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**H1N 646 651 664 700 707 872 UJ**  
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(56) Documents cited  
**GB A 2135633**    **GB 0966181**    **US 3990565**  
**GB 1016993**    **WO 85/03035**  
**IBM Technical Disclosure Bulletin Vol. 23 No. 10, March**  
**1981 H. D. Maxey, pp. 4611-4613**

(58) Field of search  
**B6F**  
**G4H**  
**H4P**  
**H4K**  
**H1N**  
**Selected US specifications from IPC sub-class B41J**

(54) **Separable keyboard for computer; key with alterable liquid crystal display**

(57) A separable keyboard comprising two separate keyboards each to be operated by a hand. The separate keyboards can be combined to form a keyboard by means of retainers, mortise and tenon joints, pins or magnet. Keys on each keyboard are laid in radiant direction with each transverse row in a form of curve so that operation is comfortably regardless of finger positions. Each key is incorporated with a liquid crystal display to show its mode of function. Power is supplied to liquid crystal display 12 via. conductive wires 17, conductor plates 18 and conductive rubber 13 and when the key is pushed, block 20 displaces downwards so that power is cut off by wires 17 disengaging from conductor plates 18 and conductive leaf spring 15 displaces to keep contact with pins 16 to form a closed circuit. Pushing of the key therefore ends the display and the mode.

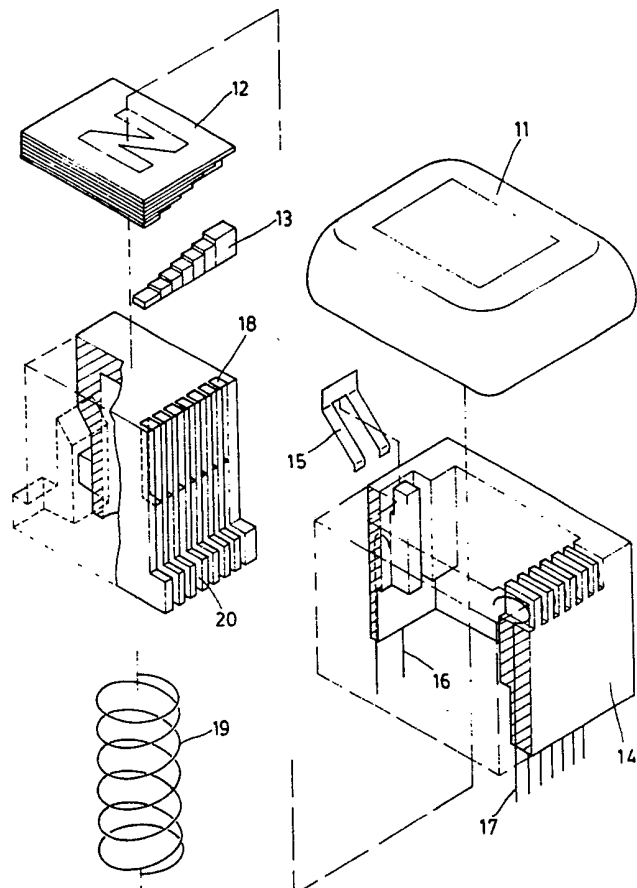


FIG. 10

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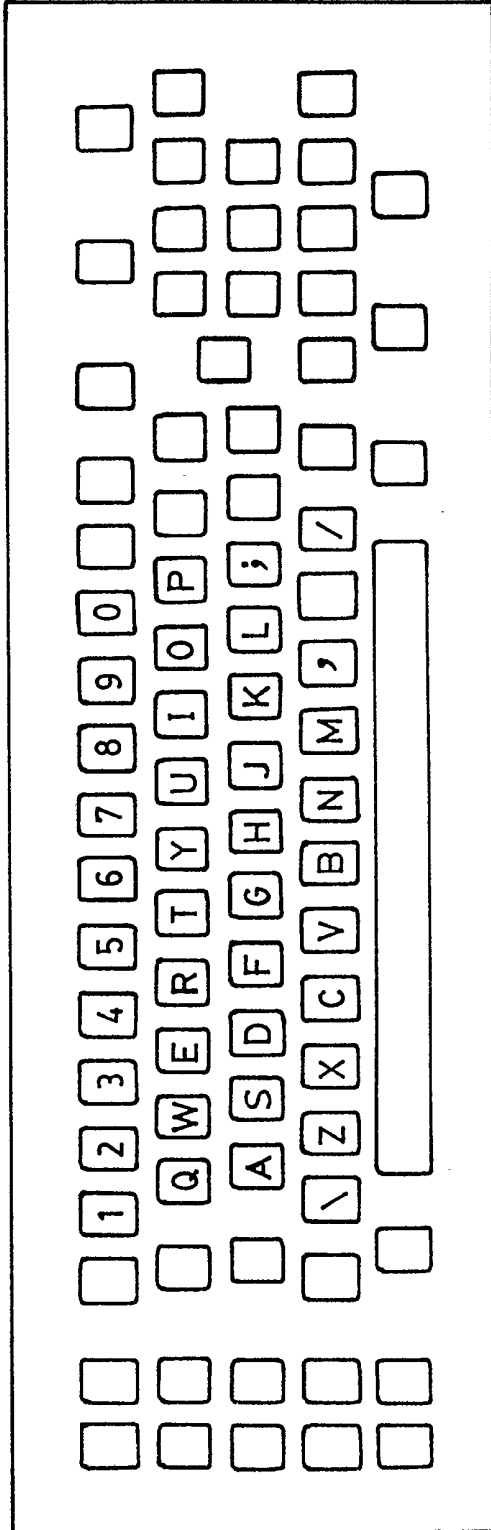


FIG. 1

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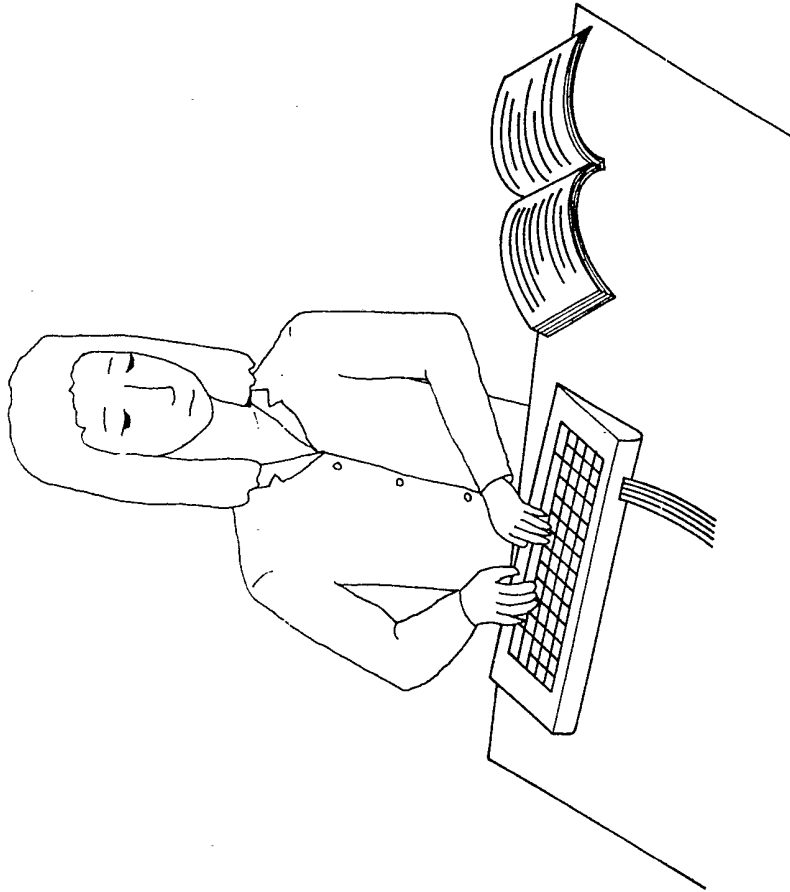


FIG. 2

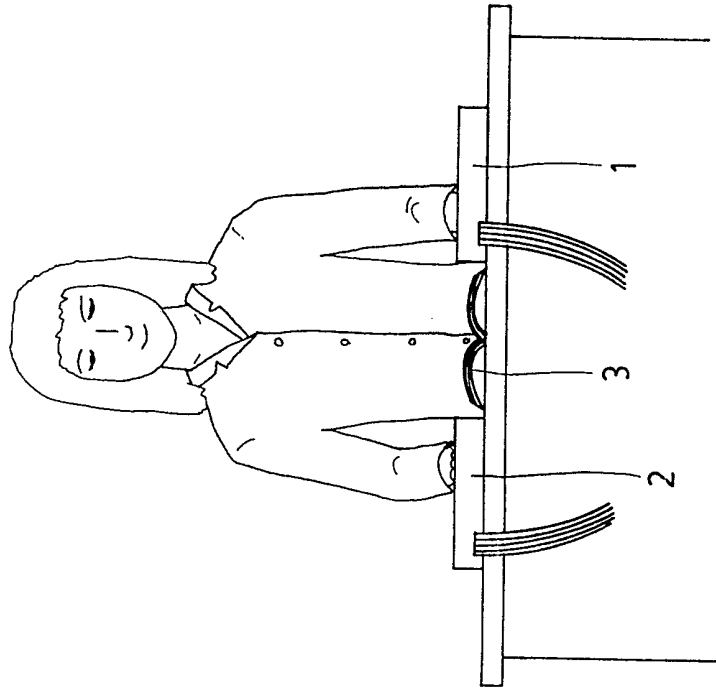


FIG. 4

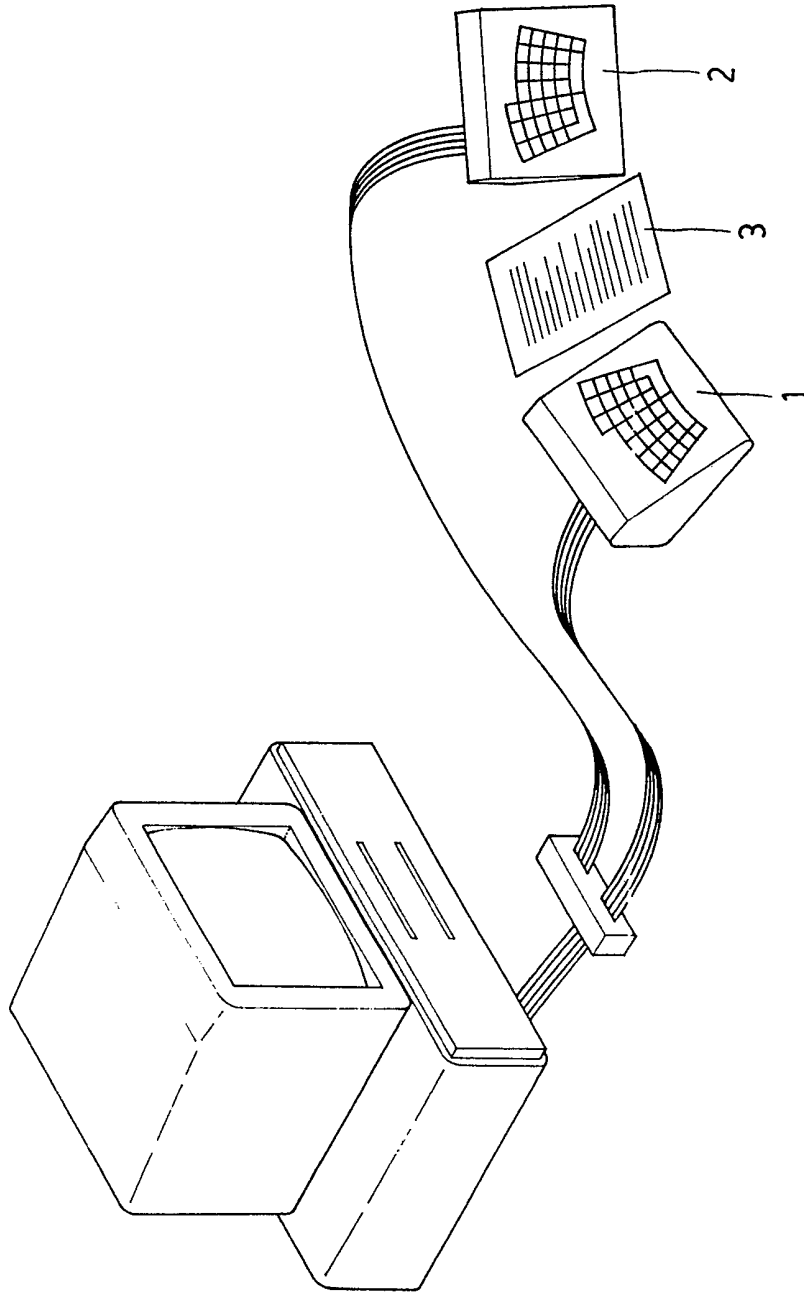


FIG. 3

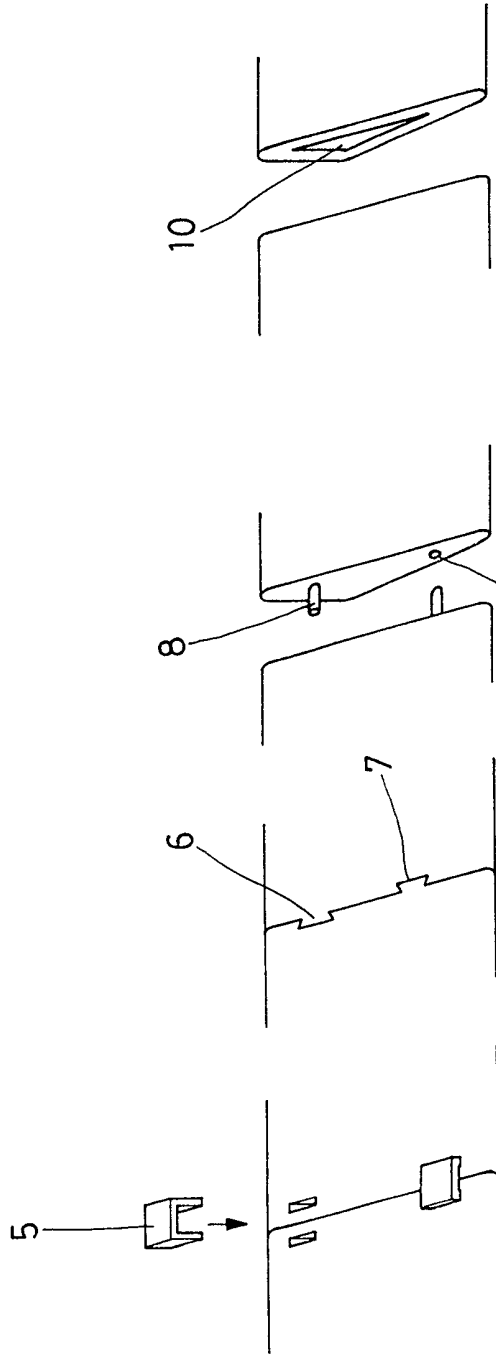


FIG. 8

FIG. 7

FIG. 6

FIG. 5

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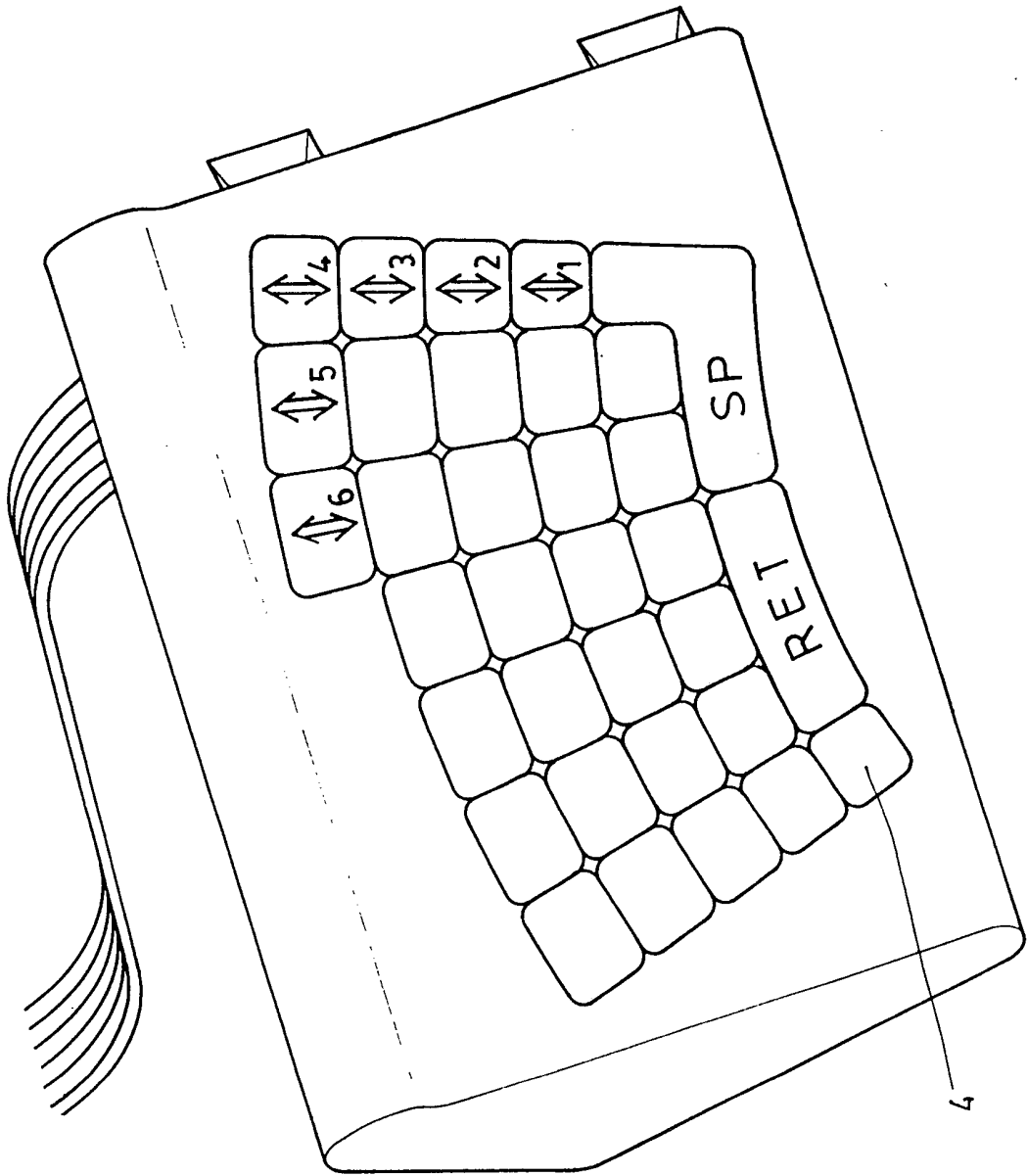


FIG. 9

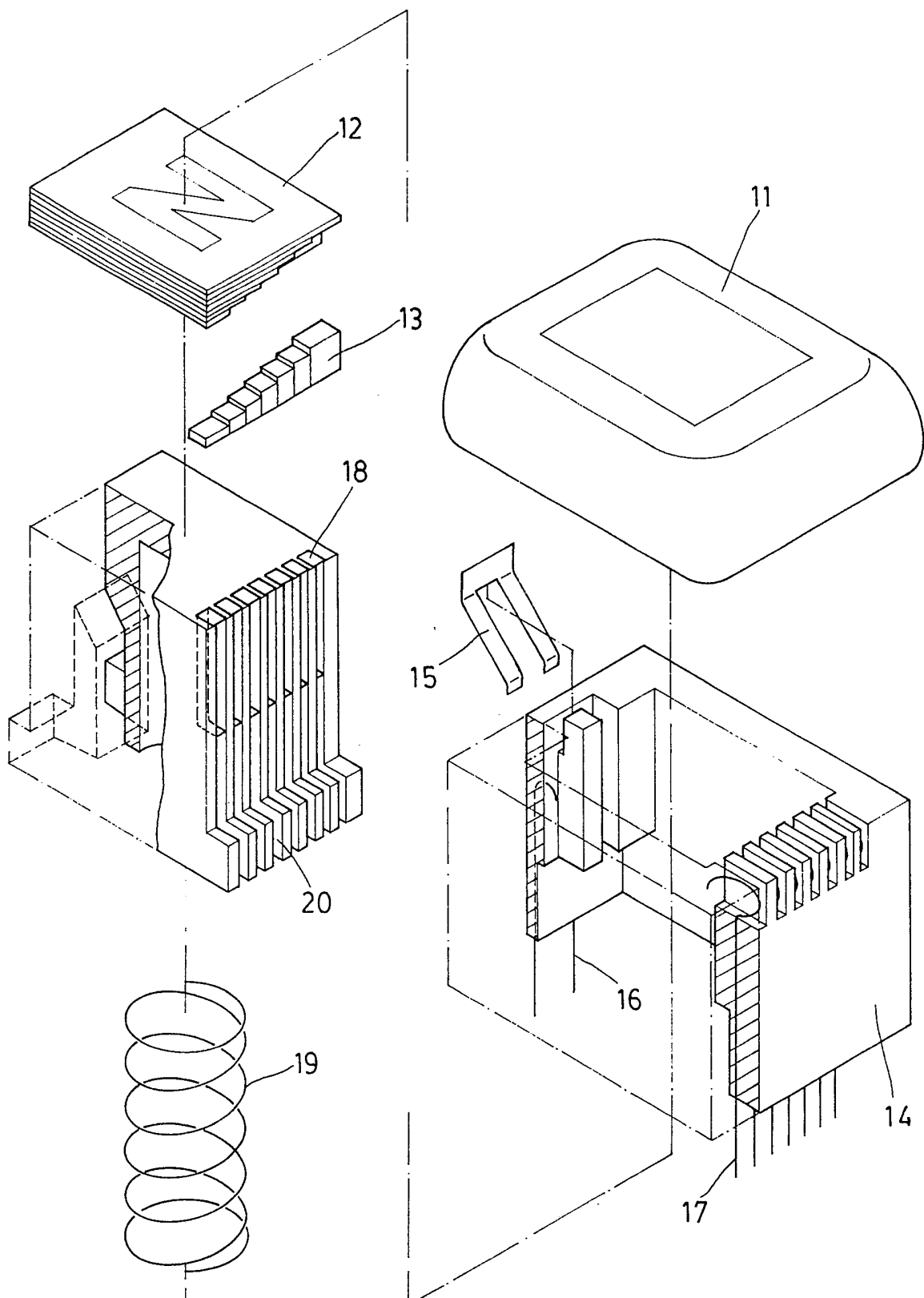


FIG. 10

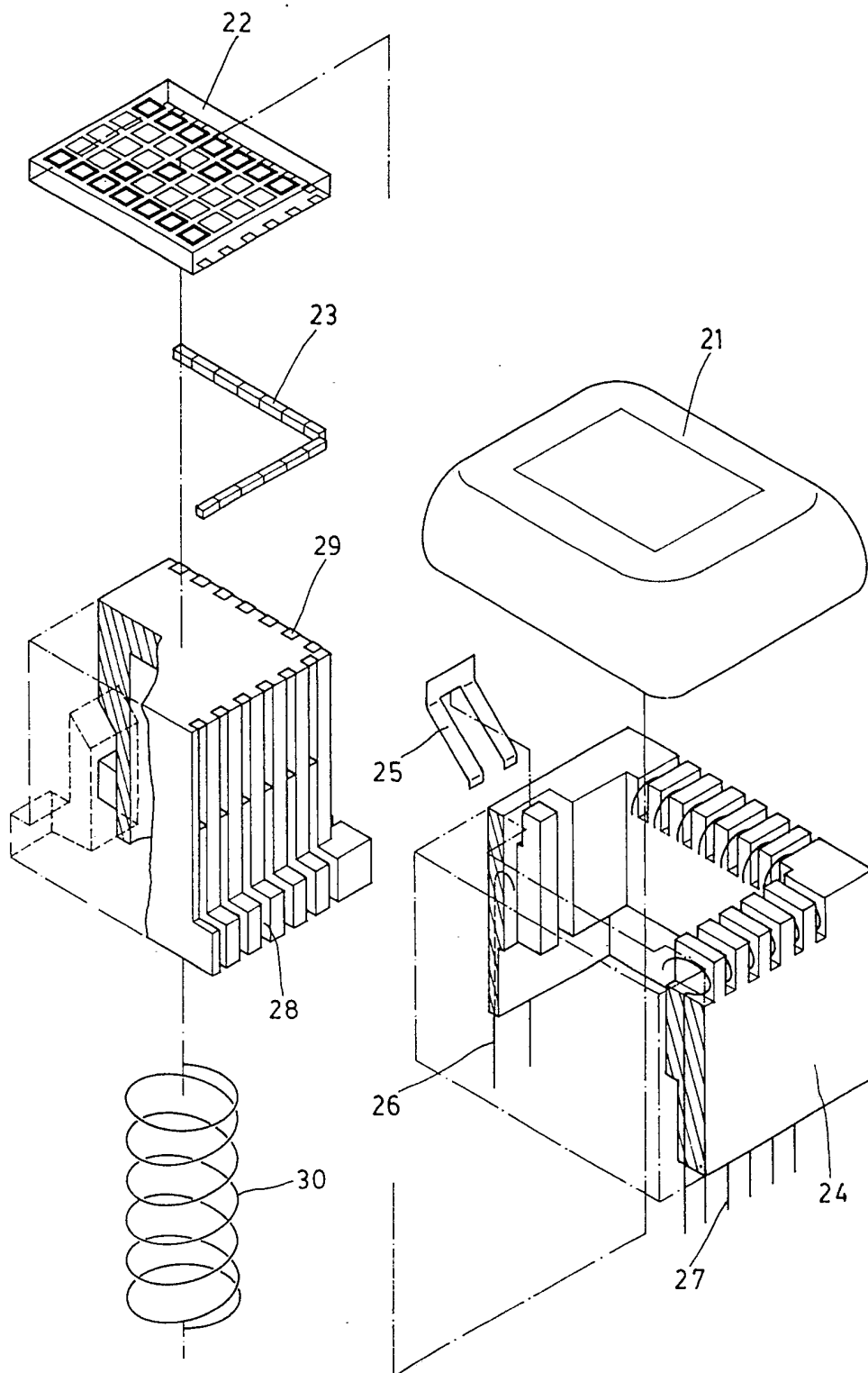


FIG. 11



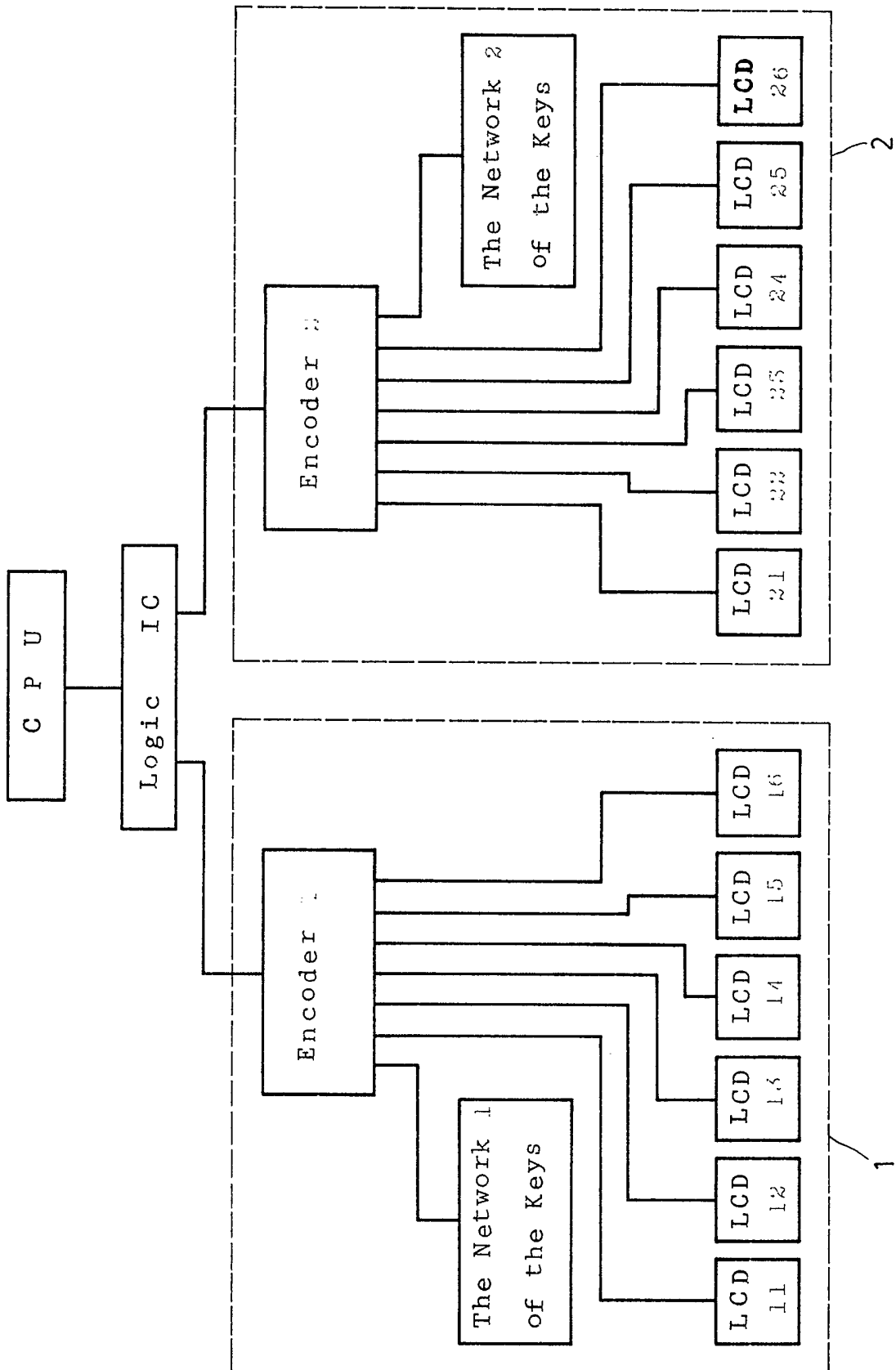


FIG. 12

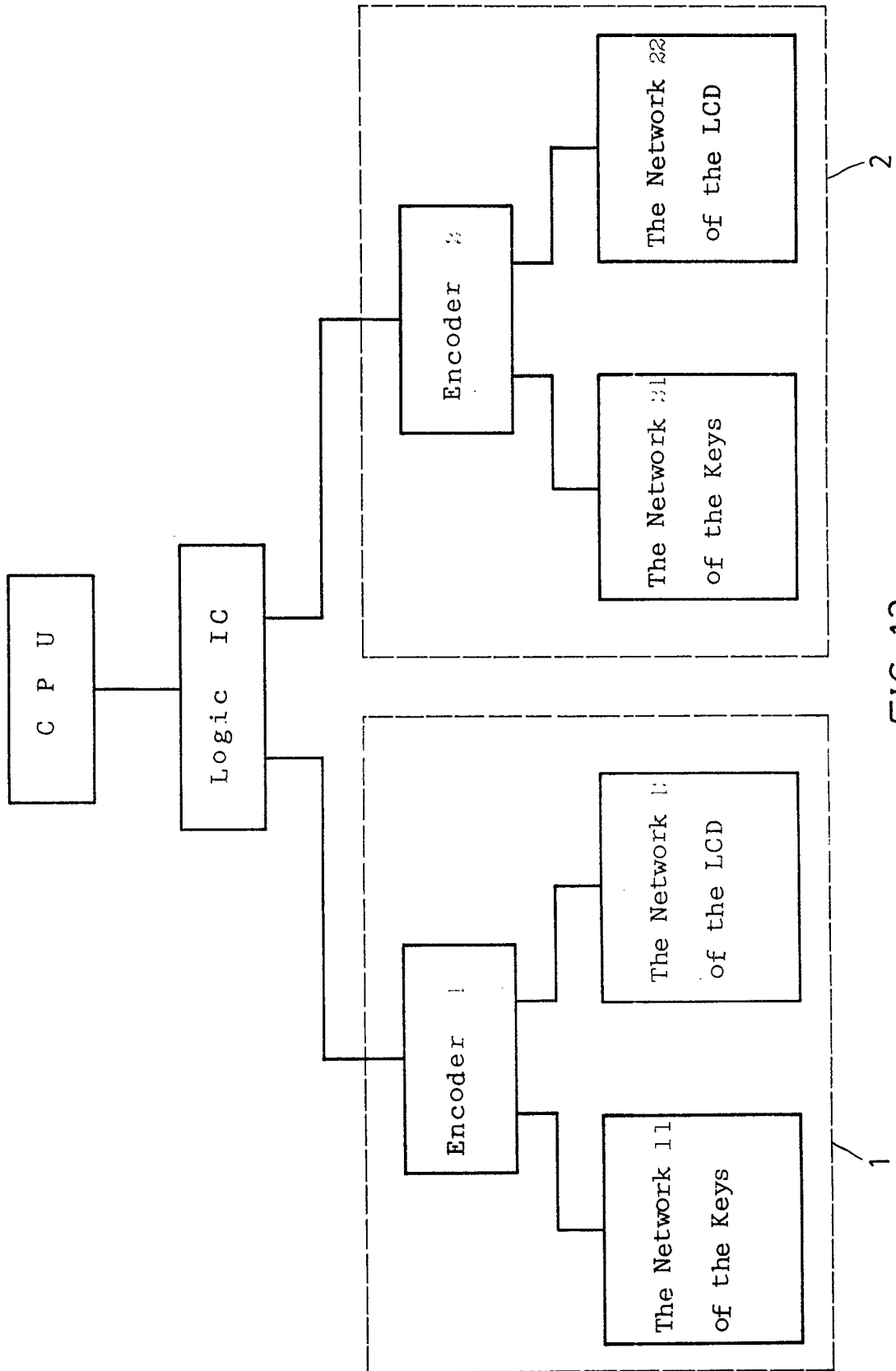


FIG. 13

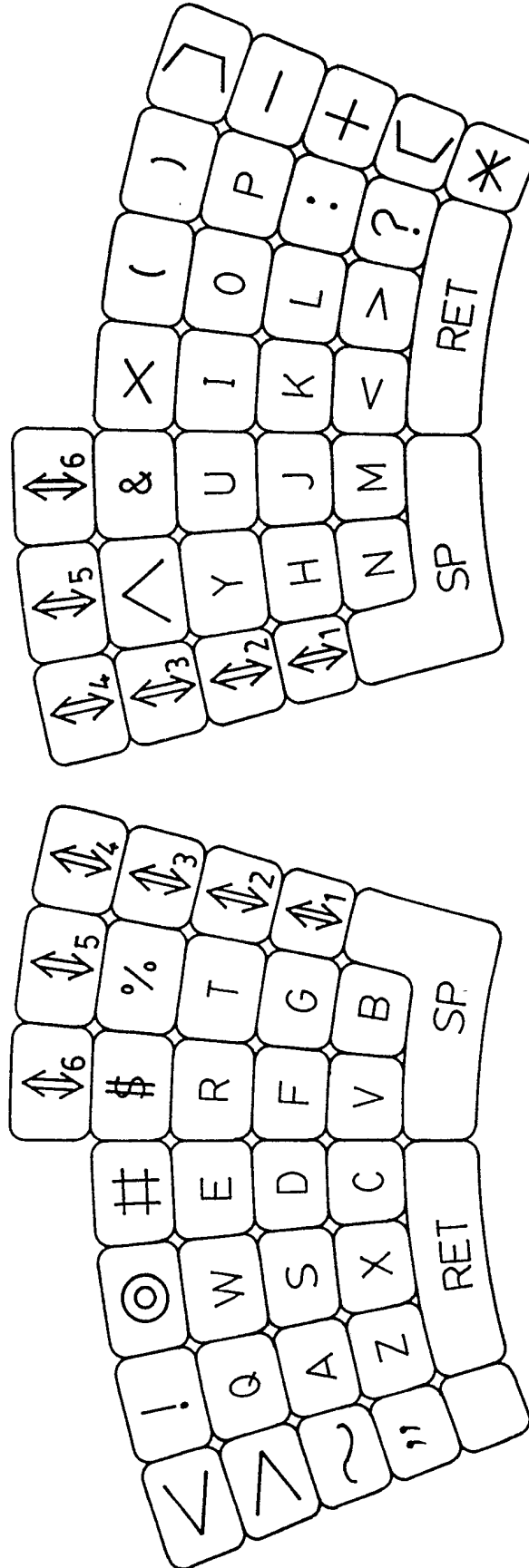


FIG. 14

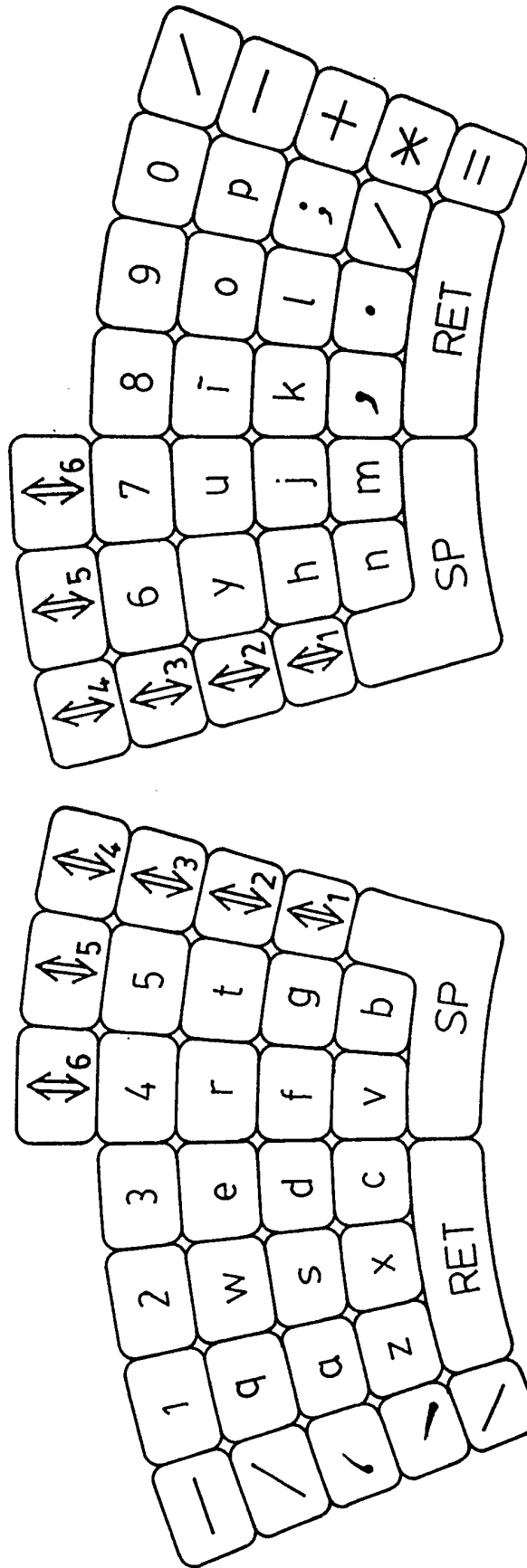


FIG. 15

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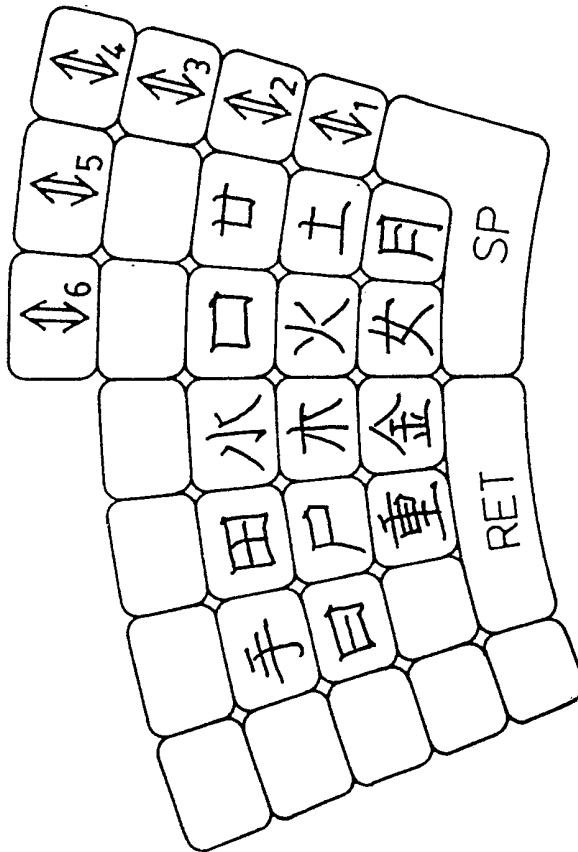
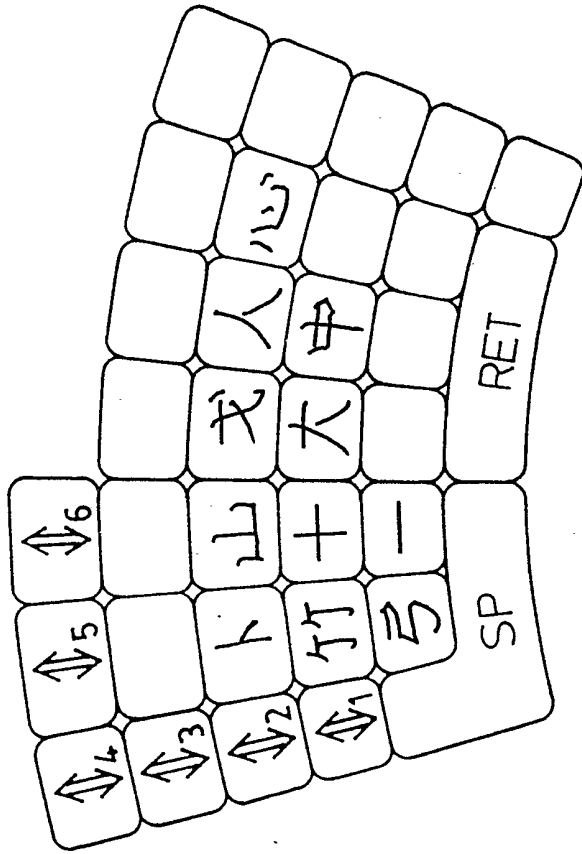


FIG. 16



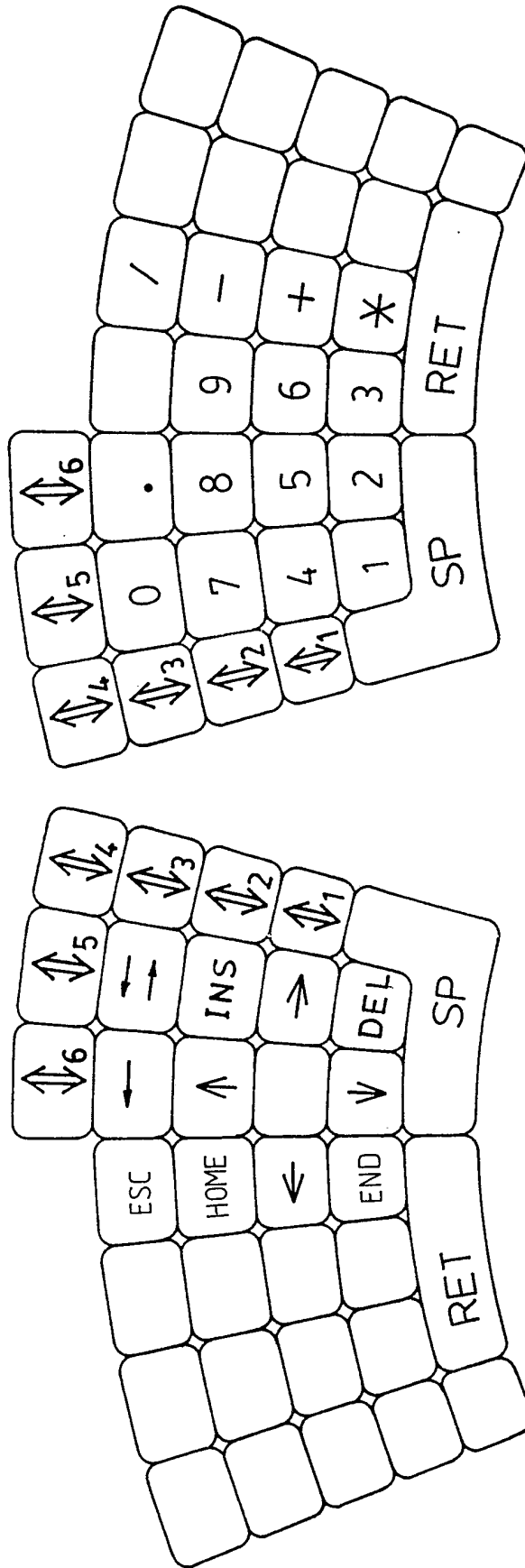


FIG. 18

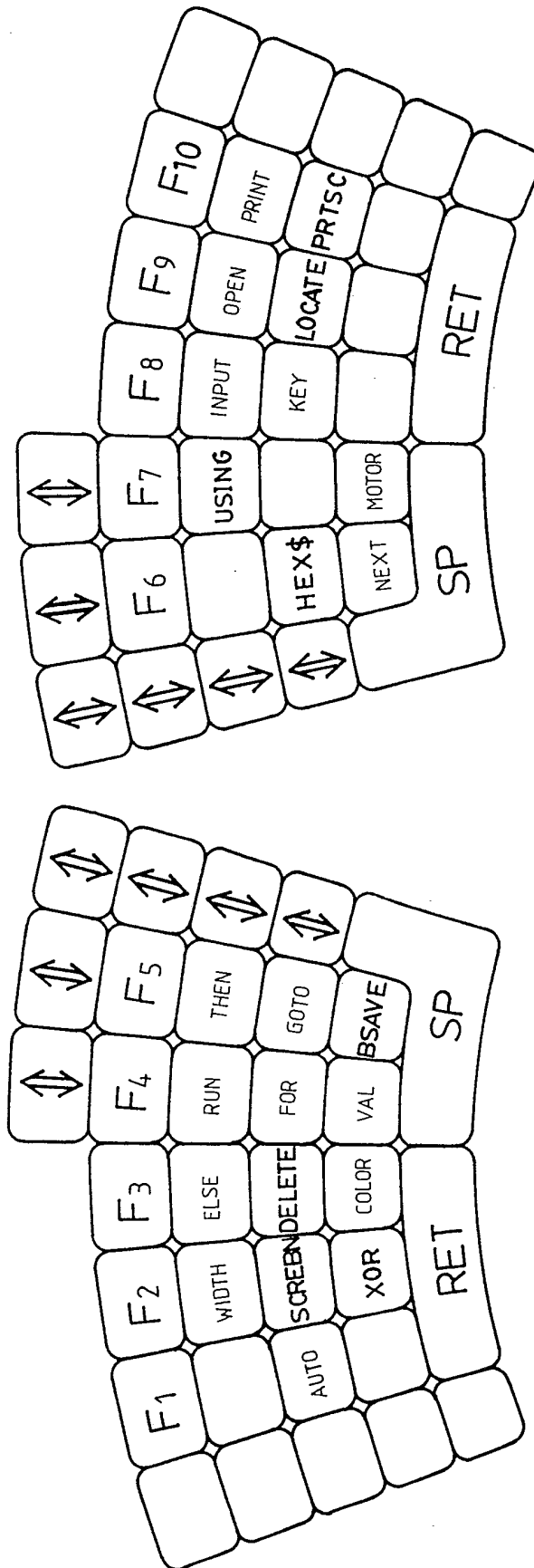


FIG. 19



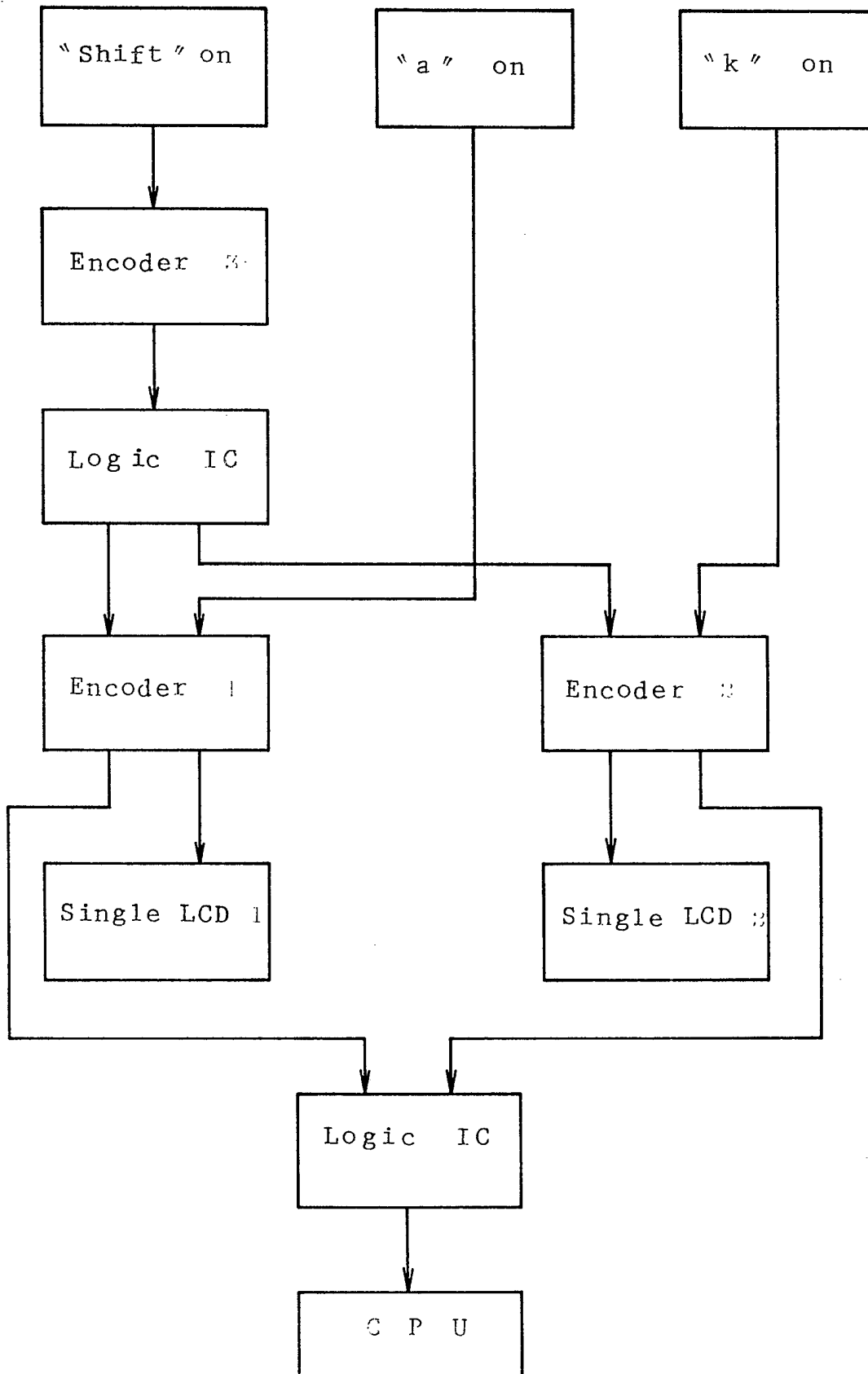


FIG. 20

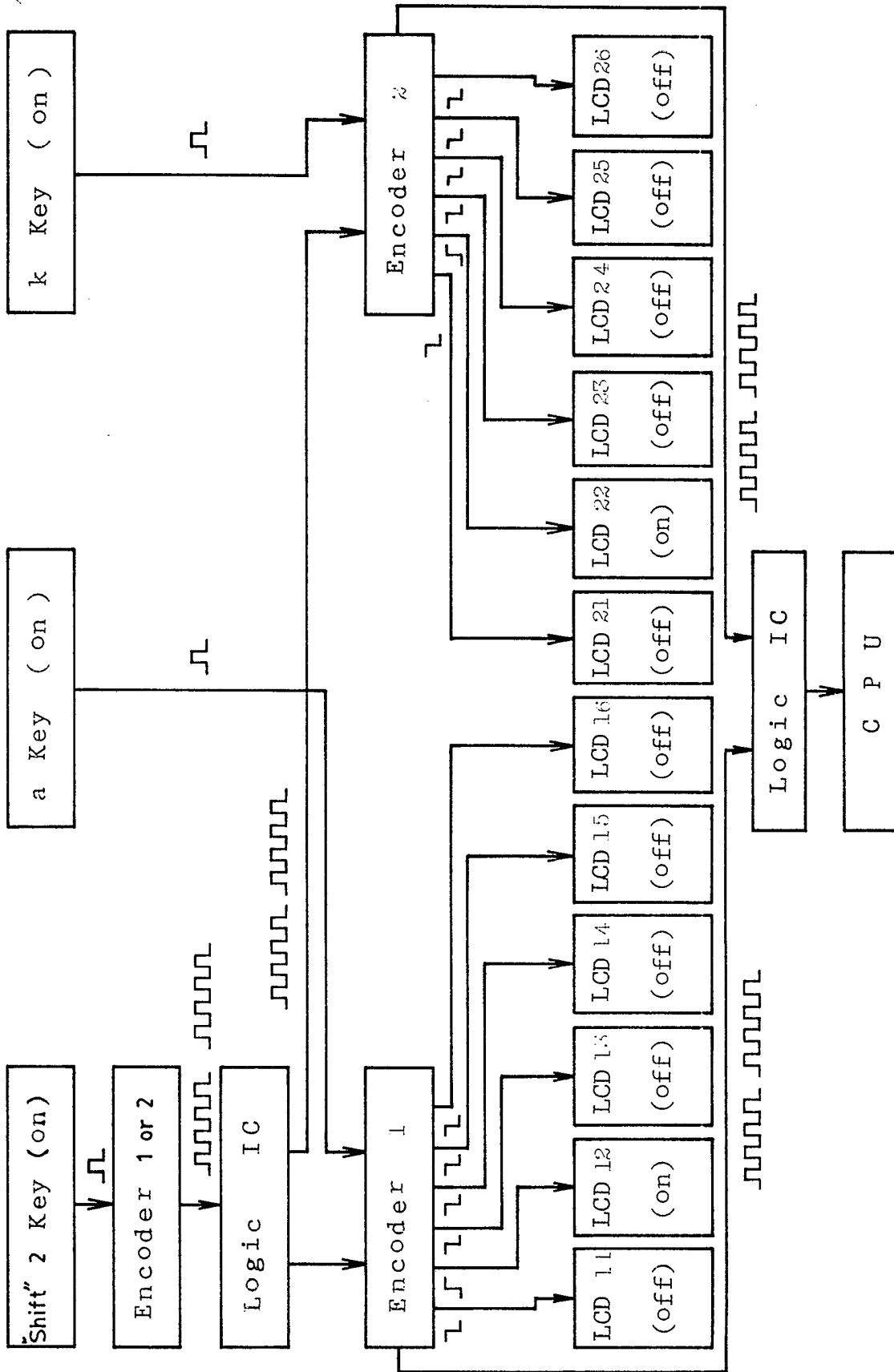


FIG 21

## SPECIFICATION

**Separable keyboard**

5 The present invention relates to a creative design of keyboard for computer, particularly a separable keyboard.

Generally keyboard layout for computer is of Qwerty type, a kind of keyboard layout  
 10 created by Christopher Sholes about 100 years ago and patented by the U.S. Patent and Trademark Office on August 27, 1878, Letter Patent No. 207559. The name  
 15 "Qwerty" refers to the first six letters in the left side of the keyboard—"Q, W, E, R, T and Y". Layout of the keyboard was designed to slow down speed of typing to avoid collision among the key strokes. Normally, keys which are used frequently are located on outer part  
 20 of the keyboard. Then, operator has to let his (her) finger to pass some keys to reach the keys which are used frequently, typing (key-in) speed in thus slowed down. According to some experts, more than a half of strokes is  
 25 done by the left hand. Therefore, load to each finger is different.

Qwerty type keyboard layout arranged the keys in a rectangular space within which fingers of both the left and right hands operate.  
 30 With such a layout paper containing data to be typed must be put beside the keyboard. Then, the operator tends to lean on a side while his (her) hands are put on the other side as shown in Fig. 2. He (she) is not sitting on  
 35 a proper attitude, and he (she) may get tired easily. Therefore, such kind of keyboard is not suitable for using as an input device for computer system.

The present invention is mainly characterized  
 40 by the division of a keyboard into two separate keyboards so that papers containing data to be typed (keyed in) can be placed between the separate keyboards and the operator can operate at a proper sitting position and for a  
 45 long time before he (she) gets tired.

The present invention is further characterized by the radiant arrangement of keys on the keyboard conforming to human engineering to fit extension of fingers and to permit  
 50 comfortable operation.

Another feature of the present invention is the structure of key with display which increases function of key, reduces number of key required, and occupies less space than  
 55 the prior art. It also eliminate error due to operating wrong key.

Another feature of the present invention is the combination of two separate keyboards by means of retainers, mortise and tenon joints, pins or magnet to adapt with the requirement  
 60 for new learner or people who are familiar with the prior art.

Details description of the present invention is given below with reference to the attached  
 65 drawings.

*Figure 1* shows a conventional layout of Qwerty type keyboard.

*Figure 2* illustrates operation of a keyboard of the prior art in improper sitting attitude so  
 70 that its operator may get tired easily.

*Figure 3* illustrates a proper layout of a separable keyboard according to the present invention.

*Figure 4* illustrates a sitting attitude to operate the keyboard according to the present invention.  
 75

*Figure 5* illustrates combination of the separate keyboards by means of retainers.

*Figure 6* illustrates combination of the separate keyboards by means of mortise and tenon joints.  
 80

*Figure 7* illustrates combination of the separate keyboards by means of pins.

*Figure 8* illustrates combination of the separate keyboards by means of magnets.  
 85

*Figure 9* shows a keyboard layout according to the present invention.

*Figure 10* is a fragmental view illustrating a key with multiple LCD display.

*Figure 11* is a fragmental view illustrating a key with single LCD display.  
 90

*Figure 12* is a block diagram for a key with multiple LCD display.

*Figure 13* is a block diagram for a key with single LCD display.  
 95

*Figure 14* illustrates an embodiment of a keyboard with function display.

*Figure 15* illustrates another embodiment of a keyboard with function display.

*Figure 16* illustrates the third embodiment of a keyboard with function display.  
 100

*Figure 17* illustrates the fourth embodiment of a keyboard with function display.

*Figure 18* illustrates the fifth embodiment of a keyboard with function display.  
 105

*Figure 19* illustrates the sixth embodiment of a keyboard with function display.

*Figure 20* is a control logic circuit diagram for the keyboard with function display.

*Figure 21* is a flow chart for operating signal of the present invention.  
 110

As shown in Fig. 3, the separable keyboard according to the present invention is composed of two separate keyboards 1 and 2 each to be operated independently by a hand of an operator. Papers 3 containing data to be keyed in may be placed between the keyboards 1 and 2 so that the operator can maintain a proper sitting position, read the data easily and will not feel tired after prolonged operation (see Fig. 4).  
 115

To adapt with learners or people who are familiar with the conventional keyboard, the present invention can have the two separate keyboards 1 and 2 combined into a single one. Fig. 5 illustrates the way of combination. Retainers 5 are used to combine the two keyboards 1 and 2. Or, as shown in Fig. 6, mortises 6 and tenons 7 are used, or as shown in Fig. 7, pins 8 and hokes 9 are used to  
 120  
 125  
 130

combine the keyboards 1 and 2. Or even as shown in Fig. 8, magnets 10 at conjunctive sides of the keyboards 1 and 2 are used to combine them by attractive force.

5 Fig. 9 illustrates a layout of keys 4 according to the present invention. they are laid in a radiant form in a way identical to the directions of respective fingers while extended. It is a layout conforming to the human engineering. Each transverse row is arranged in a curve so that operator can operate the keyboards comfortably regardless of his finger position.

10 The present invention has unique keys with function display to extend function of key and to reduce number of keys required in order to minimize size of keyboard and to eliminate error due to wrong key operation.

15 Among the keys 4 on the keyboards there are fixed function key and variable function key. The fixed function keys include shift keys 1, 2, 3, 4, 5 and 6, space key, and return key. The space key is to be operated by thumb. Therefore, it requires a size just enough for a thumb and it is shorter than that in the conventional keyboard. A return key is installed on the left keyboard since the right hand is frequently used in recording or preparatory works. The right keyboard may have a return key and a space key too. It is a layout which facilitates input and saves operating time.

25 Each variable function key is incorporated with a display to show mode of function. A pushing of the variable function key will end the display as well as the mode. It is a feature of the present invention.

30 The display can be in the form of multiple LCD display (as shown in Fig. 10) and single LCD display (as shown in Fig. 11), as follows:

35 A multiple LCD display is composed of a cover 11, a multiple LCD 12, a conductive rubber 13, a key seat 14, a conductive leaf spring 15, two pins 16, 7 or 12 elastic conductive wires 17, 7 or 12 C-type conductor plate 18, a spring 19 and a block 20. Each layer of LCD is composed of a glass sheet, conductor (formed by photographic effect) and liquid crystal (formed by photographic effect).

40 A photomask is covered on a lamination of LCD, under which a thick glass sheet and a mercury coating is applied. Number of layers in a LCD lamination will determine capacity of function variation. Its circuit diagram is shown in Fig. 12. Generally, power to LCD is supplied via the elastic conductive wires 17, C-type conductor plates 18 and the conductive rubber 13. Power to different layer of LCD is supplied through different conducting path. As soon as the variable function key is pushed, the block 20 displaces downwards, power is cut off because the elastic conductive wire 17 is disengaged from the C-type conductor plate 18, the conductive leaf spring 15 displace to keep contact with the pins 16 due to an oblique plane on the block 20. So, a cycle from pushing to releasing the key, the LCD is changing in a cycle of OFF-ON-OFF to generate a signal pulse as well as to end function of the LCD to indicate that the key is sending a signal.

45 A single LCD display is composed of a cover 21, a layer of LCD 22, a conductible rubber 23, a key seat 24, a conductive leaf spring 25, two pins 26, 13 elastic conductive wires 27, a block 28, 13 C-type conductor plates 29 and a spring 30. The same working principle for the multiple LCD is applied. Fig. 11 shows an embodiment of a single LCD 22 which is of 5×7 dots. Fig. 13 shows its circuit diagram. Through function available in a single LCD is less than that in multiple LCD 12, change of circuit and application of electronic scanning joint may be used to extend its scope of function.

50 Fig. 14, 15, 16, 17, 18, and 19 illustrates display of different modes on the keys by selection of different functions.

55 Fig. 20 is a control logic circuit diagram for display on the keys according to the present invention. Some examples of operations are described below with reference to Fig. 21.

60 a. After pushing the shift key 2, a pulse is generated to drive an encoder which will then generate a signal of 8 bits to run a logic circuit for the keyboards to reset all variable function keys, and the logic circuit will generate high or low outputs (for multiple LCD display) or scanning signal (for single LCD display) to drive LCD to display mode of function.

65 b. After pushing a key on which a letter "a" is displayed, the key generates a pulse to encode new 8-bit codes with the encoder and give output through the logic circuit and a CPU.

70 c. After pushing a key on which a letter "K" is displayed the same action as that for the key "a" occurs, except it is pushed by a finger of the right hand.

75

80

#### CLAIMS

1. A separable keyboard comprising two separate keyboards to be operated by left hand and right hand separately.

2. A separable keyboard as claimed in Claim 1 wherein the separable keyboards can be combined by means of retainers, mortise and tenon joints, pins or magnets.

3. A separable keyboard as claimed in Claim 1 wherein the keys on each separate keyboard are laid on radiant directions and transverse row in a form of curve to fit extension of fingers so that they can be operated comfortably regardless of position of fingers.

4. A structure of key with display which has a display device on each key to display mode of function.

5. A structure of key with display as claimed in Claim 1 wherein the display can be

in the form of multiple LCD or single LCD according to the mode of display.

6. A structure of key with display as claimed in Claim 5 wherein the multiple LCD is  
5 composed of a cover, a multiple-layer LCD, a conductive rubber, a key seat, a conductive leaf spring, two pins, 7 or 12 elastic conductive wires, 7 or 12 C-type conductor plates, a  
10 block and a spring, and power to different layer of the multiple LCD is supplied through different conducting path in the conductive rubber.

7. A structure of key with display as claimed in Claim 5 wherein the single LCD is  
15 composed of a cover, a single-layer LCD, a conductive rubber, a key seat, a conductive leaf spring, two pins, 13 elastic conductive wires, a block, 13 C-type conductor plates and a spring, and the single LCD is of matrix  
20 dot structure.

8. A structure of key with display as claimed in Claim 4, 5 and 6 wherein each key can have its power cut off due to disengagement of the elastic conductive wires from the  
25 C-type conductor plates as soon as it is pushed to cause downward displacement of the block and then the conductive leaf spring forced to keep contact with the pins to form a close circuit due to displacement along an  
30 oblique plane on the block.