Method and apparatus for electronically processing bits of information, particularly Chinese characters where the information is Chinese characters or the like, the steps comprising digitally converting the Chinese character by means of a 480 point matrix and converting the digitized character to 120 hexadecimal digit code units.

33 Claims, 28 Drawing Figures
FIG. 4
Digitized Characters Organization

<table>
<thead>
<tr>
<th>Group</th>
<th>Section</th>
<th>Character Number</th>
<th>Digitized Chinese Character Data Record 120 Hexadecimal Digits</th>
<th>Comments (For Reference Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>001</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>002</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>016</td>
<td></td>
<td>1</td>
<td>00000 00000 01080 01080 01080 01080 01080 01080 01080 01080</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00 FF00</td>
<td></td>
</tr>
</tbody>
</table>

Chinese Phonetic Alphabet: ㄑ
Chinese Phonetic Symbol: ㄑ
Roma nized Syllable: Pei
Chinese Character: 北
meaning: North
FIG. 5

Master File

<table>
<thead>
<tr>
<th>Record Number</th>
<th>Record (Data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five-digit</td>
<td>120 Hexadecimal Digits</td>
</tr>
<tr>
<td>10011</td>
<td>..........................</td>
</tr>
<tr>
<td>10165</td>
<td>00000 00000 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080</td>
</tr>
<tr>
<td></td>
<td>7F0FE 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080 01080</td>
</tr>
</tbody>
</table>

FIG. 6

Diagram of a computer system with the CPU connected to various components labeled 10 through 22.
SYSTEM FOR THE ELECTRONIC DATA PROCESSING OF CHINESE CHARACTERS

This application is a continuation-in-part of my application Ser. No. 225,048 filed Feb. 10, 1972.

BACKGROUND OF THE INVENTION

This invention relates to a novel system for electronic data processing of bits of information, particularly Chinese characters, and more particularly to a Chinese typewriter and a teletype machine for direct Chinese message transmission and switching from one station to another.

In the prior art, a Chinese typewriter comprises a complex mechanism and a galley in which many lead types are attached. The typist must be trained to memorize the location of each character type positioned on the galley. This training takes at least four months or more. In operation, each character is retrieved physically and mechanically from the galley and then stamped on paper one at a time. A well trained typist can only type about 20 to 30 characters per minute.

At the present time, in order to send a telegram in Chinese, the sender must use a Standard Telegraph Code Book and translate the message into a specified numerical code. Similarly, the receiver also must use the same reverse procedure to decode the message. This procedure is inefficient, costly and highly inconvenient. Accordingly, there is need for a system for electronic data processing of Chinese characters.

Therefore, an electrically operated Chinese typewriter and a computerized Chinese character, in particular, have recently been the subject of extensive research and development. However, due to inherent problems in processing Chinese characters in particular, no digitalized alphabet of Chinese characters being conveniently and simply stored and no arrangement, classification or organization of Chinese characters being provided for quick and easy access, a practical automated or computerized Chinese typewriter is still not commercially available.

SUMMARY OF INVENTION

Accordingly, it is an object of this invention to provide a novel system particularly suitable for electronic data processing of Chinese characters.

It is another object of this invention to provide a novel Chinese character typewriter and a teletype machine for direct Chinese message transmission and switching from one remote station to another.

It is a further object of this invention to provide a system which revolutionizes Chinese character typing and Chinese character telegraph operation, and which eliminates the necessity of coding and decoding operations used in present Chinese telegraph systems.

These and other objects are attained by this invention which, in a preferred form, comprises a system wherein each Chinese character is digitalized by means of a 20x24 matrix (480 grid points) and simplified by being converted into a code unit of 120 hexadecimal digits, and selectively stored in a master file within a direct access storage apparatus. A keyboard is provided for quick access to the master file. Under the keyboard a motor driven reference character sheet is disposed with the characters grouped therein according to the order of the Chinese phonetic alphabet. By appropriate keying of selected buttons corresponding to certain groups, sections and characters, mechanism within the apparatus retrieve code units for corresponding characters from the master file. Printing means are provided for printing out the characters which are retrieved. The printing means comprises a twenty four wire printing head which is selectively actuated in accordance with the retrieved code units to print the corresponding characters.

BRIEF DESCRIPTION OF DRAWING

FIG. 1A is a Chinese character "Pei," meaning "North."
FIG. 1B depicts a digitalized form of the Chinese character "Pei" as shown in FIG. 1A;
FIG. 1C depicts a binary representation of the digitalized character shown in FIG. 1B;
FIG. 1D depicts the hexadecimal equivalent of the binary digits shown in FIG. 1C;
FIG. 2A depicts another Chinese character "Ying," meaning "Eagle," representing a typical long pattern of Chinese characters;
FIG. 2B depicts the digitalized form of the character "Ying," shown in FIG. 2A;
FIG. 2C depicts the binary representation of the digitalized character shown in FIG. 2B;
FIG. 2D depicts the hexadecimal equivalent of the binary digits shown in FIG. 2C;
FIG. 3A depicts another Chinese character "Tieh," meaning "Iron," representing a typical wide pattern of Chinese characters;
FIG. 3B depicts the digitalized form of the Chinese character "Tieh," as shown in FIG. 3A;
FIG. 3C depicts the binary representation of the digitalized character shown in FIG. 3B;
FIG. 3D depicts the hexadecimal equivalent of the binary digits shown in FIG. 3C;
FIG. 4 depicts a chart showing a preferred organization of a portion of digitalized characters organized in accordance with the present invention, wherein the Chinese characters are divided into four groups, each group comprising 160 sections, each section comprising 15 characters, and each character being digitalized in the form of code units of hexadecimal digits;
FIG. 5 depicts a form of a master file for the code units in accordance with this invention;
FIGS. 6A and 7B are plan views of the right and left parts of a keyboard panel showing four push-buttons for character group selection, 160 push-buttons for section selection, and 15 push-buttons for character number selection;
FIG. 8 is a schematic side elevation of the combination of the keyboard panel and the character reference sheet with associated parts being omitted for clarity;
FIG. 9 is a partial perspective view of the character reference sheet;
FIG. 9A is a partial perspective view of a modified embodiment of the terminal unit and keyboard according to the present invention;
FIG. 9 is a section on line 9A-9A of FIG. 9A;
FIG. 9C is a perspective view of a character sheet arrangement for use with the embodiment of FIGS. 9A and 9B;
FIG. 9D is a partial perspective view of another modified embodiment of the terminal unit and keyboard according to the present invention.
FIG. 10 is a perspective view of a Chinese matrix printer; FIG. 11 is a schematic diagram showing the electrical connection between the buffer and matrix printhead; FIG. 11A is a side view of the matrix print head of FIG. 11; FIG. 12 is a schematic diagram of the structure inside a print head comprising 24 pieces of fine wire with only one piece of printing wire being shown for clarity; and FIG. 13 is a perspective view of a terminal unit and keyboard of another modified embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following description, the method and apparatus are disclosed as being for handling of Chinese characters. However, as will be apparent from this description, the method and apparatus can be used to handle other similar information which can be grouped and represented in a similar fashion.

DIGITALIZATION OF CHINESE CHARACTERS

An important aspect of the preferred embodiment of this invention is that the Chinese characters used in the typewriter of the invention are digitalized by means of a 20x24 matrix (480 grid points), and each digitalized character is, in turn, represented by 120 hexadecimal digits.

Referring now to FIGS. 1A–1D, a Chinese character “pei” is shown. The Chinese character is superimposed in discrete form, i.e., in the form of dots, on a matrix of 20x24 grid points as shown in FIG. 1B. Then the character is digitalized, i.e., the points on the grid are represented in binary form as shown in FIG. 1C with the points occupied by dots having one binary form and the unoccupied points having the other binary form. For simplicity, the binary form of the character is, in turn, converted into a hexadecimal form in a conventional manner, as shown in FIG. 1D.

Similarly, FIGS. 2A–2D and FIGS. 3A–3D depict other examples of typical long and wide patterns of Chinese characters, respectively. Character “Ying,” shown in FIGS. 2A–2D, requires a minimum of 24 rows for sufficient clarity, although it only takes 16 out of 20 columns in the matrix. The character “Tieh,” shown in FIGS. 3A–3D, requires a minimum of 20 columns for sufficient clarity.

A COMPUTERIZED FILE SYSTEM FOR THE DIGITIZED CHINESE CHARACTERS

Having digitalized all Chinese characters and converted them into hexadecimal form, a computerized file system is then established by arranging the digitized Chinese characters according to the standard 37 Chinese Phonetic Alphabets. The thus converted characters are stored in a direct-access storage device in an electronic data processing system according to the arrangement of the file system, such that they can be retrieved with ease.

According to the present invention, digitalized Chinese characters are arranged in four groups. Each group has a capacity of 2,400 characters. It is to be noted that 7,773 Chinese characters are considered to be currently in use. The most widely used 2,400 characters are organized as the first group. The less used 2,400 characters are organized as the second group, etc. The least used characters are organized as the fourth group. Also, special characters which are not currently in use but are of special interest in a particular field, such as financial, medical, scientific, engineering, etc., can be placed in the fourth group. Up to 2,128 special characters can be placed in the fourth group.

Each group of 2,400 characters is divided into 160 sections. Each section has 15 characters of the same Standard Chinese Phonetic Syllable. The 160 sections are arranged in alphabetical order according to the Standard 37 Chinese Phonetic Alphabets.

Reference is made to FIGS. 7A and 7B which show a Group No. 1 represented schematically. The 160 rectangles 131a are for the section within Group No. 1, and, in actual practice, each section has 15 characters therein, as shown in section 016 in the upper-right-hand corner of FIG. 7A. It will be seen that section 016 is in a subgroup 131b, outlined in solid lines, of six sections, sections 014–016 and 030–032, all of which form one of the 37 phonetic subgroups in the phonetic alphabet. This is indicated in the figure in the individual sections by the Chinese symbol for this part of the phonetic alphabet. Other subgroups are outlined and in the drawing the sections contain the Chinese symbols for the other parts of the phonetic alphabet. In actual practice, each section will contain 15 Chinese characters, just as does section 016 in the drawing.

The character “pei” in FIG. 1 appears at position 5 in Group 1, Section 016 in FIG. 7A. Thus, for example, the character “pei” in FIGS. 1 and 7A would appear in the file system in Group No. 1, Section 016, Character No. 5, with a five digit file system number 10165, where the first digit 1 is the Group Number, the second, third and fourth digits together are the Section Number 016, and the fifth digit is the Character Number 5 within the particular section. In FIG. 4, the fifth digit, which can be a single digit number or a two digit number, is handled as a hexadecimal digit. Thus, the fifth character will require only one digit space. The master file, as shown in FIG. 5, is created by entering the data for the digitized character in the storage device of an EDP system in the form of input data cards or other similarly known means. In order to provide quick and easy access to the master file, such that the digitalized character can be retrieved, the following techniques and apparatus or devices have been developed.

The reason that four is the number of groups into which the characters are divided is that the decimal numbers from 1 to 4 can be represented by four bits in a binary system. The reason that 15 is the number of characters per section 131 is that the decimal numbers from 1 to 15 can be represented by four bits in the binary system. The numbers of the sections within a group can be represented by eight bits in the binary system.

Although only 160 sections have been provided in the disclosed embodiment, it will be clear to those skilled in the art that with eight bits, up to 256 decimal numbers can be represented. Therefore, the number of sections within any group can be increased up to 256. The total number of bits by which the file system number can be represented is thus seen to be 14, so that any file system number in binary form can be divided into two seven-bit groups. These groups are in conformity with the American Standard Code for Information Interchange (ASCII), in which information in binary
form is transmitted and received in seven-bit groups. The system of the present invention is therefore fully compatible with current information interchange systems.

A SYSTEM FOR PERFORMING CHINESE TYPEWRITER OPERATIONS

The system for retrieving and utilizing characters according to the present invention is shown in FIG. 6, and comprises a terminal unit 10 connected to a CPU (central processing unit) 20 which in turn is connected to a direct access storage device 21, such as a disk in which the master file system is stored. It is to be understood that the CPU 20 is preferably a conventional computer which is programmed to (a) search switches on a keyboard, to be described hereinafter, to detect which switches are closed and to derive the file system number from the closed switches; (b) retrieve the data for the digitalized data for the character corresponding to a file system number from the storage device; (c) convert the hexadecimal data to binary form; (d) feed the converted data to a buffer storage means and control the buffer storage means for driving a matrix printer and a character display unit, both to be described hereinafter; and (e) to convert the file system number to the ASCII code and transmit and receive such code and reconvert received coded file system numbers for use in retrieval from the storage device. The CPU can thus have transmission lines 22 connected thereto which can be connected to a like system, and the CPU can transmit and receive ASCII coded file system numbers to and from said lines. It is thus seen that the system has communications capability. The terminal unit 10 is a means for supplying a signal representing a file system number and is connected to CPU 20 through communications lines 30. It will be appreciated that more than one terminal unit 10 can share the same CPU 20, if desired.

The terminal unit includes character display unit 11, keyboard 13 and Chinese character printer 14. Item 12 can be another display unit.

CHARACTER DISPLAY UNIT

The character display unit 11 may be either a conventional cathode ray tube (CRT) type of device or a conventional display matrix utilizing light emitting diodes. In the use of a CRT device, the minimum resolution is preferably 4,096 points per square inch. In the case of a display matrix using light emitting diodes, the matrix should be 20×24 matrix grid points per character corresponding to the digitalized Chinese character matrix. In either case, there is preferably a buffer storage means in the display unit 11 which may have a capacity of 450 characters for display data and 50 characters for system use. The initial position of the character to be displayed can be selected and adjusted with respect to the vertical and horizontal position by conventional cursor buttons among the operational pushbuttons 136-140 on the keyboard 13.

KEYBOARD

The keyboard 13, shown in FIGS. 6, 7A, 7B and 8, comprises a switch means such as push-buttons 134-134 for character Group selection, 160 switch means such as push-buttons 131-131 for Section selection, 15 switch means such as push-buttons 133-133 for character number selection, and switch means such as push-buttons 132, 134, 135, 136, 137, 138, 139 and 140 for operational use. The respective switch means are connected to the CPU 20 for supplying thereto a signal representing a part of the file system number corresponding to the push-button. For example, to supply a signal for “pei” of FIG. 1, push-button 1 of buttons 134 is pressed and sends a signal representing the first or “group” digit of the file system number. Then push-button 131 for section 016 is pushed and then push-button 5 of push-buttons 133 is pushed to send signals representing the second through the fifth digit and the sixth digit of the file system number, respectively.

In FIGS. 8 and 9, a character reference sheet 16 is provided for each group of sections, there being four reference sheets 16. The sheets are positioned relative to the push-buttons 131 so that there is one section corresponding to each push-button. Preferably, the reference sheets are joined to each other in a continuous endless belt and are placed around a set of motor driven rollers 17-17 (the motor not being shown) controlled by group push-buttons 134 and located under keyboard 13. Push-buttons 131 are transparent and display the sections on the respective sheets throughout. In this manner, the sheet for any one of the four character groups can be caused to move into position under pushbuttons 131 by pressing the corresponding push button group buttons 134-134 (see FIGS. 6, 7A and 7B). Preferably indicating lights positioned in group buttons 134-134 will be turned on when the buttons are pressed to indicate that certain groups are being used.

By searching through the 160 section push-buttons 131-131, any one of the 2,400 characters for a given group can be read from the character reference sheet 16 positioned under the keyboard panel 13. As can be seen from FIG. 6, all of the 160 section push-buttons 131-131 are in the form of a magnifying lens to enable clear reading of the characters.

When a Section button 131 is pressed, a three digit number is generated to indicate which section is selected. The three digit number for a given section then becomes the middle three digits of the five digit file system number.

Having selected a Section, any particular character within the section can be selected by pressing the Character Number button 133-133 located on the keyboard according to the position of the character in that section (see FIGS. 7A and 7B).

When a particular Character Number button 133 is pressed, a digit is generated to indicate which number is pressed, and if desired, a push-button 132 can be provided which is pushed after pushing any one of push-buttons 133 to produce an EOB (End of Block) 132 code signal. Note that on the keyboard the Character Number push-buttons 133-133 are designated as 1, 2, . . ., 14, 15. Internally, however, a signal representing a single hexadecimal digit 1, 2, . . ., 9, A, B, C, D, E or F is generated. This Character Number digit then becomes the last digit of the five-digit file system number identifying the desired character in the storage device.

Thus, for a given character in the Character Reference Sheet 16, there is a one-to-one correspondence for signal representing the five digit file system number sent from the keyboard 13 and the five-digit file system
number for the code unit in the storage device 21 for that particular character.

All push-buttons on the keyboard may be constructed utilizing printed circuit technology so that there is no obstacle under the keyboard panel to prevent movement of character reference sheets 16.

In addition, in accordance with the invention, the quick direct operation by the operator to look up all sections of characters sharing the same part of the Chinese phonetic alphabet is facilitated by coloring the panel with various colors for various parts of the alphabet. All sections under the same part of the phonetic alphabet would have the same color. For example, in FIGS. 7A and 7B, on the top right corner there are six sections which are designated as sections 014, 015, 016, 030, 031, and 032 and have characters having the same initial sound “$” and these can have the same color, e.g., red. Note that other light colors such as ivory and beige may be used.

An alternative arrangement is shown in FIGS. 9A and 9B in which the keyboard 13 on the terminal unit 10 is comprised of a plurality of simple pressure sensitive switches 231, which preferably have lights incorporated therein which are turned on when the switch is actuated. A U-shaped channel frame 232 is provided around the sides and bottom of the area occupied by the switches 231, the individual members of the frame having a cross-section in which a vertical portion 232a extends upwardly from the surface of the keyboard and a horizontal portion 232b extends horizontally from the upper end thereof. A character sheet 233 is provided which has printed thereon sections having the characters within the sections in the same manner as illustrated in FIGS. 7A and 7B. The character sheet 233 fits removable into the U-shaped channel frame 232 and the printed sections overlie corresponding switches 231, so that simple finger pressure on the sheet on a desired section actuates the switch therebehind, and the section of the sheet is illuminated from beneath by the light in the switch. The remainder of the keyboard 13 is the same as in the embodiment of FIG. 6.

The character sheet 233 is at least opaque, and can be printed with one group on one side, or can have one group on one side and a second group on the other side. In order to have four groups available, it will be necessary to have a minimum of two sheets.

In order to have the two sheets in convenient form so that the operator can shift from one group to another quickly, a combined character sheet 234 can be provided, as shown in FIG. 9C. The sheet has two sheet portions 234a and 234b secured at the transverse centerlines to form what is essentially a four page booklet.

It will be appreciated that by properly printing the sections on the various pages, by opening the booklet to the centerfold one group can be displayed, by opening the booklet to between the first and second pages, a second group can be displayed, by opening the booklet to between the third and fourth pages a third group can be displayed, and by turning the booklet over a fourth group can be displayed on the outside faces of pages 1 and 4. All four groups of sections can thus be combined in one handy character sheet which can be slipped into the U-shaped frame 232 very easily.

Another alternative arrangement is shown in FIG. 9D in which the keyboard has the same pressure sensitive switches 231 thereon, but instead of the frame 232 it has a plurality of fastening means around the periphery of the area occupied by the switches. The fastening means are shown here as simple posts 235 for insertion through corresponding apertures 236 in the corners of sheet 233. However, the fastening means could also be simple spring clips or the like, under which the upper edge of the sheet could be held, or could be magnets for attracting magnet means on the sheet.

CHINESE CHARACTER MATRIX PRINTER

Referring to FIG. 10, there is shown a perspective view of a Chinese matrix printer according to the invention, in which a paper 141 which is to have characters printed thereon is inserted around a roller 142 rotated in response to printing head 144 reaching the end of each row and contained in body 143 of the printer. It is appreciated that the matrix print head 144 is an essential part of the system.

As shown in FIG. 11, matrix print head 144 comprises 24 pieces of fine wire 150 (only two of which are shown), such as stainless steel wire, with a diameter of 0.010 inch, each having a wire pin 152 and wire drive 153 (see also FIG. 12). Each wire 150 is operatively connected to its associated wire pin 152 which is actuated by wire drive 153 which is, in turn, electrically connected to buffer storage means in display unit 11. Four buffer storage means here being designated 146, through register 147 by conductors 148—149 and 145—146. They are operated in response to signals from buffer storage means 146 (see FIG. 11), wherein a and b represent 20 points on a row and 24 points in a column of the matrix grid, respectively.

In this way, each of the print wires can be actuated electromechanically and electronically. 24 pieces of wire are arranged in a line corresponding to one column of each digitized Chinese character (see FIG. 11A). In particular, the ends 151 of wires 150 (as viewed in FIG. 11A from the ends of wires 150) represent a column of 24 grid points of a digitized character. In other words, all of the wires are actuated simultane-ously and one column of dots forming part of a character is printed simultaneously. When less than all the wires are actuated, only parts of the column are printed. Thus, matrix print head 144 will print the digitalized Chinese character one column at a time from left to right. The data for the dots in the column, which together form the pattern of a character and number of characters to be printed per line, is obtained from display buffer storage means 146.

FIG. 12 shows a schematic diagram of a single printer wire 150 within print head 144, one end of which is free and normally held in the surface of the printing head out of contact with the surface of paper 141 by the force of spring 154 between retainer 155 a flange on a wire pin 152. A stop 156 on wire pin 152 limits movement of wire pin 152, and thus wire 150, away from the paper 141. A wire drive 153 is mounted on a support member 157. When wire drive 153 is actuated for example by solenoid or fluidic means, wire pin 152 and wire 150 are pushed, and end 151 of wire 150 projects out of surface of print head 144 and into contact with the surface of paper 141 to form a dot as part of the pattern in accordance with the data obtained from display buffer storage means 146.

It should be pointed out that the scale of the print head shown in FIG. 12 is considerably enlarged for the purpose of clarity. In practice, each wire is about 0.010 inch in diameter and the total length of the line of 24
pieces of wire would be about 0.24 inch. In a length of 1/4 inch for the line of wires there is some clearance for the lubrication of the wires.

There are two conventional styles of writing Chinese documents. One is horizontally from left to right and then from top to bottom. The other is vertically from top to bottom and from right to left. The CPU is programmed for supplying data for the character to the buffer storage means 146 in either style, and the proper program is selected by pressing the "vertical" or the "horizontal" buttons 139 or 137 on keyboard 13.

If the vertical style is selected, the matrix printer will print the document as if it is for horizontal style except one character from each vertical line is printed and then from left to right. As far as the printer is concerned, it is not aware of which style is to be or being printed, for it simply follows the bit pattern in the display buffer storage means 146. The pattern in which the data is placed in the buffer storage means 146 determines the style.

TYPING PROCEDURE AND DATA FLOW

Style Selection
Enter either horizontal style or vertical style through the buttons 137 or 139 located on keyboard 13. A button light can be provided which will be turned on to indicate which style is being typed.

Display Position Adjustment
The vertical and horizontal "Display" buttons 140 and 138 on the keyboard 13 are coupled to the display device 11 to adjust the location of the character to be displayed on the display device 11 to the desired position by conventional control means.

Character Group Selection
The operator quickly determines which one of the four groups to which the desired character belongs and then presses the proper button 134 on the keyboard. The button light will be turned on to indicate which group of characters is selected for typing. At the same time, the motor driven rollers 17—17 will move the Character Reference Sheet 16 under the keyboard 13 to a predetermined position such that the entire group of characters can be read through the transparent push buttons 131—131. And simultaneously, a signal representing digit 1, 2, 3 or 4, depending upon which group is selected, is generated and sent to the buffer storage means 146 to become the first digit of a five-digit file system number.

Section Selection
The operator quickly determines the Chinese Phonetic Symbol for the desired character and then goes to the subgroup of sections which share the same part of the Chinese phonetic alphabet and then scans through the windows 131—131 in the subgroup for the desired character. Once the desired character is located in a section of the Character Reference Sheet 16, the Section button 131 is pressed. A three-digit number corresponding to the section number is generated and sent to the buffer storage means 146 to become the middle three-digits of a five digit file system number.

Character Number Selection
The operator presses one of the 15 Character number push buttons 133 to select the desired character in the section. The Character Number push buttons 133—133 are arranged on the keyboard 13 in physical positions corresponding to the positions of the characters within the sections on character reference sheet.

16. At the same time, a hexadecimal digit number is generated and sent to the buffer storage means 146 to become the fifth digit of the five digit record number. In a practical embodiment, the buffer storage means 146 then generates a signal to inform the CPU 20 that a desired character with the file system number in the buffer storage means 146 is wanted. The CPU control program then causes the CPU to take the file system number from the buffer storage means and retrieve from the storage device 21 the 120 hexadecimal digits for the desired character and send them to the buffer storage means 146 in the display device 11 and the digitzed Chinese character is displayed. The process continues until either a page of document is completed or the 450 character buffer storage means is filled, whichever occurs first.

Print
The operator presses the "Print" button 135 on the keyboard and all characters on the display device 11 are printed on the matrix printer 14 and a hard copy is obtained.

Typing Example 1

<table>
<thead>
<tr>
<th>Chinese Character</th>
<th>Standard Chinese Phonetic Symbol</th>
<th>Romanized Phonetic Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ㄎ</td>
<td>ㄎ</td>
<td>Pei</td>
<td>North</td>
</tr>
</tbody>
</table>

Suppose the character "Pei" or "North" shown above is the desired character to be typed. Since this is a widely used character, the operator quickly determines it to be in Character Group 1. Hence, the operator presses "1" button 134 under "Character Group". The operator then quickly determines the Standard Chinese Phonetic Symbol for this character which is ㄎ. The operator then scans through Sections 131a in the subgroup 131b in the top right hand corner of the keyboard 13, as seen in FIG. 7A, and finds the desired character in section 016 in the second row, second line, corresponding to character number button 133, which is in position 5, in FIG. 7B.

The operator then presses the Section button 131 which is for section 016 and then presses Character Number Button 133, corresponding to position "5." Since the desired character is in the No. 5 position, a five digit file system number 010165 is generated from the keyboard which is the file system number for the desired character "Pei" stored in the form of 120 hexadecimal digits. The data is then retrieved from storage and placed in display buffer storage means 146 for printing by the matrix printer 14.

CHINESE TELETYPES MACHINE FOR MESSAGE TRANSMISSION AND SWITCHING

As shown in FIG. 6, the terminal unit 10 which is connected to CPU 20 via communications lines 30 is for a Chinese Typing System according to the present invention. Several terminal units 10 can be connected to the CPU 20 via communications lines 30.

If the transmission and switching of a Chinese character message is desired, the operator simply types the message as if it is a regular typing operation except after the entire message is finished and displayed on the display device 11, the operator presses a transmission button 136 on the keyboard 13, causing it to generate
a signal which causes the program in the CPU 20 to
carry out transmission of the file system numbers. The
first thing the transmission program does is to send a
message to the sending terminal "Enter Receiving Ter-

5       minal Number", which is displayed on the display de-
vice or buffer storage means 146 (see FIG. 11). The
operator on the sending terminal then enters the re-
ceiving terminal number through the Character Num-
ber buttons 133—133 on the keyboard 13 and then
presses EOB key. The message handling control pro-
gram in the CPU 20 then reads in the message from the
display buffer storage means 146 of the sending termi-
nal 10 and checks whether the receiving terminal is
busy. If not, the message is transmitted to the buffer
storage means 146 of the receiving terminal. Thus,
transmission and switching of a Chinese character mes-

10      sage from one terminal to another is completed.

Alternate Typing System

An alternate typing system can be provided in which
the 160 section push buttons 131—131 on the key-
board 13 and the display device 11 are eliminated, as
shown in FIG. 13. The capacity of the buffer storage
means for the terminal is reduced to 50 characters. The
Character Reference Sheet 16 is displayed directly in
front of the operator, for example through a window

15      240. An additional push button 241 for the digit zero
"0" is added to the 15 character push-buttons
133—133. Otherwise, the buttons are the same as in
FIG. 6. In operation, the operator selects the Group
Number, and then enters the Section Numbers, as well
as the Character Number through the 16 numeric but-

20      tons 133, 241 (0, 1, 2, . . . 15), in accordance with this
embodiment of the invention. Thus, instead of pressing
the Section button 131 to generate the three digit sec-
tion number, the section number is now entered manu-

25      ally through the numeric buttons 133 and 241. The
alternate typing system is to enter the file system Number
for the desired character one character at a time and
is printed on the matrix printer 14 on a one to one ba-

30      sis.

Alternate Message Switching System

As in the alternate typing system, the character is en-

35      tered as well as transmitted and switched one character
at a time in the alternate message switching system.
The section push buttons and display device are elimi-
nated in the alternate system. The section number is
entered manually through the numeric buttons.

30      It should be noted that the master file can be stored in
a Read-Only-Storage (ROS) memory device as a
stand alone typing system.

The foregoing is intended to be only illustrative of the
principles of the invention. Numerous modifications
and variations thereof would be evident to the worker
skilled in the art. All such modifications and variations
are to be considered to be within the spirit and scope
of the invention.

What is claimed is:

1. A means for storing, retrieving and reproducing
individual characters in a large number of characters,
comprising a plurality of sheets equal to a number of
relatively large groups of the characters in which
groups the characters are according to the frequency
with which the characters are used, each sheet having
a plurality of sections arranged thereon and each sec-

40      tion having a relatively small number of characters
therein each having a common characteristic, a key-
board having thereon a first plurality of switches equal
in number to the number of sheets, a second plurality
of switches equal in number to the number of sections
and arranged on said keyboard in the same arrange-
ment as said sections are arranged on said sheets, and

45      a third plurality of switches equal in number to the
number of characters in a section and arranged on said
keyboard in the same arrangement as said characters
are arranged in said sections on said sheets, means for

50      placing said sheets in juxtaposition with said second
plurality of switches with the sections on the sheets in
positions corresponding to the positions of said
switches, means connected to the respective switches
for generating a signal when the respective switches are
actuated, whereby a signal representative of a file sys-
tem number including the group, the section and the
position of the character in each section for the charac-
ters on the sheets is generated when switches for the re-

55      spective group, section and position for each character
are actuated, a storage means for storing code units
representative of the characters according to a file sys-
tem in which each code unit is assigned the correspond-

60      ing file system number, access and retrieval means cou-
ed between said signal generating means for said
switches and storage means for gaining access to said
storage means and retrieving the code units for charac-
ters corresponding to the file system numbers from said
signal generating means, and character representing

65      means coupled to said access and retrieval means for
receiving therefrom the code units for the retrieved
characters and representing the characters in visible
form.

2. Means as claimed in claim 1 in which there are
four sheets and four switches in said first plurality of
switches, and 15 characters in each section and 15

70      switches in said third plurality of switches.

3. Means as claimed in claim 1 in which the charac-
ters are Chinese characters, and there are four groups
of characters and four switches in said first plurality
of switches, there are 160 sections and 160 switches in
said second plurality of switches, and there are 15 char-
acters in each section and 15 switches in said third plu-

75      rality of switches.

4. Means as claimed in claim 3 in which the sections
on said sheets are arranged in subgroups according to
the Chinese phonetic alphabet.

5. Means as claimed in claim 4 in which the areas of
the sheets occupied by the subgroups of sections are
derent colors.

6. Means as claimed in claim 1 in which said sheets
are connected together in a continuous length, and
means beneath said keyboard for moving said continuous length beneath said keyboard for positioning sheets beneath the keyboard, said switches in said first plurality being coupled to said moving means for controlling said moving means for moving the length to position the sheet corresponding to the respective switches beneath the keyboard according to which switch is actuated, said keyboard having transparent portions corresponding to each switch for viewing the sections on the respective sheets through the keyboard.

7. Means as claimed in claim 6 in which said switches have transparent actuators as a part thereof, and said sheets have the sections thereon positioned immediately beneath the transparent actuators when they are placed in juxtaposition with said switches.

8. Means as claimed in claim 7 in which said actuators are magnifying lenses.

9. Means as claimed in claim 1 in which said switches are pressure sensitive switches, and said keyboard has means thereon for positioning said sheets one at a time over said switches, whereby finger pressure by an operator on the sheet over the switches is sufficient to actuate switches corresponding to the sections on the sheets.

10. Means as claimed in claim 9 in which said switches have lights therein and said sheets are opaque, whereby light from the switches can shine through the sheet when a switch is actuated by pressure on the sheet.

11. Means as claimed in claim 9 in which said positioning means on said keyboard comprises a U-shaped channel frame around the sides and bottom of the keyboard for receiving the sheets.

12. Means as claimed in claim 9 in which said sheets are individual sheets which are held by said positioning means one at a time.

13. Means as claimed in claim 9 in which said sheets are attached to each other in the form of a booklet.

14. Means as claimed in claim 1 in which said storage means stores code units which are representations of the characters in discrete form on a matrix of grid points.

15. Means as claimed in claim 14 in which said storage means stores code units which are hexadecimal forms of binary digitalized discrete characters, and said access and retrieval means comprises means for converting the code units from the hexadecimal form to the binary form.

16. Means as claimed in claim 14 in which the character representing means is a matrix printer.

17. Means as claimed in claim 16 in which said matrix printer comprises means for printing dots on a matrix grid of twenty by twenty-four grid points, and said code units received from said access and retrieval means are binary digitalized discrete characters on a matrix of twenty by twenty-four grid points which can be printed by said matrix printer.

18. Means as claimed in claim 1 further comprising a buffer storage means coupled between said access and retrieval means and said character representing means for storing code units and control means on said keyboard coupled to said buffer storage means for feeding stored code units to said character representing means under control of said control means.

19. Means as claimed in claim 1 in which said character representing means comprises a cathode ray type display device.

20. Means as claimed in claim 1 in which said character representing means comprises a cathode ray type display device, coupled to said access and retrieval means, a matrix printer, a buffer storage means coupled between said access and retrieval means and said matrix printer, and control means on said keyboard coupled to said buffer storage means for controlling the buffer storage means to feed stored code units to said matrix printer.

21. A means for generating signals corresponding to file system numbers for character in a large number of characters, comprising a plurality of sheets equal to a number of relatively large groups of the characters in which the characters are according to the frequency with which the characters are used, each sheet having a plurality of sections arranged thereon and each section having a relatively small number of characters therein each having a common characteristic, a keyboard having thereon a first plurality of switches equal to the number of sheets, a second plurality of switches equal to the number of sections and arranged on said keyboard in the same arrangement as said sections are arranged on said sheets, and a third plurality of switches equal in number to the number of characters in a section and arranged on said keyboard in the same arrangement as said characters are arranged in said sections on said sheets, means for placing said sheets in juxtaposition with said second plurality of switches with the sections on the sheets in positions corresponding to the positions of said switches, and means connected to the respective switches for generating a signal when the respective switches are actuated, whereby a signal representative of a file system number including the group, the section and the position of the character in each section for the characters on the sheets is generated when switches for the respective group, section and position for each character are actuated.

22. Means as claimed in claim 21 in which there are four sheets and four switches in said first plurality of switches, and fifteen characters in each section and fifteen switches in said third plurality of switches.

23. Means as claimed in claim 21 in which the characters are Chinese characters, and there are four groups of characters and four switches in said first plurality of switches, there are 160 sections and 160 switches in said second plurality of switches, and there are 15 characters in each section and 15 switches in said third plurality of switches.

24. Means as claimed in claim 23 in which the sections on said sheets are arranged in subgroups according to the Chinese phonetic alphabet.

25. Means as claimed in claim 24 in which the areas of the sheets occupied by the subgroups of sections are different colors.

26. Means as claimed in claim 24 in which said sheets are connected together in a continuous length, and means beneath said keyboard for moving said continuous length beneath said keyboard for positioning sheets beneath the keyboard, said switches in said first plurality being coupled to said moving means for moving the length to position the sheet corresponding to the respective switches beneath the keyboard according to which switch is actuated, said keyboard having transparent portions corresponding to each switch for viewing the sections on the respective sheets through the keyboard.
27. Means as claimed in claim 26 in which said switches have transparent actuators as a part thereof, and said sheets have the sections thereon positioned immediately beneath the transparent actuators when they are placed in juxtaposition with said switches.

28. Means as claimed in claim 27 in which said actuators are magnifying lenses.

29. Means as claimed in claim 21 in which said switches are pressure sensitive switches, and said keyboard has means thereon for positioning said sheets one at a time over said switches, whereby finger pressure by an operator on the sheet over the switches is sufficient to actuate switches corresponding to the sections on the sheets.

30. Means as claimed in claim 29 in which said switches have lights therein and said sheets are opaque, whereby light from the switches can shine through the sheet when a switch is actuated by pressure on the sheet.

31. Means as claimed in claim 29 in which said positioning means on said keyboard comprises a U-shaped channel frame around the sides and bottom of the keyboard for receiving the sheets.

32. Means as claimed in claim 29 in which said sheets are individual sheets which are held by said positioning means one at a time.

33. Means as claimed in claim 29 in which said sheets are attached to each other in the form of a booklet.

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