

"KEYBOARD, INPUT APPARATUS AND METHOD FOR
ENCODING IDEOGRAPHIC CHARACTERS"

The invention relates to a keyboard, input apparatus and method for encoding ideographic characters, and in particular to a keyboard and input apparatus for encoding ideographic characters and to a method of using a conventional keyboard for encoding ideographic characters.

Some written languages, such as Chinese, Japanese and Korean, use individual symbols (that is, ideographs, or ideographic characters) to represent individual words or concepts. Such languages do not traditionally possess an alphabet from which words and phrases are constructed. Although a language may have 30,000 or more ideographs, generally fewer are required for everyday use. However, even for everyday use, the number of ideographs with which a person must be familiar is relatively high. For example, in Chinese, a written vocabulary of 10,000 ideographs would generally be sufficient for most uses. Some official vocabularies define about 7,000 ideographs, which would provide reasonable proficiency in written communication.

Such large numbers of different ideographs result in difficulties in written communication. A writer must have a high degree of literacy. He must have most standard ideographs memorized, or be constantly checking an ideographic dictionary. A publisher must have a substantial library of different ideographic characters. Physically, it may be difficult to store a large number of ideographic printing elements. Once in storage, it may also be difficult to relocate a particular printing element for

use. Typewriters may have hundreds of keys, resulting in slow, inconvenient typing.

Similarly, in telecommunications or in electronic data processing systems, conventionally each ideographic character is assigned a unique, but arbitrary, code. In order to input text into such a system, an operator must memorize thousands of codes, or be constantly checking codes from a table. The former case requires a highly trained operator. The latter case requires large expenditures of time. In addition, tables, lists or dictionaries of ideographic characters are conventionally arranged according to phonetic rules. Accordingly, even in the latter case, the operator must have some phonetic training in the language in order to be able to locate the proper codes from a phonetically arranged table.

In order to improve the use of ideographic characters, particularly in electronic applications, various methods have been proposed for the systematic encoding of ideographic characters. Some methods are based on pronunciation or phonetic rules. Such methods suffer the disadvantage that there may be pronunciation differences from dialect to dialect and even individual to individual. They also require some phonetic training by the operator; in other words, an operator must have some degree of literacy.

Other encoding methods are based upon the physical structure of the written character. See, for example, United States patents #3,665,450; 4,173,753; 4,327,421; 4,379,288; 4,462,703; 4,490,789; and 4,505,602. The specific application of

such methods may vary depending on the specific language.

However, in general, the principles for such structural encoding methods are similar.

5 Generally, the ideographic characters of the language are analyzed into their component strokes or sub-structures. Such strokes or sub-structure are compared to a predetermined set of idealized basic elements. Each basic element may correspond to one or more actual component strokes or sub-structures. Each
10 stroke or sub-structure in the character is identified with one of the idealized basic elements. For example, United States patent #4,379,288 teaches that Chinese characters may be reasonably encoded by considering only 5 basic stroke elements - a horizontal stroke, a vertical stroke, a dot, two oblique strokes or curves
15 (left and right) and an angular stroke. As shown in various examples therein, different ideographic characters may be encoded, by considering the same 5 basic stroke elements. United States patent #4,379,288 uses a relatively simple scheme for encoding. Others, such as United States patent #3,665,450 or some of the
20 prior art referred to in United States patent #4,379,288, may teach more complex methods.

Such coding systems suffer from the disadvantage that each character or character sub-structure must be analyzed into
25 its code components each time such character or sub-structure is to be entered. This may be a tedious, time consuming process, subject to relatively high error.

Many ideographic characters include recognizable
30 sub-structures, which are commonly used as components in various

ideographic characters. Such sub-structures are known as radicals. About 700 radicals are recognized to exist in Chinese, probably less than 100 of which could be considered as being in relatively common use.

5

In some conventional coding systems (such as disclosed in United States patent #4,379,288), each time a radical must be entered, it must be analyzed into its basic components, even though the radical may appear frequently in the text being entered. The repeated entry of radicals according to basic components may represent a significant amount of operator time and effort and a source of input error.

Other conventional coding systems make use of radicals for coding purposes (see, for example, United States patent #4,327,421). However, such systems generally require specially designed and constructed keyboards to accomodate a relatively large number of radicals. Notwithstanding the use of radicals, each time an ideographic character or phrase must be entered, it must still be analyzed into its radical or other stroke or sub-structure components, even though the ideographic character or phrase may appear frequently in the text being entered. Accordingly, the repeated entry of characters or phrases according to their structural components may represent a significant amount of operator time and effort and a source of input error.

United States patent #4,379,288 teaches the use of special entry keys representing various high frequency combinations of code components. However, such a system may be difficult and inconvenient to use because of reliance on code

numbers and combinations thereof. Such combinations are somewhat theoretical and a particular code combination may not correspond visually to any character, radical or other sub-structure. Such a system would require an operator highly trained in the use of codes. For the same reasons, the reliance on codes may result in a greater possibility of operator error.

In order to apply the various conventional coding techniques, various keyboard apparatuses have been proposed. In addition to the disadvantages described above with the conventional coding systems themselves, the conventional ideographic keyboards suffer from further disadvantages.

For example, United States patent #4,327,421 teaches an encoding method using standard Chinese character radicals, as well as a set of basic stroke components and some other sub-structure components. An oversized keyboard in order to accommodate the substantial number of sub-structures required is disclosed. Each key on the keyboard can define one of two sub-structures. A selection is made by pressing or not pressing the "shift" key. Systems of this sort require specially designed expensive keyboards. Such a specially designed keyboard may be unfamiliar to operators, thus resulting in slower learning. If the keyboard is physically large, it may be necessary for the operator's hands to move substantial distances, thus slowing data entry and increasing fatigue and the possibility of error.

In addition, such keyboards may physically be inefficiently laid out. The sub-structures included on the

keyboard may be selected somewhat arbitrarily, resulting in inefficient data entry. Hence, speed and accuracy may be impaired. Finally, reliance on a shift key may substantially reduce the speed at which characters can be entered. Because one hand must be used to operate the shift key, numerous changes from "lower case" characters to "upper case" characters will reduce typing speed. The result of such factors is that the number of keystrokes required to enter typical ideographic text may be relatively high. In certain instances, the operator may be forced to use one hand, thus further reducing speed and increasing fatigue.

It should be understood that traditional Chinese ideographic characters do not have a lower case form and an upper case form. In relation to ideographic characters, in this specification, the term "lower case character" refers to a character on a conventional keyboard that is typed or input without also pressing the shift key. Similarly, an "upper case character" is a character on a conventional keyboard that is conventionally typed or input by simultaneously pressing the "shift key" or by typing a special mode selection key (such as a "shift lock" or "caps lock" key).

In order to avoid confusion, use of the terms "lower case" and "upper case" are avoided as much as possible in this specification. Instead, the different characters associated with a single key are each referred to as being on a different "level" of the keyboard. For instance, in a conventional English language typewriter, all lower case characters would be on a first level of the keyboard and all upper case letters on a second level.

Characters in the conventional keyboard are selected from one level or the other by pressing or not pressing the shift key simultaneously with the individual character key.

5 United States patent #4,379,288 discloses the use of a conventional keyboard arrangement having 3 or 4 rows of keys, as might be used in a conventional Qwerty keyboard, having the 26 letters of the Latin alphabet, together with numeral, punctuation and special function keys. Various code combinations are
10 associated with various keys for two-handed operation. The monographic code keys are located on opposite sides of the keyboard. Such an arrangement may present difficulties or be inconvenient to a novice operator, who may wish to type with only one hand, while following along in the Chinese text with the
15 other. Finally, the conventional keyboard would require a shift key for changing from one level of the keyboard to another. Thus, the difficulties discussed above in relation to shift keys, resulting in slower operation, continue to exist.

20 The keyboards of United States patents #4,379,288 and 4,462,703 suffer from the further disadvantage that the Latin alphabet may not be included on the keyboard. Accordingly, with such keyboards it would be impossible to switch from the encoding of ideographic characters to the transliteration thereof into the
25 Latin alphabet or even to the typing of another language, such as English.

According to a first aspect of the invention, there is provided an apparatus for generating code signals representing ideographic characters of an ideographic language, said ideographic characters
5 being coded by components selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components, said apparatus comprising:

10 keyboard means having first entry keys each of which is associated with a said basic stroke component, and

second entry keys each associated with a said radical frequently used in said language,

each said first and second entry keys also
15 being associated with a complete ideographic character frequently used in said language, and

wherein each said entry key is actuatable to produce a unique signal;

said keyboard means also having a first
20 selection key actuatable to produce a unique signal to identify a series of entry key actuations as being associated with said basic stroke component(s) and/or radical(s) associated with the actuated entry keys and to identify the signals produced by said series of
25 actuations as representing a complete ideographic character coded by the basic stroke component(s) and/or radical(s) associated with the actuated entry keys, said keyboard means also having a second selection key operable to produce a unique signal to
30 identify the actuation of an entry key as representing the associated complete ideographic character, and

interpreter means responsive to the signals produced by the sequential actuation of said entry and selection keys to generate said code signals.

35 Preferably, said set comprises five basic stroke components.

In an embodiment, said interpreter means comprises: interface means for controlling the generation of said code signal in response to signals from the keyboard means; and first memory means
5 connected to said interface means for storing code signal information regarding said basic stroke components and said selected frequently used radicals and complete ideographic characters.

Preferably said interface means comprises
10 first test means for determining whether said second selection key has been actuated; second test means connected to said first test means for determining whether said first selection key has been actuated; a storage buffer connected to said second test means for
15 temporarily storing keystroke signals originating from said keyboard means; stroke/radical coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal;
20 complete character coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal; said first test means connected to and operable to enable said complete
25 character coder means; and said second test means connected to and operable to enable said stroke/radical coder means.

In an alternative embodiment, said interpreter means comprises; interface means responsive to
30 incoming signals from the keyboard means for controlling the generation of said code signals; first memory means connected to said interface means for storing code signal information regarding said basic stroke components and said selected frequently used
35 radicals and complete ideographic characters; and second memory means connected to said interface

means for storing code signal information regarding said phrases. Preferably said interface means comprises: first test means for determining whether said second selection key has been actuated; second
5 test means connected to said first test means for determining whether said first selection key has been actuated; a counter connected to said second test means for counting the number of keystrokes; a storage buffer connected to said counter for temporarily
10 storing keystroke signals originating from said keyboard means; third test means connected to said first test means, operable when said second selection key has been actuated, and also connected to said counter for determining whether more than one
15 keystroke has been counted; stroke/radical coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal; complete character coder means connected to said
20 buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal; phrase coder means connected to said buffer and to said second memory means for receiving said keystroke signals from said buffer and
25 converting same to said code signal; said second test means connected to and operable to enable said stroke/radical coder means; said third test means connected to and operable to enable said complete character coder means when one keystroke has been
30 counted; and said third test means connected to and operable to enable said phrase coder means when more than one keystroke has been counted.

According to a second aspect of the invention, there is provided a keyboard for entering ideographic
35 characters of an ideographic language into a system, said ideographic characters being coded by components

selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components, said keyboard comprising:

5 first entry keys each of which is associated with a said basic stroke component;

second entry keys each associated with a said radical frequently used in said language;

10 each said first and second entry keys also being associated with a complete ideographic character frequently used in said language, and wherein each said entry key is actuatable to produce a unique signal;

15 a first selection key actuatable to produce a unique signal to identify a series of entry key actuations as being associated with said basic stroke components and/or radicals associated with the actuated entry keys, and to identify the signals produced by said series of actuations as representing a complete ideographic character coded by the basic stroke component(s) and/or radical(s) associated with the actuated entry keys; and

20 a second selection key operable to produce a unique signal to identify the actuation of an entry key as representing the associated complete ideographic character.

25 According to a third aspect of the invention, there is provided a method for entering ideographic characters of an ideographic language into a system using a keyboard having a plurality of entry keys thereon, for representing basic stroke components, radicals and complete ideographic characters, each
30 said key being operable to produce a unique signal upon actuation thereof, said ideographic characters being coded by components selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components,
35 said method comprising:

associating each said basic stroke component with a respective first entry key on said keyboard;

5 associating radicals frequently used in said language with respective second entry keys on said keyboard;

associating each said first and second entry key also with a complete ideographic character frequently used in said language;

10 associating a first selection key on said keyboard with a series of entry key actuations representing said basic stroke components and/or radical(s) frequently used in the language to represent a complete ideographic character coded by
15 the basic stroke component(s) and/or radical(s) associated with the actuated entry keys;

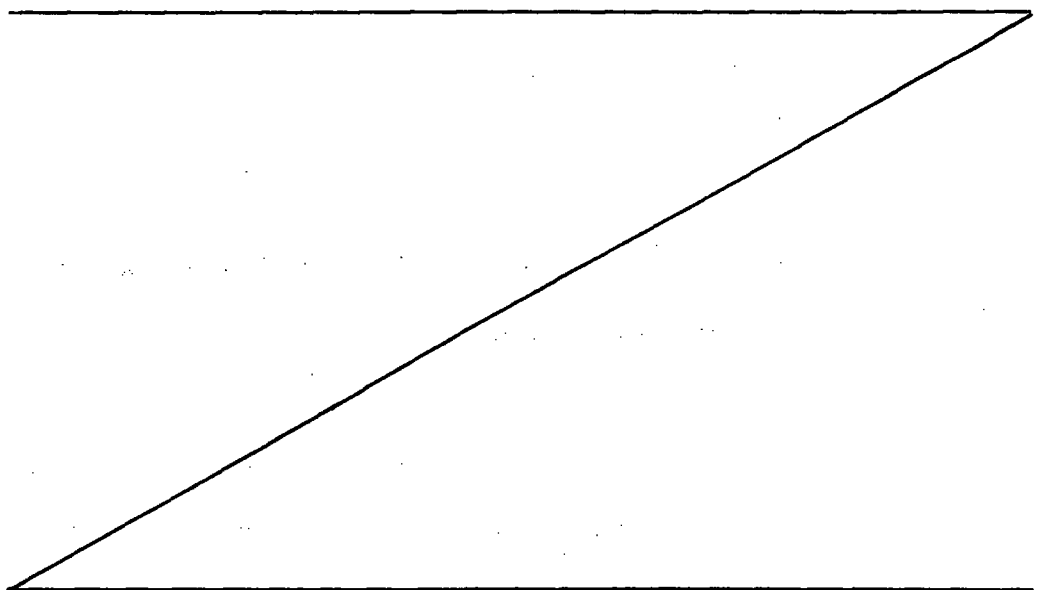
associating a second selection key on said keyboard with an entry key actuation to represent a complete ideographic character;

20 interpreting signals from said keyboard to generate, in response to sequential actuation of said entry and selection keys, code signals representing said ideographic characters to be entered.

25

30

35



The keyboard, input apparatus and method of the invention allow for the relatively rapid encoding of ideographic characters. The number of strokes required to encode conventional ideographic text, such as Chinese text, is reduced. Use of radical and character keys dedicated to selected high frequency use radicals and characters reduces the required number of keystrokes, thus allowing for improved speed and accuracy.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

IN THE DRAWINGS

Figure 1 is a block diagram, illustrating a keyboard according to the invention, as may be used in association with a system;

Figure 2 is a schematic drawing of an unlabelled keyboard according to the invention;

Figure 3 is a schematic drawing of a labelled keyboard according to one embodiment of the invention; and,

Figure 4 is a block diagram of an interpreter means.

DETAILED DESCRIPTION OF A SPECIFIC EMBODIMENT

Referring to Figure 1, there is shown an input means 100, according to the invention, connected to system 120. The output of input means 100 is connected to system 120, which may advantageously be a telecommunications system, an electronic data processing system, an electronic typewriter output or the like. System 120 may also be an electro-mechanical apparatus or an electronic output device.

Input means 100 comprises a keyboard 140, according to the invention, connected to interpreter means 150. The output of interpreter means 150 is adapted to connect to system 120.

Referring to Figure 2, keyboard 140 comprises a conventional Latin alphabet keyboard (such as of the Qwerty-type) with keys 160. In particular, keyboard 140 preferably has four rows of at least about ten keys 160 each, available for the entry of various symbols. Keyboard 140 also has shift keys 180 for changing from one level of the keyboard to another. Keyboard 140 also includes a conventional carriage return key 200 and space bar 220. Some keys 160 may be reserved for special functions, carriage control, punctuation and the like. It is to be clearly understood that the keys 160 of keyboard 140, according to the invention, are assigned different functions (described below) than would be assigned in a conventional Latin alphabet keyboard.

Keyboard 140 is operable by a user for the purpose of entering data into system 120. Keyboard 140, as is well understood in the art, is operable to deliver a unique code signal

(generally standardized and known as ASCII code), according to which key is depressed. Accordingly, the output from keyboard 140 comprises a train of code signals according to the sequence in which the various keys are depressed.

5

Keyboard 140 may be notionally divided into left and right hand halves by the line 240.

10 For touch typing on keyboard 140, it is well understood that there is only one ergonomically preferred "home" key for touch typing on each of the left and right hand sides, namely keys 160a. Similarly, the next preferred keys for rapid touch typing, in order of preference, are keys 160b, 160c and 160d. The numerals from 2 to 25 shown on keys 160 represent the ergonomic
15 preferences from lowest to highest of the keys 160 relative to each other. It is to be noted that some of the keys 160 have the same ergonomic preference. For example, there are eight keys 160c having the same ergonomic preference value of 15. There appears to be no structural reason for preferring one such key 160c over
20 another in the assignment of key symbols.

Interpreter means 150 is operable to receive the train of code signals from keyboard 140 and to interpret them in a pre-determined manner, as is described below.

25

Referring to Figure 3, there is shown a keyboard 140, according to the invention, showing the labelling of the various keys 160.

30

It has been found that, for the purposes of encoding Chinese ideographs, a set of five basic stroke components may be adequately used. In particular, it has been found that the five basic stroke components may conveniently be a dot (or short) stroke, a horizontal (or left-to-right) stroke, a vertical (or downward) stroke, a left oblique (or lower-left-to/from-upper-right) stroke a right oblique (or upper-left-to/from-lower-right) stroke.

The embodiment of the invention described herein uses a five basic stroke encoding method merely as an illustration of the inventive principles. It will be appreciated that other encoding methods may be used. Accordingly, although keyboard 140 is illustrated having one particular selection of Chinese symbols, other selections may also be devised, depending on the encoding method used and language to be entered. It is not intended that the scope of the invention be restricted to the particular encoding method or language used herein as examples, but rather it is intended that the scope of the invention include any input method or apparatus constructed or operating according to the principles of the invention. Furthermore, even though one particular arrangement of symbols for a particular keyboard 140 is illustrated for use with the particular five basic stroke encoding method, other arrangements in accordance with the invention may also be devised. It is not intended that the scope of the invention be restricted to the particular arrangement of symbols or keyboard disclosed, but rather it is intended that the scope of the invention include any keyboard arranged according to the principles of the invention.

Each of the five basic stroke elements is associated with one of keys 160 on a first level of keyboard 140. It has been found that the most frequently used basic stroke element in encoding Chinese text is the horizontal stroke, and that the others in order of decreasing frequency of use are the vertical stroke, the dot stroke, the left oblique stroke and the right oblique stroke. Such components are assigned to a block 170 of high preference keys on one side of keyboard 140, preferably the right hand side. Preferably, block 170 includes a highest preference key 160a. In particular, such basic stroke elements are respectively assigned the keys 160a, 160b, 160c (lower row), 160c (upper row) and 160d in order of decreasing frequency of use. Such an arrangement allows the operator to enter a code string for an ideographic character, conveniently using one hand. The fingers of one hand are not required to move significant distances in order to input character codes using the basic stroke components. In particular, the fingers of the operating hand are not required to move from one side of the keyboard to the other, as may be the case in keyboards designed for two-handed operation. Such an arrangement allows an operator to touch type, entering character codes, with one hand while following along in the Chinese text with the other. In addition, it has been found in typical Chinese typing situations using the keyboard 140, that basic stroke components are only infrequently consecutively typed. Accordingly, locating the five basic components adjacent to each other may also improve two-handed operation, by allowing for the alternate typing of basic stroke and other keys.

Preferably, depictions 190 are shown on, or otherwise associated with, keys 160a to 160d to represent the basic stroke components.

5 The most frequently used radicals (i.e. most frequently used in encoding typical Chinese text) are assigned the remaining key positions on the first level of keyboard 140 in order of two-handed key preference according to the frequency of use of such radicals. Preferably, depictions 192 are shown on, or
10 otherwise associated with, keys 160 to represent such radicals.

 On a second level of keyboard 140, each key 160 is also preferably associated with frequently used and relatively complicated complete ideographic characters. Some frequently
15 used, but relatively simple, ideographic characters may only require a few radical and basic component keystrokes to enter, and such simple characters may be omitted from keyboard 140. The frequently used characters are assigned key positions in order of two-handed key preference according to the frequency of use of
20 such characters. Preferably, depictions 194 are shown on, or otherwise associated with, keys 160 to represent the complete characters.

 On a third level of keyboard 140, combinations of keys
25 160 may also be preferably associated with commonly used ideographic phrases, that is sequences of ideographic characters. As described below, such phrases may be pre-selected or pre-programmed by the operator and may change from time to time according to the operator's requirements. Accordingly, preferably

30 there is no depiction of such phrases associated with the keys 160, although in certain cases such depictions may be desirable.

Finally, on a fourth level of keyboard 140, each key 160 is preferably also associated with the conventional Latin alphabet symbols, such as letters, numerals, punctuation marks and the like.

5 Depictions 190, 192 and 194 and other symbols may be directly indicated on or near keys 160. Alternatively, a keyboard overlay, as is well known in the art, may be used to associate the selected symbols with their particular keys 160.

10 In summary, keyboard 140 may be considered as defining several different levels. A first level may be defined by the basic stroke components and radicals. A second level may be defined by the complete ideographic characters. A third level may be defined by ideographic phrases. A fourth level may be defined by the Latin alphabet symbols.

20 Spacebar 220 (Figure 2) is associated with a special stroke/radical selection, or "end-of-components" (herein referred to as "EOC"), code and is defined to be an EOC key 260 (Figure 3). As explained further below, EOC key 260 will be actuated by an operator after a sequence of keys 160 representing strokes and/or radicals has been typed. Actuation of EOC key 260 indicates that the previously typed keys represent a combination of strokes and/or radicals.

25

Similarly, return key 200 (Figure 2) is associated with a special character/phrase selection, or "end-of-complete-character/phrase" (herein referred to as "EOCC/P"), code and is defined to be an EOCC/P key 280. As explained further below, EOCC/P key 280 will be actuated by an operator after only one key 160 representing a complete character has been previously typed. Actuation of EOCC/P key 280 indicates in such a case that the single previously typed key represents a complete character. EOCC/P key 280 will also be actuated after a sequence of keys 160 representing a phrase has been typed. In such a case, actuation of EOCC/P key 280 indicates that the previously typed keys represent a phrase.

Interpreter means 150 is operable to identify which keys 160 of keyboard 140 have been typed and to construct a complete character code in response to the typing of such keys. In particular, interpreter means 150 is operable to recognize that a particular key 160 has been typed and to make available for output (in a form that system 120 will recognize) the corresponding portion of the character code of the ideographic character being entered.

For example, if the horizontal basic stroke component key 160a is typed, interpreter means 150 is operable to recognize same and to substitute a code (such as, for example, the numeral 1) in a code string to be outputted to system 120.

On other hand, if a radical key 160 is typed, interpreter means 150 is operable to recognize same and to substitute therefor

in the code string an appropriate code, which may be a combination of basic stroke component codes, for example the numerals 324.

If the EOC key 260 is typed, interpreter means 150 will recognize same. It will also recognize that the previous code string has been completed and represents a complete ideographic character and that the next keyboard entry will represent the beginning of a new incoming ideographic character. If the EOCC/P key 280 is typed, interpreter means 150 is operable to recognize same and to substitute the character code for the complete ideographic character associated with the key 160 previously typed, if only one key 160 has been so previously typed. Interpreter means 150 may also be operable to recognize the EOCC/P word/phrase key 280 as representing the end of a phrase identified by the two or more previous keys typed. In such a case, interpreter means 150 is operable to substitute the correct coding for the entire phrase, as may be predetermined and pre-entered by the user.

Referring to Figure 4, there is shown an example of an interpreter means 150 which may be used in association with the keyboard 140 according to the invention.

It is not intended to restrict the scope of the particular interpreter means disclosed. It is intended that the scope of the invention include any interpreter means constructed or operating according to the principles of the invention. Interpreter means 150 comprises an interface means 300, adapted to receive keyboard signals. Connected to interface means 300 is a

first memory means 310. Preferably, memory means 310 is pre-programmed to store code signal information regarding the individual basic stroke components and the high frequency use radicals and complete ideographic characters, on keyboard 140. A second memory means 320 is shown connected to interface means 300. Preferably, memory means 320 is programmable by the operator to store code signal information regarding high frequency use phrases.

Interface means 300 comprises a series of test means for ascertaining whether the EOCC/P or EOC keys 280 or 260 have been typed and, if so, providing the appropriate output. In particular, interface means 300 comprises a first test means 330 for ascertaining whether the EOCC/P key 280 has been pressed. Each keystroke received from keyboard 140 is tested. If the answer to the test is negative, the keyboard signal is passed to second test means 340. Second test means 340 is operable to determine whether the EOC key 260 has been depressed. If not, then the key which has been struck must be either a stroke component or a radical key. The number of such keystrokes is counted in counter 350 and the keystroke signal then transferred to storage buffer 360. Storage buffer 360 is operable to temporarily store the various keystroke signals consecutively entered into it.

If the answer to the test in second test means 340 is positive, this is an indication that all previous keystrokes, stored in buffer 360, now represents a completed ideographic character. Accordingly, second test means 340 is connected to

transfer the keystroke signal to buffer 360 and also connected to stroke/radical coder 370 to enable same.

If the answer to the test in first test means 330 is positive, a third test is made in third test means 380 to determine whether the EOCC/P keystroke represents the completion of a complete ideographic character or of a phrase. If two or more strokes have been previously counted by counter 350, this is an indication that the EOCC/P keystroke represents a phrase. If only one previous keystroke has been counted by counter 350, this is an indication that the EOCC/P keystroke indicates the entry of a complete ideographic character. Accordingly, third test means 380 is connected to receive a count signal from counter 350. Specifically, third test means 380 may test whether the count from counter 350 is greater than 1. If the answer to the test in third test means 380 is positive, third test means 380 is connected to phrase coder 390 to enable same. If the answer is negative, third test means 380 is connected to complete character coder 400 to enable same. If the answer to the test in first test means 330 is positive, first test means 330 is connected to transfer the keystroke signal to storage buffer 360.

If any of codes 370, 390 or 400 are enabled, buffer 360 is operable to deliver its contents to the enabled coder 370, 390 or 400, as the case may be.

Stroke/radical coder 370 is connected to first memory means 310. If enabled, coder 370 is operable to receive the contents of buffer 360 and by using the information stored in

first memory means 310 to convert the keystroke contents of buffer 360 into a character code suitable for delivery to system 120.

Similarly, complete character coder 400 is also connected to first memory means 310. By using the information contained in first memory means 310, complete character coder 400 is operable to receive the contents of buffer 360 and convert same into a character code.

10

Similarly, phrase coder 390 is connected to second memory means 320. Phrase coder 390 is operable to receive the contents of buffer 360 and to convert same into an appropriate phrase code for delivery to system 120.

20

In operation, the user will type a series of keys 160 on keyboard 140. Interpreter means 150 receives the string of keyboard codes. Interpreter means 150 sequentially substitutes therefor the proper code strings for the symbols depicted on the keys. If interpreter means 150 recognizes that the EOC key 220 has been typed, it converts the previously typed keystrokes into a code string, which may then be outputted to system 120. If interpreter means 150 recognizes that the EOCC/P key 240 has been typed and that only one previous key has been typed, interpreter means 150 will substitute the complete character code string of the ideographic character associated with such previous key. If interpreter means 150 recognizes that EOCC/P key 240 has been typed and that two or more keys have been typed previously, interpreter means 150 will substitute the complete code string for the entire ideographic character phrase, according to a set of pre-determined phrases. The completed character code string of

30

the ideographic character or phrase is subsequently available to be outputted to system 120.

In a simpler embodiment, keyboard 140 may not be associated with any ideographic phrases. Accordingly, in such an embodiment, third test means 380, counter 350, phrase coder 390 and second memory means 320 could be omitted. In such a case, first test means 330 would be connected directly to completed character coder means 400 to enable same in the event of a positive test result.

The foregoing is a description of preferred embodiments of the invention, which is given herein by way of example only. The invention is not to be taken as limited to any of the specific features described, but comprehends all such variations thereof as come within the scope of the appended claims.



CLAIMS

1. An apparatus for generating code signals representing ideographic characters of an ideographic language, said ideographic characters being coded by components selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components, said apparatus comprising:
 - 5 keyboard means having first entry keys each of which is associated with a said basic stroke component, and
 - second entry keys each associated with a said radical frequently used in said language,
 - 15 each said first and second entry keys also being associated with a complete ideographic character frequently used in said language, and
 - wherein each said entry key is actuatable to produce a unique signal;
 - 20 said keyboard means also having a first selection key actuatable to produce a unique signal to identify a series of entry key actuations as being associated with said basic stroke component(s) and/or radical(s) associated with the actuated entry keys and
 - 25 to identify the signals produced by said series of actuations as representing a complete ideographic character coded by the basic stroke component(s) and/or radical(s) associated with the actuated entry keys, said keyboard means also having a second
 - 30 selection key operable to produce a unique signal to identify the actuation of an entry key as representing the associated complete ideographic character, and
 - interpreter means responsive to the signals produced by the sequential actuation of said entry and
 - 35 selection keys to generate said code signals.
2. An apparatus as claimed in claim 1 wherein



said set comprises five basic stroke components.

3. An apparatus as claimed in either one of claims 1 or 2 wherein predetermined combinations of said entry keys are each associated with a predetermined ideographic character phrase and said second selection key is also operable to indicate that actuation of said entry keys represents an ideographic character phrase.

4. An apparatus as claimed in claim 3 wherein said interpreter means is responsive to actuation of a said combination of said entry keys and actuation of said second selection key to generate a code signal corresponding to the ideographic character phrase associated with said combination.

5. An apparatus as claimed in claim 4 wherein said interpreter means is programmable to store code signals corresponding to said phrases associated with said combinations of keys.

6. An apparatus as claimed in either one of claims 1 or 2 wherein said interpreter means comprises:

interface means for controlling the generation of said code signal in response to signals from the keyboard means; and

first memory means connected to said interface means for storing code signal information regarding said basic stroke components and said selected frequently used radicals and complete ideographic characters.

7. An apparatus as claimed in claim 6 wherein the actuation of said first or said second selection keys is subsequent to actuation of said entry key or keys.

8. An apparatus as claimed in claim 7 wherein said interface means comprises:

first test means for determining whether said second selection key has been actuated;



second test means connected to said first test means for determining whether said first selection key has been actuated;

5 a storage buffer connected to said second test means for temporarily storing keystroke signals originating from said keyboard means;

stroke/radical coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal;

10 complete character coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal;

15 said first test means connected to and operable to enable said complete character coder means; and

said second test means connected to and operable to enable said stroke/radical coder means.

20 9. An apparatus as claimed in claim 4 wherein said interpreter means comprises;

interface means responsive to incoming signals from the keyboard means for controlling the generation of said code signals;

25 first memory means connected to said interface means for storing code signal information regarding said basic stroke components and said selected frequently used radicals and complete ideographic characters; and

30 second memory means connected to said interface means for storing code signal information regarding said phrases.

10. An apparatus as claimed in claim 9 wherein the actuation of said first or said second selection keys is subsequent to actuation of said entry key or keys.

35 11. An apparatus as claimed in claim 10 wherein



said interface means comprises:

first test means for determining whether said second selection key has been actuated;

second test means connected to said first test means for determining whether said first selection key has been actuated;

a counter connected to said second test means for counting the number of keystrokes;

a storage buffer connected to said counter for temporarily storing keystroke signals originating from said keyboard means;

third test means connected to said first test means, operable when said second selection key has been actuated, and also connected to said counter for determining whether more than one keystroke has been counted;

stroke/radical coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal;

complete character coder means connected to said buffer and to said first memory means for receiving said keystroke signals from said buffer and converting same to said code signal;

phrase coder means connected to said buffer and to said second memory means for receiving said keystroke signals from said buffer and converting same to said code signal;

said second test means connected to and operable to enable said stroke/radical coder means;

said third test means connected to and operable to enable said complete character coder means when one keystroke has been counted; and

said third test means connected to and operable to enable said phrase coder means when more than one keystroke has been counted.



12. An apparatus as claimed in either one of claims 1 or 2 wherein said keyboard means has a shift key and each said entry key is also associated with a conventional Latin alphabet keyboard symbol and said interface means is responsive to the actuation of a said entry key and said shift key to generate a code signal corresponding to said Latin alphabet keyboard symbol.

13. An apparatus as claimed in claim 3 wherein said keyboard means has a shift key and each entry key is also associated with a conventional Latin alphabet keyboard symbol and said interface means is responsive to the actuation of said entry key and said shift key to generate a code signal corresponding to said Latin alphabet keyboard symbol.

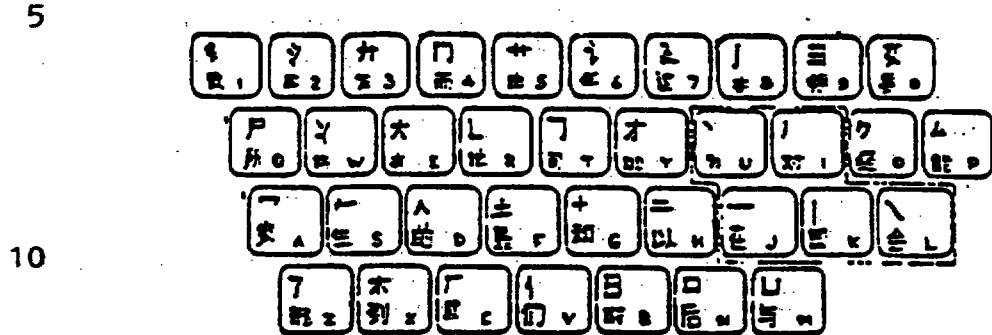
14. An apparatus as claimed in either one of claims 1 or 2 wherein entry keys having basic stroke components associated therewith are located adjacent each other to define a block of entry keys.

15. An apparatus as claimed in claim 14 wherein certain of said entry keys are ergonomically preferred relative to others for two-handed operation, said block of entry keys comprise the most preferred keys on one side of said keyboard, each of said basic stroke components being associated with a said entry key in said block according to the frequency of use during encoding of said basic stroke components, each said radical being associated with another entry key outside said block according to the frequency of use during encoding of said radical, and each said ideographic character being associated with one of said entry keys according to the frequency of use during encoding of said ideographic characters.

16. An apparatus as claimed in claim 15 wherein said ideographic language is Chinese and said set comprises five basic stroke components.



17. An apparatus as claimed in claim 16 wherein said entry keys are associated with basic stroke components, radicals and ideographic characters generally as shown below:



18. An apparatus as claimed in claim 16 wherein radicals selected from the following group of radicals:

ㄥ ㄣ ㄣ ㄣ ㄣ ㄣ ㄣ ㄣ

are associated with certain of said entry keys.

19. An apparatus as claimed in claim 16 wherein ideographic characters selected from the following group of ideographic characters:

他 可 加 力 生 的
是 和 以 在 国 会

are associated with certain of said entry keys.

20. An apparatus as claimed in claim 16 wherein radicals selected from the following group of radicals:

ㄥ ㄣ ㄣ ㄣ ㄣ ㄣ ㄣ ㄣ



are associated with certain of said entry keys, and ideographic characters selected from the following group of ideographic characters:

5 他 可 加 力 生 的
 是 和 以 在 国 会

10 are associated with certain of said entry keys.

21. A keyboard for entering ideographic characters of an ideographic language into a system, said ideographic characters being coded by components selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components, said keyboard comprising:

15 first entry keys each of which is associated with a said basic stroke component;

 second entry keys each associated with a said radical frequently used in said language;

20 each said first and second entry keys also being associated with a complete ideographic character frequently used in said language, and wherein each said entry key is actuatable to produce a unique signal;

25 a first selection key actuatable to produce a unique signal to identify a series of entry key actuations as being associated with said basic stroke components and/or radicals associated with the actuated entry keys, and to identify the signals produced by said series of actuations as representing a complete ideographic character coded by the basic stroke component(s) and/or radical(s) associated with the actuated entry keys; and

30 a second selection key operable to produce a unique signal to identify the actuation of an entry key as representing the associated complete



ideographic character.

22. A keyboard as claimed in claim 21 wherein said set comprises five basic stroke components.

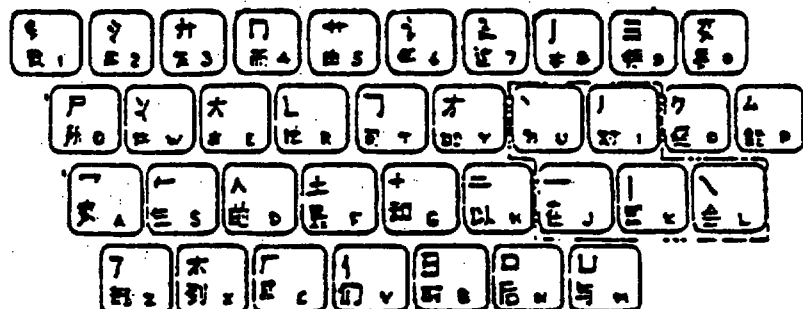
23. A keyboard as claimed in claim 22 further comprising a shift key and wherein each said entry key is also associated with a conventional Latin alphabet keyboard symbol.

24. A keyboard as claimed in claim 21 wherein said first entry keys are located adjacent each other to define a block of first entry keys.

25. A keyboard as claimed in claim 24 wherein certain of said entry keys are ergonomically preferred relative to others for two-handed operation, said block of entry keys comprise the most preferred keys on one side of said keyboard, each said basic stroke component being associated with a said entry key in said block according to the frequency of use during encoding of said basic stroke components, each said radical being associated with another entry key outside said block according to the frequency of use during encoding of said radical, and each said ideographic character being associated with one of said entry keys according to the frequency of use during encoding of said ideographic characters.

26. A keyboard as claimed in claim 25 wherein said ideographic language is Chinese and said set comprises five basic stroke components.

27. A keyboard as claimed in claim 26 wherein said entry keys are associated with basic stroke components radicals and ideographic characters generally as shown below:





28. A keyboard as claimed in claim 26 wherein radicals are selected from the following group of radicals:

5 ㄥ 丿 ㄣ ㄣ 人 土 十 二

are associated with certain of said entry keys.

29. A keyboard as claimed in claim 26 wherein ideographic characters are selected from the following group of ideographic characters:

10 他 可 加 力 生 的
 是 和 以 在 国 会

15 are associated with certain of said entry keys.

30. A keyboard as claimed in claim 26 wherein radicals selected from the following group of radicals:

20 ㄥ 丿 ㄣ ㄣ 人 土 十 二

are associated with certain of said entry keys, and ideographic characters selected from the following group of ideographic characters:

25 他 可 加 力 生 的
 是 和 以 在 国 会

30 are associated with certain of said entry keys.

31. A method for entering ideographic characters of an ideographic language into a system using a keyboard having a plurality of entry keys thereon, for representing basic stroke components, radicals and

35



complete ideographic characters, each said key being operable to produce a unique signal upon actuation thereof, said ideographic characters being coded by components selected from a set of basic stroke components and/or radicals coded by components selected from said set of basic stroke components, said method comprising:

associating each said basic stroke component with a respective first entry key on said keyboard;

associating radicals frequently used in said language with respective second entry keys on said keyboard;

associating each said first and second entry key also with a complete ideographic character frequently used in said language;

associating a first selection key on said keyboard with a series of entry key actuations representing said basic stroke components and/or radical(s) frequently used in the language to represent a complete ideographic character coded by the basic stroke component(s) and/or radical(s) associated with the actuated entry keys;

associating a second selection key on said keyboard with an entry key actuation to represent a complete ideographic character;

interpreting signals from said keyboard to generate, in response to sequential actuation of said entry and selection keys, code signals representing said ideographic characters to be entered.

32. A method as claimed in claim 31 wherein said set comprises five basic stroke components.

33. A method as claimed in either one of claims 31 or 32 comprising the further step of associating predetermined ideographic character phrases with predetermined combinations of said entry keys and



wherein said second selection key is operable to indicate that actuation of said entry keys represents an ideographic character phrase.

34. A method as claimed in claim 33 wherein
5 interpreting further occurs in response to actuation of a said combination of said entry keys and actuation of said second selection key to generate a code signal corresponding to the ideographic character phrase associated with said combination.

10 35. A method as claimed in claim 34 comprising the further step of pre-programming a memory to store code signals corresponding to said phrases associated with said combinations of keys.

36. A method as claimed in either one of claims 31
15 or 32 wherein the actuation of said first or said second selection keys is subsequent to actuation of said entry key or keys.

37. A method as claimed in claim 36 wherein said interpreting step comprises the steps of:
20 determining whether said second selection key has been actuated;

determining whether said first selection key has been actuated;

25 converting keystroke signals originating from said keyboard into a stroke or radical code signal in the event that said first selection key has been actuated; and

30 converting said keystroke signals from said keyboard into a character code signal in the event that said second selection key has been actuated.

38. A method as claimed in claim 37 comprising the further step of temporarily storing said keystroke signals in a storage buffer and said conversion steps convert said keystroke signals from said buffer.

35 39. A method as claimed in claim 34 wherein the actuation of said first or said second selection keys



is subsequent to actuation of said entry key or keys.

40. A method as claimed in claim 39 wherein said interpreting step comprises the steps:

5 determining whether said second selection key has been actuated;

determining whether said first selection key has been actuated;

counting the number of keystrokes originating from said keyboard;

10 determining whether more than one keystroke has been counted;

converting said keystroke signals into a stroke or radical code signal in the event that said first selection key has been actuated;

15 converting said keystroke signals into a character code signal in the event that said second selection key has been actuated and only one keystroke has been counted; and

20 converting said keystroke signals into a phrase code signal in the event that said second selection key has been actuated and more than one keystroke has been counted.

41. A method as claimed in claim 40 comprising the further step of temporarily storing said keystroke signals in a storage buffer and said conversion steps convert said keystroke signals from said storage buffer.

42. A method as claimed in either one of claims 31 or 32 wherein said keyboard has a shift key and the method comprises the further step of associating each said entry key also with a conventional Latin alphabet keyboard symbol.

43. A method as claimed in claim 33 wherein said keyboard has a shift key and the method comprises the further step of associating each said entry key also with a conventional Latin alphabet keyboard symbol.

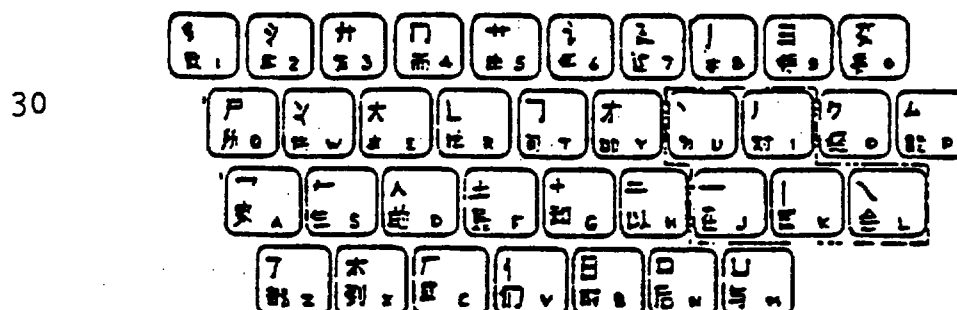


44. A method as claimed in either one of claims 31 or 32 including the further step of locating said entry keys having basic stroke components associated therewith adjacent each other to define a block of entry keys.

45. A method as claimed in claim 44 wherein certain of said entry keys are ergonomically preferred relative to others for two-handed operation, said block of entry keys comprise the most preferred keys on one side of said keyboard, each of said basic stroke components being associated with a said entry key in said block according to the frequency of use during encoding of said basic stroke components, each said radical being associated with another entry key outside said block according to the frequency of use during encoding of said radical, and each said ideographic character being associated with one of said entry keys according to the frequency of use during encoding of said ideographic characters.

46. A method as claimed in claim 45 wherein said ideographic language is Chinese and said set comprises five basic stroke components.

47. A method as claimed in claim 46 wherein said basic stroke components, radicals and ideographic characters are associated with said entry keys generally as shown below:





48. A method as claimed in either one of claims 31 or 32 wherein radicals selected from the following group of radicals:

5 ㄥ ㄣ 才 ㄣ 人 土 + =

are associated with certain of said entry keys.

49. A method as claimed in either one of claims 31 or 32 wherein ideographic characters selected from the following group of ideographic characters:

15 他 可 加 力 生 的
是 和 以 在 国 会

are associated with certain of said entry keys.

50. A method as claimed in either one of claims 31 or 32 wherein radicals selected from the following group of radicals:

20 ㄥ ㄣ 才 ㄣ 人 土 + =

are associated with certain of said entry keys, and ideographic characters selected from the following group of ideographic characters:

25 他 可 加 力 生 的
30 是 和 以 在 国 会

are associated with certain of said entry keys.