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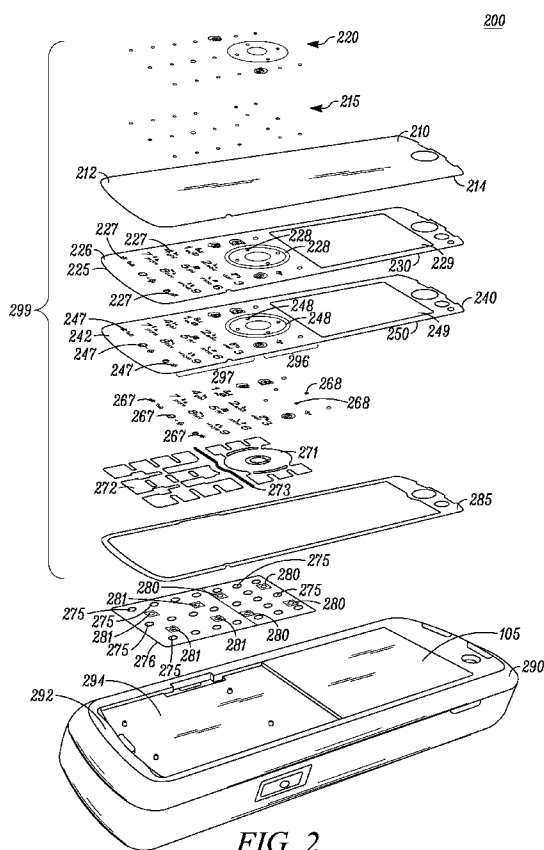
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(54) Title: ELECTRONIC DEVICE WITH SELECTIVELY ILLUMINATED KEYPAD AREAS



(57) Abstract: An electronic device 200 with selectively illuminated keypad areas (296, 297) has a keypad (155) with at least two light pipes these being first light pipe (271) and a second light pipe (272). There is a first lighting assembly illuminator (190, 280) associated with the first light pipe (271) and a second lighting assembly illuminator (195, 281) associated with the second light pipe (272). A partition (273) is disposed between the first light pipe (271) and the second light pipe (272) and a processor (103) is coupled to the first lighting assembly illuminator (190, 280) and the second lighting assembly illuminator (195, 281). In use, the processor (103) selectively provides a signal to illuminate only the first lighting assembly illuminator (190, 280) or illuminate both the first lighting assembly illuminator (190, 280) and second lighting assembly illuminator (195, 281), wherein the partition (273) blocks light transmission between the light pipes.



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**ELECTRONIC DEVICE WITH SELECTIVELY
ILLUMINATED KEYPAD AREAS**

FIELD OF THE INVENTION

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The present invention relates generally to the field of portable electronic devices that have selectively illuminated keypad areas. The invention is particularly useful for, but not necessarily limited to, portable electronic devices with lighting assemblies for illuminating keypads used for data, text and command entry into such electronic devices.

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BACKGROUND OF THE INVENTION

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Many portable handheld electronic devices such as mobile telephones have keypads for data, text and command entry. Typically such keypads have indicia such as alphanumeric numerals printed on individual keys, these keys corresponding to the data, texts or commands to be entered into a device.

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In recent times selective lighting technology has been created to allow keypads to change their visual appearance. This selective lighting technology is often referred to as morphing and provides for aesthetically appealing keypads. However, keypad morphing can be relatively expensive to implement when compared to conventional keypads. Furthermore, illumination of all the keypad regardless of what the electronic device's current application may be unnecessary and drain more battery power than is absolutely necessary.

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BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be readily understood and put into practical effect, reference will now be made to an exemplary embodiment as illustrated with reference to the accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views. The figures together with a detailed description below, are incorporated in and form part of the specification, and serve to further illustrate the embodiments and explain various principles and advantages, in accordance with the present invention where:

FIG. 1 is a schematic block diagram illustrating circuitry of an electronic device in accordance with an embodiment of the invention;

FIG. 2 is a partially exploded perspective view of an electronics device, that includes the circuitry of FIG. 1, in accordance with an embodiment of the invention;

FIG. 3 is an underside view of a multi layered interface structure forming part of the electronics device of FIG. 2; and

FIGS. 4-7 illustrate selective illumination of keypad areas of the electronic device of FIG. 2.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of embodiments of the present invention.

DETAILED DESCRIPTION

Before describing in detail embodiments that are in accordance with the present invention, it should be observed that the embodiments reside primarily in device components related to an electronic device with selectively illuminated keypad areas. Accordingly, the device components have been represented where appropriate by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present invention so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

In this document, relational terms such as first and second, top and bottom, and the like may be used solely to distinguish one entity or action from another entity or action without necessarily requiring or implying any actual such relationship or order between such entities or actions. The terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that device components that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such a device component. An element preceded by "comprises ...a" does not, without more constraints, preclude the existence of additional identical elements in the device that comprises the element.

According to one aspect of the invention there is provided an electronic device with selectively illuminated keypad areas, the electronic device comprising a keypad having at least two light pipes these being first light pipe and a second light pipe. There is a first lighting assembly illuminator associated with the

first light pipe and a second lighting assembly illuminator associated with the second light pipe. A partition is disposed between the first light pipe and the second light pipe and a processor is coupled to the first lighting assembly illuminator and the second lighting assembly illuminator. In use, the processor selectively provides a signal to illuminate only the first lighting assembly illuminator or illuminate both the first lighting assembly illuminator and second lighting assembly illuminator, wherein the partition blocks light transmission between the light pipes.

Referring to FIG. 1, there is illustrated a schematic diagram of circuitry 100 of an electronic device, typically in the form of a mobile telephone comprising a radio frequency communications unit 102 coupled to be in communication with a processor 103. The circuitry 100 also includes a display screen 105. There is also an alert module 115 that typically contains an alert speaker, vibrator motor and associated drivers. The display screen 105, and alert module 115 are coupled to be in communication with the processor 103.

The processor 103 includes an encoder/decoder 111 with an associated code Read Only Memory (ROM) 112 for storing data for encoding and decoding voice or other signals that may be transmitted or received by the circuitry 100. The processor 103 also includes a micro-processor 113 coupled, by a common data and address bus 117, to the encoder/decoder 111, the radio frequency communications unit 102, a character Read Only Memory (ROM) 114, a Random Access Memory (RAM) 104, static programmable memory 116 and a Removable User Identity Module (RUIM) interface 118. The static programmable memory 116 and a RUIM card 119 (commonly referred to as a Subscriber Identity Module (SIM) card) operatively

coupled to the RUIM interface 118 each can store, amongst other things, Preferred Roaming Lists (PRLs), subscriber authentication data, selected incoming text messages and a Telephone Number Database (TND phonebook) comprising a number field for telephone numbers and a name field for identifiers associated with one of the numbers in the name field. The RUIM card 119 and static programmable memory 116 may also store passwords for allowing accessibility to password-protected functions.

The micro-processor 113 has ports for coupling to the display screen 105, and the alert module 115. Also, micro-processor 113 has ports for coupling to a microphone 135, a communications speaker 140, a keypad 155 and a selector 180. The selector 180 is coupled to two lighting assembly illuminators (typically each of which are being at least one light emitting diode) these being a first lighting assembly illuminator FLA 190 and second lighting assembly illuminator SLA 195. Thus, the processor 103 is coupled to the first lighting assembly FLA illuminator 190 and the second lighting assembly SLA illuminator 195.

The character Read Only Memory 114 stores code for decoding or encoding text messages that may be received by the radio frequency communications unit 102. In this embodiment the character Read Only Memory 114, RUIM card 119, and static programmable memory 116 may also store Operating Code (OC) for the micro-processor 113 and code for performing functions associated with the circuitry 100.

The radio frequency communications unit 102 is shown for simplicity as a single operation unit, but it is envisaged that multiple radio frequency communications units 102 could possibly, but not necessarily, be included in the circuitry 100 in order to enable multiple communications modes for different cellular standards and two-way radio standards. Typically the radio frequency

communications unit 102 is a combined receiver and transmitter having an antenna 107. The radio frequency communications unit 102 has a transceiver 108 coupled to the antenna 107 via a radio frequency amplifier 109. The transceiver 108 is also coupled to a combined modulator/demodulator 110 that couples the radio frequency communications unit 102 to the processor 103.

Referring to FIG. 2, there is illustrated a partially exploded perspective view of an electronic device 200 that includes the circuitry 100. The electronic device 200 includes a transparent and flexible polycarbonate sheet 210 with a display surface 212 on which are deposited an array of metallic decorative indicia 215 (typically dots). A key identification coating 220 of transparent bumps and arcs is deposited on over or around one or more of the metallic decorative indicia 215 to thereby provide sensory (touch) feedback to a user's finger. A flexible transparent decorative polycarbonate sheet 225 with a decorative coating 226 outlining keypad indicia 227 keypad markings 228 and a display screen region 229 is adhered to an underside 214 of the flexible polycarbonate sheet 210. A partially coated flexible transparent polycarbonate sheet 240 that is partially coated with a colour coating 242 by a colour plating process is adhered to an under surface 230 of the flexible transparent decorative polycarbonate sheet 225. The colour coating 242 is deposited by Tint Non-Conductive Vacuum Metallization process and outlines keypad indicia 247 keypad markings 248 and a display screen region 249 that are in respective alignment with the keypad indicia 227, keypad markings 228 and a display screen region 229 of the flexible transparent decorative polycarbonate sheet 225.

On an under surface 250 of the partially coated flexible transparent polycarbonate sheet 240 there are

keypad indicia 267 and keypad markings 268 are deposited at the corresponding keypad indicia 247 keypad markings 248. These keypad indicia 267 keypad markings 268 are deposits of a translucent ink that are screen printed onto the under surface 250 of the partially coated flexible transparent polycarbonate sheet 240.

Part of the above structure mainly forms part of the keypad 155 and the keypad 155 also includes at least two light pipes these being first light pipe 271 and a second light pipe 272 made from a transparent flexible plastics material. Underneath and appropriately aligned with the first light pipe 271 and a second light pipe 272 are an array of dome switches 275 mounted on a switch contact substrate 276. Also mounted on the switch contact substrate 276 are the first lighting assembly FLA illuminator 190 and second lighting assembly SLA illuminator 195. The first lighting assembly FLA illuminator 190 is a plurality of Light Emitting Diodes 280 positioned and associated with the first light pipe 271 to thereby selectively illuminate the first light pipe 271. Similarly, the second lighting assembly SLA illuminator 195 is a plurality of Light Emitting Diodes 281 positioned and associated with the second light pipe 272 to thereby selectively illuminate the second light pipe 272. There is a partition disposed between the first light pipe 271 and a second light pipe 272. The first light pipe 271 and a second light pipe 272 and partition 273 are adhered to the under surface 250 of the partially coated flexible transparent polycarbonate sheet 240. More specifically, the keypad 155 comprises: (a) a navigation key display area or keypad area 296 that overlays the light emitting diodes 280 (first lighting assembly FLA illuminator 190) and the first light pipe 272; and (b) an alphanumeric key display area or keypad area 297 that overlays the light emitting diodes 281

(second lighting assembly SLA illuminator 195) and the second light pipe 272.

The partially coated flexible transparent polycarbonate sheet 240 and the other sheets 210, 225 are adhered together along with the light pipes 271 and 272 and the partition 273 to form a structure hereafter referred to a multi layered interface structure 299.

The mounting gasket 285, having both surfaces coated with adhesive, provides for mounting of the multi layered interface structure 299 to a flange 292 of a housing 290 within which is housed most of the circuitry 100 including the processor 103. Also, the display screen 105 is mounted on an outer surface of the housing 290, as illustrated, and the switch contact substrate 276 is mounted in a recess 294 on an outer surface of the housing 290.

Referring to FIG. 3 there is illustrated an underside view of multi layered interface structure 299. As illustrated the underside of the first light pipe 271 and second light pipe 272 have a reflective coating 310 and plungers 320. The reflective coating 310 provides for guiding light and directing light in the first light pipe 271 and second light pipe 272, whereas the plungers 320 in use engage and actuate respective aligned dome switches 275. It should also be noted that the first light pipe 271 includes an array of interconnected keys 340, interconnected by links 345. Similarly, the second light pipe 272 includes an array of interconnected keys 350, interconnected by links 355. As will be apparent to a person skilled in the art, each of the interconnected keys 324 and interconnected keys 350 form boundaries of at least some of the keys of the keypad 155.

Referring to FIGS. 4-7 there is illustrated selective illumination of the keypad areas 296, 297 of

the electronic device 200. In FIG. 4 the transparent and flexible polycarbonate sheet 210 is mounted to the housing 290 and provides a front face of the electronic device 200. The transparent and flexible polycarbonate sheet 210 forms part of the keypad 155 and also covers the display screen 105. Further, the transparent and flexible polycarbonate sheet 210 (flexible sheet) solely forms a front face 410 of the electronic device 200. As illustrated, both keypad areas 296, 296 and the display screen 105 are not illuminated and thus the keypad areas 296, 297 appear to be almost devoid of indicia and markings (for illustrative purposes in this Fig the indicia and markings of the keypad areas 296, 297 cannot be seen).

In FIG. 5 the electronic device 200 in use is illustrated wherein the processor 103 has selectively provided a signal to illuminate only the first lighting assembly FLA illuminator 190. Hence, navigation key indicia 510 are illuminated when the first lighting assembly FLA illuminator 190 is illuminated. Thus, the navigation key indicia 510 that was substantially visibly unnoticeable by a user becomes visible (noticeable) when the first lighting assembly FLA illuminator 190 is illuminated (for illustrative purposes in this Fig the indicia and markings of the keypad area 297 cannot be seen because the partition 273 blocks light transmission between the light pipes 271, 272).

In FIG. 6 the electronic device 200 in use is illustrated wherein the processor 103 has selectively provided a signal to illuminate both the first lighting assembly FLA illuminator 190 and the second lighting assembly SLA illuminator 195. As shown, the alphanumeric key display region 297 comprises alphanumeric key indicia

610 and in use the alphanumeric key indicia 610 and navigation key indicia 510 are illuminated when both the second lighting assembly SLA illuminator 195 and first lighting assembly FLA illuminator 190 are illuminated. Thus, the alphanumeric key indicia 610 that was substantially visibly unnoticeable by a user becomes visible (noticeable) when the second lighting SLA assembly illuminator is illuminated.

In FIG. 7 the electronic device 200 in use is illustrated wherein the processor 103 selectively provides a signal to illuminate only the second lighting assembly SLA illuminator 195. Hence, the alphanumeric key indicia 610 is illuminated as the second lighting assembly SLA illuminator 195 is illuminated (for illustrative purposes in this Fig the indicia and markings of the keypad area 296 cannot be seen). Moreover, in FIG. 5 only the navigation key indicia 510 are illuminated and in FIG. 7 only the alphanumeric key indicia 610 are illuminated because the partition 273 blocks light transmission between the light pipes 271,272.

Advantageously, the present invention provides for selective illumination of the keypad areas 296,297 and when not illuminated these keypad areas 296,297 appear to be almost devoid of indicia. In operation, the keypad area 296 (navigation key display area) may be illuminated (without illumination of keypad area 297) to thereby illuminate the navigation key indicia 510 when, for instance, the electronic device 200 is performing the function of video conferencing or game applications are displayed on the display screen 105. In contrast, the keypad area 297 (alphanumeric key display area) may be illuminated (without illumination of keypad area 296) to

thereby illuminate the alphanumeric key indicia 520 when, for instance, the electronic device 200 is performing the function of data entry. Also, when the electronic device 200 is in text entry mode both the alphanumeric key indicia 520 and navigation key indicia 510 are illuminated. Hence, the present invention provides an aesthetically appealing keypad 155 that is selectively illuminated and may reduce battery power drain resulting from illuminating the keypad 155.

In the foregoing specification, specific embodiments of the present invention have been described. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the present invention as set forth in the claims below. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of present invention. The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements of any or all the claims. The invention is defined solely by the appended claims including any amendments made during the pendency of this application and all equivalents of those claims.

WE CLAIM:

- 5 1. An electronic device with selectively illuminated keypad areas, the electronic device comprising:
- A keypad having at least two light pipes these being first light pipe and a second light pipe;
- A first lighting assembly illuminator associated
10 with the first light pipe;
- A second lighting assembly illuminator associated with the second light pipe;
- A partition disposed between the first light pipe and the second light pipe; and
- 15 A processor coupled to the first lighting assembly illuminator and the second lighting assembly illuminator, wherein in use the processor selectively provides a signal to illuminate only the first lighting assembly illuminator or illuminate both the first lighting
20 assembly illuminator and second lighting assembly illuminator and wherein the partition blocks light transmission between the light pipes.
- 25 2. An electronic device as claimed in claim 1, wherein in use the processor selectively provides a signal to illuminate only the second lighting assembly illuminator.
- 30 3. An electronic device as claimed in claim 1, wherein the keypad comprises a navigation key display region that overlays the first lighting assembly illuminator and the first light pipe.
4. An electronic device as claimed in claim 3, wherein the keypad comprises an alphanumeric key display region

that overlays the second lighting assembly illuminator and the second light pipe.

5 5. An electronic device as claimed in claim 3, wherein the navigation key display region comprises navigation key indicia, wherein in use the navigation key indicia are illuminated when the first lighting assembly illuminator is illuminated.

10 6. An electronic device as claimed in claim 5, wherein the navigation key indicia is substantially visibly unnoticeable by a user until the first lighting assembly illuminator is illuminated.

15 7. An electronic device as claimed in claim 4, wherein the alphanumeric key display region comprises alphanumeric key indicia, wherein in use the alphanumeric key indicia are illuminated when the second lighting assembly illuminator is illuminated.

20 8. An electronic device as claimed in claim 7, wherein the alphanumeric key indicia is substantially visibly unnoticeable by a user until the second lighting assembly illuminator is illuminated.

25 9. An electronic device as claimed in claim 1, further comprising:

a housing within which is housed the processor;

a display screen;

30 and a flexible sheet mounted to the housing and providing a front face of the electronic device, wherein the flexible sheet forms part of a keypad and also covers the display screen.

10. The electronic device of claim 9, wherein the flexible sheet solely forms a front face of the electronic device.

5 11. The electronic device of claim 1, wherein the first light pipe includes an array of interconnected keys interconnected by links forming boundaries of at least some keys of a keypad.

10 12. The electronic device of claim 1, wherein the second light pipe includes an array of interconnected keys interconnected by links forming boundaries of at least some keys of a keypad.

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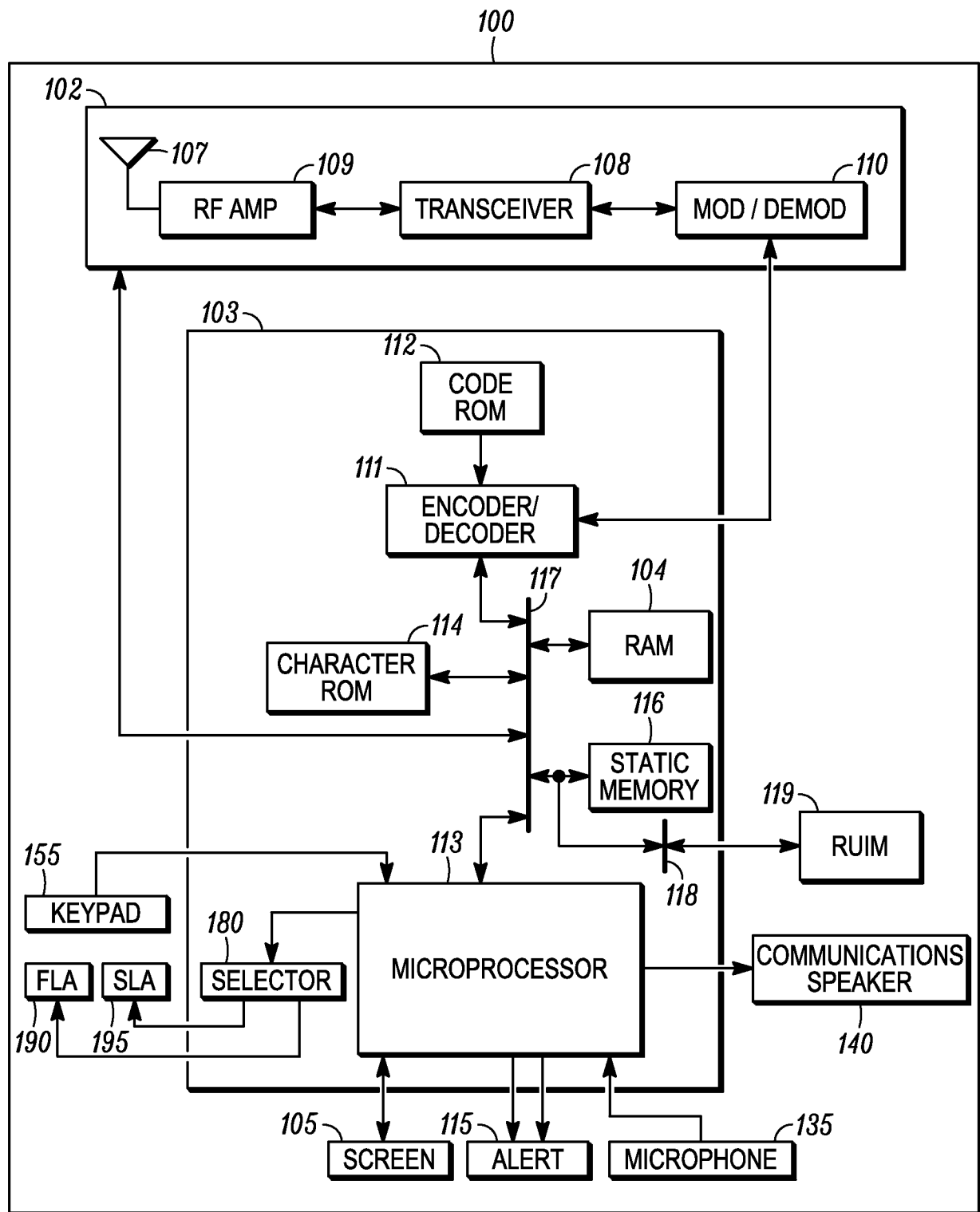
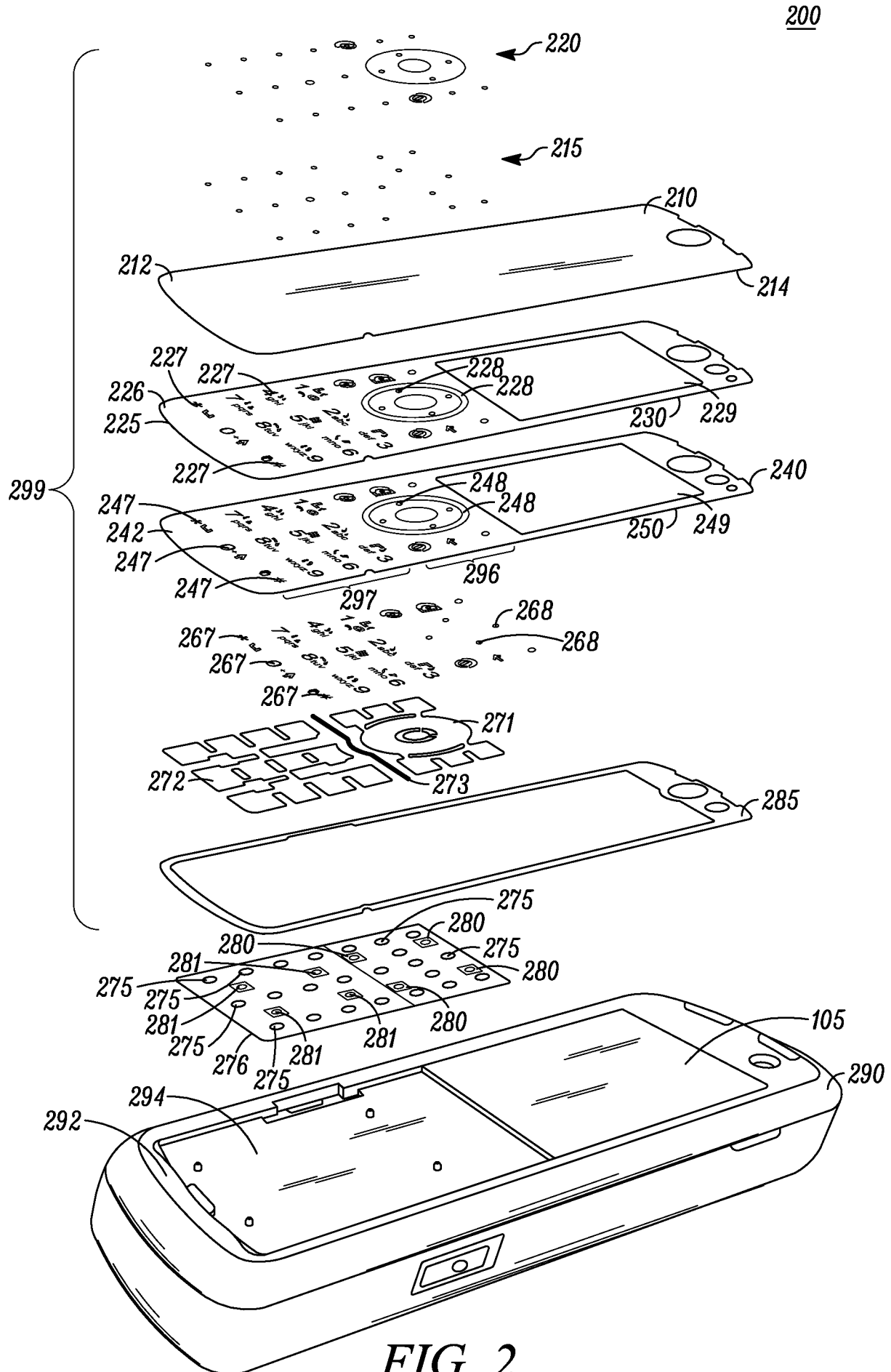


FIG. 1

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299

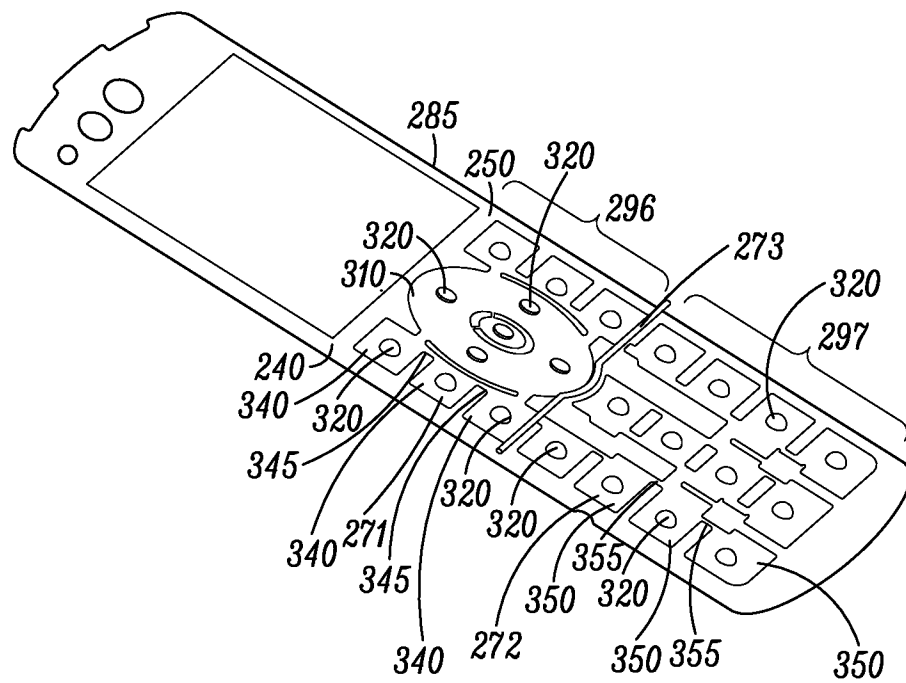


FIG. 3

200

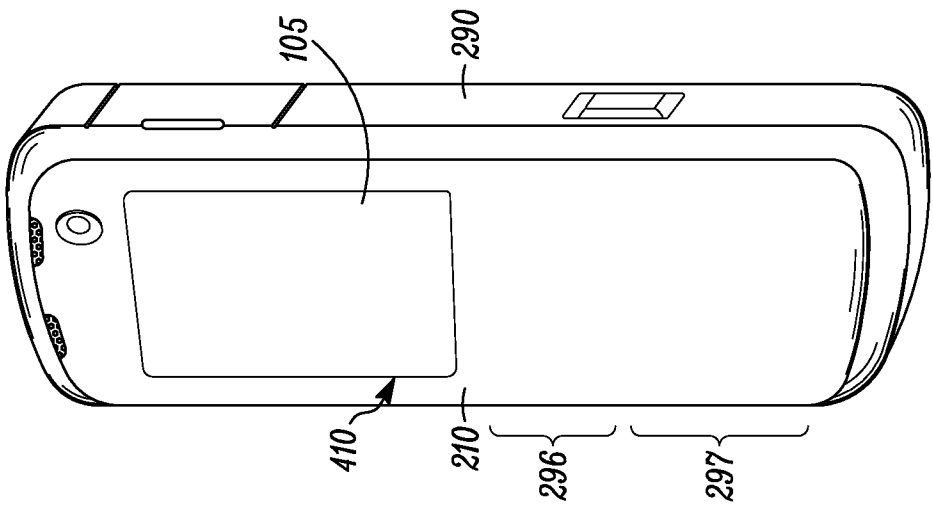


FIG. 4

200

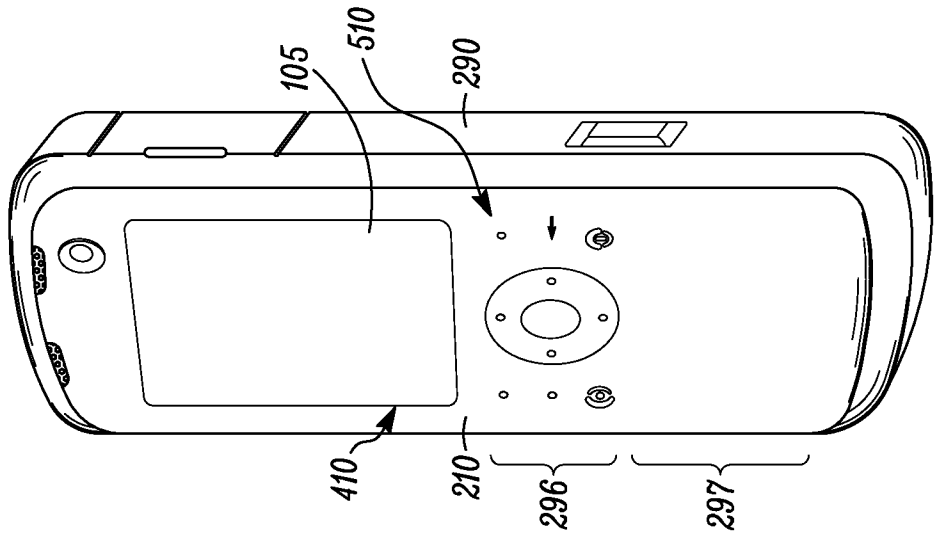


FIG. 5

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200

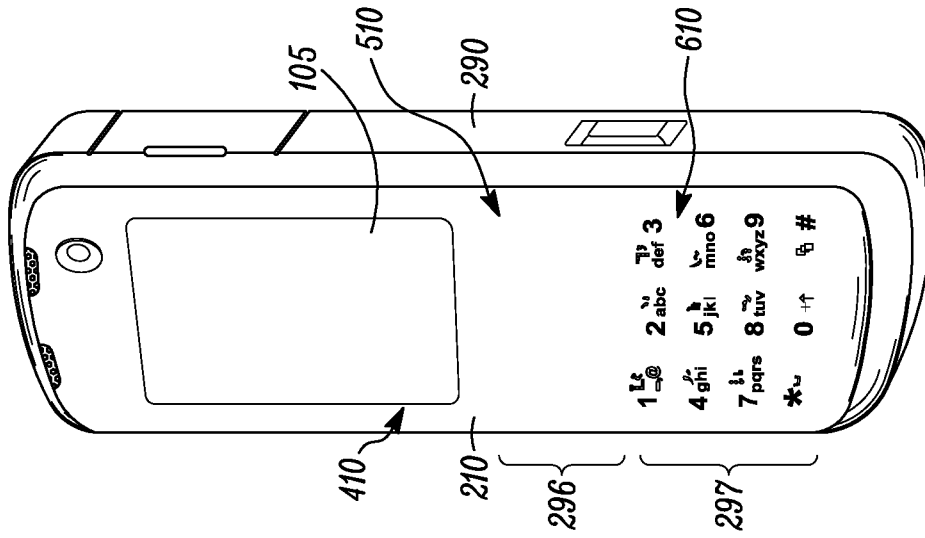


FIG. 6

200

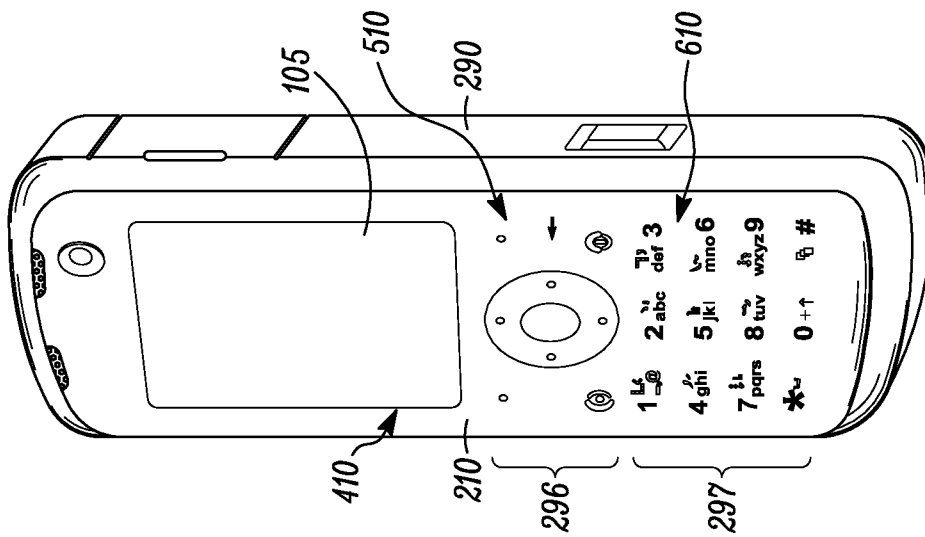


FIG. 7