively, of the other one of the two guide

members **42**. For illustrative purposes, the first, second, third and fourth contact positions, are denoted by (I), (II), (III) and (IV), respectively, and the first and second 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 button **62'** is depressed, so that the first switch **40'** is in an on-state, as shown in Fig. 9B and the key cap **28** is in the first contact 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 button **62"** is depressed, so that second switch **40"** is in an on-state, as shown in Fig. 9C and the key cap **28** is in the first contact position. In order to obtain an output signal from the third set of output signals, both switches **40** have to be in an on-state, that is, both push buttons **62** have to be depressed, as shown in Fig. 9D. For example the output signal for the numeral 9 is given symbolically by the combination (IXb) + (IXc) + (I).

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**.

In accordance with the first embodiment described above, each of the two switches **40** has a stem **44** and an associated guide member **42**. As is clear from the above description of the first embodiment, the stems **44** and guide members **42** are required in order to obtain the four contact positions.

With reference to Fig. 11, in accordance with a second embodiment of a multi-function key assembly 126, only one stem **144** and associated guide member **142** is required, the single stem **144** and the single guide member **142** being joint to both switches **140** (**140'**, **140"**). The stem **144** is electrically grounded along with one of the leads **152** of each switch **140**. As with the first embodiment, the guide member **142** is electrically non-conducting and has a cross-shaped aperture comprising two

throughgoing guide grooves **172, 174** perpendicular to each, with electrical contacts **178, 180, 182, 184**) being located at each end of each guide groove (**172, 174**). Consequently, there are all in all four electrical contacts (**178, 180, 182, 184**). The stem (**144**) passes through the cross-shaped aperture, and a given contact position is obtained when the stem (**144**) is in electrical abutment with a given electrical contact (**178, 180, 182, 184**).

With reference to Figs. 12 to 14, the key cap **128** is coupled to one end of the single stem **144**, which is centrally located with respect to the key cap **128**. As in the case of the first embodiment, the key cap **128** has a pair of pushbuttons **162'**, **162"**. The other end of the stem **144** is affixed to a flexible holding member **198**, which may be made, for example, of rubber. The holding member **198** is located in a base member **100**, which in turn is located in the housing **138**. The guide member **142** has two transverse grooves **102**, in its upper side **104** in which two transverse rails **106**, protruding from the lower side **108** of a sliding member **110**, are slidingly received. The sliding member **110** has a longitudinal groove **112** in its upper side **114** in which a longitudinal rail **116** protruding from the lower surface **160** of the key cap **128** is slidingly received. Each switch **140** (**140'**, **140"**) comprise an upper component **140U** and a lower component **140L**, so that each switch is in an off-state (electrically non-conducting) when a gap exists between the upper and lower components **140U**, **140L** and in an on-state (electrically conducting) when upper and lower components **140U**, **140L** contact each other.

The twelve distinct output signals are obtained from the multifunction key assembly **126** of the second embodiment, by applying the same set of operations to the key cap **128** as described for the first embodiment. For example, by depressing the first push button **162'** (see Fig. 9B with respect to pushbutton **62'**), so that the upper and lower components **140U**, **140L** of the first switch **140'** are brought into contact thereby causing the first switch **140'** to be in an on-state, and sliding the key cap to the first contact position (so that the stem **144** is in contact with the first electrical contact **178**), the output signal for the numeral 1 is obtained. As with the first embodiment,

this is given symbolically by the combination (IXb) + (I). Similarly, the other eleven distinct output signals are obtained as described above for the first embodiment.

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.

## CLAIMS:

**1.** A multifunction key assembly (26; 126) comprising:

two switches (40', 40"; 140', 140") electrically connected to each other, each switch being capable of giving rise to exactly four distinct output signals when in an electrically on-state;

a single key cap (28, 128) coupled to the two switches (40', 40"; 140', 140"), the single key cap being capable of selectively activating the two switches (40', 40"; 140', 140") either separately or simultaneously, whereby a total of twelve possible distinct output signals can be outputted from the multifunction key assembly (26; 126), eight distinct output signals being obtained when each of the two switches (40', 40"; 140', 140") is activated separately and four distinct output signals when the two switches (40', 40"; 140', 140") are activated simultaneously.

**2.** The multifunction key assembly (26; 126) according to claim 1, wherein the key cap (28, 128) is moveable from a non-active position to an active position by vertically depressing at least a portion of the key cap (28, 128), wherein in the non-active position both switches (40', 40"; 140', 140") are in an electrically off-state and wherein in an active position at least one of the switches (40', 40"; 140', 140") is in an electrically on-state, there being a total of three active positions, a first active position corresponding to one of the switches (40', 40"; 140', 140") being in an electrically on-state, a second active position corresponding to the other one of the switches (40', 40"; 140', 140") being in an electrically on-state and a third active position corresponding to the two switches (40', 40"; 140', 140") being simultaneously in an electrically on-state.

**3.** The multifunction key assembly (26; 126) according to claim 2, wherein the key cap (28, 128) is horizontally displaceable in two mutually perpendicular directions to four contact positions.

**4.** The multifunction key assembly (26; 126) according to claim 3, wherein for each combination of a given contact position and a particular active position of the

key cap (28, 128), a specific distinct output signal of the twelve possible distinct output signals is outputted by the multifunction key assembly (26; 126).

**5.** The multifunction key assembly (26) according to claim 4, wherein each switch comprises a single electrically conducting stem (44) and wherein the keycap (28) is coupled to the stem (44) of each switch (40', 40").

**6.** The multifunction key assembly (26) according to claim 5, wherein each switch comprises an electrically non-conducting guide member (42), the guide member (42) having two throughgoing guide grooves (72, 74) perpendicular to each other forming a cross-shaped aperture, each end of the two guide grooves (72, 74) being provided with an electrical contact (78, 80, 82, 84),a given contact position being obtained when a part of the at least one of the switches (40', 40") is in electrical abutment with a given electrical contact (78, 80, 82, 84).

**7.** The multifunction key assembly (26) according to claim 6, wherein the stem (44) of each switch (40', 40") passes through the grooves of an associated guide member and wherein the part of the at least one of the switches (40', 40") which is in electrical abutment with one of four electrical contacts (78, 80, 82, 84) is the stem (44) of the at least one of the switches (40', 40").

**8.** The multifunction key assembly (126) according to claim 4, wherein the key cap (128) is coupled to a single centrally located electrically conducting stem (144).

**9.** The multifunction key assembly (126) according to claim 8, wherein the single stem (144) passes through a single cross-shaped aperture in a single electrically non-conducting guide member (142), the aperture comprising two throughgoing guide grooves (172, 174) perpendicular to each, with electrical contacts (178, 180, 182, 184) being located at each end of each guide groove (172, 174), there being in all four electrical contacts (178, 180, 182, 184), wherein a given contact position is obtained when the stem (144) is in electrical abutment with a given electrical contact (178, 180, 182, 184).

**10.** The multifunction key assembly (126) according to claim 1, wherein there are exactly two switches (140', 140") that are 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; 126) comprising two switches (40', 40"; 140', 140") electrically connected to each other and coupled to a single key cap (28, 128);

(b) vertically displacing the key cap (28, 128) from a non-active position to an active position by depressing at least a portion of the key cap (28, 128), wherein in the non-active position both switches (40', 40"; 140', 140") are in an electrically off-state and wherein in an active position at least one of the switches (40', 40"; 140', 140") is in an electrically on-state; and

(c) horizontally displacing the key cap (28, 128) in one of two mutually perpendicular directions to one of four contact positions, thereby providing the one of the twelve distinct output signals.

**12.** 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; 126) comprising:

two switches (40', 40"; 140', 140") electrically connected to each other, each switch (40', 40") being capable of outputting exactly four distinct output signals when in an electrically on-state;

a single key cap (28, 128) coupled to the two switches (40', 40"; 140', 140"), the single key cap (28, 128) being capable of selectively activating the two switches (40', 40"; 140', 140") either separately or simultaneously, whereby a total of at least twelve possible distinct output signals can be outputted from the multifunction key assembly (26; 126), eight distinct output signals being obtained when each of the two switches (40', 40"; 140', 140") is activated separately and four distinct output signals when the two switches (40', 40"; 140', 140") are activated simultaneously.

**13.** The cellular telephone (20) according to claim 12, wherein the key cap (28, 128) is moveable from a non-active position to an active position by vertically depressing at least a portion of the key cap (28, 128), wherein in the non-active position both switches (40', 40"; 140', 140") are in an electrically off-state and wherein in an active position at least one of the switches (40', 40"; 140', 140") is in an electrically on-state, there being a total of three active positions, a first active position corresponding to one of the switches (40', 40"; 140', 140") being in an electrically on-state, a second active position corresponding to the other one of the switches (40', 40"; 140', 140") being in an electrically on-state and a third active position corresponding to the two switches (40', 40"; 140', 140") being simultaneously in an electrically on-state.

**14.** The cellular telephone (20) according to claim 13, wherein the key cap (28, 128) is horizontally displaceable in two mutually perpendicular directions to four contact positions.

**15.** The cellular telephone (20) according to claim 14, wherein for each combination of a given contact position and a particular active position of the key cap (28, 128), a specific distinct output signal of the twelve possible distinct output signals is outputted by the multifunction key assembly (26; 126).

**16.** The cellular telephone (20) according to claim 15, wherein each switch (40', 40") comprises a single electrically conducting stem (44) and wherein the keycap (28) is coupled to the stem (44) of each switch (40', 40").

**17.** The cellular telephone (20) according to claim 16, further comprising exactly two electrically non-conducting guide members (42), each guide member (42) having two guide grooves (72, 74) perpendicular to each other forming a cross-shaped aperture, each end of the two guide grooves (72, 74) being provided with an electrical contact (78, 80, 82, 84), a given contact position being obtained when a part of the at least one of the switches (40', 40") is in electrical contact with one of four electrical contacts (78, 80, 82, 84).

**18.** The cellular telephone (20) according to claim 17, wherein the stem of each switch (40', 40") passes through the grooves (72, 74) of an associated guide member (42) and wherein the part of the at least one of the switches (40', 40") which is in electrical abutment with a given electrical contact (78, 80, 82, 84) is the stem (44) of the at least one of the switches (40', 40").

**19.** The cellular telephone (20) according to claim 12, wherein the key cap (128) is coupled to a single centrally located electrically conducting stem (144).

**20.** The cellular telephone (20) according to claim 19, wherein the single stem (144) passes through a single cross-shaped aperture in a single electrically non-conducting guide member (142), the aperture comprising two throughgoing guide grooves (172, 174) perpendicular to each, with electrical contacts (178, 180, 182, 184) being located at each end of each guide groove (172, 174), there being in all four electrical contacts (178, 180, 182, 184), wherein a given contact position is obtained when the stem (144) is in electrical abutment with a given electrical contact (178, 180, 182, 184).

**21.** The cellular telephone (20) according to claim 12, wherein the display screen (24) is located on a front surface (25) of the casing (22) and the key cap (28; 128) is located on a side surface (37) of the casing (22).

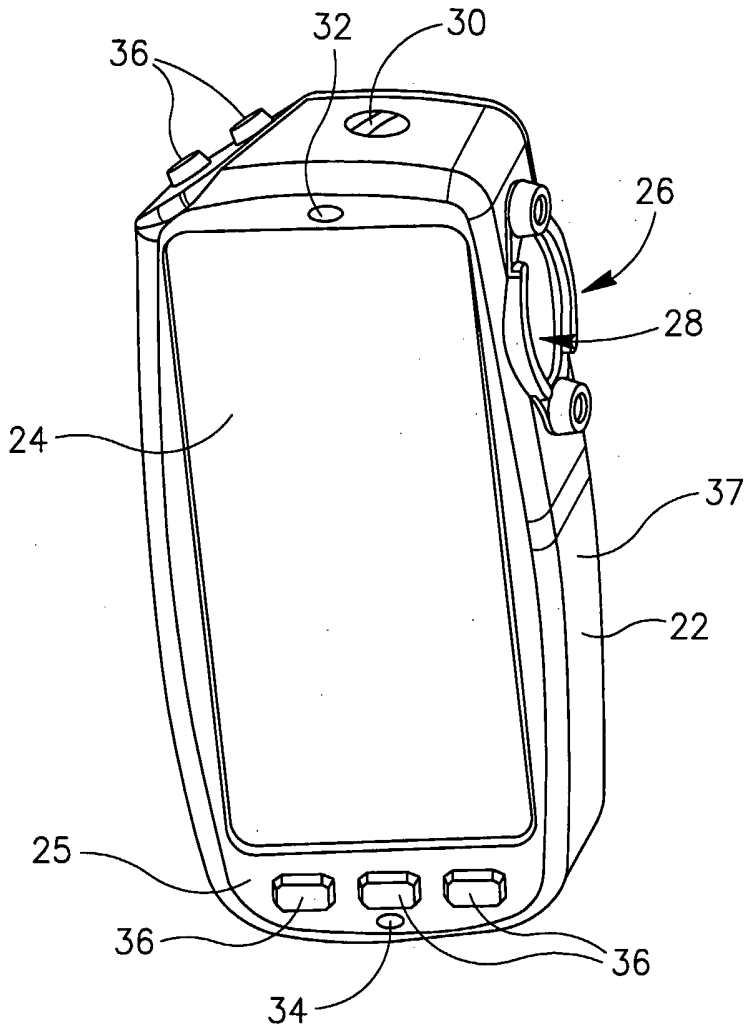



FIG.1

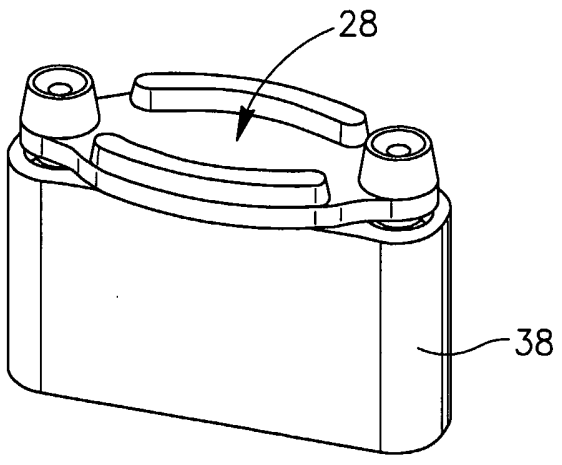



FIG.2

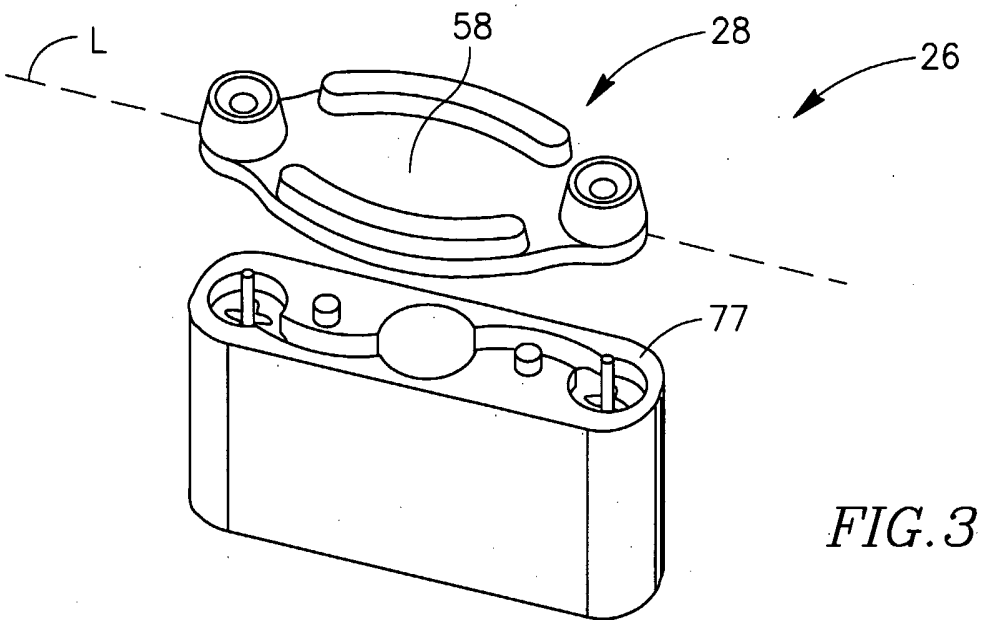



FIG.3

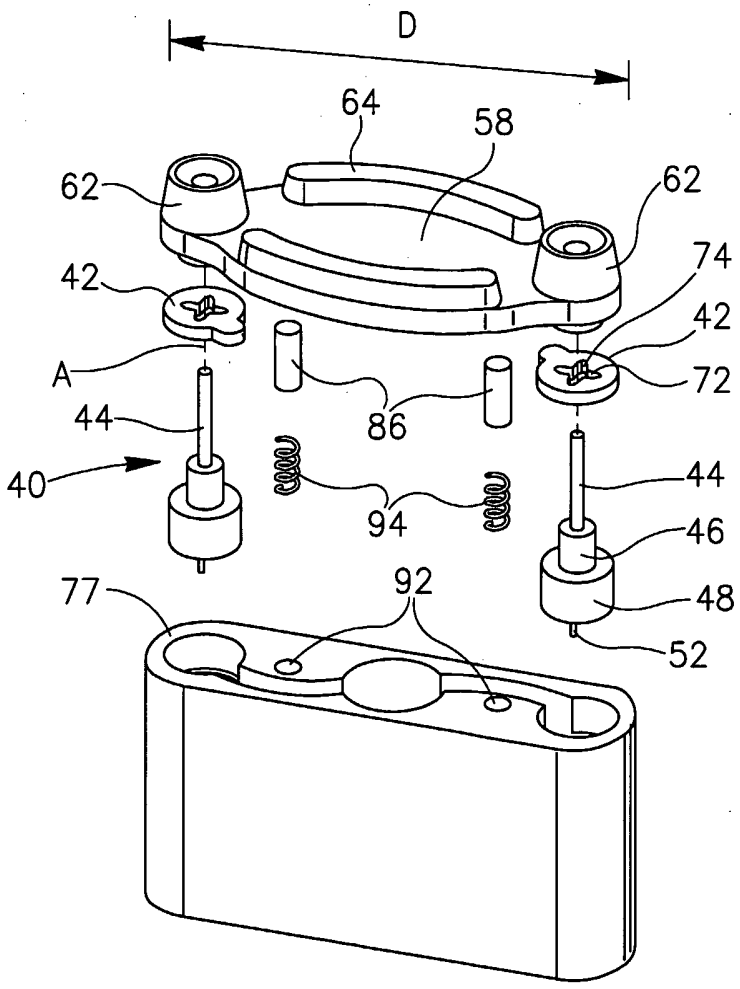
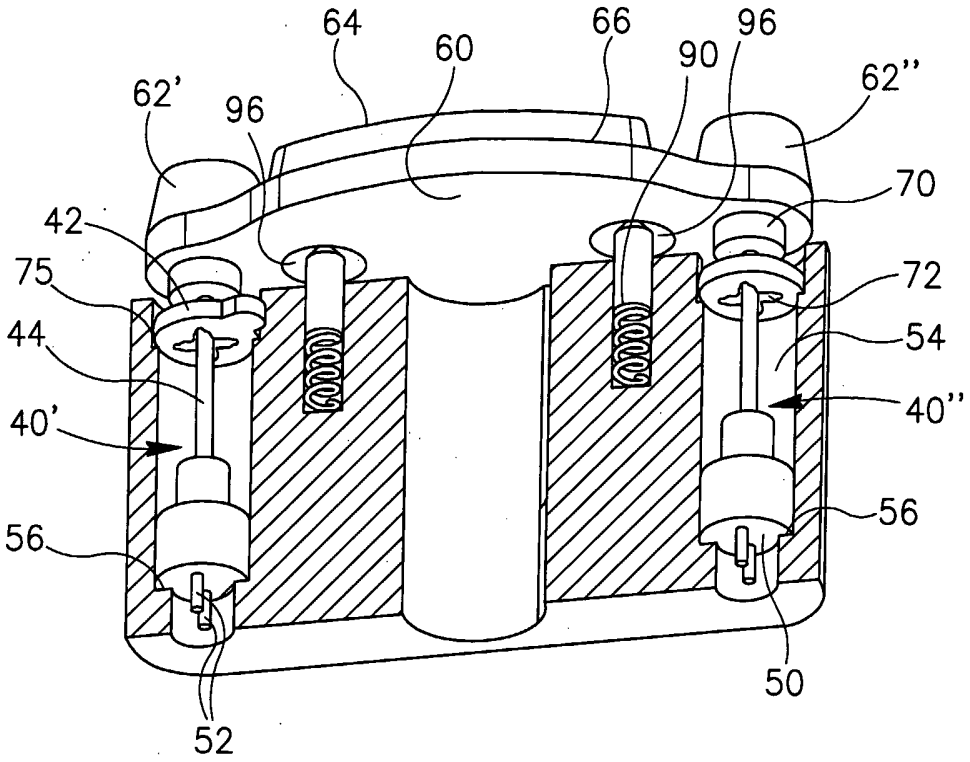



FIG.4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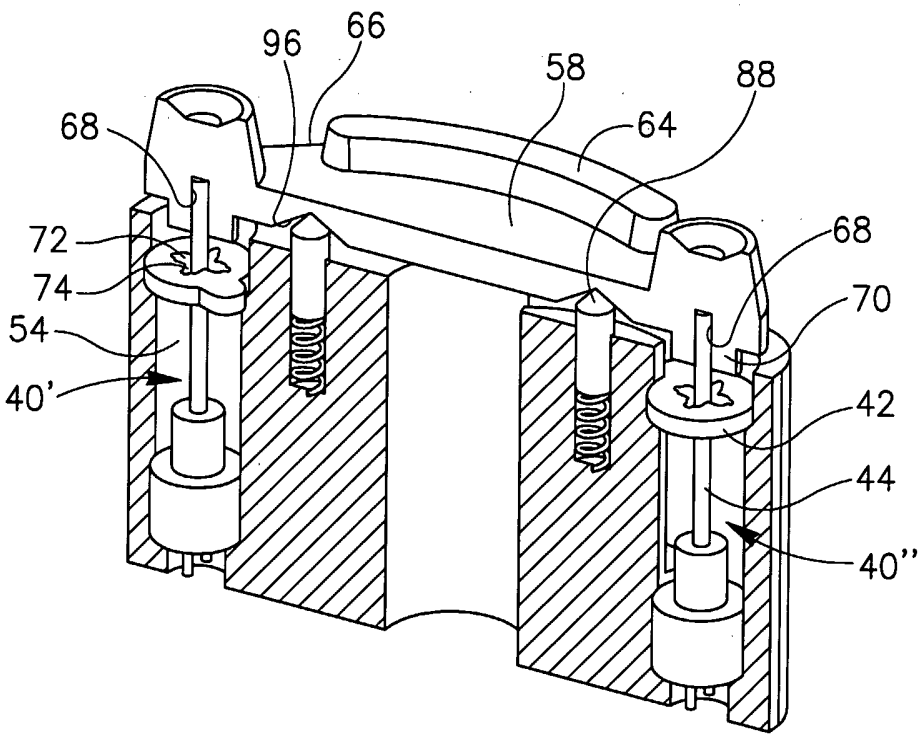
60
66
90
96
62''
62'
96
70
42
75
72
44
54
40''
40'
56
56
50
52

FIG.5


96
66
58
88
68
64
72
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54
42
40'
44
40''

FIG.6

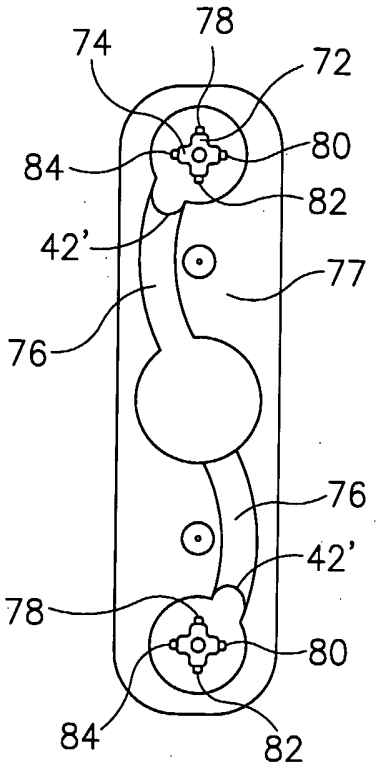



FIG. 7

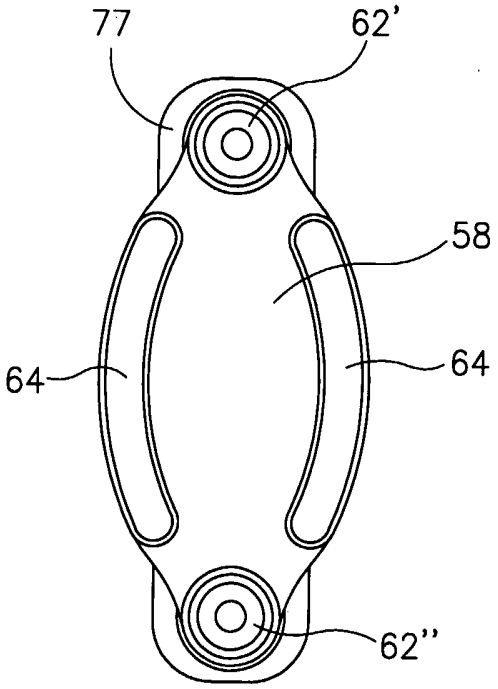



FIG. 8

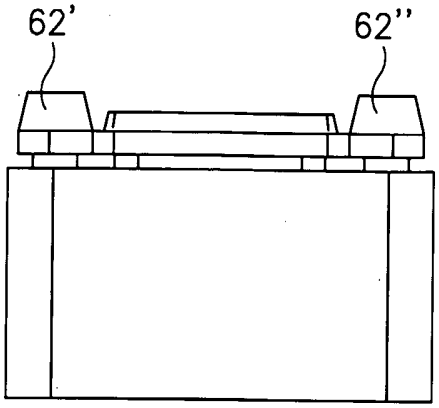



FIG. 9A

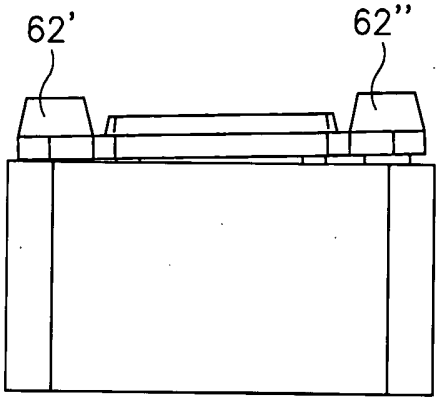



FIG. 9B

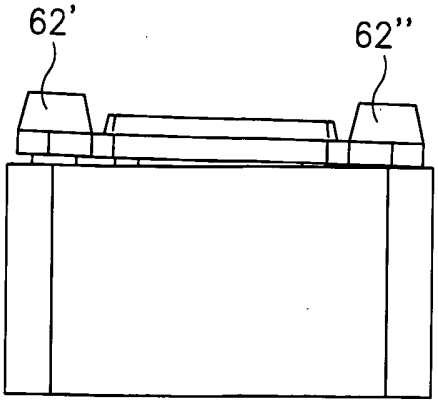



FIG. 9C

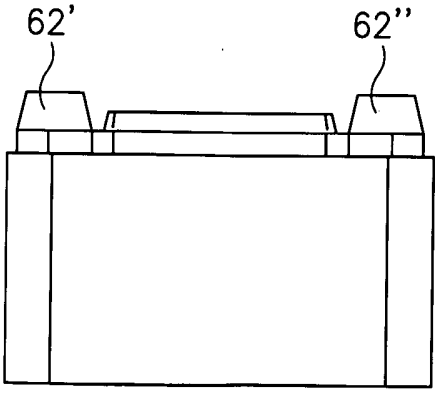



FIG. 9D

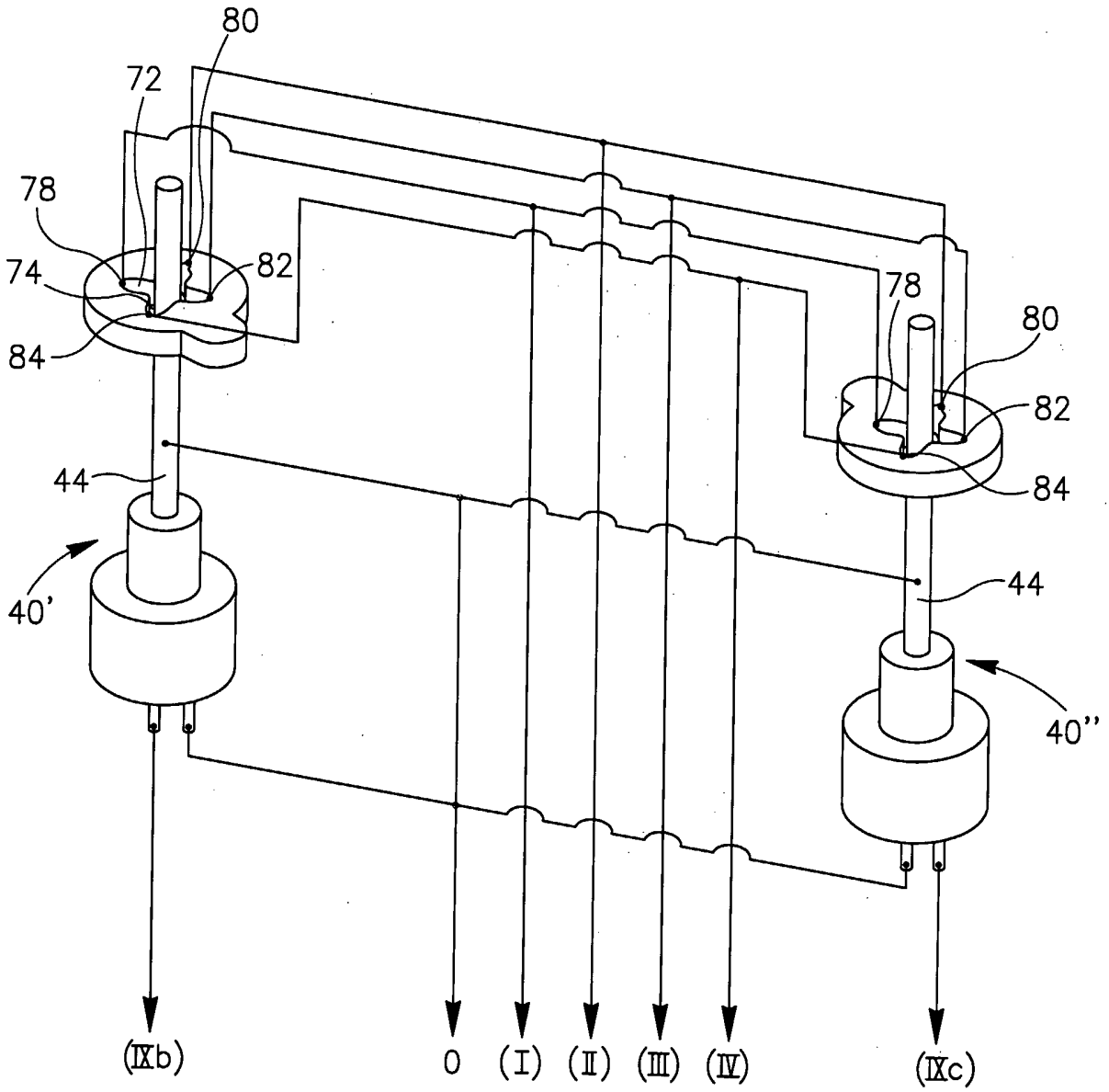
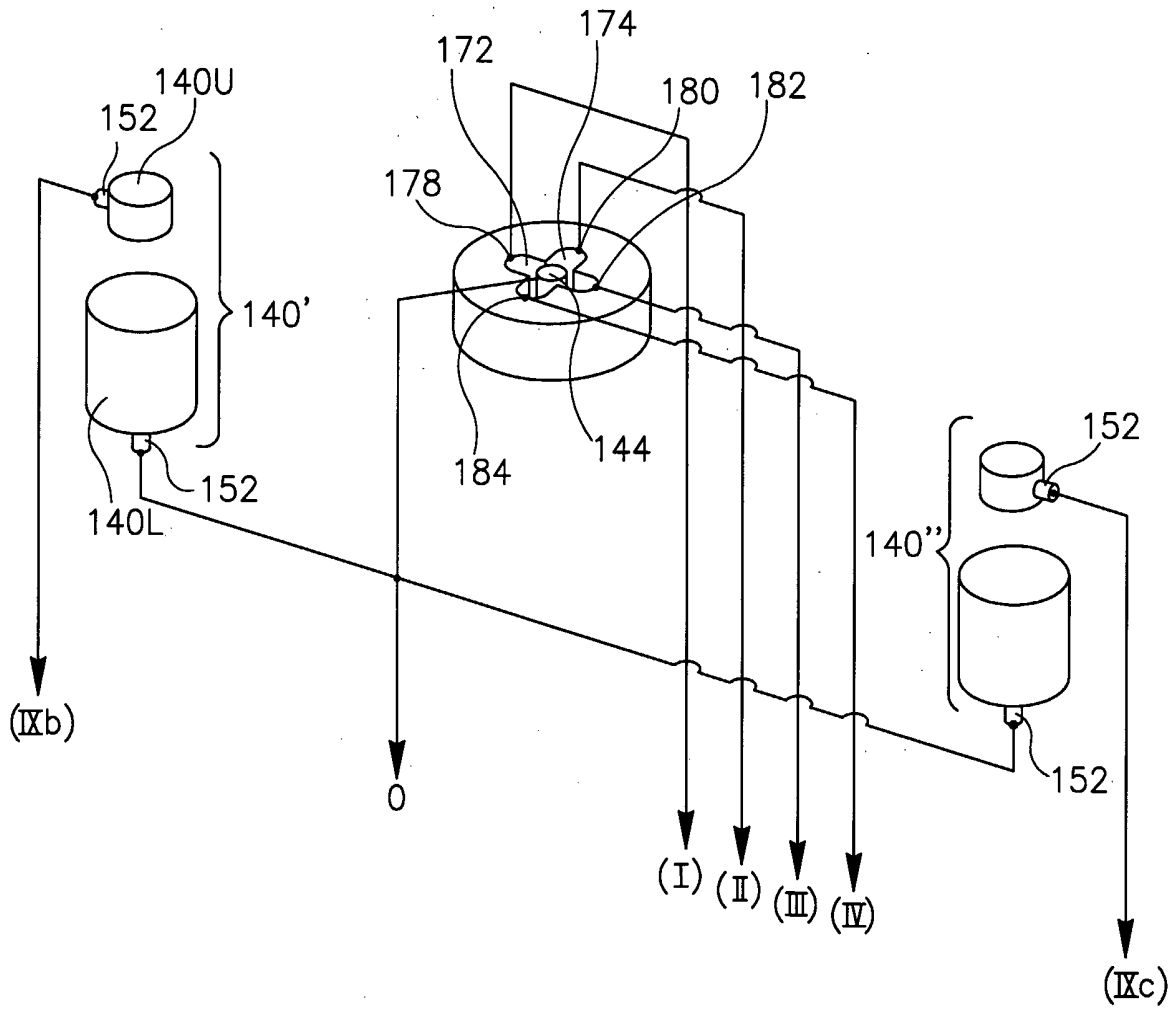



FIG.10


140U
152
140'
140L
152
(IXb)
172
174
180
182
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144
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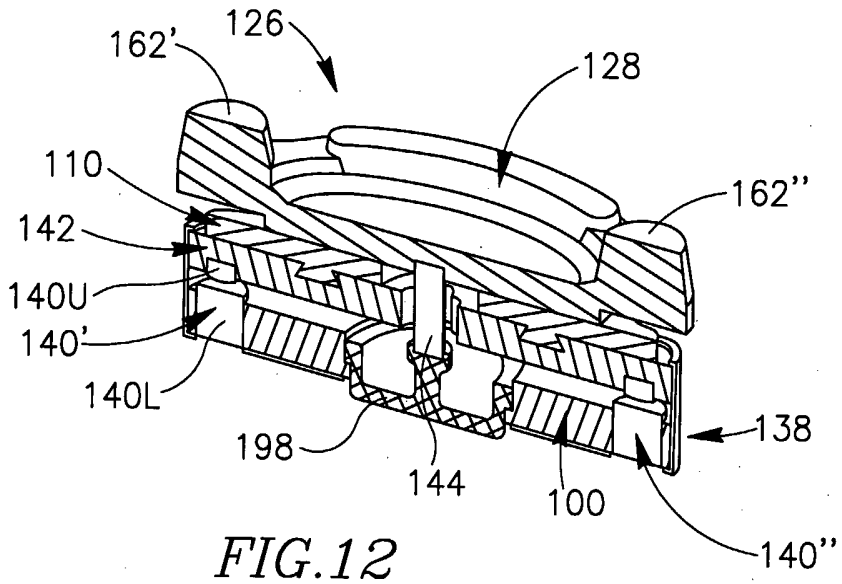
(I)
(II)
(III)
(IV)
152
140''
152
(IXc)

FIG.11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126
128
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140U
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140L
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144
100
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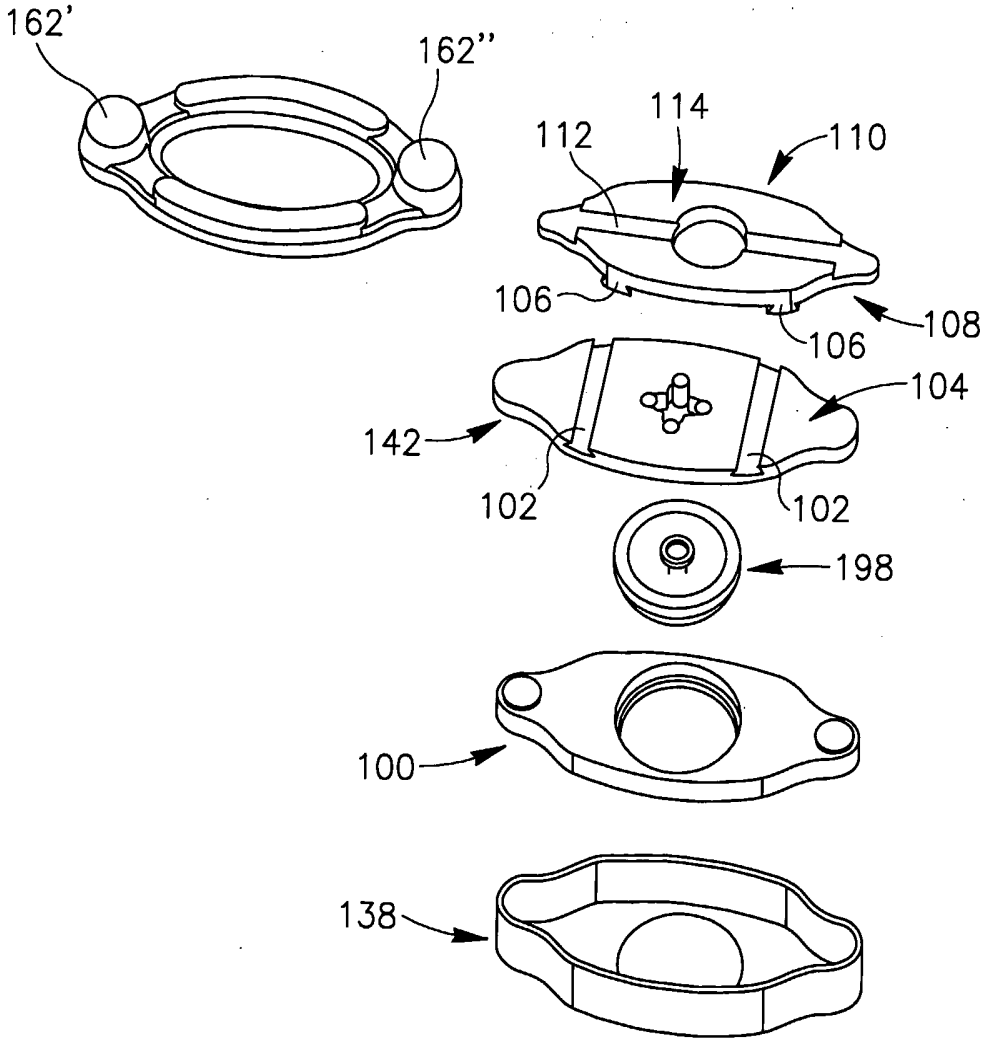
FIG.12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162''
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FIG.13

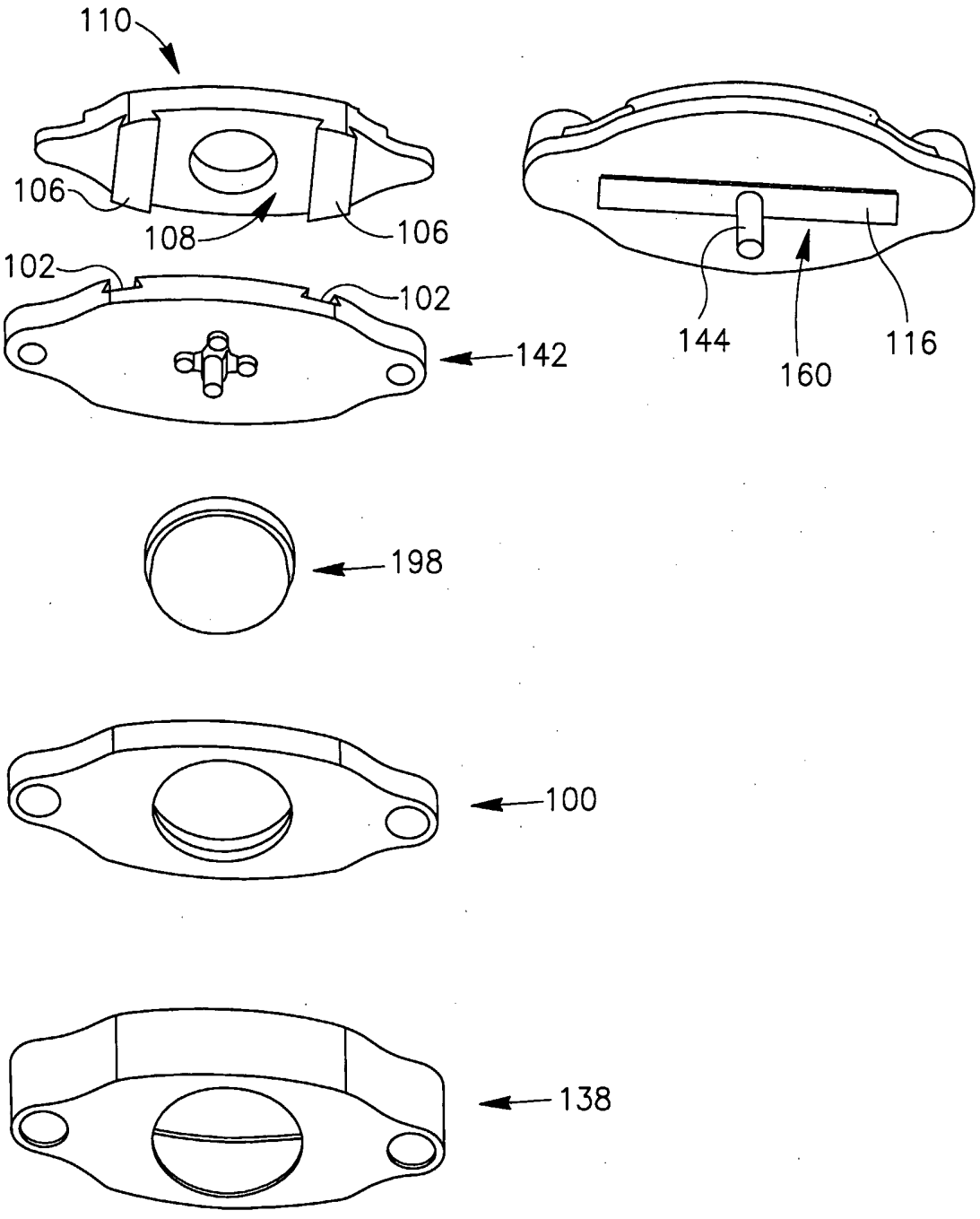


FIG.14

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL2005/000488

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01H23/28 H01H25/00 H01H23/00

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 7 H01H G05G G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| Y | US 4 894 650 A (KRIEG ET AL)<br>16 January 1990 (1990-01-16)<br>column 3, line 19 - column 5, line 43;<br>figures 2,3 | 1-21 |
| Y | US 5 796 056 A (BREDOW ET AL)<br>18 August 1998 (1998-08-18)<br>column 2, line 22 - column 5, line 16;<br>figure 1 | 1-21 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another 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

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 18 August 2005 | 29/08/2005 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Nieto, J.M. |

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL2005/000488

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| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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Form PCT/ISA/210 (continuation of second sheet) (January 2004)

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PCT/IL2005/000488

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| | | | DE | 59500608 D1 | 09-10-1997 |
| | | | EP | 0740844 A1 | 06-11-1996 |
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| | | | WO | 9944212 A1 | 02-09-1999 |
| | | | US | 6157323 A | 05-12-2000 |