SPECIFICATION

A portable keyboard device

This invention relates to portable keyboard devices and it particularly relates to a portable electronic word-processing unit.

Known, non-portable word-processors are electronic keyboard devices which can manipulate, or process text input to the device as alpha-numeric characters from a keyboard in response to a programme and instructions input to the device via the keyboard and pass the processed text on to printing or other devices.

Any word-processor should include the features of:—

a "cursor", to enable any part of the text stored in a memory to be displayed;
"editing", to enable the insertion, deletion or correction of text; and
"print formatting", for the control of a printer for the "lay-out" of edited text when it is printed, such as left and right margin justification and/or tabulation and/or margin indenting and/or end of page pause.

The term "non-portable" is meant, in the context of this description, to be a device which is not self-powered and is not capable of being operated whilst held in the operator's hand.

A portable electronic keyboard device is known in the form of a portable teletype machine which will store alpha-numeric character text and typing instructions input to the machine in much the same way as a conventional teleprinter, the machine also having the facility to allow any text in the display to be deleted before it is stored. This facility does not make such a machine a word-processor within the meaning of this description.

It is an object of the present invention to provide a portable electronic word-processor capable of editing and storing input alpha-numeric text and of controlling the printed format of the edited text when the word-processor is connected to a printer.

According to the present invention, a single hand portable word-processor comprises the following components in the one housing:-

(i) a micro-processor and, connected thereto,
(ii) a manually operable input chord keyboard having only four finger keys and at least one thumb key;
(iii) an alpha-numeric display device;
(iv) output means to enable the word-processor to be connected to a printer;
(v) memory means; and
(vi) an internal power supply connected to supply power to all the aforesaid components; the micro-processor having the facility of responding to signals produced by operation of a chord of keys, comprising an combination of one to a maximum of five keys, to generate coded signals representing each alpha-numeric character of a particular alpha-numeric system, having a total number of characters greatly in excess of the number of keys, and representing processing instructions, the micro-processor also having the facility to process the character signals in response to the instruction signals, feed signals to the display device, for display of processed characters as an edited text, and to the memory means, to store the edited text and to store print-format instruction signals available for transmission through the output means.

By "single hand portable" is meant a device which can comfortably be held by one of an operator's hands to be operated only by the other or supported against a surface to be operated only by one hand.

In a first embodiment of the invention each one of the four finger keys is positioned so as to be preferentially operated by a respective one of the fingers of an operator's hand the thumb key is conveniently positioned to be operated by the operator's thumb.

In a preferred embodiment of the invention, two thumb keys are provided, each key being conveniently positioned to be operated by the operator's thumb.

The invention is illustrated, by way of example, on the accompanying drawings, wherein:-

Fig. 1 is a plan view of a word-processor in accordance with the invention,
Fig. 2 is an end elevation of the processor of Fig. 1,
Fig. 3 is a block circuit diagram for the processor, and
Figs. 4*a* to 4*d* are charts illustrating key-operator codes for alpha-numeric characters and punctuation.

The word-processing unit 1 shown by Figs. 1 and 2 has a main body part generally in the form of a truncated square pyramid.

The rear face 3 of this pyramid is essentially planar and is intended to be used as a rest for the heel of an operator's hand. The opposite face 4 carries four keys 5, 6, 7 and 8 arranged to be operated solely by the first, index, ring and little fingers respectively of the operator's hand. A side face 9 of the body pyramid 2 carries two further keys 10 and 11, each to the operated by the operator's thumb.

With these two "thumb" keys 10 and 11, two five-key keyboards are produced, each being operable by movement of the fingers and thumb of an operator's right hand without relative movement between that hand and the rest 3. A suitable five-keyed keyboard being described in United Kingdom Patent Specification No. 1496522.

The front face 4 of the main body has a forwardly and upwardly sloping extension 12 that carries an alpha-numeric display 13 that can show characters produced by selective operation of any one key of a combination of up to a maximum of five keys.

Each key consists of a button mounted to operate a conventional micro-switch and, as shown by Fig. 1, the finger keys 5, 6, 7 and 8 are each set in ellipsoidally concave insets in the front face 4. These insets serving to guide and help retain the appropriate finger against the respective finger-key.

As shown by Fig. 2 the rear face 3 of the main body part also contains an ON-OFF switch 14, a Charger Socket 15 and a Data Socket 16.

The electronic circuit for the unit is illustrated in block diagram by Fig. 3 which shows a CMOS 8 bit micro-processor μP (RCA type CDP 1802) to which are connected the six key keyboard 2, an 8192 byte CMOS RAM memory (8x Toshiba Type TC 5047P), a 12 character alpha-numeric LED display (Litronix Type DL 1416), a 2048 byte CMOS EPROM memory (Intersil Type 1M 6604) and an input/output circuit 17 connected to the DATA socket 16. The input/output circuit is to enable the word-processing unit to communicate with an external device such as a printer. Other external devices could be a TV or monitor visual display unit or a cassette recorder to provide additional magnetic storage.

The unit is powered from a re-chargeable battery pack 18 connected to the Charger Socket 15. The ON/OFF switch 14 generally controls the supply of power (voltage) to the device with the exception of the RAM memory which has a direct connection to the battery pack 18, by-passing the ON/OFF switch. This effectively renders the RAM memory non-volatile. Thus data can be retained in the RAM memory with the unit switched-off as long as sufficient power remains in the battery pack (this can be up to three weeks).

A resident programme is stored in the EPROM memory that enables the word-processing unit to operate in the manner to be hereinafter described. The programme per se is not thought to be unique and does not form part of the present invention. It is believed that sufficient information will be given in the description to enable a suitable programme to be written.

In use, the processor μP scans the keyboard micro-switches and starts to assemble a character when any key is depressed (operated). This process continues until all the keys in a particular character code have been released, at which point the assembled code is converted to ASC11, 7 bit code and stored in the memory RAM.

Characters assembled and stored in the memory RAM form a text that can be accessed by keying various control-code characters in order to cause any selected part of the text to be displayed on the display 13, the "cursor"; to edit the text stored in the memory (RAM); or to store print formatting instructions.

The unit's resident programme provides most of the aforesaid editing and print formatting facilities found in conventional, non-portable word processors.

The resident programme detects low battery voltage and warns the operator with a message (CHARGE-ME) on the display 13. The resident programme also enables the word-processing unit to communicate, via suitable interfaces, with a number of external devices such as a Daisy wheel printer, a TV or monitor screen display, a dictaphone micro-cassette drive or a Modem/accoustic coupler. The programme permitting operator-defined areas of text stored in the memory RAM to be transmitted through the input/output circuit 17 to an external device connected to the DATA socket 16. In the case of a printer of screen display, the programme automatically formats the text, justifies left and right margins and sets tabs.

The programme also enables text to be read into the memory RAM from an external device connected to the DATA socket.

In scanning the keyboard micro-switches, the micro-processor μP is programmed to respond to operative strokes of the keyboard. An operative stroke being defined as the acts of operating and then releasing a single key or the acts of operating the keys of a selected keys-combination, either simultaneously or sequentially, and then releasing the operated keys; the stroke being completed when the or all the operated keys have been released. Completion of an operative stroke being the condition for the processor to store an assembled code representing a particular character.

Fig. 4 illustrates a particularly suitable operator code for use with the keyboard device. The arrangement of the keys corresponding to a given pattern of five points of which a point or points combination lies on the outline of the majority of the alphabet letters of a given type face, the relationship between unique signals produced by operating selected keys or key-combinations and the alphabet letters represented thereby being such that, for such majority of the alphabet, there is a graphic correlation between a letter and the point or points-combination occupied by the key or keys-combination for an operative stroke required to generate the unique signal representing that letter.

The figure shows a series of 31 five-point patterns being the maximum number of ways of combining five points. Each point represents the nominal position of one key being, from left to right, the thumb key 10, the index finger key 5, the middle finger key 6, the ring finger key 7 and the little finger key 8 respectively.

A black point represents a key to be operated and the alphabet letter or other character represented by that particular point or points-combination is shown in its pictographic relation, wherever this is possible, with that point or points-combination. These characters that can be entered

into the word-processor unit by simple operation of the five keys 10, 5, 6, 7 and 8 are referred to as the alphabet register.

For this alphabet register, operation of the thumb key 10 alone signals a SPACE; finger keys 5, 6 and 7 signals a FULL STOP; finger keys 5, 7 and 8 a COMMA; keys 10 5, 6 and 8 an APOSTROPHE and finger keys 5, 6 and 8 a DASH.

The other thumb key 11 is a control key, the operation of which puts the unit into a punctuation and numeric register. The points codes for punctuation and numbers are also given by Fig. 4. It will be seen that the number codes follow the conventional deaf and dumb sign number system.

Operation of this thumb control key 11 in combination with the four finger keys 5, 6, 7 and 8 provides another five-key keyboard and this second keyboard is used to input control or processing instructions to the word-processing unit. The control instructions listed below are given by means of codes based on the equivalent alphabet letter codes. For convenience these are denominated by the letter underlined, for example D the code signal produced by operation of the thumb control key 11 with finger keys 5 and 6.

CONTROL	KEY COMBINATION	DISPLAY
Register switch	Key 11	—
Upper case: single character	Y; Keys 11, 6, 7	—
Upper case lock	P; Keys 11, 5, 6, 7, 8	—
Unlock upper case	Y, P	—
Single space forward	F; Keys 11, 5, 6, 7	Display advances by one space.
Continuous forward read	Y, F	Display reads forward continuously.
Single space backward	K; Keys 11, 7	Display goes back one space.
Continuous backward read	Y, K	Display reads backwards continuously.
Halt	H; Keys 11, 8	Display movement stops.
Single character deletion	D; Keys 11, 5, 6	Character on right of display is erased and is replaced by the next character (or space) in the memory.
Continuous deletion	Y, D	Above process repeats automatically.
Instant deletion	W; W; Keys 11, 5, 7, 8	Memory deleted between signs > and <.
Insertion	I; Keys 11, 5	Flashing symbol  on right of display.
Cancel insertion	Y, I	Above display ceases.
	C; Keys 11, 6	[
Tabulate	R; Keys 11, 5, 7	^
Margin in	,; Keys 11, 5, 6, 8	> (flashing)
Cancel margin in	Y, '	< (flashing)

CONTROL	KEY COMBINATION	DISPLAY
Start printing sign	L; Keys 11, 5, 8	>
Stop printing sign	Y, L	<
Short zip	Z; Keys 11, 6, 8	Display jumps ahead by 128 characters or next > sign, whichever is shorter zip.
Long zip	Y, Z	Display jumps to next >.
Short jump-back	J; Keys 11, 7, 8	Display jumps back to previous >.
Long jump-back	Y, J	START (of memory).
Print (single space)	X; Keys 11, 6, 7, 8	PRINT.
Print (double space)	Y	PRINT.

It is believed that the operator code illustrated by Fig. 4 is easily memorized because although the individual graphic correlation between a selected key or keys-combination for a given alphabet letter might be changed, there is an overall graphic correlation that enables the majority of the alphabet letters to be so represented and this provides a learning framework.

It has been found that use of such an operator code is an effective aid in the use of the word-processing unit because it is easily and speedily memorable.

The use of what is basically a five key keyboard, the additional thumb key providing a second five key keyboard, with the word-processing unit of the invention has the advantages of providing a simpler, smaller and cheaper construction than that of a conventional keyboard because the need for a separate key for each character or control instruction is obviated and the speed of use of this keyboard is comparable with a conventional keyboard as the fingers do not need to be moved from one key to another and the thumb has only to move between two keys and does not have to move when alphabet letters are being inputted to the unit.

Although a right-hand keyboard device has been described and illustrated, it is apparent that a "mirror-image" left-handed device could equally well be produced.

CLAIMS

1. A single hand portable word-processor comprising the following components in one housing:-

(i) a microprocessor and, connected thereto,

(ii) a manually operable input chord keyboard having only four finger keys and at least one thumb key;

(iii) an alpha-numeric display device;

(iv) output means to enable the word-processor to be connected to a printer;

(v) memory means; and

(vi) an internal power supply connected to supply power to all the aforesaid components; the micro-processor having the facility of responding to signals produced by operation of a chord of keys, comprising any combination of one to a maximum of five keys, to generate coded signals representing each alpha-numeric character of a particular alpha-numeric system, having a total number of characters greatly in excess of the number of keys, and representing processing instructions, the micro-processor also having the facility to process the character signals in response to the instruction signals, feed signals to the display device, for display of processed characters as an edited text, and to the memory means, to store the edited text and to store print-format instruction signals available for transmission through the output means.

2. A word-processor as claimed in claim 1, wherein each one of four finger keys is positioned so as to be preferentially operated by a respective on of the fingers of an operator's hand and the thumb key is conveniently positioned to be operated by the operator's thumb.

3. A word-processor as claimed in claim 1 or claim 2, wherein two thumb keys are provided, each key being conveniently positioned to be operated by the operator's thumb.

4. A word-processor as claimed in claim 2 or claim 3, wherein the word-processor has a main body generally in the form of a truncated square pyramid, the front face of which carries the four finger keys and a side face of which carries the or each thumb key.

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Start printing sign	L; Keys 11, 5, 8	>
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4. A word-processor as claimed in claim 2 or claim 3, wherein the word-processor has a main body generally in the form of a truncated square pyramid, the front face of which carries the four finger keys and a side face of which carries the or each thumb key.

5. A word-processor as claimed in claim 4, wherein each of the keys is a micro-switch and the four finger keys are each set in an ellipsoidally concave insert in the front face.

6. A word-processor as claimed in claim 4 or claim 5, wherein the rear face of the main body pyramid is essentially planar and is arranged to act as a rest for the heel of an operator's hand.

7. A word-processor as claimed in any of claims 4 to 6, wherein the front face of the main body pyramid has a forwardly and upwardly sloping extension to carry the alpha-numeric display device.

8. A single hand portable word-processor substantially as described with reference to or as shown by Figs. 1 to 3 of the Drawings.

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