

CHINESE CHARACTER INPUT APPARATUS FOR A TELEPHONE SET

BACKGROUND OF THE INVENTION

(Field of the Invention)

The invention relates to a Chinese character input apparatus that utilizes the keypad of a conventional telephone set to input Chinese characters in the telephone set using phonetic markers.

(Description of the Prior Art)

In view of progress made in the communications technology, telephones have become an indispensable tool in our modern life. The keypads commonly used in telephone sets usually include twelve keys (e.g., 0 to 9, * and #) for inputting the telephone number of the called party so as to establish communication via the communications network. Progresses made in the fields of electronics and displays have recently made it possible to combine a liquid crystal display and a telephone set, thereby enabling the user to verify the accuracy of a telephone number that was inputted. In addition, telephone sets can now accommodate a larger memory device such as a random access memory or a read only memory, thereby permitting the realization of a short message transmission function or a database function. For example, by inputting a surname as a search term, the database can be searched automatically to find a corresponding telephone number. Thus, how the telephone set can be effectively used to input messages or to construct a database has become an important concern.

The input of characters in a computer is currently accomplished primarily with the use of a keyboard. Thus, many related methods have been proposed. Methods which are closely related to telephone keypads include Chinese character input methods that rely on the numeric keypad of computers, such as the numeric key Chinese character phonetic input method disclosed in

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R.O.C. Patent Publication No. 73889, and the input method disclosed in R.O.C. Patent Publication No. 73890, both of which are directed to the input of Chinese characters through their Mandarin Chinese pronunciations in the western system of romanization using numeric keys. In these two patent publications, Mandarin
5 Chinese phonetic markers are assigned to eight keys, e.g., "1" to "8" digit keys, of a numeric keypad on the right side of a keyboard for inputting Chinese characters.

In addition, R.O.C. Patent Publication No. 119811 discloses a stroke-based input method, where sixteen character roots are used to input
10 Chinese characters. At present, the Chunghwa Telecom Co., Ltd. and the Academia Sinica, both of Taiwan, are cooperating to modify existing methods to a twelve character root-based input method for application in the input of Chinese characters in the next generation of telephone sets.

A conventional method and apparatus for inputting characters in
15 a mobile telephone set has been disclosed in Japanese Patent Publication No. (Hei) 4-31615. The system block diagram of an embodiment thereof is shown in Fig. 7. As illustrated in Fig. 7, reference numeral 34 denotes a keypad portion which includes numeric keys (0 to 9) and related function keys, such as a character conversion key. Reference numeral 36 denotes a display portion for
20 displaying characters or numbers thereon. Reference numeral 38 denotes a timer. Reference numeral 40 denotes a mode display portion of a mobile telephone set. Reference numeral 32 denotes a control portion for controlling the signals of the different portions in the telephone set. Reference numeral 42 denotes a selector portion for selecting among Japanese
25 phonetic and alphanumeric characters. Reference numeral 44 denotes a display memory for display use. Reference numeral 46 denotes a key signal/Japanese phonetic converting index portion for converting input key signals into Japanese phonetic symbols. Reference numeral 48 denotes a key signal-to-alphanumeric character converting index portion for converting input

key signals into alphanumeric characters. Reference numeral 50 denotes a character converting portion for converting Japanese phonetic symbols into Japanese characters. Reference numeral 52 denotes a similarly pronounced character deciding portion for deciding among conflicting Japanese characters
5 that have the same pronunciation.

In an embodiment of the aforementioned conventional character input method for a telephone set, the ten consonants of the Japanese language are separately assigned to ten keys, e.g., 0 to 9 digit keys, as shown in Fig. 8. According to the number of times a key is pressed, one of the five Japanese
10 vowels is selected to result in the desired Japanese phonetic symbol. As for the voiced and semi-voiced sounds of the Japanese language, they are selected using the "*" and "#" keys. After a phonetic symbol string has been inputted, the character converting portion 50 must be operated to convert the phonetic symbol string into the desired Japanese character. For example, "3333" is
15 inputted to obtain the Japanese phonetic symbol for "su," "3333#" is inputted to obtain the Japanese phonetic symbol for "zu," and "222" is inputted to obtain the Japanese phonetic symbol for "ki." Thereafter, when the character converting portion 50 is operated, the Japanese characters "鈴木" are obtained.

The drawbacks associated with the aforementioned prior art are
20 as follows:

1. The Chinese character input methods that employ numeric keys only utilize ten keys, e.g., 0 to 9 digit keys, and fail to involve twelve keys. Many Chinese phonetic markers must be printed on the face of each key, thereby resulting in inconvenience to the user.
- 25 2. Input methods that use character radical, such as stroke-based input methods, need a longer amount of time to master before they can be used and can easily result in a burden to the user.
3. Only English or Japanese input methods are currently available, and no Chinese character input method has been applied to present telephone sets.

4. Each key of the telephone set is generally associated with a number of phonetic symbols. Before a succeeding phonetic symbol is inputted, there is no way of verifying a current phonetic symbol that is inputted. Thus, the user must operate the character converting key to verify the accuracy of the phonetic symbols that were inputted and to commence character conversion. As such, not only must the user operate a larger number of keys to input characters, automatic character conversion is not possible. For example, when "song" is inputted to input the character "松" in a telephone set having each key thereof associated with several sounds, the system is unable to automatically determine whether the input of the character has been completed even after inputting the letter "g".

SUMMARY OF THE INVENTION

Therefore, the object of the present invention is to provide a Chinese character input apparatus that utilizes the keypad of a conventional telephone set to input Chinese characters in a telephone set using phonetic markers, and that is capable of overcoming the above drawbacks commonly associated with the aforementioned conventional character input methods.

Accordingly, the Chinese character input apparatus of this invention is adapted for use in a telephone set and comprises:

20 a key signal-to-phonetic look-up memory portion for storing key signals and corresponding phonetic markers indexed according to number of times a particular key is operated;

a dictionary memory portion for storing Chinese characters indexed according to Mandarin Chinese phonetic markers therefor and frequency of use;

25 an input portion adapted for enabling the user to input the key signals;

a display portion for displaying a phonetic marker string that is being processed and corresponding converted characters;

a buffer region for temporary storage of register values, the phonetic marker string that is being processed, and the corresponding converted characters;

5 a key signal converting portion connected to and searching the key signal-to-phonetic look-up memory portion to obtain the phonetic marker that corresponds to the key signal that was inputted and the number of times the particular key is operated;

10 a character converting portion connected to and referring to the dictionary memory portion for converting the phonetic marker string into a character string via a sound-to-character conversion method using the phonetic marker string that was inputted as an indexing term; and

15 a control portion connected to the input portion, the buffer region, the display portion, the key signal converting portion and the character converting portion, the control portion receiving the key signals that were inputted from the input portion and referring to contents of the buffer region, the control portion controlling the key signal converting portion and the character converting portion to process and convert the key signals that were inputted into the character string and an unconverted phonetic marker string, the control portion storing intermediate processing results in the buffer region and controlling the display
20 portion to display the character string and the unconverted phonetic marker string thereon.

Based on the construction of the Chinese character input apparatus for a telephone set according to the present invention, after the control portion receives the key signals that were inputted from the input portion,
25 and retrieves a key signal value and a key operation number from the buffer region, the key operation number is adjusted by performing matching and calculation. After reference is made to the key signal-to-phonetic look-up table memory portion to obtain the corresponding phonetic marker, a phonetic marker string and a character string are retrieved from the buffer region. The retrieved

phonetic marker string is updated by the key signal converting portion, and the phonetic marker string and the character string are provided to the character converting portion. The character converting portion refers to the dictionary memory portion to obtain a character string and an unconverted phonetic marker string, and the buffer region is updated with the key signal, the key operation number, the unconverted phonetic marker string, the character string and the phonetic marker string. Thereafter, the character string and the unconverted phonetic marker string are shown on the display portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment made with reference to the accompanying drawings, in which:

Fig. 1 is a schematic block diagram of the preferred embodiment of the present invention;

Fig. 2 is a process flowchart of a control portion of the preferred embodiment of this invention;

Fig. 3 is a process flowchart of a key signal converting portion of the preferred embodiment of this invention;

Fig. 4 is a process flowchart of a character converting portion of the preferred embodiment of this invention;

Figs. 5A and 5B illustrate contents of a key signal-to-phonetic look-up memory portion according to the preferred embodiment of this invention;

Fig. 6 illustrates contents of a dictionary memory portion of the preferred embodiment of this invention;

Fig. 7 is a block diagram of a system in the prior art; and

Fig. 8 is a schematic diagram of a key signal-to-Japanese phonetic converting index portion of the system shown in Fig. 7.

DESCRIPTION OF THE EMBODIMENT

Referring now to Fig. 1 showing a schematic system block diagram of the preferred embodiment of a Chinese character input apparatus for a telephone set according to the present invention, reference numeral 550 denotes a key signal-to-phonetic look-up memory portion for storing key signals and corresponding phonetic markers indexed according to the number of times a particular key is operated, such as that shown in Fig. 5A, which uses Mandarin Chinese phonetic markers, and Fig. 5B, which uses Mandarin Chinese pronunciations in the western system of romanization. Reference numeral 650 denotes a dictionary memory portion for storing Chinese characters indexed according to the Mandarin Chinese phonetic markers therefor and the frequency of their use, such as that shown in Fig. 6. Reference numeral 500 denotes a key signal converting portion for searching the key signal-to-phonetic look-up memory portion 550 to obtain the phonetic marker corresponding to the input key signal and the number of times a particular key is operated. The process flowchart of the key signal converting portion 500 is shown in Fig. 3.

Reference numeral 710 denotes a conversion flag register for storing the number of phonetic markers in the phonetic marker string that can be converted into characters. Reference numeral 720 denotes a key signal register for storing a current key signal. 730 denotes a key operation number register for recording number of consecutive times a current key was operated. Reference numeral 100 denotes an input portion for enabling the user to input key signals. 200 denotes a buffer region for temporary storage of a phonetic marker string that is being processed and the corresponding converted characters. Reference numeral 300 denotes a display portion for displaying the phonetic marker string that is being processed and the corresponding converted characters. Reference numeral 600 denotes a character converting portion which refers to the dictionary memory portion 650 for converting the phonetic marker string into a character string and an unconverted phonetic marker string

via a sound-to-character conversion method using the phonetic marker string that was inputted as an indexing term. The process flowchart of the character converting portion 600 is shown in Fig. 4.

Reference numeral 400 denotes a control portion which
5 receives the key signals that were inputted from the input portion 100 and which refers to contents of the buffer region 200, the conversion flag register 710, the key signal register 720 and the key operation number register 730. The control portion 400 controls the key signal converting portion 500 and the character
10 converting portion 600 to process and convert the key signals that were inputted into the character string. The control portion 400 further controls the display portion 300 to display the character string thereon. The process flowchart of the control portion 400 is shown in Fig. 2.

The operation of the control portion 400 will now be described with reference to the process flowchart of Fig. 2. In step s201, after the input portion
15 100 is operated to input a key signal (i), the flow proceeds to step s202 to verify whether the input key signal (i) is "#" or "##." If yes, in step s203, the character converting portion 600 is controlled to perform character conversion of the phonetic marker string in the buffer region 200 (as will be described in greater detail with reference to the process flowchart of Fig. 4), and the process is
20 terminated after the buffer region 200 and the various registers are updated. If the decision made in step s202 is no, the flow proceeds to step s205, where it is determined if the character string and the phonetic marker string in the buffer region 200 are null. If yes, step s210 is performed to initialize the registers and the buffer region 200. Thereafter, in step s215, a key signal (j) is retrieved from
25 the key signal register 720. If the decision made in step s205 is no, the flow proceeds directly to step s215. In step s220, it is determined if the key signal (j) is an initial value (e.g. 100). If yes, the flow proceeds to step s225, where the key signal (i) is stored in the key signal register 720.

Subsequently, in step s230, the value "1" is stored in the key operation number register 730, and in step s235, the key signal converting portion 500 obtains a corresponding phonetic marker "m" using the key signal in the key signal register 720 and the value in the key operation number register 730 as indexing terms. In step s240, the phonetic marker string in the buffer region 200 is retrieved, and the phonetic marker "m" is appended thereto (this operation will be described in more detail with reference to the process flowchart of Fig. 3), and the updated phonetic marker string is outputted to the display portion 300. In step s245, the updated phonetic marker string is stored in the buffer region 200. The process is then terminated.

If the decision made in step s220 is no, the flow proceeds to step s250, where it is determined if the key signal (i) is equal to the key signal (j). If yes, the value (k) in the key operation number register 730 is retrieved in step s265, and is incremented by one in step s270. In step s275, the key signal converting portion 500 is controlled so as to obtain a phonetic marker "m" corresponding to the key signal (i) and the value (k) in the key operation number register 730. If the decision made in step s250 is no, the flow proceeds to step s255, where the key signal (i) is stored in the key signal register 720, and to step s260, where the value (k) in the key operation number register 730 is set to 1, before the flow proceeds to step s275.

After step s275, step s280 is performed, where the phonetic marker string in the buffer region 200 is retrieved, and the phonetic marker "m" is appended thereto. The updated phonetic marker string is outputted to the character converting portion 600 to obtain a character string "q" and an unconverted phonetic marker number "n". Then, in step s285, it is determined if the unconverted phonetic marker number "n" is equal to 0. If no, it is determined in step s290 if the value in the conversion flag register 710 is equal to 0. If the conversion flag register 710 is not 0 in step s290, it is determined in step s295 if the unconverted phonetic marker number "n" is equal to 2 (indicating

that the phonetic markers inputted for the previous character are accurate). If yes, the flow proceeds to step s297, where the character string in the buffer region 200 is updated with the character string "q". Then, in step s299, the character string "q" and the unconverted phonetic markers are displayed on the display portion 300. In step s289, after the values "i" and "k" are stored separately in the key signal register 720 and the key operation number register 730, the flow proceeds to step s245.

If the decision made in step s285 is yes, the flow proceeds to step s287, where the length of the phonetic marker string is used to update the conversion flag register 710. Step s289 is performed thereafter.

If the decision made in step s290 is yes, the flow proceeds automatically to step s289.

If the decision made in step s295 is no, the flow also proceeds automatically to step s289.

The operation of the key signal converting portion 500 will now be described with reference to the process flowchart of Fig. 3. In step s301, the control portion 400 provides the key signal (i) and the key operation number (j). Thereafter, in step s305, using the key signal (i) as an indexing term, reference is made to the key signal-to-phonetic look-up memory portion 550 to obtain the phonetic marker A[k]. Then, step s310 is performed to determine if the value "j" is greater than P. If no, step s320 is performed to output the corresponding phonetic marker A[j] and the value "j". Otherwise, the value "j" that is substituted by the remainder of $(j-1)/P$ is determined in step s315 before the flow proceeds to step s320.

The operation of the character converting portion 600 will now be described with reference to the process flowchart of Fig. 4. After a phonetic marker string is inputted in step s401, a character string "q" and an unconverted phonetic marker number "n" are obtained in step s405 from the dictionary memory portion 650 by giving priority to longer phrases. The flow subsequently

proceeds to step s410, where the character string "q" and the unconverted phonetic marker number "n" are outputted.

The following processing example of the Chinese character input for a telephone set serves to illustrate the operation of the preferred embodiment. For example, when the telephone keypad is used to input the Chinese characters "松下" using the western system of romanization, the phonetic and character strings in the buffer region, as well as the contents of the various registers will vary as follows:

	Key Input	Phonetic String	Character String	Flag Register	Key Signal	Key Number
10	7	P		0	7	1
	7	R		0	7	2
	7	S		0	7	3
	6	SM		0	6	1
15	6	SN		0	6	2
	6	SO		0	6	3
	#	SO		0	0	0
	6	SOM		0	6	1
	6	SON		0	6	2
20	4	SONG		0	4	1
	9	SONGW		0	9	0
	9	SONGX		0	9	2
	4	SONGXG	松	4	4	4
	4	SONGXH	松	4	4	2
25	4	SONGXI	松	4	4	3
	2	SONGXIA	松	4	2	1
	##	SONGXIA	松下	7	100	0

Note that the user needs to operate only 17 keys to input the Chinese characters "松下".

The present invention should not be limited to the disclosed embodiment, and should cover other embodiments which do not change the intent thereof. For example, the scheme employed in the character converting portion should not be limited to the longer phrase priority scheme. Other frequency of connection schemes, such as bi-gram or tri-gram, should be considered as possible modifications of the preferred embodiment since they are known schemes generally applied in the selection of Chinese characters.

The advantages of the apparatus of this invention are as follows:

1. The twelve keys on the keypad of the telephone set are fully utilized to facilitate the application of the Chinese character input method on the telephone set.
2. A dedicated character converting key is not needed. Thus, the need to operate the same after the input of the phonetic markers for one character has been obviated to dramatically increase the Chinese character input efficiency. For example, input of the Chinese characters "松下" in the prior art requires twenty keys. Only seventeen keys are needed in the present invention.
3. Because phonetic markers are employed in the input of Chinese characters, the user need not invest a large amount of time to learn how to use the present invention.

While the present invention has been described in connection with what is considered the most practical and preferred embodiment, it is understood that this invention is not limited to the disclosed embodiment but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

WHAT IS CLAIMED IS:

1. A Chinese character input apparatus for a telephone set, the input apparatus not requiring a character converting key and being capable of automatically performing character conversion, the input apparatus comprising:
 - 5 a key signal-to-phonetic look-up memory portion for storing key signals and corresponding phonetic markers indexed according to number of times a particular key is operated;
a dictionary memory portion for storing Chinese characters indexed according to Mandarin Chinese phonetic markers therefor and frequency of use;
 - 10 an input portion adapted for enabling the user to input the key signals;
a display portion for displaying a phonetic marker string that is being processed and corresponding converted characters;
a buffer region for temporary storage of register values, the phonetic marker string that is being processed, and the corresponding converted
 - 15 characters;
a key signal converting portion connected to and searching the key signal-to-phonetic look-up memory portion to obtain the phonetic marker that corresponds to the key signal that was inputted and the number of times the particular key is operated;
 - 20 a character converting portion connected to and referring to the dictionary memory portion for converting the phonetic marker string into a character string via a sound-to-character conversion method using the phonetic marker string that was inputted as an indexing term; and
a control portion connected to the input portion, the buffer region, the
 - 25 display portion, the key signal converting portion and the character converting portion, the control portion receiving the key signals that were inputted from the input portion and referring to contents of the buffer region, the control portion controlling the key signal converting portion and the character converting portion to process and convert the key signals that were inputted into the character



string and an unconverted phonetic marker string, the control portion storing intermediate processing results in the buffer region, and controlling the display portion to display the character string and the unconverted phonetic marker string thereon.

