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Ko

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(54) **METHOD AND APPARATUS FOR ENTERING DATA STRINGS INCLUDING HANGUL (KOREAN) AND ASCII CHARACTERS**

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(51) **Int. Cl.**⁷ **G06K 9/18**

(52) **U.S. Cl.** **382/185**; 382/189; 345/171; 715/535

(58) **Field of Search** 382/180, 181, 382/186, 187, 189, 229, 282, 284, 309, 310, 313; 341/28; 345/141, 157, 168, 171, 467; 455/422.1; 715/535, 536, 540

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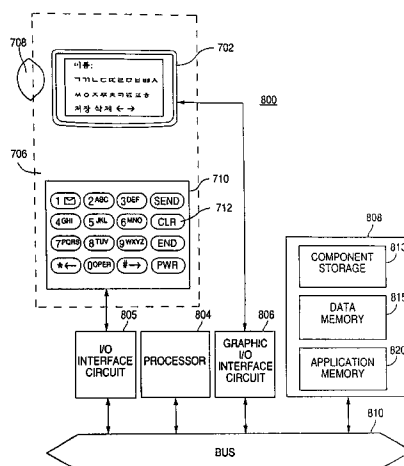
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(57) **ABSTRACT**

Described are methods for entering and editing data strings that are inputted into cellular telephones having a screen. In one method, all basic Hangul consonants and some of the compound Hangul consonants are included in a candidate consonant list and all basic Hangul vowels and some of the compound vowels are included in a candidate vowel list. The candidate consonant and vowel lists are alternatively displayed on a component display region (906) located on the screen. For form a Korean character, a user can select consonant(s) and vowel from the candidate consonant and vowel lists. To form a compound Hangul component that is not included in either the candidate consonant list or the candidate vowel list, the user selects a basic Hangul component as a first part of the compound Hangul component from either the candidate consonant list or the candidate vowel list. The user then re-displays the candidate consonant list or the candidate vowel list and selects a basic Hangul component as a second part of the compound Hangul component. A compound Hangul component is formed by combining the two selected basic Hangul components and displayed in a data string display region (904) located on the screen. In another method, a data string can be formed using both Hangul and ASCII characters. In yet another method, a data string can include unusual characters that are invalid to the existing cellular telephone. In still another method, editing can be made at any position of a data string that is inputted to the cellular telephones.

60 Claims, 13 Drawing Sheets



ㄱ ㄴ ㄷ ㄹ ㅁ ㅂ ㅅ ㅇ ㅈ ㅊ ㅋ ㅌ ㅍ ㅎ

FIG. 1

Г Г Д Д Е Е Ё Ё Ж Ж З З И И Й Й К К Л Л М М Н Н О О П П Р Р С С Т Т У У Ф Ф Х Х Ц Ц Ч Ч Ш Ш Щ Щ Ъ Ъ Ы Ы Ь Ь Э Э Ю Ю Я Я

FIG. 2

† ‡ † ‡ ⊥ μ τ π − |

FIG. 3

ㅁ ㅂ ㅅ ㅇ ㅈ ㅊ ㅋ ㆁ ㆅ ㆆ ㆇ ㆈ ㆉ ㆊ ㆋ ㆌ ㆍ ㆎ ㆏ ㆐ ㆑ ㆒ ㆓ ㆔ ㆕ ㆖ ㆗ ㆘ ㆙ ㆚ ㆛ ㆜ ㆝ ㆞ ㆟ ㆠ ㆡ ㆢ ㆣ ㆤ ㆥ ㆦ ㆧ ㆨ ㆩ ㆪ ㆫ ㆬ ㆭ ㆮ ㆯ ㆰ ㆱ ㆲ ㆳ ㆴ ㆵ ㆶ ㆷ ㆸ ㆹ ㆺ ㆻ ㆼ ㆽ ㆾ ㆿ ㆿ

FIG. 4

ㄱ ㄴ ㄷ ㄹ ㅁ ㅂ ㅅ ㅆ ㅇ ㅈ ㅊ ㅋ ㆁ ㆅ ㆇ ㆈ

FIG. 5

卜 卩 亅 𠂇 丄 𠂆 丅 丌 一 丨 𠂇 𠂇 𠂇 𠂇

FIG. 6

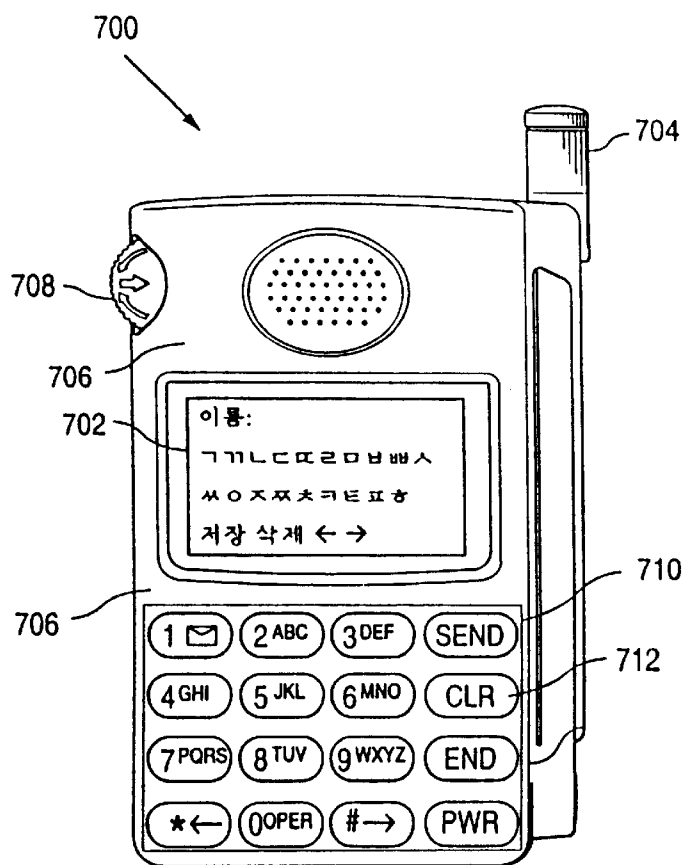


FIG. 7A

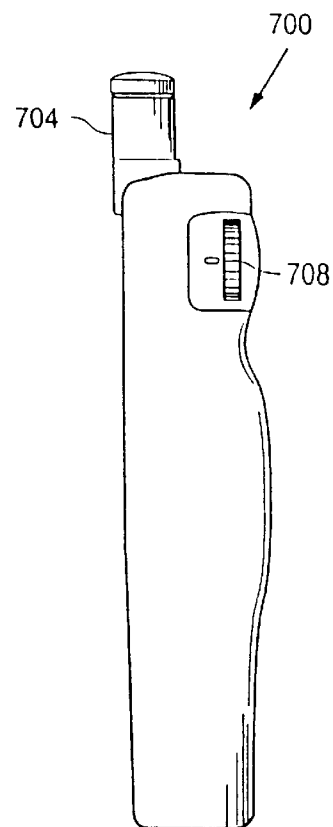


FIG. 7B

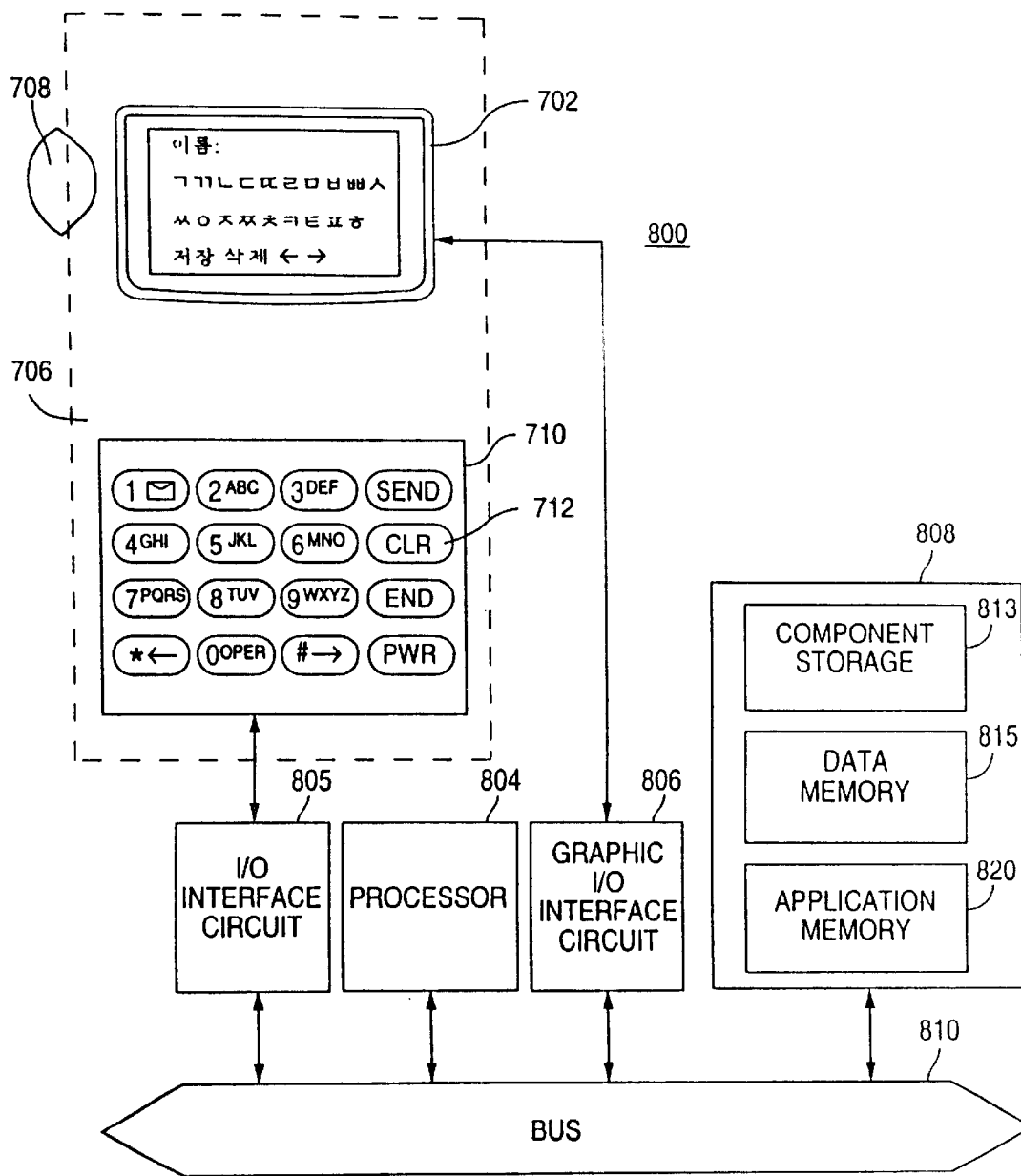


FIG. 8

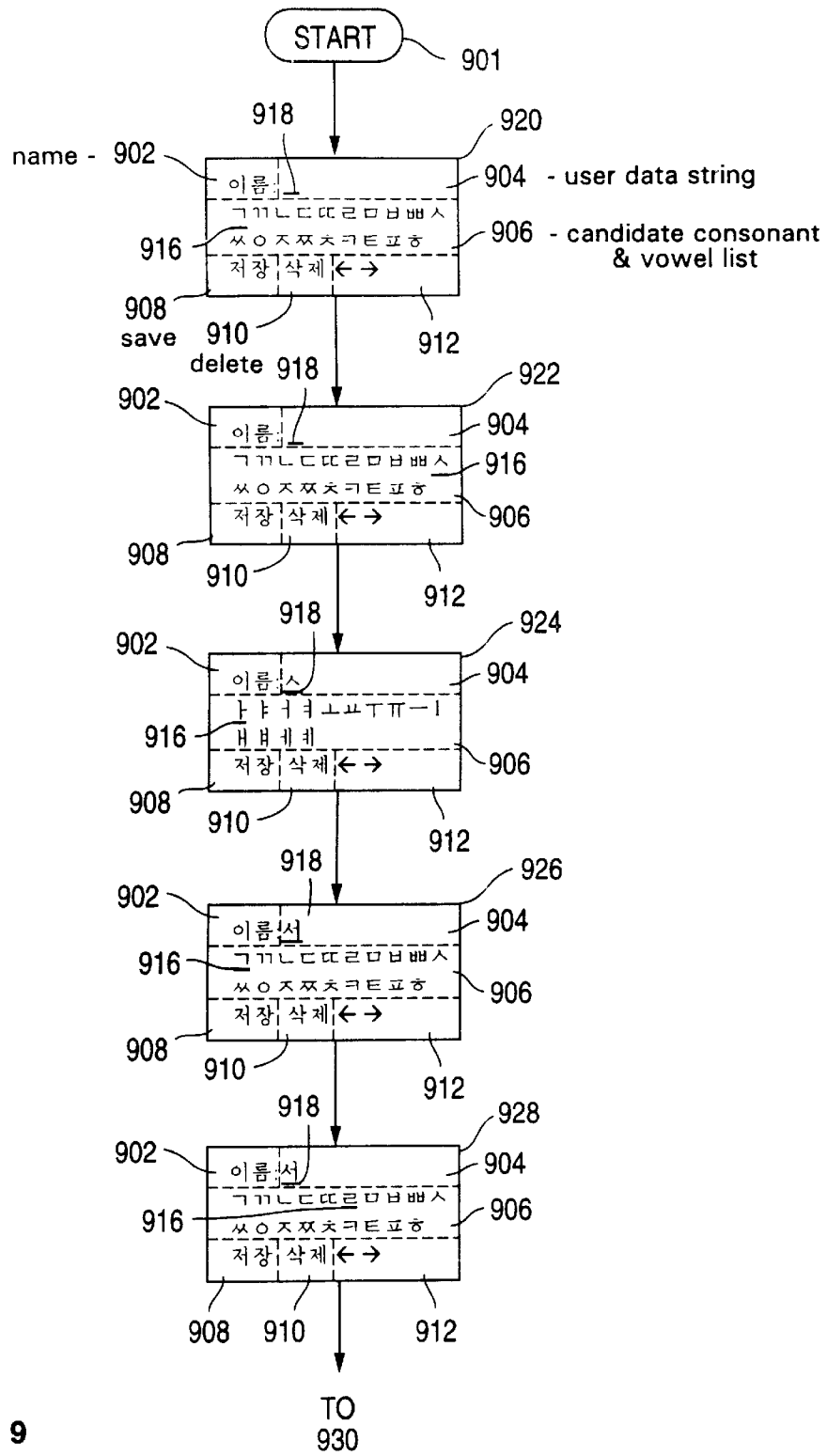
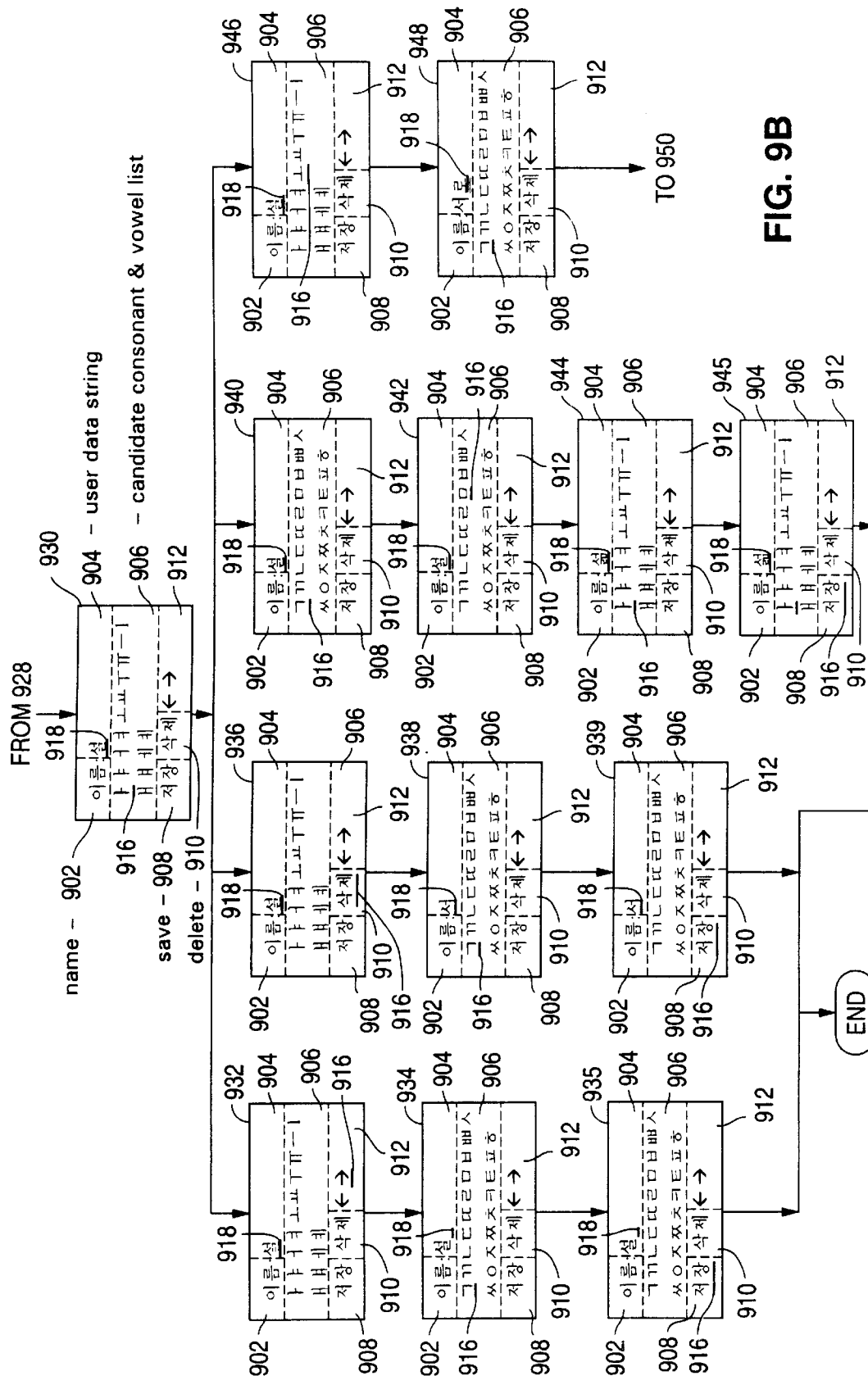


FIG. 9

FIG. 9A

FIG. 9A
FIG. 9B
FIG. 9C
FIG. 9D



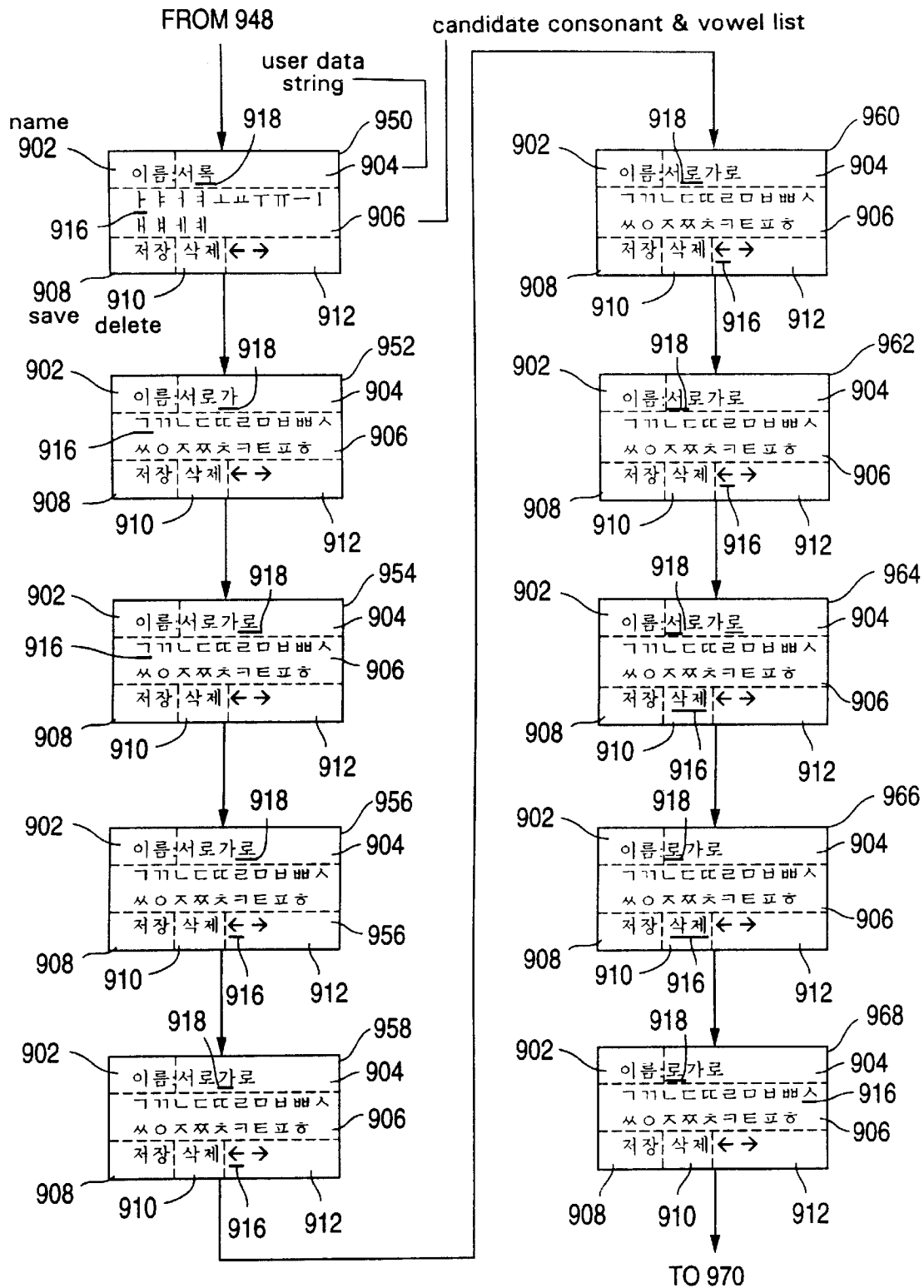


FIG. 9C

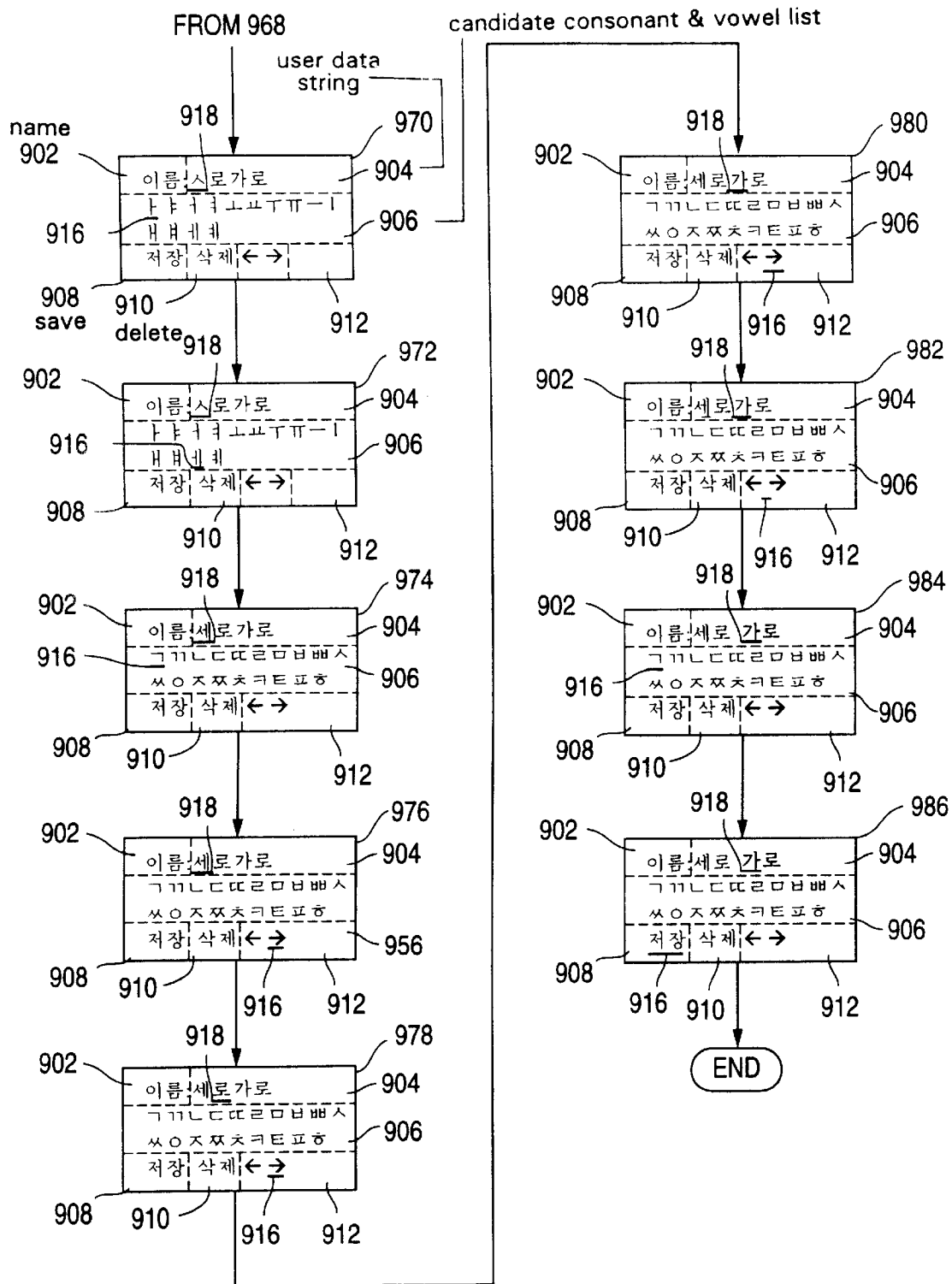


FIG. 9D

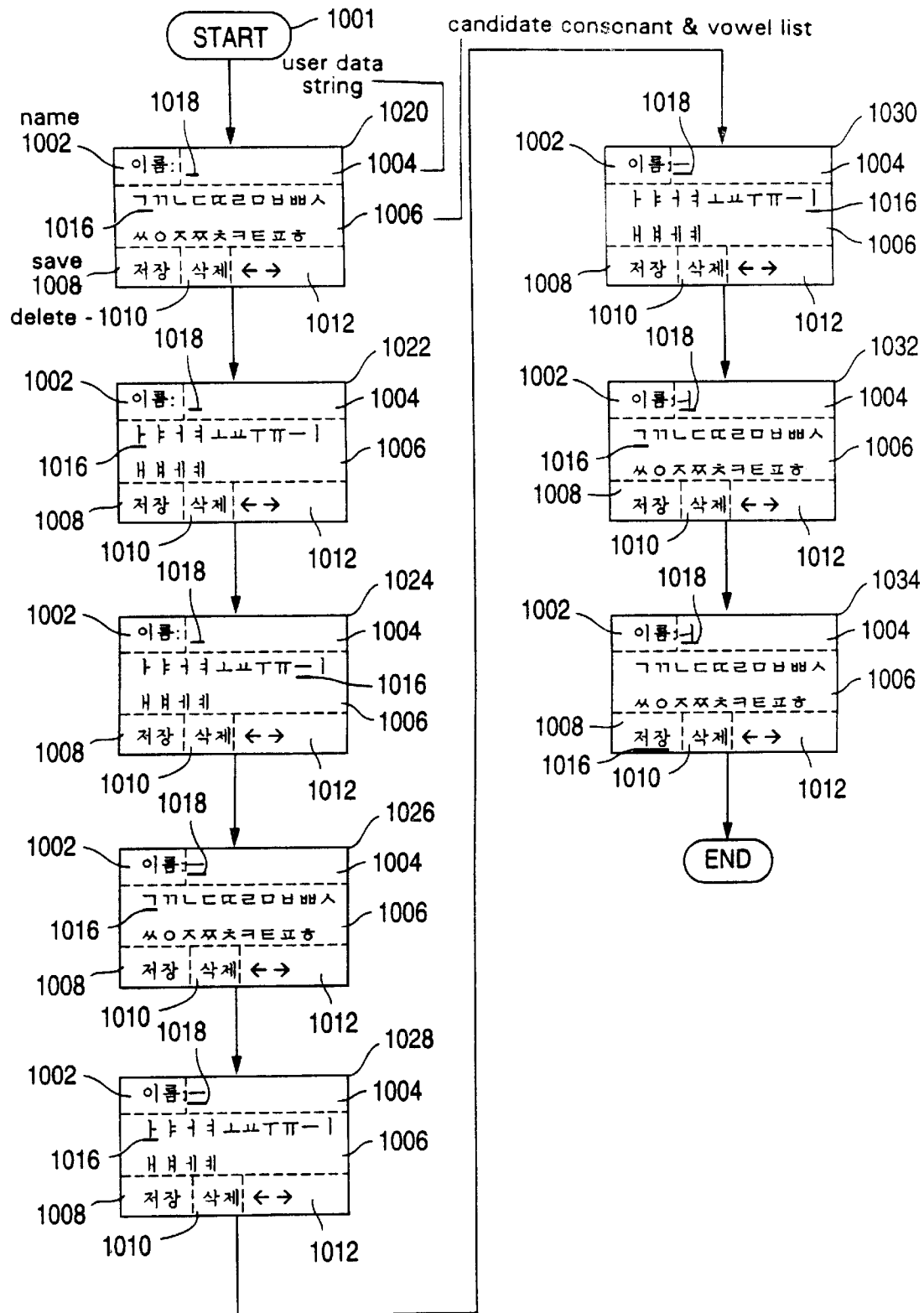


FIG. 10

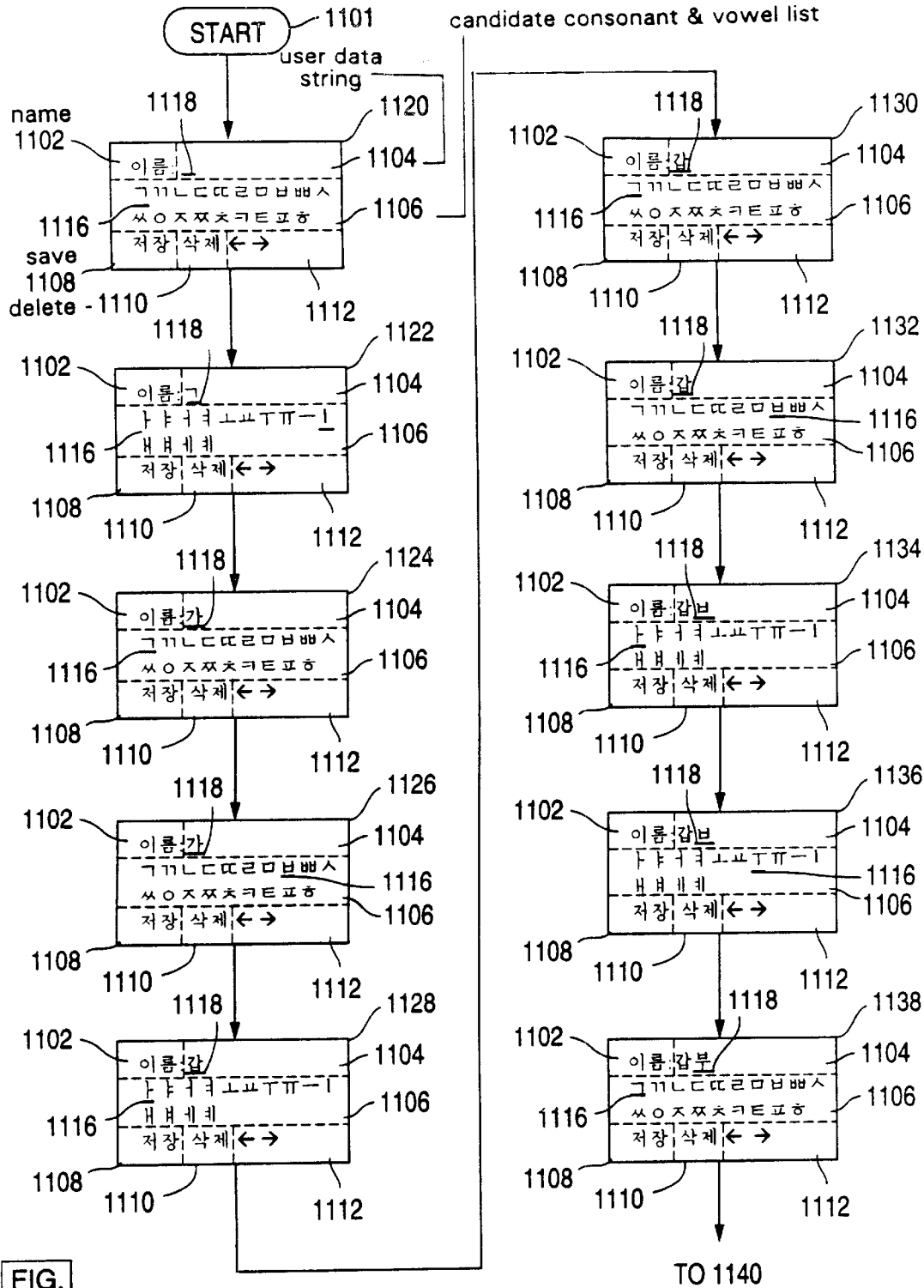


FIG. 11A
FIG. 11B

FIG. 11

FIG. 11A

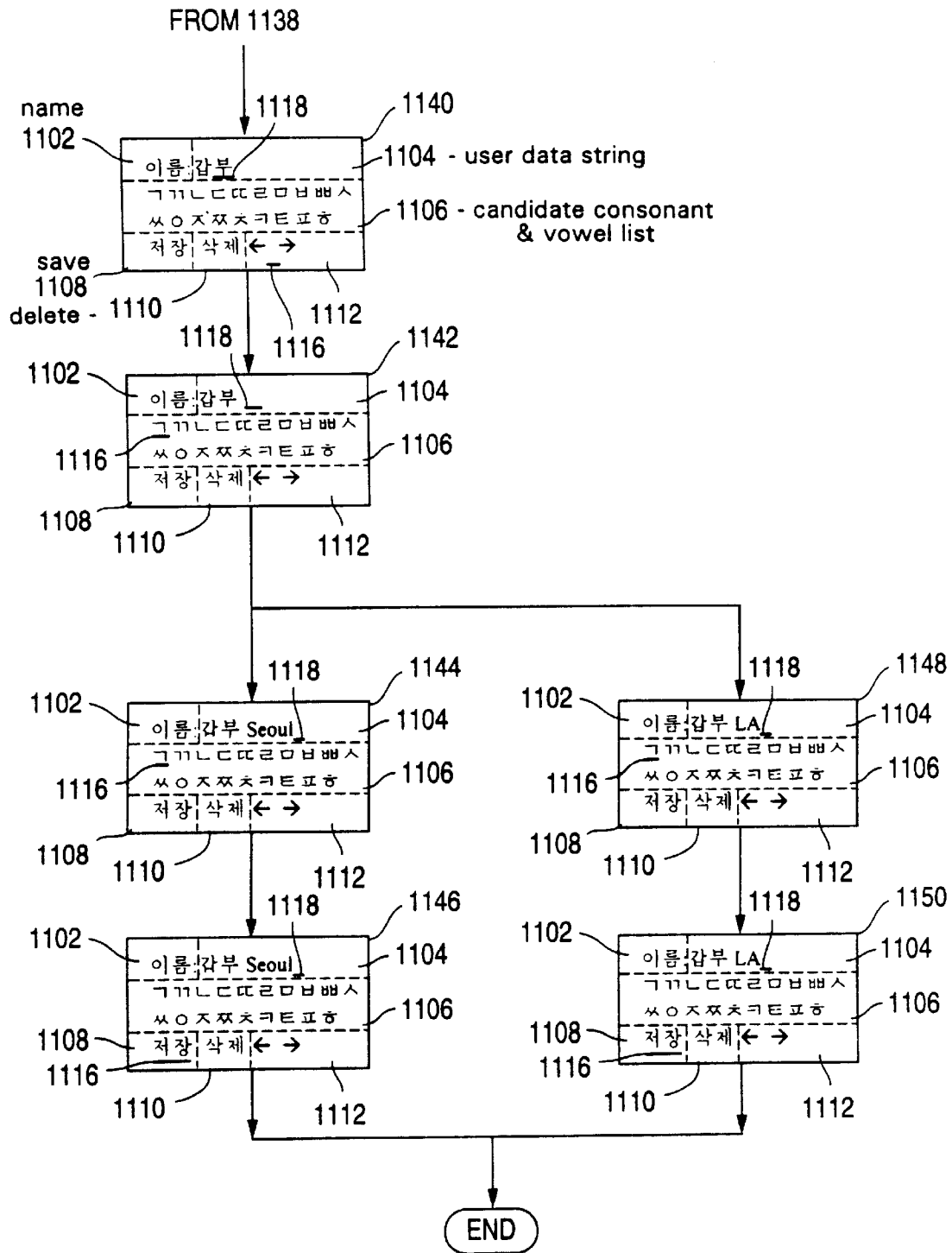
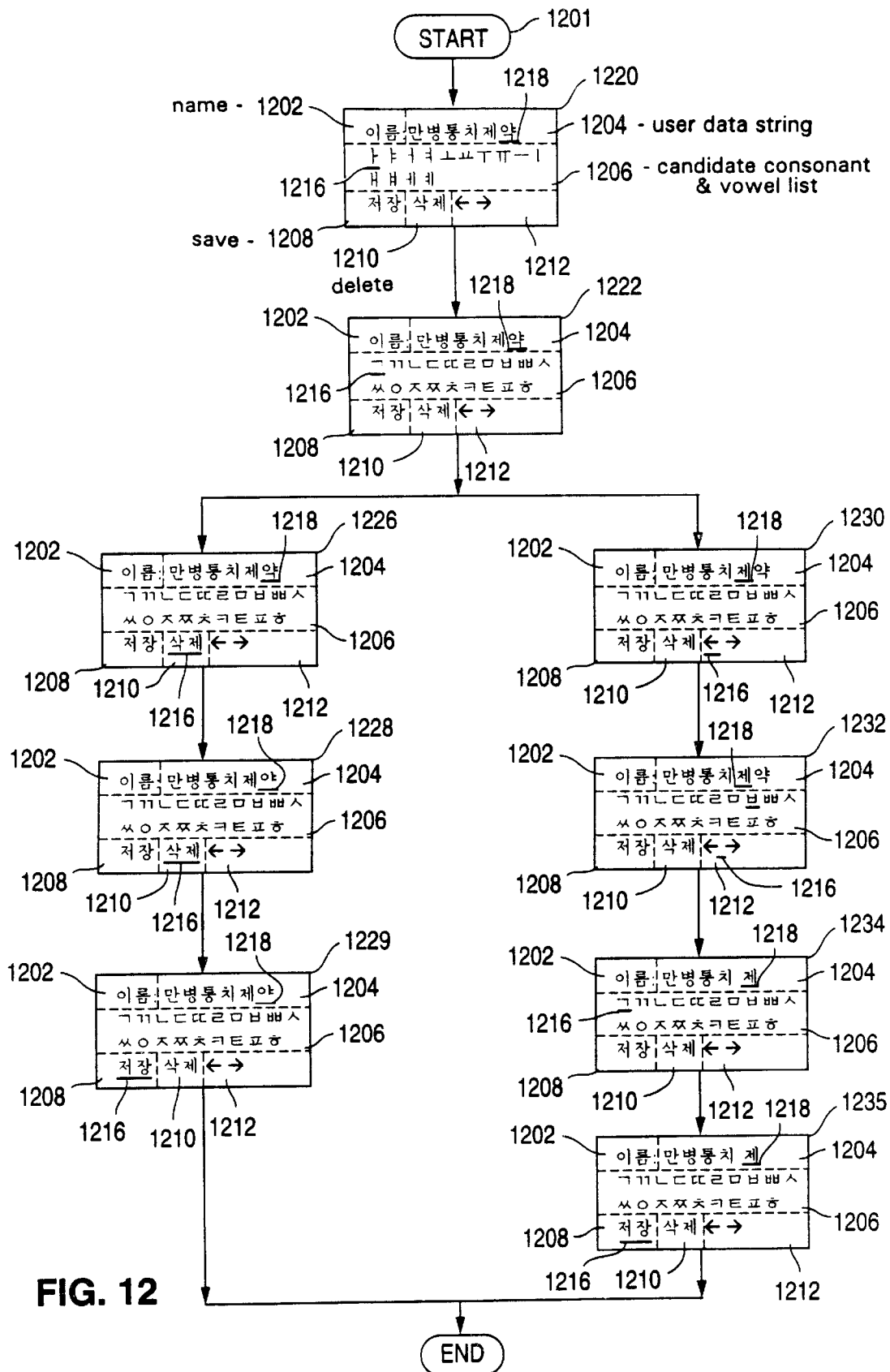


FIG. 11B



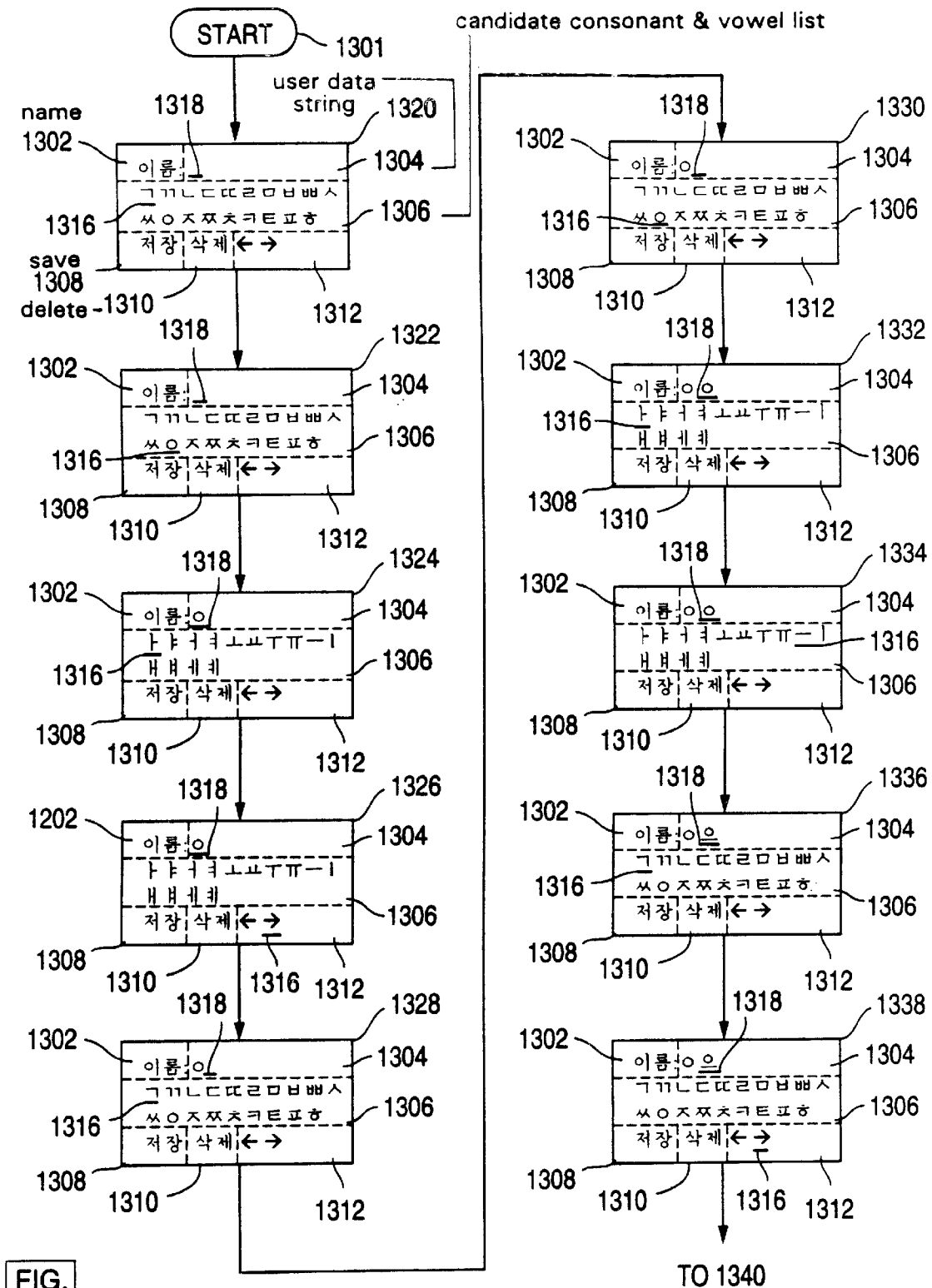


FIG. 13A
FIG. 13B

FIG. 13

FIG. 13A

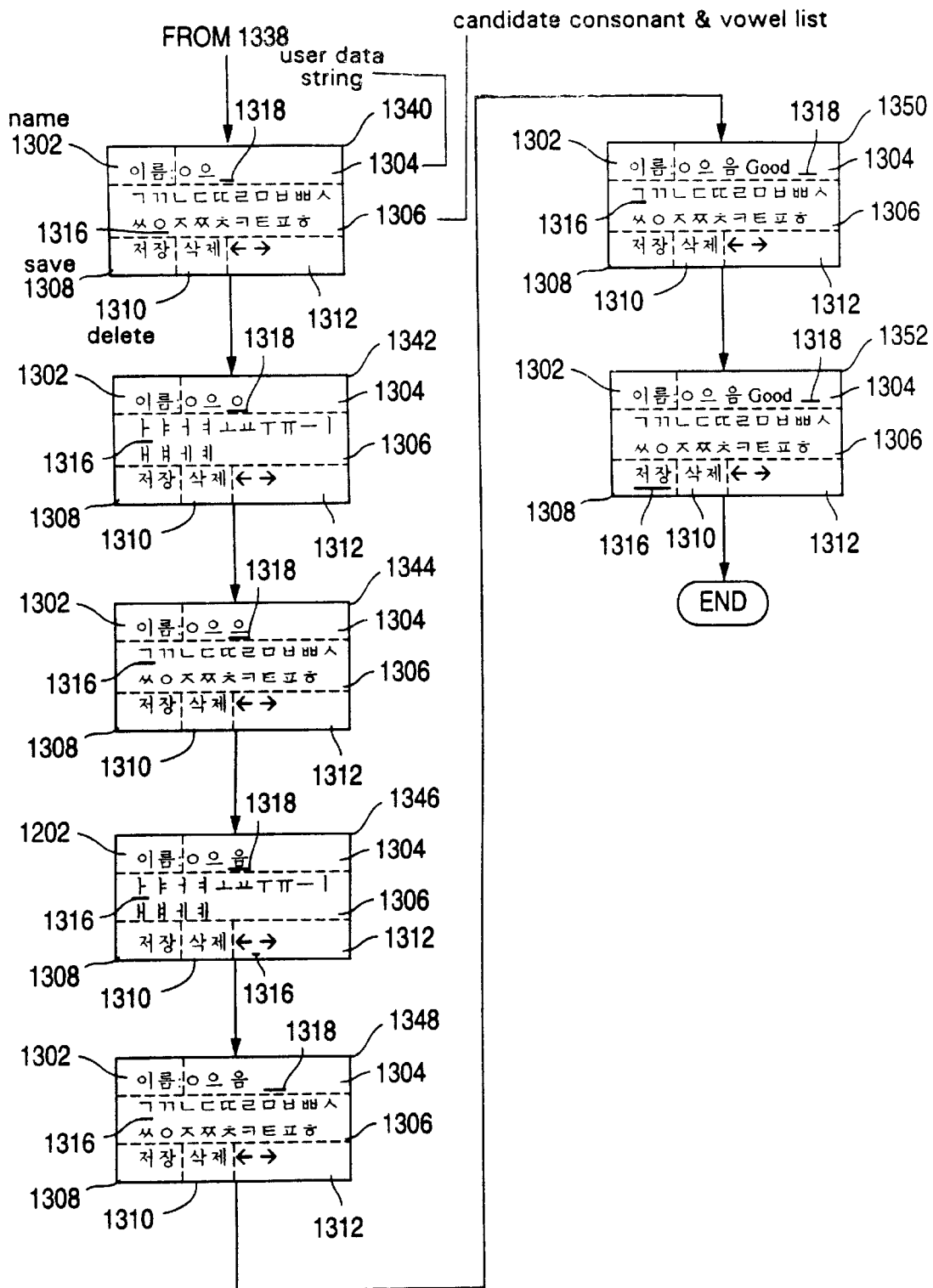


FIG. 13B

1

METHOD AND APPARATUS FOR ENTERING DATA STRINGS INCLUDING HANGUL (KOREAN) AND ASCII CHARACTERS

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 09/234,429 of Soon Ko filed Jan. 20, 1999, now U.S. Pat. No. 6,430,314.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a method and apparatus for entering data strings including Hangul (Korean) and/or ASCII characters into electronic devices and, more specifically, to a method and apparatus for forming data strings by selecting Hangul character components displayed on a relatively small display region and selecting ASCII characters from a key panel.

2. Related Art

To effectively marketing electronic devices such as cellular telephone and personal digital assistant (PDA) in Korean market, the instruction and information displayed on these electronic devices should be primarily in Korean language. The Korean written language uses two types of characters: Hangul and Hanja. Hangul is the native name for the Korean language, and Hanja is the Korean name for ideographic characters of Chinese origin. The Hanja characters are usually used in more formal written communications. Most daily communications are written in Hangul. Therefore, it is necessary to provide a mechanism to allow users to enter Hangul characters into electronic devices, because some information in electronic devices needs to be customized by individual users.

Hangul characters are composed of Hangul components which include thirty consonants and twenty one vowels. Conventionally, the whole set of Hangul consonants and vowels are assigned to the keys on a keyboard. For example, the thirty Hangul consonants and twenty one vowels can be assigned to a computer keyboard having no more than fifty keys when used with the SHIFT and ALT keys. However, the conventional method is not suitable for portable electronic devices which have few keys or do not have a keyboard at all. An external keyboard could be attached to these portable electronic devices. However, it is inconvenient to do so due to the small size of these portable electronic devices. Furthermore, portable electronic devices typically have a relatively small display region. This increases the difficulty of entering Hangul characters into the portable electronic devices.

The existing cellular telephones are not user friendly in entering data strings. Specifically, the existing cellular telephones are unable to enter a data string including both Hangul and ASCII characters. In addition, the existing cellular telephones are only able to accept valid, fully constructed Hangul characters. For example, the existing cellular telephones do not accept one Hangul consonant, two Hangul consonants, or two Hangul vowels as a valid Hangul input. Furthermore, the existing cellular telephone are unable to delete and insert a character in a middle position of a data string. To delete a character in a middle position of a data string, a user has to delete all trailing characters up to that character. Similarly, to insert a character in a middle position of a data string, a user has to delete all characters up to that position, enter the character needed to be inserted,

2

and then re-enter all the earlier erased trailing characters. These shortcomings are inconvenient for users to entering data strings to cellular telephones.

There is, therefore, a need to provide an improved method and apparatus for entering Hangul characters into electronic devices that have few keys or do not have a key board.

There is another need to provide an improved method and apparatus for entering Hangul characters into electronic devices that have a relatively small display region.

There is also another need to provide an improved method and apparatus for entering a data string including both Hangul and ASCII characters.

There is yet another need to provide an improved method and apparatus for entering unusual Hangul component combinations.

There is still another need to provide an improved method and apparatus for deleting and inserting a character in the middle position of a data string.

The present invention provides the methods and apparatuses to meet these needs.

SUMMARY OF THE INVENTION

To overcome the shortcomings in the available art, the present invention provides novel methods for forming Hangul characters on electronic devices.

In one aspect, the present invention provides a method for selecting Hangul components to form Hangul characters. The Hangul components include a plurality of first type basic components and a plurality of first type compound components. Each of the first type compound components is composed of two first type basic components. The Hangul components further include a plurality of second type basic components and a plurality of second type compound components. Each of the second type compound components is composed of two second type basic components. The method comprises the steps of: (a) forming a first list including all the first type basic components; (b) forming a second list including all the second type basic components; (c) displaying the first list on a first screen region located on a screen, and inputting a first Hangul component by selecting a first type basic component from the first list; (d) if the first Hangul component is a first type compound component, displaying the first list in the first display region, selecting a first type basic component from the first list, and forming the first Hangul component by combining the first type basic component selected in the step (c) with the first type basic component selected in the step (d); and (e) displaying the second list on the first region to replace the first list, and inputting a second Hangul component by selecting a second type basic component.

In another aspect, the present invention provides a method for forming a Hangul character by selecting Hangul components from a consonant group and a vowel group. The consonant group contains a plurality of basic consonants and a plurality of compound consonants. Each of the compound consonants is composed of two of the basic consonants. The vowel group contains a plurality of basic vowels and a plurality of compound vowels. Each of the compound vowels is composed of two of the basic vowels. The method comprises the steps of: (a) forming a consonant list containing all the basic vowels and some of the compound consonants; (b) forming a vowel list containing all the basic vowels and some of the compound vowels; (c) displaying the consonant list on a first screen region located on a screen; (d) selecting a consonant from the consonant list displayed

3

on the first screen region; (e) displaying the vowel list on the first screen region to replace the consonant list; (f) selecting a vowel from the vowel list displayed on the first screen region; and (g) forming a Hangul character by combining the selected consonant and vowel.

In also another aspect, the present invention provides a method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel. The method comprises the steps of: displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen; inputting at least one Hangul character by selecting at least one Hangul component from the list displayed in the first region; inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and forming the data string using the inputted Hangul character and the inputted ASCII character.

In yet another aspect, the present invention provides a method for entering a Hangul character into an electronic device having a screen. The method comprises the steps of: displaying a plurality of Hangul consonants; selecting one of the consonants; indicating a completion of the selection; and forming a Hangul character using the selected consonant.

In still another aspect, the present invention provides a method for entering a Hangul character into an electronic device having a screen. The method comprises the steps of: displaying a plurality of Hangul vowels; selecting one of the vowels; indicating a completion of the selection; and forming a Hangul character using the selected vowel.

The present invention also provides the apparatuses for performing the steps in the methods discussed above.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objectives, features and advantages of the invention will be more readily understood upon consideration of the following detailed description of certain preferred embodiments of the invention, taken in conjunction with the accompanying drawings.

FIG. 1 depicts fourteen basic Hangul consonants;

FIG. 2 depicts sixteen compound Hangul consonants;

FIG. 3 depicts ten basic Hangul vowels;

FIG. 4 depicts eleven compound Hangul vowels;

FIG. 5 depicts a candidate consonant list including the fourteen basic Hangul consonants and four of the sixteen compound Hangul consonants, in accordance with the present invention;

FIG. 6 depicts a candidate vowel list including the ten basic Hangul vowels and four of the eleven Hangul compound vowels, in accordance with the present invention;

FIG. 7A depicts the front view of a cellular telephone that has the capability of entering Hangul and ASCII characters, in accordance with the present invention;

FIG. 7B depicts the side view of the cellular shown in FIG. 7A;

FIG. 8 depicts a block diagram, illustrating some components of the cellular telephone shown in FIG. 7A;

FIG. 9 depicts a sequence of screen shots, illustrating a process of selecting Hangul components, forming Hangul characters, and entering the formed Hangul characters into the cellular telephone shown in FIG. 7A, in accordance with the present invention;

FIG. 10 depicts a sequence of screen shots, illustrating a process of constructing a compound vowel, in accordance with the present invention;

4

FIG. 11 depicts a sequence of screen shots, illustrating a process of entering a data string including both the Hangul and ASCII characters, in accordance with the present invention;

FIG. 12 depicts a sequence of screen shots, illustrating a process of behavior of the cellular telephone when there is no room for further entering characters, in accordance with the present invention; and

FIG. 13 depicts a sequence of screen shots, illustrating a process of entering a data string containing unusual Hangul consonant combinations that are invalid to conventional cellular telephones but valid to the cellular telephone in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides novel methods and apparatuses for entering data strings into electronic devices that have a relatively small display screen and few input keys.

A Hangul character is a single syllabic character formed by combining one or two Hangul consonants with a Hangul vowel. FIG. 1 shows fourteen basic Hangul consonants. FIG. 2 shows sixteen compound Hangul consonants, each of which is formed by combining two or more basic Hangul consonants. FIG. 3 shows ten basic Hangul vowels. FIG. 4 shows eleven compound Hangul vowels, each of which is formed by combining two or more basic Hangul vowels. As shown in FIGS. 1-4, Hangul includes a total thirty of consonants and twenty one vowels. FIG. 5 shows a candidate consonant list including the fourteen basic Hangul consonants and most frequently used four of the sixteen Hangul compound consonants. FIG. 6 shows a candidate vowel list including the ten basic Hangul vowels and most frequently used four of the eleven Hangul compound vowels.

In the present invention, the candidate consonant list and the candidate vowel list are alternatively displayed in a display region so that a user can alternatively select a Hangul consonant and a Hangul vowel from these two lists, respectively. To form a Hangul character, a user can select Hangul components from the candidate consonant list and/or the candidate vowel list. To form a compound Hangul consonant that is not included in the candidate consonant list, after selecting a first basic Hangul consonant from the candidate consonant list, the user re-displays the candidate consonant list and selects a second basic Hangul consonant from the candidate consonant list. Similarly, to form a compound Hangul vowel that is not included in the candidate vowel list, after selecting a first basic Hangul vowel from the candidate vowel list, the user re-displays the candidate vowel list and selects a second basic Hangul vowel from the candidate vowel list.

FIG. 7A shows a front view of a cellular telephone 700, which has the capability of entering Hangul and ASCII characters in accordance with the present invention.

As shown in FIG. 7A, the cellular telephone 700 includes a display screen 702, an antenna 704, and a control panel 706. The control panel 706 includes a jog dial wheel 708 and a key panel 710, including twelve alpha/numeric keys. The jog dial wheel 708 can be moved in three directions (turn-up, turn-down, and press-in), as indicated by the three arrows. The cursor 916, 1016, 1116, 1216, or 1316 (as will be discussed in greater detail in connection with FIGS. 9, 10, 11, 12, and 13) displayed on the display screen 702, can be moved to the left and right by turning the jog dial wheel 708 up and down, respectively. A component (or a command)

5

displayed on the display screen 702 can be selected (or activated) by first moving the cursor 916, 1016, 1116, 1216, or 1316 to the component (or the command) and then pressing-in the jog dial wheel 708.

FIG. 7B shows a side view of the cellular telephone 700 is shown to illustrate the side view of the jog dial wheel 708.

FIG. 8 shows a block diagram 800 to illustrate some components of the cellular telephone 700 shown in FIG. 7A, in accordance with the present invention.

The block diagram 800 includes a processor 804, an I/O (input and output) interface circuit 805, a graphic I/O interface circuit 806, a memory 808, and a bus 810. The processor 804, the I/O interface circuit 805, the graphic I/O interface circuit 806, and the memory 808 are all coupled to the bus 810.

The memory 808 includes: (1) a component storage 813 for storing Hangul components (including Hangul consonants and vowels) and ASCII characters, (2) a data memory 815 for storing data strings entered into the cellular telephone 700, and (3) an application memory 820 for storing an application to form data strings in accordance with the present invention.

The processor 804 controls the operations of the I/O interface circuit 805, the graphic I/O interface circuit 806, the memory 808, and the display region 702. More specifically, the processor 804 is able to: (1) get access to the Hangul components and ASCII characters stored in the component storage 813, (2) interact with the control panel 706 via the I/O interface circuit 805, (3) display the Hangul components and ASCII characters stored in the component storage 813 on the display region 702 via the graphic I/O interface circuit 806, (4) execute the application stored in the application memory 820 to form data strings, and (5) store the data strings in the data memory 815.

In response to a user's movement of the jog dial wheel 708 or a user's press of any key on the key panel 710, the control panel 706 generates a request signal, which is in turn sent to the processor 804 via the I/O interface circuit 805. In response, the processor 804 executes the application stored in the application memory 820, thereby performing a particular function for the request signal.

FIG. 9 shows a sequence of screen shots sequentially displayed on the display screen 702 to illustrate a process of selecting Hangul components, forming Hangul characters, and entering the formed Hangul characters into the cellular telephone 700, in accordance with the present invention.

In describing the process shown in FIG. 9, it is assumed that the cellular telephone is set in a data entering mode for enabling the processor 804 to execute the application stored in the application memory 820, thereby allowing the user to input a first component into the cellular telephone 700. Once the cellular telephone 700 is set in the data entering mode, it can be switched between an appending mode or in an editing mode. The cellular telephone 700 is in an appending mode when the user places new data at the end position of a data string. The cellular telephone 700 remains in the appending mode so long as the newly inputted data is placed at a data string's end position, which does not have pre-existing data. The cellular telephone 700 is in an editing mode when the user either inserts or deletes. The input position change over the previously entered data is considered as an editing mode action. Since the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, and 1318 in FIG. 13) indicates the position of a subsequent operation to a data string, the application can determine whether the cellular telephone 700 should be set in an appending mode

6

or an editing mode by detecting the position of the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, and 1318 in FIG. 13).

Screen Shot 920:

The screen shot 920 has six display regions 902, 904, 906, 908, 910, and 912. The region 902 displays "name" in Hangul. The regions 904 displays the data string entered by a user. The region 906 alternatively displays the candidate consonant list and the candidate vowel list. The region 908 displays a command "save" in Hangul for saving the data string that are displayed in the region 904. The regions 910 displays a command "delete" in Hangul. In an appending mode, the selection of the "delete" command deletes a Hangul component or an ASCII character which was last entered. However, in an editing mode, the selection of the "delete" command deletes a Hangul character (which may include up to four Hangul components) or an ASCII character indicated by the cursor 918, 1018, 1118, 1218, or 1318.

The region 906 contains a cursor 916 and two display lines. Each display line contains ten full-size spaces, and each full-size space contains two half-size spaces. A Hangul character occupies a full-size space, and an ASCII character occupies a half-size space. Since the cellular telephone 700 is currently set in an appending mode to input a first component of a data string, the region 916 displays the candidate consonant list and the cursor 916 points to the first consonant in the candidate consonant list.

The cursor 916 can be moved to the left and right in the regions 906, 908, 910 and, 912, by turning the jog dial wheel 708 up and down, respectively. Specifically, when the cursor 916 is located at the last space of the first display line, further turning the jog dial wheel 708 down moves the cursor 916 to the first space of the second display line. When the cursor 916 is located at the last Hangul character of the second display line, further turning the jog dial wheel 708 down moves the cursor 916 to the region 908. When the cursor 916 is located in the region 908, continuously turning the jog dial wheel 708 down moves the cursor 916 from the region 908 to the region 912 through the region 910. When the cursor 916 is located at the right arrow "→" icon of the region 912, further turning the jog dial wheel 708 down moves the 916 to the first space of the first display line in the region 906.

Similarly, when the cursor 916 is located in the region 912, continuously turning the jog dial wheel 708 up moves the cursor 916 from the region 912 to the region 908 through the region 910. When the cursor 916 is located in the region 908, further turning the jog dial wheel 708 up moves the cursor 916 to the last Hangul character of the second display line. When the cursor 916 is located at the first space of the second display line, further turning the jog dial wheel 708 up moves the cursor 916 to the last space of the first display line. When the cursor 916 is located at the first display line in the region 906, further turning the jog dial wheel 708 up moves the cursor 916 to the right arrow "→" icon in the region 912.

The region 904 has six full-size spaces and contains a cursor 918. The cursor 918 can be moved a full-size space or a half-size space, depending whether the character to be pointed by the cursor 918 is a Hangul character or an ASCII character.

The region 912 displays three symbols, namely a left arrow "←" icon, a "space" character, and a right arrow "→" icon. The selection of the left arrow "←" moves the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, or 1318 in FIG. 13) one half-size space or one full-size space to the left in the region 904 (1004 in FIG. 10, 1104 in FIG. 11, 1204 in FIG. 12, or 1304 in FIG. 13), depending on

whether the character to be pointed by the cursor **918** is a Hangul or an ASCII character. The selection of the "space" character appends or inserts an ASCII space character into the region **904** (**1004** in FIG. **10**, **1104** in FIG. **11**, **1204** in FIG. **12**, and **1304** in FIG. **13**). The selection of the right arrow "→" icon moves the cursor **918** (**1018** in FIG. **10**, **1118** in FIG. **11**, **1218** in FIG. **12**, and **1318** in FIG. **13**) one half-size space or one full-size space to the right in the region **904** (**1014** in FIG. **10**, **1104** in FIG. **11**, **1204** in FIG. **12**, and **1304** in FIG. **13**), depending on whether the character to be pointed by the cursor **918** is a Hangul or an ASCII character. In an appending mode, the selection of right arrow "→" icon also inserts a delimiter indicating completion of a Hangul character.

In the process of entering a Hangul character, the region **906** alternatively displays the candidate consonant and vowel lists without requiring a user's intervention. To re-display a Hangul candidate list previously displayed, a user can press-in and holds the jog dial wheel **708**, indicating a request to re-display the previous Hangul candidate list. In response, the processor **804** executes the application to switch to the Hangul candidate list previously displayed.

In FIG. **9**, all other screen shots have the same layout as screen shot **920**.

Screen Shot **922**:

To select the tenth Hangul consonant from the candidate consonant group, the user moves the cursor **916** to the tenth full-size component of the first display line in the display region **916** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application stored in the application memory **820** to select the tenth Hangul consonant from the candidate consonant list and display the selected Hangul consonant in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **924**:

In the screen shot **924**, the consonant selected from the screen shot **922** is displayed in the region **904**. In the region **906**, the candidate consonant list in the screen shot **922** is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel in the candidate vowel list. To select the third vowel from the candidate vowel list, the user moves the cursor **916** to the third full-size component of the first display line in the display region **906** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the third Hangul vowel from the candidate vowel list and displays the Hangul vowel selected in the screen shot **924**, together with the Hangul consonant selected in the screen shot **922**, in the region **904**. The processor **804** then executes the application to display the candidate consonant list in the region **906**.

Screen Shot **926**:

In the screen shot **926**, a character constructed from the two components selected in the screen shots **922** and **924** is displayed in the region **904**. In region **906**, the candidate vowel list in the screen shot **924** is automatically replaced by the candidate constant list, and the cursor **916** automatically points to the first vowel in the candidate vowel list.

Screen Shot **928**:

To select the sixth consonant from the candidate consonant list, the user moves the cursor **916** to the sixth full-size component of the first display line in the region **906** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the sixth Hangul consonant from the candidate consonant list and displays the

Hangul consonant selected in the screen shot **928**, together with the Hangul components selected in the screen shots **922** and **924**, in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **930**:

In the screen shot **930**, a character constructed from the three components selected in the screen shots **922**, **924** and **928** is displayed in the region **904**. In the region **906**, the candidate consonant list is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel in the candidate vowel list. At the screen shot **930**, the process can be led to four paths:

- (1) path one, including the screen shots **932**, **934**, and **935**, to enter an explicit delimiter to indicate the completion of a character;
- (2) path two, including the screen shots **936**, **938**, and **939**, to delete the last component previously entered;
- (3) path three, including the screen shots **940**, **942**, **944**, and **945**, to construct a compound consonant; and
- (4) path four, including **946**, **948**, **950**, **952**, **954**, **956**, **958**, **960**, **962**, **964**, **966**, **968**, **970**, **972**, **974**, **976**, **978**, **980**, **982**, **984**, and **986**, to further enter Hangul and ASCII characters.

Screen Shot **932**:

To indicate that the three selected components has formed the first Hangul character, the user moves the cursor **906** to the right arrow "→" icon in the region **912** and presses-in the jog dial wheel **708**. The right arrow "→" icon is an explicit delimiter to indicate the completion of a character. In response, the processor **804** executes the application to move the cursor **918** one full-size space to the right in the region **904**. The processor then executes the application to display the candidate consonant list on the region **906**.

Screen Shot **934**:

In the screen shot **934**, the cursor **918** is moved a full-size space to the right, and the candidate vowel list in the screen shot **932** is automatically replaced by the candidate consonant list.

Screen Shot **935**:

To save the data string shown in the screen shot **934**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **934** into the data memory **815**.

Screen Shot **936**:

To delete the Hangul component that was last entered, the user moves the cursor **916** to the region **910** and presses-in the jog dial wheel **708**. Since the cellular telephone **700** is now in an appending mode, the processor **804** executes the application to delete the last Hangul component previously entered. The processor **804** then executes the application to display the candidate consonant list in the region **906**.

Screen Shot **938**:

As shown in the screen shot **938**, the last Hangul component previously entered is deleted. The candidate vowel list in the screen shot **936** is automatically replaced by the candidate consonant list.

Screen Shot **939**:

To save the data string shown in the screen shot **938**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **938** into the data memory **815**.

Screen Shot **940**:

The screen shot **940** is the continuation of the screen shot **930**. To construct a compound consonant, the user presses-in

and holds the jog dial wheel **708**. The application is able to recognize that this act is a request to construct a compound Hangul component. Since the previously entered Hangul component is a consonant, the application recognizes that the user wishes to construct a compound consonant. Thus, the processor **804** executes the application to re-display the candidate consonant list.

Screen Shot **942**:

In the screen shot **942**, the candidate consonant list is re-displayed in the region **906**. To select the seventh consonant from the candidate consonant list, the user moves the cursor **916** to the seventh full-size component of the first display line in the region **906** and presses-in the jog dial wheel **708**. It should be noted that, to the existing cellular telephones, two consecutively entered consonants are invalid as a whole independent Hangul character. However, the application stored in the application memory **820** is able to recognize that these two consecutively entered consonants here are meant to construct a compound consonant. Thus, the processor **804** executes the application to: (1) select the seventh consonant from the candidate constant list, (2) combine the consonant selected in the screen shot **928** with the consonant selected in the screen shot **942** to construct a compound consonant, (3) display the constructed consonant, together with the two components in the screen shots **922** and **924**, in the region **904**, and (4) display the candidate vowel list in the region **906**.

Screen Shot **944**:

In the screen shot **944**, a character constructed from the components selected in the screen shots **922**, **924**, **928** and **942** is displayed in the region **904**. The two consonants selected in the screen shots **928** and **842** forms a compound consonant. The candidate consonant list in the screen shot **942** is automatically replaced by the candidate vowel list.

Screen Shot **945**:

To save the data string shown in the screen shot **944**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **944** into the data memory **815**.

Screen Shot **946**:

The screen shot **946** is the continuation of the screen shot **930**. To select the fifth vowel from the candidate vowel list, the user moves the cursor **916** to the fifth full-size component of the first display line in the region **906** and then presses-in the jog dial wheel **708**. Even though no explicit delimiter is entered in the screen shot **930**, the application is able to recognize the consonant last entered is the first consonant for the vowel selected in the screen shot **946**. Therefore, the processor **804** executes the application to: (1) move the last consonant from the preceding character, (2) select the fifth vowel from the candidate vowel list, (3) display the vowel selected in the screen shot **946**, together with the moved consonant, in the position indicated by the cursor **918** in the region **904**, and (4) display the candidate consonant list in the region **906**.

Screen Shot **948**:

As shown in the screen shot **948**, the vowel selected in the screen shot **946**, together with the consonant moved from the preceding Hangul character, is now displayed in the second full-size space in the region **904**. The candidate vowel list in the screen shot **946** is automatically replaced by the candidate consonant list, and the cursor **916** automatically points to the first consonant in the candidate consonant list. To select the first consonant from the candidate consonant list, the user presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the first

consonant from the candidate consonant list and display it, together with the two components previously selected, in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **950**:

In the screen shot **950**, a second Hangul character is constructed and displayed in the second full-size space in the region **904**. The candidate consonant list in the screen shot **948** is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel of the candidate vowel list. Without entering a delimiter, the user presses-in the jog dial wheel **708** to select the first vowel of the candidate vowel list. Even though no explicit delimiter is entered for the preceding Hangul character, the application is able to recognize that the consonant last entered is the first consonant for the vowel selected in the screen shot **950**. Therefore, the processor **804** executes the application to: (1) move the last consonant from the preceding character, (2) select the first vowel from the candidate vowel list, (3) display the selected vowel, together with the moved consonant, in the position indicated by the cursor **918** in the region **904**, and (4) display the candidate consonant list in the region **906**.

Screen Shot **952**:

As shown in the screen shot **952**, a third Hangul character is constructed and displayed in the third full-size space in the region **904**. The candidate vowel list in the screen shot **950** is automatically replaced by the candidate consonant list, and the cursor **916** automatically points to the first consonant in the candidate consonant list. The user can now use the same steps as shown in the screen shots **948** and **950** to enter a fourth Hangul character shown in the screen shot **954**.

Screen Shot **954**:

In the screen shot **954**, the fourth Hangul character is displayed in the region **904**. If needed, the user can add consonant(s) on the forth character making the forth character to be different from the second character. At this point, assume that the user recognizes the first Hangul character was erroneously entered.

Screen Shot **956**:

To delete the Hangul character located in the first full-size space in the region **904**, the user moves the cursor **916** to the left arrow "←" icon in the region **912** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the cursor **918** one full-size space to the left in the region **904**. Since the cursor **918** is moved to a position where a pre-existing character exists, the application realizes the user wishes to make changes to the data string that was entered. Thus, the processor executes the application to switch the cellular telephone **700** from an appending and an editing mode.

Screen Shot **958**:

As shown in the screen shot **958**, the cursor **918** is moved from the fourth full-size space to the third full-size space in the region **904**. To further move the cursor **918**, the user pressed-in the jog dial wheel **708** again while the cursor **916** is still on the left arrow "←". In response, the processor **804** executes the application to move the cursor **918** from the third full-size space to the second full-size space in the region **904**.

Screen Shot **960**:

As shown in the screen shot **960**, the cursor **918** is moved from the third full-size space to the second full-size space in the region **904**. To further move the cursor **918**, the user pressed-in the jog dial wheel **708** again while the cursor **916** is still on the left arrow "←". In response, the processor **804** executes the application to move the cursor **916** from the second full-size space to the first full-size space in the region **904**.

Screen Shot 962:

As shown in the screen shot 962, the cursor 918 is moved from the second full-size space to the first full-size space in the region 904.

Screen Shot 964:

To delete the character located in the first full-size space in the region 904, the user moves the cursor 916 to the region 910 and then presses-in the jog dial wheel 708. Since the cellular telephone is now in the editing mode, the processor 804 executes the application to delete the first character (which may include more than one Hangul components) from the first full-size space and move the remaining three characters one full-size space to the left in the region 904.

Screen Shot 966:

In the screen shot 966, the first Hangul character shown in the screen shot 964 is deleted, and the remaining three Hangul characters are moved one full-size space to the left in the region 904.

Screen Shot 968:

To select the tenth consonant from the candidate consonant list, the user moves the cursor 916 to the tenth full-size component of the first display line in the region 906 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to: (1) move the existing three characters one full-size space to the right in the region 904, (2) insert the selected consonant into the first full-size space in the region 904, and (3) display the candidate vowel list in the region 906.

Screen Shot 970:

In the screen shot 968, the three existing characters are moved one full-size space to the right and the consonant selected in the screen shot 968 is inserted into the first full-size space in the region 904. The candidate consonant list in the screen shot 968 is automatically replaced by the candidate vowel list, and the cursor 916 automatically points to the first vowel in the candidate vowel list.

Screen Shot 972:

To select the thirteen vowel (a compound vowel) from the candidate vowel list, the user moves the cursor 916 to the third full-size component of the second display line in the region 906 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the vowel and display the compound vowel selected in the screen shot 972, together with the consonant selected in the screen shot 968, in the first full-size space in the region 904. The processor 804 then executes the application to display the candidate consonant list in the region 906.

Screen Shot 974:

In the screen shot 974, a character constructed from the consonant selected in the screen shot 968 and the compound vowel selected in the screen shot 972 is displayed in the first full-size space in the region 904. The candidate vowel list in the screen shot 972 is automatically replaced by the candidate consonant list, and the cursor 916 automatically points to the first consonant in the candidate consonant list.

Screen Shot 976:

To place an explicit delimiter for the Hangul character inserted, the user moves the cursor 916 to the right arrow "→" icon in the region 912 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to acknowledge completion of inserting the Hangul character and move the cursor 918 from the first full-size space to the second full-size space in the region 904.

Screen Shot 978:

In the screen shot 978, the cursor 918 is moved to the second full-size space in the region 904. To further move the

cursor 918 one full-size space to the right in the region 904, the user presses-in the jog dial wheel 708. In response, the processor 804 executes the application to move the cursor 918 one full-size space to the right in the region 904.

Screen Shot 980:

In the screen shot 980, the cursor 918 is moved from the second full-size space to the third full-size space in the region 904.

Screen Shot 982:

To insert an ASCII space, the user moves the cursor 916 to the "space" character in the region 912 and then presses-in the jog dial wheel 708. The application is able to recognize that the "space" character is an ASCII character. Thus, the processor 804 executes the application to move the third and fourth Hangul characters one half-size space to the right and insert a half-size space before the third Hangul character.

Screen Shot 984:

In the screen shot 984, a half-size space is inserted before the third Hangul character in the region 904.

Screen Shot 986:

In the screen shot 986, the cellular telephone 700 still remains in the editing mode. To save the data string shown in the screen shot 984, the user moves the cursor 916 to the region 908 and presses-in the jog dial. In response, the processor 804 executes the application to store the data string into the data memory 815 and ends a text entering session.

FIG. 10 shows a sequence of screen shots sequentially displayed on the display screen 702 to illustrate a process of constructing a compound vowel, in accordance with the present invention. In describing the process shown in FIG. 9, it is assumed that the cellular telephone 700 is set in an appending entering mode for enabling the processor 804 to execute the application stored in the application memory 820, thereby allowing the user to input a first component into the cellular telephone 700.

Screen Shot 1020:

The screen shot 1020 contains six display regions 1002, 1004, 1006, 1008, 1010, and 1012. The structures and functions of the regions 1002, 1004, 1006, 1008, 1010, and 1012 are the same as these of the regions 902, 904, 906, 908, 910, and 912 shown in FIG. 9. The screen shot 1020 further contains two cursors 1016 and 1018. The operations of the cursors 1016 and 1018 are the same as these of the cursors 916 and 918 shown in FIG. 9.

Since the cellular telephone 700 is set in an appending mode to enter a first component in a data string, the region 1006 displays the candidate consonant list, and the cursor 1016 points to the first consonant of the candidate consonant list.

To select a vowel from the candidate vowel list as a first component, the user presses-in and holds the jog dial wheel 804. In response, the processor 804 executes the application to replace the candidate consonant list with the candidate vowel list in the region 1006.

Screen Shot 1022:

In the screen shot 1022, the candidate consonant list is replaced by the candidate vowel list. The cursor 1016 points to the first vowel in the candidate vowel list.

Screen Shot 1024:

To select the ninth vowel from the candidate vowel list, the user moves the cursor 1016 to the ninth full-size component of the first display line in the region 1006 and presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the first vowel from the candidate vowel list and display the selected vowel in the region 1004. The processor 804 then executes the application to display the candidate consonant list in the region 1006.

Screen Shot 1026:

In the screen shot **1026**, the vowel selected in the screen shot **1024** is displayed in the region **1004**. The candidate vowel list is automatically replaced by the candidate consonant list, and the cursor **1016** automatically points to the first consonant in the candidate consonant list.

To construct a compound vowel, the user presses-in and holds the jog dial wheel **708**. The application is able to recognize this act as a request to switch the candidate list. Since the previously entered Hangul component is a vowel, the application recognize that the user is requesting to construct a compound vowel. Thus, the processor **804** executes the application to re-display the candidate vowel list.

Screen Shot 1028:

In the screen shot **1028**, the candidate vowel list is displayed in the region **1006**.

Screen Shot 1030:

To select the tenth vowel from the candidate vowel list, the user moves the cursor **1016** to the tenth full-size component of the first display line in the region **1006** and then presses-in the jog dial wheel **708**. It should be noted that, to the existing cellular telephones, two consecutively entered vowels are invalid as the first component of a character or as a whole character. However, the application stored in the application memory **820** is able to recognize that these two consecutively entered vowels here are meant to construct a compound vowel. Thus, the processor **804** executes the application to: (1) select the tenth vowel from the candidate vowel list, (2) combine the vowel selected in the screen shot **1024** with the vowel selected in the screen shot **1030** to construct a compound vowel, (3) display the constructed vowel in the region **1004**, and (4) display the candidate consonant list in the region **1006**.

Screen Shot 1032:

In the screen shot **1032**, the compound vowel constructed from the vowels selected in the screen shots **1024** and **1030** is displayed in the region **1004**. The candidate vowel list in the screen shot **1030** is automatically replaced by the candidate consonant list.

Screen Shot 1034:

To save the compound vowel, the user moves the cursor **1016** to the region **1008** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the compound vowel in the data memory **815**.

FIG. 11 shows a sequence of screen shots sequentially displayed on the display screen **702** to illustrate a process of entering a data string containing both Hangul and ASCII characters into the cellular telephone **700**, in accordance with the present invention.

In describing the process shown in FIG. 11, it is assumed that the cellular telephone **700** is set in an appending mode, enabling the processor **804** to execute the application stored in the application memory **820**, thereby allowing a user to input a first component into the cellular telephone **700**.

Screen Shot 1120:

The screen shot **1120** contains six display regions **1102**, **1104**, **1106**, **1108**, **1110**, and **1112**. The structures and functions of the regions **1102**, **1104**, **1106**, **1108**, **1110**, and **1112** are the same as these of the regions **902**, **904**, **906**, **908**, **910**, and **912** shown in FIG. 9. The screen shot **1120** further contains two cursors **1116** and **1118**. The operations of the cursors **1116** and **1118** are the same as these of the cursors **916** and **918** shown in FIG. 9.

Since the cellular telephone **700** is set to enter the first component of a character string, the region **1106** displays the candidate consonant list, and the cursor **1116** points to the first consonant of the candidate consonant list.

To select the first consonant in the candidate consonant list, the user presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the first consonant from the candidate consonant list and display the selected consonant in the region **1104**. The processor **804** then executes the application to display the candidate vowel list in the region **1106**.

Screen Shot 1122:

In the screen shot **1122**, the consonant selected in the screen shot **1020** is displayed in the region **1104**. Since selected consonant is a Hangul component, the application displays it in full-size. In the region **1106**, the candidate consonant list in the screen shot **1120** is automatically replaced by the candidate vowel list, and the cursor **1116** automatically points to the first vowel in the candidate vowel list. To select the first vowel from the candidate vowel list, the user presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the first vowel from the candidate vowel list and display the vowel selected in the screen shot **1122**, together with the consonant selected in the screen shot **1120**, in the region **1104**. The processor **804** then executes the application to display the candidate consonant list in the region **1106**.

Screen Shot 1124:

In the screen shot **1124**, a character constructed from the two components selected in the screen shots **1120** and **1122** is displayed in the region **1104**. In the region **1106**, the candidate vowel list is automatically replaced by the candidate constant list.

Screen Shot 1126:

To select the eighth consonant from the candidate consonant list, the user moves the cursor **1116** to the eighth full-size component of the first display line in the region **1106** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the eighth consonant from the candidate consonant list and displays the consonant selected in the screen shot **1126**, together with the two components selected in the screen shot **1120** and **1122**, in the region **1104**. The processor **804** then executes the application to display the candidate vowel list in the region **1106**.

Screen Shot 1128:

In the screen shot **1128**, a character constructed from the three components selected in the screen shots **1120**, **1122** and **1126** is displayed in the region **1104**. In the region **1106**, the candidate consonant list in the screen shot **1126** is automatically replaced by the candidate vowel list, and the cursor **1116** automatically points to the first vowel in the candidate vowel list. To re-display the candidate consonant list, the user presses-in and holds the jog dial wheel **708**. In response, the processor **804** executes the application to re-display the candidate consonant list in the region **1106** so that the user can select a consonant to start a trailing character.

Screen Shot 1130:

In the screen shot **1130**, the candidate consonant list is displayed in the region **1106**, and the cursor **1116** automatically points to the first consonant in the candidate consonant list.

Screen Shot 1132:

To select the eighth consonant from the candidate consonant list, the user moves the cursor **1116** to the eighth full-size component in the first display line in the region **1106** and presses-in the jog dial wheel **708**. Since the previously selected component is also a Hangul consonant and the cellular telephone **700** is in an appending mode, the processor **804** executes the application to: (1) move the

cursor **1118** one full size to the right in the region **1104** to input a new character, (2) select the eighth consonant from the candidate consonant list, (3) display the selected consonant in the region **1104** in the position indicated by the cursor **1118**, and (4) display the candidate vowel list in the region **1106**.

Screen Shot **1134**:

In the screen shot **1134**, the consonant selected in the screen shot **1132** is displayed in the region **1104**. The candidate consonant list in the screen shot **1132** is automatically replaced by the candidate vowel list, and the cursor **1116** automatically points to the first vowel in the candidate vowel list.

Screen Shot **1136**:

To select the seventh vowel from the candidate vowel list, the user moves the cursor **1116** to the seventh full-size component of the first display line in the region **1106** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the seventh vowel from the candidate consonant list and display the vowel selected in the screen shot **1136**, together with the consonant selected in the screen shot **1132**, in the region **1104**. The processor **804** then executes the application to display the candidate consonant list in the region **1106**.

Screen Shot **1138**:

In the screen shot **1138**, a character constructed from the two components selected in the screen shots **1132** and **1136** are displayed in the region **1106**. The candidate vowel list in the screen shot **1136** is automatically replaced by the candidate consonant list, and the cursor **1116** automatically points to the first consonant in the candidate consonant list.

Screen Shot **1140**:

To append a half-size space, the user moves the cursor **1116** to the "space" character in the region **1112** and presses-in the jog dial wheel **708**. The application is able to recognize the "space" character in the region **1112** is an ASCII character. Thus, the processor **804** executes the application to move the cursor **1118** a half-size space to the right in the region **1104**.

Screen Shot **1142**:

In screen shot **1142**, the cursor **1118** is moved a half-size space to the right in the region **1104** since the "space" in the region **1112** is an ASCII character. At the screen shot **1142**, the process are led to two paths:

- (1) path one: the screen shots **1144** and **1146**, and
- (2) path two: the screen shots **1148** and **1150**.

Screen Shot **1144**:

As shown in the screen shot **1144**, from the key panel **710**, the user sequentially selects "S", "e", "o", "u", and "l". The application is able to recognize that each of the selections from the key panel **710** is an ASCII character input. Thus, the processor **804** executes the application to sequentially select the ASCII symbols "S", "e", "o", "u", and "l" in response to the selections on the key panel **710**, and display each of them in a half-size space in the region **1104**. Since the inputted components are ASCII characters, the candidate list displayed in the region **1106** will not be changed.

It should be noted that eight of the ten alpha/numeric keys on the key panel **710** are mapped to multiple ASCII characters. For example, the numeric key "2" is mapped to seven ASCII characters, including "A", "B", "C", "a", "b", "c", and "2". By continuously pressing the numeric key "2", the user can choose any one of the seven ASCII characters. In response to user's continuous presses on the numeric key "2", the application consecutively scrolls and selects among these seven letters. This principle also applies to the operations on the numeric keys "3-9".

Screen Shot **1146**:

To save the data string as shown in the screen shot **1144**, the user moves the cursor **1116** to the region **1108** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

Screen Shot **1148**:

As shown in the screen shot **1148**, from the key panel **710**, the user sequentially selects "L" and "A". Since the selection is from the key panel **710**, the processor **804** executes the application to sequentially select the ASCII symbols "L" and "A" in response to the selections on the key panel **710**, and display each of them in a half-size space in the region **1104**. Since the inputted components are ASCII characters, the candidate list displayed in the region **1106** will not be changed.

Screen Shot **1150**: To save the data string as shown in the screen shot **1148**, the user moves the cursor **1116** to the region **1108** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

It should be noted that in the example shown in FIG. **11**, the ASCII characters are appended at the end of the data string. However, using the principle shown in the present invention, an ASCII character can be entered before a Hangul character or between two Hangul characters.

FIG. **12** shows a sequence of screen shots is shown sequentially displayed on the display screen **702** to illustrate behavior of the cellular telephone **700** when there is no room in a character display region for further entering characters, in accordance with the present invention. In describing the process shown in FIG. **12**, it is assumed that the cellular telephone **700** is set in an appending mode.

Screen Shot **1220**:

The screen shot **1220** contains six display regions **1202**, **1204**, **1206**, **1208**, **1210**, and **1212**. The structures and functions of the regions **1202**, **1204**, **1206**, **1210**, **1208**, and **1212** are the same as these of the regions **902**, **904**, **906**, **908**, **910**, and **912** shown in FIG. **9**. The screen shot **1220** further contains two cursors **1216** and **1218**. The operations of the cursors **1216** and **1218** are the same as these of the cursors **916** and **918** shown in FIG. **9**.

The region **1204** contains a data string having six Hangul characters, and the cursor **1218** points the last Hangul character in the data string. Since the region **1204** contains six full-size spaces or twelve half-size spaces, there is no room for appending any further characters. After the sixth Hangul character was entered, the cellular telephone **700** remains in the appending mode. Thus, the application does not respond to the actions of: (1) pressing-in the jog dial wheel **708** to activate right arrow "→" icon in the region **1212**, (2) pressing-in the jog dial wheel **708** to select "space" character in the region **1212**, and (3) selecting any keys on the key panel **710**. However, the application still responds to the actions of: (1) pressing-in and holding the jog dial wheel **708**, and (2) pressing-in the jog dial wheel **708** to activating the left arrow "←" icon in the region **1212**.

To display the candidate consonant list, a user presses-in and holds the jog dial wheel **708**. In response, the processor **804** executes the application to display the candidate consonant list in the region **1206**.

Screen Shot **1222**:

In the screen shot **1222**, the candidate vowel list shown in the screen shot **1220** is replaced by the candidate consonant list. At the screen shot **1222**, the process is led to two paths:

- (1) path one, including screen shots **1226**, **1228**, and **1229**, to delete the last entered component in the region **1204** under an appending mode; and

17

(2) path two, including screen shots **1230**, **1232**, **1234**, and **1235**, to insert components in the data string in the region **1204** under an editing mode.

Screen Shot **1226**:

To delete the last entered component in the region **1204**, the user moves the cursor **1216** to the region **1210** and then presses-in the jog dial wheel **708**. Since the cellular telephone **700** is in the appending mode, the processor **804** executes the application to delete the one Hangul component last entered in the region **1204**.

Screen Shot **1228**:

As shown in the screen shot **1228**, the last entered component is deleted.

Screen Shot **1229**:

To save the data string as shown in the screen shot **1228**, the user moves the cursor **1216** to the region **1208** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

Screen Shot **1230**:

To insert a character before the fifth character in the region **1204**, the user moves the cursor **1216** to the left arrow “←” icon in the region **1210** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the cursor **1218** one full-size space to the left in the region **1204**. Since the cursor **1218** is moved into the data string, the application recognizes the user wishes to insert or delete one or more characters. Thus, the processor **804** executes the application to switch the cellular telephone **700** from the appending mode to an editing mode.

Screen Shot **1232**:

In the screen shot **1232**, the cursor **1218** is moved pointing to the fifth character. To insert a “space” character, the user moves the cursor **1216** to the “space” character in the region **1212** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the fifth and sixth characters one half-size space (since the “space” character is an ASCII character) to the right and insert a “space” character before the fifth character. At the same time, the processor **804** executes the application to drop the last character (i.e. the sixth character) to keep the data string within the maximum length of the region **1204**.

Screen Shot **1234**:

In the screen shot **1234**, a half-size space is inserted before the fifth character in the region **1204**. At this point, the user can insert up to three more half-size characters, in any combinations of: (1) one half-size character, (2) two half-size characters, (3) one full-size character, (4) one half-size and one full-size characters, and (5) three half-sizes characters. The character at the end of the data string will be dropped as the insertion continues.

It should be noted that if a Hangul character is inserted into a middle position of the data string, the character at the end of the data string will also be dropped.

Screen Shot **1235**:

To save the data string as shown in the screen shot **1234**, the user moves the cursor **1216** to the region **1208** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data stream in the data memory **815**.

FIG. **13** shows a sequence of screen shots sequentially displayed on the display screen **702** to illustrate a process of entering a data string containing unusual Hangul consonant combinations that are invalid to a conventional cellular telephone but valid to the cellular telephone **700**, in accordance with the present invention. In describing FIG. **13**, it is assumed that the cellular telephone **700** is set in an append-

18

ing mode, enabling the processor **804** to execute the application stored in the application memory **820**, thereby allowing a user to input a first component into the cellular telephone **700**.

Screen Shot **1320**:

The screen shot **1320** contains six display regions **1302**, **1304**, **1306**, **1308**, **1310**, and **1312**. The structures and functions of the regions **1302**, **1304**, **1306**, **1308**, **1310**, and **1312** are the same as these of the regions **902**, **904**, **906**, **908**, **910**, and **912** shown in FIG. **9**. The screen shot **1320** further contains two cursors **1316** and **1318**. The operations of the cursors **1316** and **1318** are the same as these of the cursors **916** and **918** shown in FIG. **9**.

Since the cellular telephone **700** is set in an appending mode, the region **1306** displays the candidate consonant list, and the cursor **1316** points to the first consonant in the candidate consonant list.

Screen Shot **1322**:

To select the twelfth consonant from the candidate consonant list, the user moves the cursor **1316** to the second full-size component of the second display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the twelfth consonant and display it in the region **1304**. The processor **804** then executes the application to display the candidate vowel list in the region **1306**.

Screen Shot **1324**:

In the screen shot **1324**, the consonant selected in the screen shot **1322** is displayed in the region **1304**. The candidate consonant list in the screen shot **1322** is automatically replaced by the candidate vowel list, and the cursor **1316** automatically points to the first vowel in the candidate vowel list.

Screen Shot **1326**:

To indicate that the selected consonant forms the first character, the user moves the cursor **1316** to the right arrow “→” icon in the region **1312** and then presses-in the jog dial wheel **708**. The right arrow “→” is an explicit delimiter for indicating the completion of a character. It should be noted that, to the existing cellular telephones, one consonant is an invalid Hangul character input. However, the application of the present invention is able to recognize a single consonant as a valid Hangul character. Thus, the processor **804** executes the application to move the cursor **1318** one full-size space to the right in the region **1304**. The processor **804** then executes the application to display the candidate consonant list in the region **1306**.

Screen Shot **1328**:

In the screen shot **1328**, the candidate vowel list in the screen shot **1326** is replaced by the candidate consonant list, and the cursor **1316** automatically points to the first consonant of the candidate consonant list. The cursor **1318** is moved to the second full-size space in the region **1304**.

Screen Shot **1330**:

To select the twelfth consonant from the candidate consonant list, the user moves the cursor **1316** to the second full-size component of the second display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the twelfth consonant and display it in the region **1304**. The processor **804** then executes the application to display the candidate vowel list in the region **1306**.

Screen Shot **1332**:

In the screen shot **1332**, the consonant selected in the screen shot **1330** is displayed in the region **1304**. The candidate consonant list in the screen shot **1330** is automatically replaced by the candidate vowel list, and the cursor **1316** automatically points to the first vowel in the candidate vowel list.

Screen Shot 1334:

To select the ninth vowel from the candidate vowel list, the user moves the cursor **1316** to the ninth full-size component of the first display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the ninth vowel and display the vowel selected in the screen shot **1334**, together with the consonant selected in the screen shot **1330**, in the region **1304**. The processor **804** then executes the application to display the candidate consonant list in the region **1306**.

Screen Shot 1336:

In the screen shot **1336**, a character constructed from the two components selected in the screen shots **1330** and **1334** is displayed in the region **1304**. The candidate vowel list in the screen shot **1334** is automatically replaced by the candidate consonant list, and the cursor **1316** automatically points to the first consonant in the candidate consonant list.

Screen Shot 1338:

To indicate the completion of entering the second character, the user moves the cursor **1316** to the right arrow "→" icon in the region **1312** and then presses-in the jog dial wheel **708**. The right arrow "→" icon is an explicit delimiter to indicate the completion of the second character. In response, the processor **804** executes the application to move the cursor **1318** one full-size space to the right in the region **1304**.

Screen Shot 1340:

In the screen shot **1340**, the cursor **1318** is moved the third full-size space in the region **1304**. To select the twelfth consonant from the candidate consonant list, the user moves the cursor **1316** to the second full-size component of the second display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the twelfth consonant and display it in the region **1304**. The processor **804** then executes the application to display the candidate vowel list in the region **1306**.

Screen Shot 1342:

In the screen shot **1342**, the consonant selected in the screen shot **1340** is displayed in the region **1304**. The candidate consonant list in the screen shot **1340** is automatically replaced by the candidate vowel list, and the cursor **1316** automatically points to the first vowel in the candidate vowel list. To select the ninth vowel from the candidate vowel list, the user moves the cursor **1316** to the ninth full-size component of the first display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the ninth vowel from the candidate vowel list and display the vowel selected in the screen shot **1342**, together with the consonant selected in the screen shot **1340**, in the region **1304**. The processor **804** then executes the application to display the candidate consonant list in the region **1306**.

Screen Shot 1344:

In the screen shot **1344**, a character constructed from the two components selected in the screen shots **1340** and **1342** is displayed in the region **1304**. The candidate vowel list in the screen shot **1342** is automatically replaced by the candidate consonant list, and the cursor **1316** automatically points to the first consonant in the candidate consonant list. To select the seventh consonant from the candidate consonant list, the user moves the cursor **1316** to the seventh full-size component of the first display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the seventh consonant from the candidate consonant list and

display the consonant selected in the screen shot **1344**, together with the two components selected in the screen shots **1340** and **1342**, in the region **1304**. The processor **804** also executes the application to replace the candidate consonant list in the screen shot **1344** with the candidate vowel list.

Screen Shot 1346:

In the screen shot **1346**, a character constructed from the three components selected in the screen shots **1340**, **1342**, and **1344** is displayed in the region **1304**. To append a half-size space, the user moves the cursor **1316** to the "space" character in the region **1312** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to insert a half-size space at the end of the data string in the region **1304**. The processor **804** also executes the application to replace the candidate vowel list in the screen shot **1346** with the candidate consonant list.

Screen Shot 1348:

As shown in the screen shot **1348**, a half-size space is appended at the end of the data string in the region **1304**.

Screen Shot 1350:

As shown in the screen shot **1346**, from the key panel **710**, the user sequentially selects "G", "o", "o", and "d". The application is able to recognize that each of the selections, from the key panel **710** is an ASCII character input. Thus, the processor **804** sequentially selects the ASCII characters "G", "o", "o", and "d" in response to each of the user's selections, and display each of the selected ASCII characters in half-size in the region **1304**.

Screen Shot 1352:

To save the data string formed in the region **1304**, the user moves the cursor **1316** to the region **1308** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

It should be noted that using the principle shown in FIG. **13**, the cellular telephone **700** can enter one consonant, one vowel, two consonants, or two vowels as a Hangul character. Specifically, by entering a delimiter after one consonant, one vowel, two consonants, or two vowels that are inputted by a user, the application stored in the application memory **820** recognizes the one consonant, one vowel, two consonants, or two vowels that are inputted is a Hangul character. In response to the entering of the delimiter, the processor **804** executes the application to display the Hangul character in the region **1304**.

In the present invention, the candidate consonant list, the candidate vowel list, and the ASCII characters can be stored in the component storage **813**. The application for performing the steps shown in FIGS. **9–13** can be stored in the application memory **820**. The processor **804** executes the application to perform the steps illustrated in the screen shots shown in FIGS. **9–13**.

Although the present invention has been shown and described with respect to preferred embodiments, various changes and modifications are deemed to lie within the spirit and scope of the invention as claimed.

What is claimed is:

1. A method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel, the method comprising the steps of:

displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen;

inputting at least one Hangul character by selecting at least one Hangul component from the list displayed in the first region;

21

inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and forming the data string using the inputted Hangul character and the inputted ASCII character.

2. The method of 1, further comprising the step of: displaying the string of inputs in a second display region located on the screen.

3. The method of 1, further comprising the step of: storing the string of inputs in a memory device.

4. The method of 1, further comprising the steps of: displaying the inputted Hangul character in a full-size space in the second display region; and displaying the inputted ASCII character in a half-size space in the second display region.

5. A method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and a key panel, the method comprising the steps of:

- forming a consonant list containing a plurality of Hangul consonants;
- forming a vowel list containing a plurality of Hangul vowels;
- displaying the consonant list on a first display region located on the screen;
- selecting at least one consonant from the consonant list;
- displaying the vowel list on the first display region to replace the consonant list;
- selecting at least one vowel from the vowel list;
- forming a Hangul character by combining the selected consonant and vowel;
- forming at least one ASCII character by selecting the key panel; and
- forming the data string using the inputted Hangul character and inputted ASCII character.

6. The method of claim 5, comprising the step of: displaying the string on a second display region located on the screen.

7. The method of 5, further comprising the step of: storing the string of inputs in a memory device.

8. The method of 5, further comprising the steps of: displaying the inputted Hangul character in a full-size space in the second display region; and displaying the inputted ASCII character in a half-size space in the second display region.

9. An apparatus for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel, the apparatus comprising:

- means for displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen;
- means for inputting at least one Hangul character by selecting at least one Hangul component from the list:displayed in the first region;
- means for inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and
- means for forming the data string using the inputted Hangul character and the inputted ASCII character.

10. The apparatus of 9, further comprising: means for displaying the string of inputs in a second display region located on the screen.

11. The apparatus of 9, further comprising: means for storing the string of inputs in a memory device.

22

12. The apparatus of 9, further comprising: means for displaying the inputted Hangul character in a full-size space in the second display region; and means for displaying the inputted ASCII character in a half-size space in the second display region.

13. An apparatus for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and a key panel, the apparatus comprising:

- means for forming a consonant list containing a plurality of Hangul consonants;
- means for forming a vowel list containing a plurality of Hangul vowels;
- means for displaying the consonant list on a first display region located on the screen;
- means for selecting at least one consonant from the consonant list;
- means for displaying the vowel list on the first display region to replace the consonant list;
- means for selecting at least one vowel from the vowel list;
- means for forming a Hangul character by combining the selected consonant and vowel;
- means for forming at least one ASCII character by selecting the key panel; and
- means for forming the data string using the inputted Hangul character and inputted ASCII character.

14. The apparatus of claim 13, comprising: means for display the string on a second display region located on the screen.

15. The apparatus of claim 13, further comprising: means for storing the string of inputs in a memory device.

16. The apparatus of 13, further comprising: means for displaying the inputted Hangul character in a full-size space in the second display region; and means for displaying the inputted ASCII character in a half-size space in the second display region.

17. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

- displaying a plurality of Hangul consonants on a screen;
- selecting one of the consonants displayed on the screen;
- indicating a completion of the selection; and
- forming a Hangul character using the selected consonant.

18. The method of claim 17, further comprising the step of:

- displaying the Hangul consonants in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

19. The method of claim 17, further comprising the step of:

- storing the formed Hangul character into a memory device.

20. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

- displaying a list including a plurality of Hangul consonants on a screen;
- selecting a first consonant from the list;
- selecting a second consonant from the list;
- indicating a completion of the selections; and
- forming a Hangul character using the selected consonants.

21. The method of claim 20, further comprising the step of:

- displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

23

22. The method of claim 20, further comprising the step of:

storing the formed, Hangul character into a memory device.

23. A method for entering a Hangul character into an electronic device having a screen comprising the steps of:

displaying a plurality of Hangul vowels on a screen;

selecting one of the vowels;

indicating a completion of the selection; and

forming a Hangul character using the selected vowel.

24. The method of claim 23, further comprising the step of:

displaying the Hangul vowels in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

25. The method of claim 23, further comprising the step of:

storing the formed Hangul character into a memory device.

26. The method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a list including a plurality of Hangul vowels on a screen;

selecting a first vowel from the list;

selecting a second vowel from the list;

indicating a completion of the selections; and

forming a Hangul character using the selected vowels.

27. The method of claim 26, further comprising the step of:

displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

28. The method of claim 26, further comprising the step of:

storing the formed Hangul character into a memory device.

29. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a plurality of basic consonants on a screen;

selecting a first basic consonant;

selecting a second basic consonant; and

forming a compound consonant by combining the selected two basic consonants.

30. The method of claim 29, further comprising the step of:

displaying the basic consonants in a first display region located on the screen, and displaying the formed compound consonant in a second display region on the screen.

31. The method of claim 29, further comprising the step of:

storing the formed compound consonant into a memory device.

32. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a plurality of basic vowels on a screen;

selecting a first basic vowel;

selecting a second basic vowel; and

forming a compound vowel by combining the selected two basic vowels.

33. The method of claim 32, further comprising the step of:

24

displaying the basic vowels in a first display region located on the screen, and displaying the formed compound vowel in a second display region on the screen.

34. The method of claim 32, further comprising the step of:

storing the formed compound vowel into a memory device.

35. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying a plurality of Hangul consonants on a screen;

means for selecting one of the consonants;

means for indicating a completion of the selection; and

means for forming a Hangul character using the selected consonant.

36. The apparatus of claim 35, further comprising:

means for displaying the Hangul consonants in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

37. The apparatus of claim 35, further comprising:

means for storing the formed Hangul character into a memory device.

38. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a list including a plurality of Hangul consonants;

means for selecting a first consonant from the list;

means for selecting a second consonant from the list;

means for indicating a completion of the selections; and

means for forming a Hangul character using the selected consonants.

39. The apparatus of claim 38, further comprising:

displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

40. The apparatus of claim 38, further comprising:

apparatus for storing the formed Hangul character into a memory device.

41. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a plurality of Hangul vowels;

means for selecting one of the vowels;

means for indicating a completion of the selection; and

means for forming a Hangul character using the selected vowel.

42. The apparatus of claim 41, further comprising:

means for displaying the Hangul vowels in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

43. The apparatus of claim 41, further comprising:

means for storing the formed Hangul character into a memory device.

44. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a list including a plurality of Hangul vowels;

means for selecting a first vowel from the list;

means for selecting a second vowel from the list;

means for indicating a completion of the selections; and

means for forming a Hangul character using the selected vowels.

25

45. The apparatus of claim 44, further comprising:
means for displaying the list in a first display region
located on the screen, and displaying the formed
Hangul character on a second display region located on
the screen. 5
46. The apparatus of claim 44, further comprising:
means for storing the formed Hangul character into a
memory device.
47. An apparatus for entering a Hangul character into an
electronic device having a screen, comprising: 10
means for displaying on a screen a plurality of basic
consonants;
means for selecting a first basic consonant;
means for selecting a second basic consonant; and 15
means for forming a compound consonant by combining
the selected two basic consonants.
48. The apparatus of claim 47, further comprising:
means for displaying the basic consonants in a first
display region located on the screen, and displaying the
formed compound consonant in a second display region
on the screen. 20
49. The apparatus of claim 47, further comprising:
means for storing the formed compound consonant into a
memory device. 25
50. An apparatus for entering a Hangul character into an
electronic device having a screen, comprising:
means for displaying on a screen a plurality of basic
vowels; 30
means for selecting a first basic vowel;
means for selecting a second basic vowel; and
means for forming a compound vowel by combining the
selected two basic vowels. 35
51. The apparatus of claim 50, further comprising:
means for displaying the basic vowels in a first display
region located on the screen, and displaying the formed
compound vowel in a second display region on the
screen. 40
52. The apparatus of claim 50, further comprising:
means for storing the formed compound vowel into a
memory device.
53. A method for editing a data string inputted into a
cellular telephone having a screen, comprising the steps of: 45
displaying a plurality of Hangul components in a first
display region located on the screen;
selecting a set of Hangul components from the first
display region;
forming a data string containing a plurality of Hangul
characters using the selected Hangul components; 50
displaying the formed data string in a second display
region located on the screen;
locating any one of Hangul characters in the data string
displayed in the second display region; and 55
editing the data string in a position of the located Hangul
character without deleting the Hangul characters trail-
ing that position.
54. The method of claim 53, wherein the editing includes
insertion and deletion. 60
55. A method for editing a data string inputted into a
cellular telephone having a screen, comprising the steps of:

26

- displaying a plurality of Hangul components in a first
display region located on the screen;
setting a plurality of ASCII components on a key panel;
selecting a set of Hangul components from the first
display region;
selecting a set of ASCII components from the key panel;
forming a data string containing a plurality of characters
using the selected Hangul and ASCII components;
displaying the formed data string in a second display
region located on the screen;
locating any one of characters in the data string displayed
in the second display region; and
editing the data string in a position of the located character
without deleting the characters trailing that position.
56. The method of claim 55, wherein the editing includes
insertion and deletion.
57. An apparatus for editing a data string inputted into a
cellular telephone having a screen, comprising:
means for displaying a plurality of Hangul components in
a first display region located on the screen;
means for selecting a set of Hangul components from the
first display region;
means for forming a data string containing a plurality of
Hangul characters using the selected Hangul compo-
nents;
means for displaying the formed data string in a second
display region located on the screen;
means for locating any one of Hangul characters in the
data string displayed in the second display region; and
means for editing the data string in a position of the
located Hangul character without deleting the Hangul
characters trailing that position. 20
58. The apparatus of claim 57, wherein the editing
includes insertion and deletion.
59. An apparatus for editing a data string inputted into a
cellular telephone having a screen, comprising: 25
means for displaying a plurality of Hangul components in
a first display region located on the screen;
means for setting a plurality of ASCII components on a
key panel;
means for selecting a set of Hangul components from the
first display region;
means for selecting a set of ASCII components from the
key panel;
means for forming a data string containing a plurality of
characters using the selected Hangul and ASCII com-
ponents; 30
means for displaying the formed data string in a second
display region located on the screen;
means for locating any one of characters in the data string
displayed in the second display region; and
means for editing the data string in a position of the
located character without deleting the characters trail-
ing that position. 35
60. The apparatus of claim 59, wherein the editing
includes insertion and deletion. 40

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,760,477 B2
DATED : July 6, 2004
INVENTOR(S) : Ko, Soon

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 21,

Lines 5, 8 and 10, after "of" and before "1" insert -- claim --.

Lines 41 and 43, after "of" and before "5" insert -- claim --.

Line 57, after "list" delete ":" (colon).

Lines 63 and 66, after "of" and before "9" insert -- claim --.

Column 22,

Line 1, after "of" and before "9" insert -- claim --.


Line 33, after "of" and before "13" insert -- claim --.

Column 26,

Line 15, change "sting" to -- string --.

Signed and Sealed this

Third Day of January, 2006

A handwritten signature in black ink on a light gray dotted background. The signature is written in a cursive style and appears to read "Jon W. Dudas".

JON W. DUDAS

Director of the United States Patent and Trademark Office