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(54) A NOVEL SYSTEM FOR THE ELECTRONIC DATA
 PROCESSING OF CHINESE CHARACTERS

(71) I, CHAN HUE YEY, a United States Citizen, of P.O. Box 696, Mountain View, California 94040, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a 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 telegraph 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.

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.

According to one aspect of the invention, there is provided means for generating signals corresponding to file system numbers for a character of a plurality of characters whose position in a file system are identifiable by a numeric code, comprising a sheet having characters thereon arranged according to the frequency with which the characters are used, and divided into sections with each section containing characters having a common characteristic, a keyboard having a number of switches corresponding to the number of characters in a section, means for placing said sheet in juxtaposition with the switches with the characters in section in positional correspondence with said switches, and means connected to the switches for generating signals, upon actuation of selected ones thereof, which are representative of respective ones of said plurality of characters.

According to another aspect of the invention, there is provided means for generating signals corresponding to file system numbers for a character in a plurality of characters, comprising a plurality of sheets equal to a selected number of groups of the characters in which groups the characters are arranged according to the frequency with which the characters are used, each sheet having a plurality of sections arranged thereon and each section having a selected number of characters therein each having a common characteristic, a keyboard having thereon a first plurality of switches equal in number to the

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number of sheets, a second plurality of switches equal in number 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, 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.

According to a third aspect of the invention, there is provided means for storing, retrieving and reproducing individual characters from a plurality of characters, comprising a plurality of sheets equal to a selected number of groups of the characters in which groups the characters are arranged according to the frequency with which the characters are used, each sheet having a plurality of sections arranged thereon and each section having a selected number of characters therein each having a common characteristic, a keyboard 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 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 of 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 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, a storage means for storing code units representative of the characters according to a file system in which each code unit is assigned the corresponding file system number, access and retrieval means coupled between said signal generating means for said switches and storage means for gaining access to said storage means and retriev-

ing the code units for characters corresponding to the file system numbers from said signal generating means, and character representing 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.

In the accompanying drawings:—

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 fifteen 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;

Fig. 6 is a schematic diagram showing a novel system for electronic data processing of Chinese characters according to this invention;

Figs. 7A 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 fifteen 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;

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correspond- om said sig- r repr nt- ss and e- refrom the racters and ble form.	70	Fig. 9A is a partial perspective view of a modified embodiment of the terminal unit and keyboard according to the present invention;	Figs. 3A—3D, requires a minimum of twenty columns for sufficient clarity. 65
— Pei" mean-	75	Fig. 9B is a section taken on line 9A—9A of Fig. 9A;	A Computerized File System for the Digitized Chinese Characters 70
form of the own in Fig.	80	Fig. 9C is a perspective view of a character sheet arrangement for use with the embodiment of Figs. 9A and 9B;	Having digitalized all Chinese characters and converted them into hexadecimal form, a computerized file system is then established by arranging the digitalized 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. 75
sentation of in Fig. 1B; l equivalent g. 1C;	85	Fig. 9D is a partial perspective view of another modified embodiment of the terminal unit and keyboard according to the present invention.	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. 80
se character representing a haracters;	90	Fig. 10 is a perspective view of a Chinese matrix printer;	Each group of 2,400 characters is divided into 160 sections. Each section has 15 characters of the same <i>Standard Chinese Phonetic Syllable</i> . The 160 sections are arranged in alphabetical order according to the Standard 37 Chinese Phonetic Alphabets. 85
form of the ig. 2A;	95	Fig. 11 is a schematic diagram showing the electrical connection between the buffer and matrix print head;	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. 90
presentation wn in Fig.	100	Fig. 11A is a side view of the matrix print head of Fig. 11;	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 95
l equivalent ig. 2C;	105	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	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 100
se character representing a aracters;	110	Fig. 13 is a perspective view of a terminal unit and keyboard of another modified embodiment of the present invention.	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. 105
ed form of is shown in	115	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.	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 110
resentation of Fig. 3B;	120	Digitalization of Chinese Characters	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 115
l equivalent g. 3C;	125	An important aspect of the preferred embodiment of this invention is that the Chinese characters used in the signal generating means of the invention are digitalized by means of a 24×20 matrix (480 grid points) and each digitalized character is, in turn, represented by 120 hexadecimal digits.	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 120
a preferred alized char- ith the pre-	130	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 20×24 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.	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 125
ese charac- each group section com- h character ode units of	135	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 130	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 130
ster file for ith this in-	140	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 135	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 135
a showing a a processing to this in-	145	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 140	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 140
of the right nel showing group selec- on selection, cter number	150	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 145	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 145
levation of l panel and h associated	155	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 150	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 150
ive view of	160	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 twenty four rows for sufficient clarity, although it only takes sixteen out of twenty columns in the matrix. The character "Tieh", shown in 155	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 155

4 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. 5 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 5th character will require only one digit space. 10 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 15 the digitalized character can be retrieved, the following techniques 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 two bits in a binary system. The reason that fifteen 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 40 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.

45 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) 60 retrieve the digitalized data for the character corresponding to a file system number from the storage device; (c) convert the hexadecimal digit data to binary form; (d) feed the converted data to a buffer storage means and

control the buffer storage means for driving at 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 4096 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 push-buttons 135—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-

for driving 65
display unit,
and (2) to
the ASCII
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page device.
ion is 22
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transmit and
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Figs. 6, 7A, 110
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selection, 15
tons 133—
ection, and 115
as 132, 134,
0 for opera-
means are
plying there-
the file sys- 120
push-button.
l for "pei"
tons 134 is
esenting the
system num- 125
section 016
5 of push-

buttons 133 is pushed to send signals repre-
senting the second digit to the fifth digit,
and the sixth digit of the file system number,
respectively.

5 In Figs. 8 and 9, a character reference
sheet 16 is provided for each group of sec-
tions, there being four reference sheets 16.
The sheets are positioned relative to the push-
buttons 131 so that there is one section corres-
ponding to each push-button. Preferably, the
10 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
15 push-buttons 134 and located under keyboard
13. Push-buttons 131 are transparent and dis-
play the sections on the respective sheets
therethrough. Preferably the transparent push-
buttons 131 act as magnifying lenses to facili-
20 tate reading of the characters on the sheets.
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
25 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.

30 By searching through the 160 section push-
buttons 131—131, any one of the 2,400 char-
acters for a given group can be read from
the character reference sheet 16 positioned
under the keyboard panel 13. As can be seen
35 from Fig. 6, all of the 160 section push-but-
tons 131—131 are in the form of a magnify-
ing lens to enable clear reading of the char-
acters.

40 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 sys-
tem number.

45 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
50 (see Figs. 7A and 7B).

When a particular Character Number but-
ton 133 is pressed, a digit is generated to
indicate which number is pressed, and if
desired, a push-button 132 can be provided
55 which is pushed after pushing any one of
push-buttons 133 to produce a EOB (End of
Block) 132 code signal. Note that on the key-
board the Character Number push-buttons
133—133 are designated as 1, 2, . . . , 14, 15.
60 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
65 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 in the signals representing
the five digit file system number sent from
the keyboard 13 and the five-digit file system
70 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 key-
board panel to prevent movement of character
reference sheets 16. 75

In addition, in accordance with the inven-
tion, the quick direct operation by the opera-
tor to look up all sections of characters shar-
ing the same part of the Chinese phonetic
alphabet is facilitated by colouring 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
85 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 hav-
ing the same initial sound 90

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 95
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 incorpor-
ated therein which are turned on when the
100 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 por-
tion 232a extends upwardly from the surface
of the keyboard and a horizontal portion 232b
extends horizontally from the upper end there-
of. A character sheet 233 is provided which
has printed thereon sections having the char-
acters within the sections in the same manner
as illustrated in Figs. 7A and 7B. The char-
acter sheet 233 fits removably into the U-
shaped channel frame 232 and the printed
sections overlie corresponding switches 231,
110 so that simple finger pressure on the sheet
on a desired section actuates the switch there-
beneath, and the section of the sheet is illu-
minated from beneath by the light in the
switch. The remainder of the keyboard 13
120 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 125
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 printer.

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", 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 driver 153 which is, in turn, electrically connected to buffer storage means in display unit 11, the buffer storage means here being designated 146, through register 147 by conductors 148—148 and 145—145. 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. Twenty four 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 simultaneously 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 and 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 driver 153 is mounted on a support member 157. When wire driver 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" in diameter and the total length of the line of 24 pieces of wire would be about 0.24". In a length of 1/4" 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 then 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

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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.

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10 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 10165 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.

20 Chinese Teletype System 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.

25 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 Terminal Number", which is displayed on the display device or buffer storage means 146 (see Fig. 11). The operator on the sending terminal then enters the receiving terminal number through the Character Number buttons 133—133 on the keyboard 13 and then presses EOB key. The message handling control program in the CPU 20 then reads in the message from the display buffer storage means 146 of the sending terminal 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 message from one terminal to another is completed.

55 Alternative Typing System.

60 An alternative typing system can be provided in which the 160 section push buttons 131—131 on the keyboard 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 opera-

tor, for example through a window 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 buttons 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 section number, the section number is now entered manually through the numeric buttons 133 and 241. The alternative 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 basis.

Alternative Message Switching System

85 As in the alternative typing system, the character is entered as well as transmitted and switched one character at a time in the alternative message switching system. The section push buttons and display device are eliminated in the alternative system. The section number is entered manually through the numeric buttons.

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.

95 Although the foregoing is specific to Chinese ideographic characters, it is also applicable to the English word. For example, considering the English word "international" using the present method, the word "international" would be treated as an entity and is therefore stored as a word and assigned a fixed numeric code. An English overlay can be created and the word can be located under "I" or "INT'L" for brevity. If one wished to type the message "International Business Machines Corporation" using the existing method, 40 alphabetic letters would have to be typed and for transmission 280 bits of data would have to be transmitted (7 bits per letter). In using the method of the present invention, one has only to press the keys 8 times (twice for each word) and for transmission by the present method only 56 bits of data are required (14 bits per word). The present method thus can be extended to cover an English word or the corresponding word in another language using the Roman alphabet. The advantages for doing so are:—

1. increased typing speed, i.e. two keys per word;
2. reduced message transmission time, hence reduce load on communication facilities; and
3. elimination of misspelling of words.



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WHAT I CLAIM IS:—

1. A means for storing, retrieving and reproducing individual characters from a plurality of characters, comprising a plurality of sheets equal to a selected number of groups of the characters in which groups the characters are arranged according to the frequency with which the characters are used, each sheet having a plurality of sections arranged thereon and each section having a selected number of characters therein each having a common characteristic, a keyboard 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 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, 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, a storage means for storing code units representative of the characters according to a file system in which each code unit is assigned the corresponding file system number, access and retrieval means coupled between said signal generating means for said switches and storage means for gaining access to said storage means and retrieving the code units for characters corresponding to the file system numbers from said signal generating means, and character representing 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 fifteen characters in each section and fifteen switches in said third plurality of switches.
3. Means as claimed in claim 1 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 one hundred and sixty sections and one hundred and sixty switches in said second plurality of switches, and there are fifteen characters in each section and fifteen switches in said third plurality 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 different 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 transparent 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 the code units 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-four by twenty grid points, and said code units received from said access and retrieval means are binary digitalized discrete characters on a matrix of twenty-four by twenty 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. Means for generating signals corresponding to file system numbers for a character of a plurality of characters whose position in a file system are identifiable by a numeric code, comprising a sheet having characters thereon arranged according to the frequency with which the characters are used, and divided into sections with each section containing characters having a common characteristic, a keyboard having a number of switches corresponding to the number of characters in a section, means for placing said sheet in juxtaposition with the switches with the characters in a section in positional correspondence with said switches, and means connected to the switches for generating signals, upon actuation of selected ones thereof, which are representative of respective ones of said plurality of characters.

22. A means for generating signals corresponding to file system numbers for a character in a plurality of characters, comprising a plurality of sheets equal to a selected number of groups of the characters in which groups the characters are arranged according to the frequency with which the characters are used, each sheet having a plurality of sections arranged thereon and each section having a selected 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.

23. Means as claimed in claim 22 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.

24. Means as claimed in claim 22, 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 one hundred and sixty sections and one hundred and sixty switches in said second plurality of switches, and there are fifteen characters in each section and fifteen switches in said third plurality of switches.

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

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

27. Means as claimed in claim 22, 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.

28. Means as claimed in claim 27 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.



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

5 30. Means as claimed in claim 22 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 31. Means as claimed in claim 30 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.

15 32. Means as claimed in claim 30 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.

20 33. Means as claimed in claim 30 in

which said sheets are individual sheets which are held by said positioning means one at a time.

25 34. Means as claimed in claim 30 in which said sheets are attached to each other in the form of a booklet.

30 35. Means as claimed in Claim 1 substantially as hereinbefore described.

36. Means as claimed in Claim 21 substantially as hereinbefore described.

MICHAEL BURNSIDE & COMPANY,
Chartered Patent Agents,
36 Westminster Palace Gardens,
Artillery Row,
London SW1P 1RR,
Agents for the Applicants.

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