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G4A AKS
G5C CA310 CA319 CA342 CHA
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(56) Documents cited
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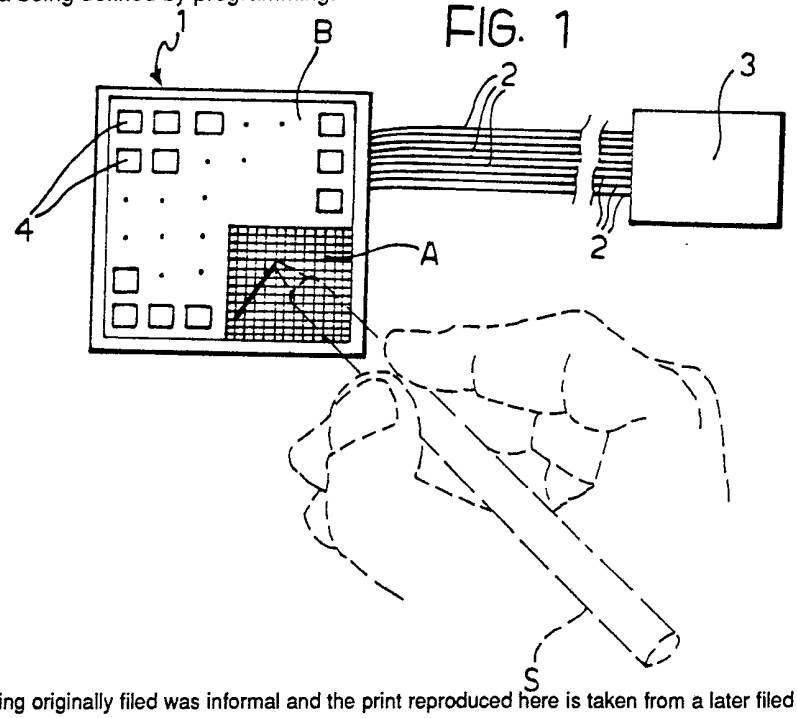
UK CL (Edition J) G4A AKS, G4R REV
INT CL⁴ G06F, G06K

# (54) Data input device

(57) A device for inserting symbols, alphanumeric characters and operating commands into an electronic computer comprises a
keyboard B and a device having a writing surface A adjacent the keyboard to receive a trace of characters written by a manual writing stylus S and means for recognising the written characters.

The device may have a pressure-sensitive surface over a liquid-crystal display, the keyboard area, writing surface area and display area being defined by programming.

FIG. 1




At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 217 499 A

FIG. 1

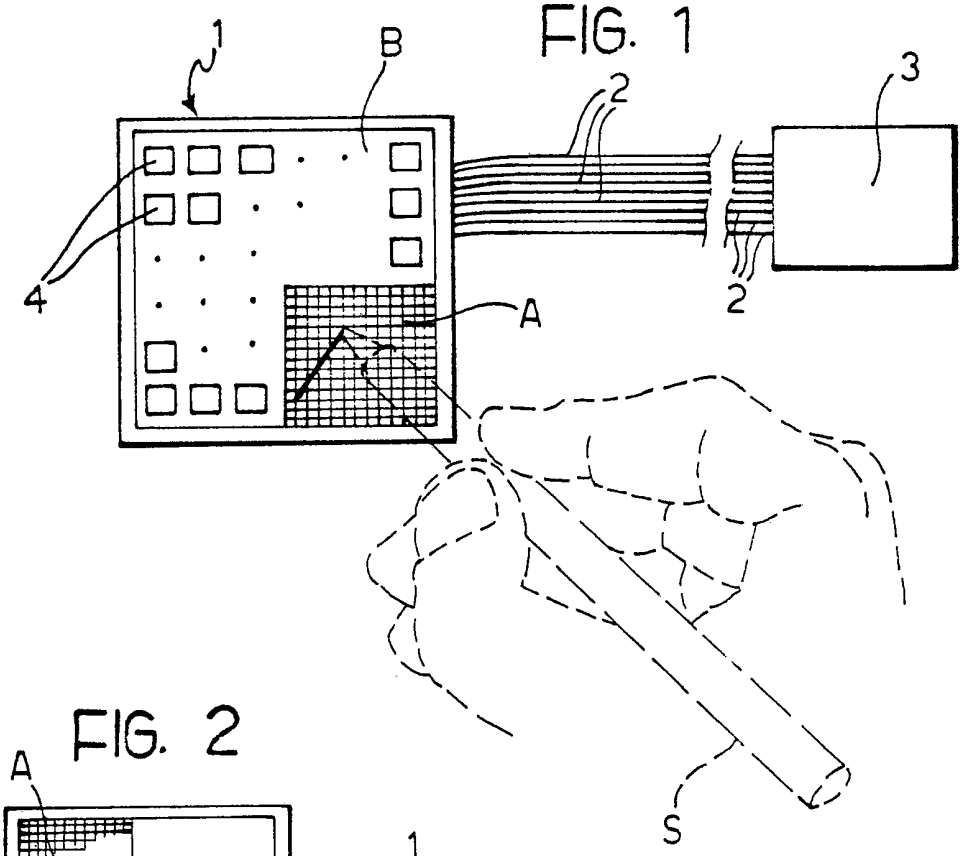



FIG. 2

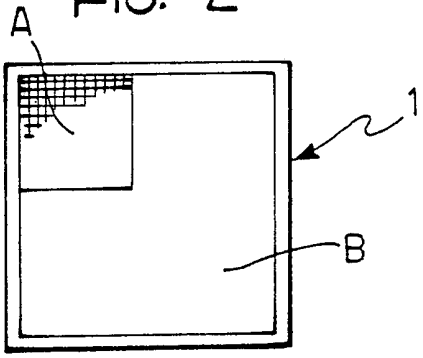



FIG. 3

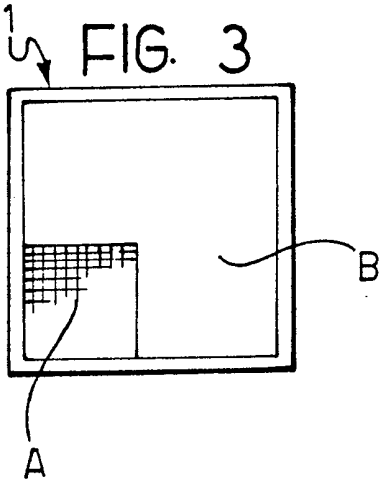



FIG. 4

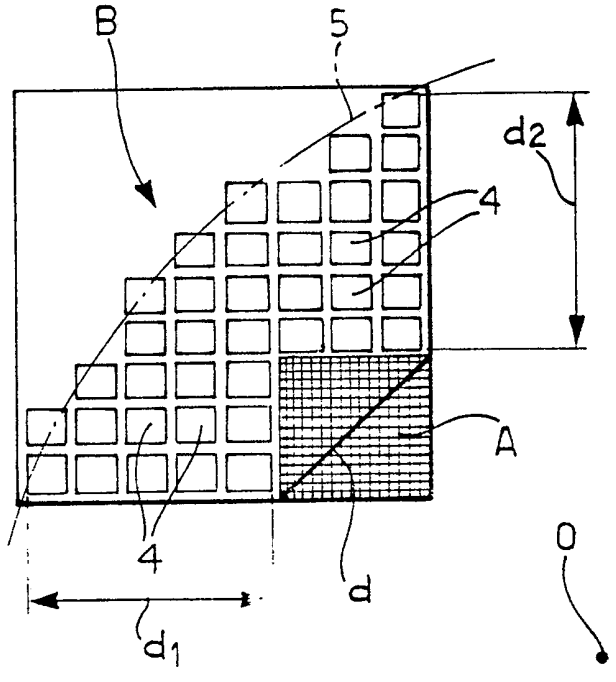


FIG. 5

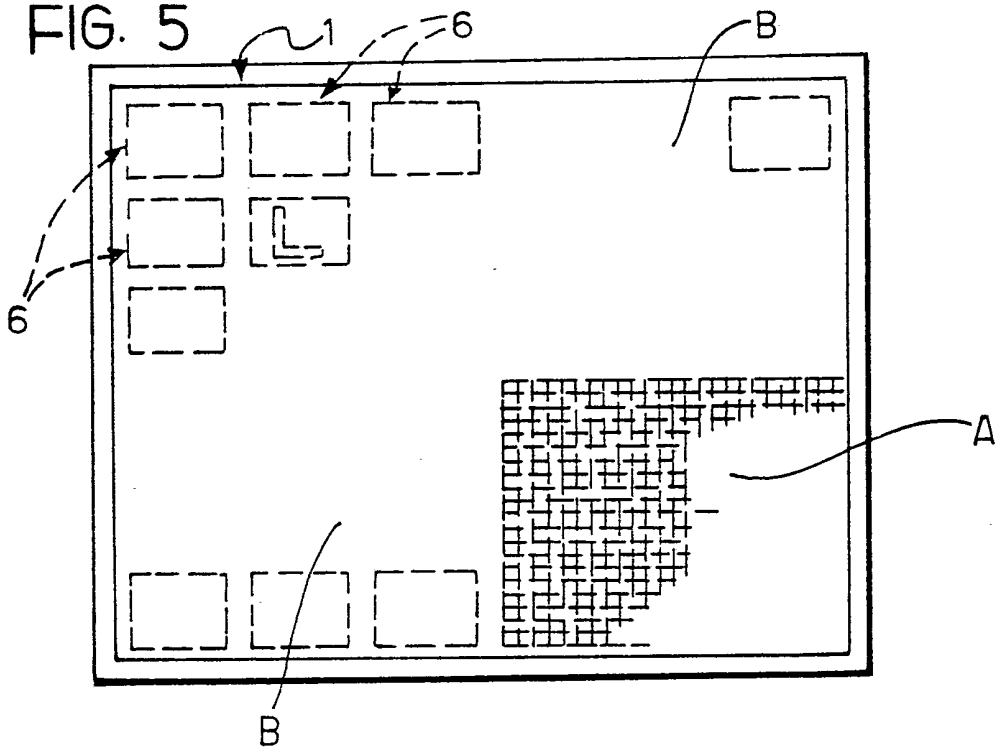



FIG. 6

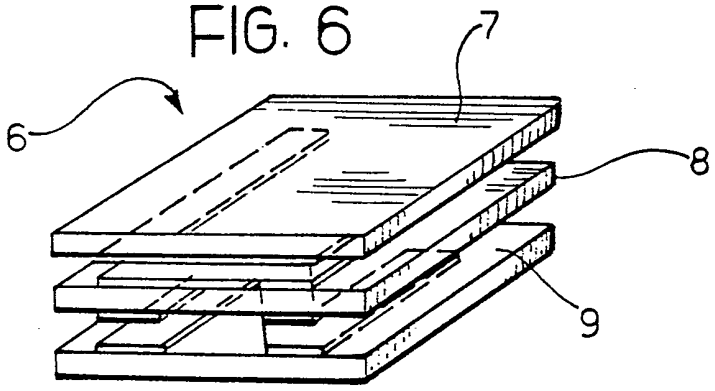



FIG. 7

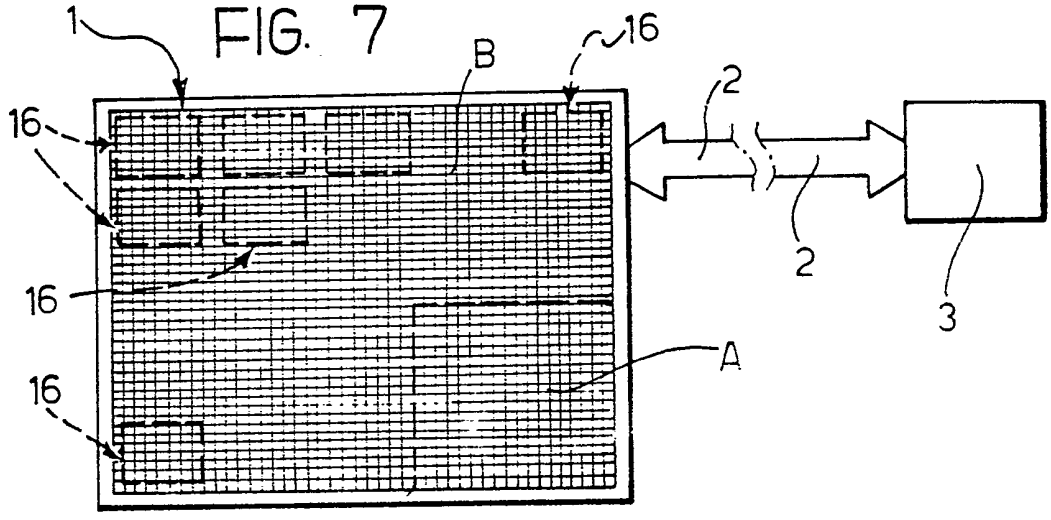


FIG. 8

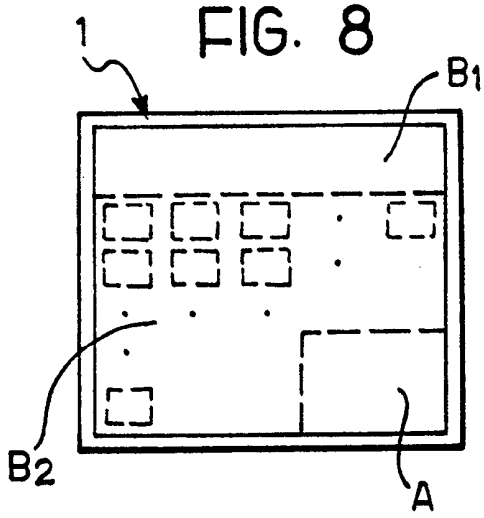



FIG. 9

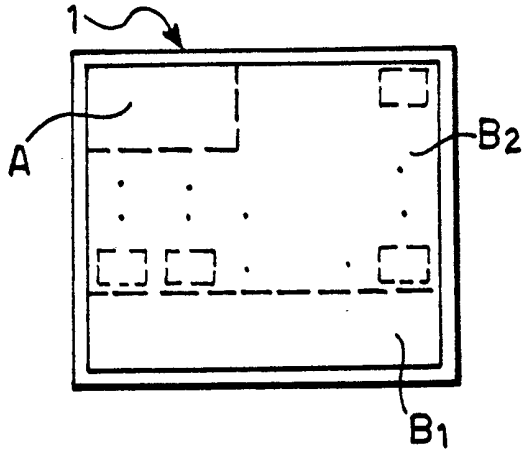



FIG. 10

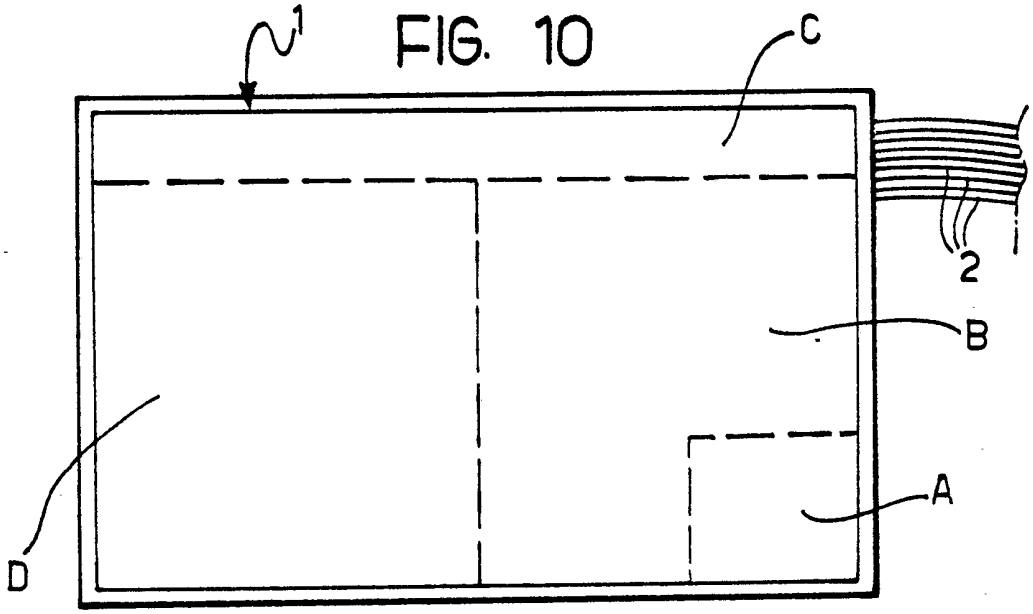



FIG. 11

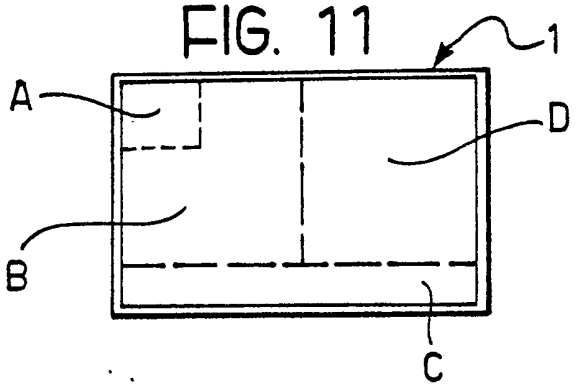


FIG. 12

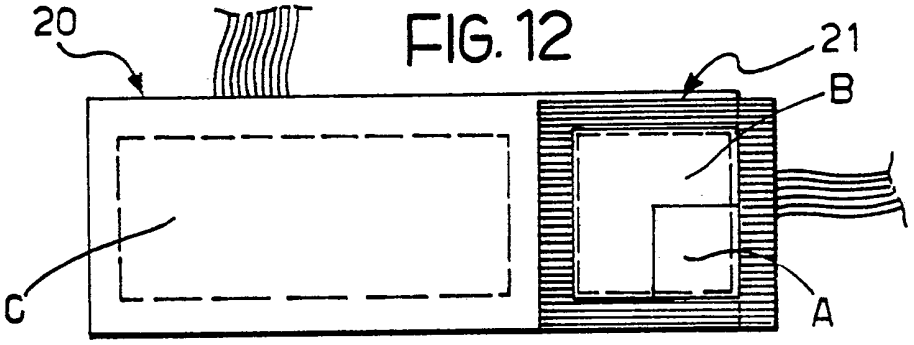



FIG. 13

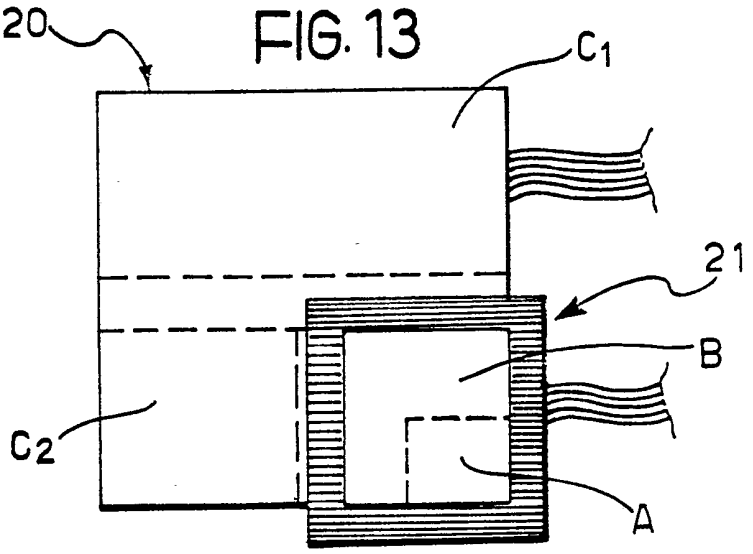



FIG. 14

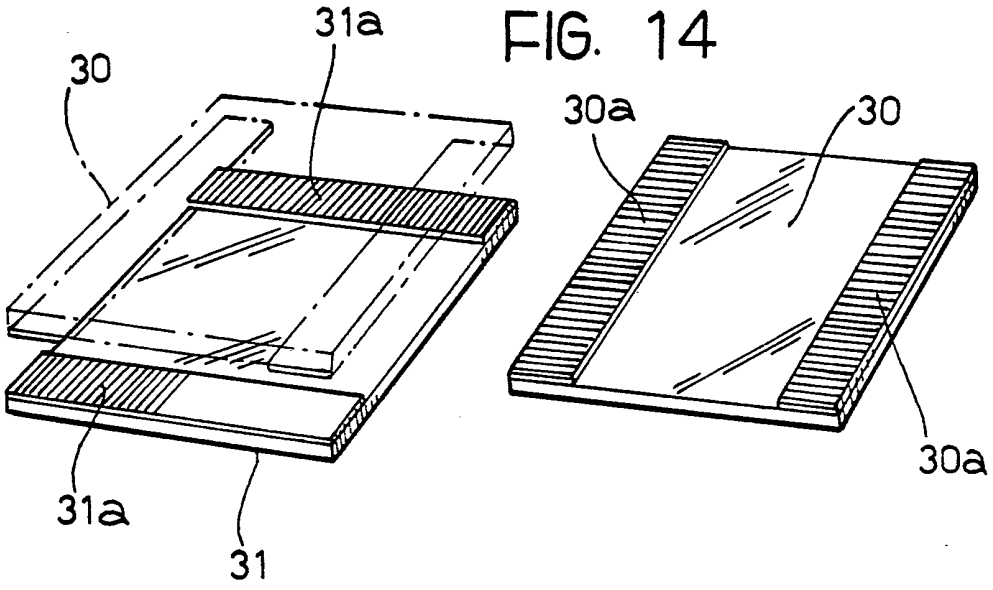


FIG. 15

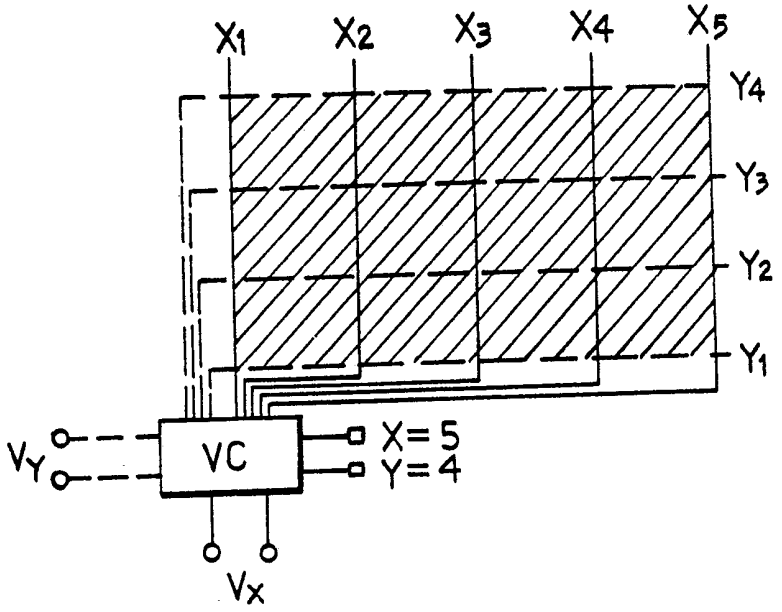
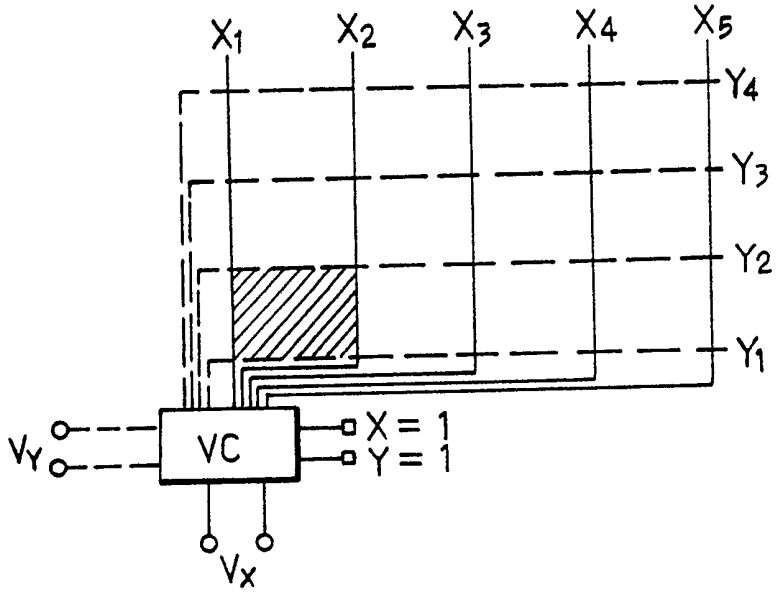

X1
X2
X3
X4
X5
Y4
Y3
Y2
Y1
VY
VC
X=5
Y=4
VX

FIG. 16


X1
X2
X3
X4
X5
Y4
Y3
Y2
Y1
VY
VC
X=1
Y=1
VX

"Means for Inserting Symbols" 2217499

The invention relates to a means for inserting symbols, alphanumeric characters and operating commands, more particularly for computers and the like, as per the preamble of claim 1.

The object of the invention is to construct a means of the aforementioned kind which can advantageously be used as a substitute for conventional electronic keyboards connected to computers or incorporated in portable or pocket terminals having a high computing capacity.

Another object of the invention is to construct a device having an improved structure and relative arrangement of its parts, so as to be extremely easy to use.

These and other objects are achieved by the invention by a means having the features defined in the claims hereinafter.

Other features and advantages of the invention will be clear from the following detailed description with reference to the accompanying drawings, given by way of non-limitative example only, in which:

Fig. 1 shows a means according to the invention comprising a keyboard containing conventional separate keys or push-buttons;

Figs. 2 and 3 are smaller-scale diagrams of alternative arrangements of the keyboard and of the device for writing and recognition of characters in the means shown in Fig. 1;

Fig. 4 is a plan view of a variant of the means shown in Fig. 1;

Fig. 5 is a diagrammatic plan view of another means according to the invention;

Fig. 6 is a perspective view, partly in section, of a possible multi-layer structure of the portion for use as a keyboard in the means according to Fig. 5;

Fig. 7 is a diagrammatic plan view of another means according to the invention;

Figs. 8 and 9 are smaller-scale diagrams of other methods of functionally dividing the panel of the means in Fig. 7;

Fig. 10 is a diagrammatic plan view of a means according to the invention constructed by using a graphic table;

Fig. 11 is a small-scale diagram of a different method of functional distribution of the surface of the means in Fig. 10;

Figs. 12 and 13 show two means according to the invention constructed by using a dot matrix display unit and a separate pressure-sensitive panel for writing and recognition of characters, the panel being superposable on a part of the display unit;

Fig. 14 is a partially exploded perspective view diagrammatically showing a possible structure of the writing and character recognition panel shown in Figs. 12 and 13, and

Figs. 15 and 16 show a pressure-sensitive panel provided with means for varying the extent of the enabled sensitive surface.

The invention specifically refers to a means which conveniently incorporates a device for writing and recognition of characters and a keyboard for input of functions or operating instructions.

As will be clear hereinafter, the term "keyboard" in the present context is used in a wide sense referring in general to any two-

dimensional ordered distribution of sensitive compartments which can be acted upon by pressure in order selectively to activate predetermined functions or operating instructions.

Some known devices for writing and recognition of characters comprise a writing surface adapted to receive the trace of characters or symbols when pressed by a manual writing stylus, the devices also comprising sensor means adapted to supply signals indicating the shape of the character or symbol when traced on the surface. Since a stylus is used for inserting alphanumeric characters by writing on a pressure-sensitive surface, it is convenient to use the same stylus for selection and actuation of functions or operating instructions associated with keys in a conventional keyboard.

The invention accordingly provides means for inserting symbols, characters and operating commands and in which a device for writing and recognition of characters is associated with a keyboard, understood in the broad sense as previously defined.

Fig. 1 shows a means according to the invention comprising a quadrilateral panel 1 including a device A for writing and recognition of characters, the device likewise being quadrilateral and disposed in the bottom right quarter of the panel. The panel 1 is filled by a keyboard (general reference B) adjacent two contiguous sides of the sensitive surface of the writing device A. The writing device A and the keyboard B are connected by electric conductors 2 to a monitoring and control unit 3 adapted in known manner to recognize characters traced manually on device A by using a stylus S, and for decoding and implementing operating instructions input via keyboard B.

Apart from the methods of constructing the writing area A and the keyboard B, the relative arrangement shown in Fig. 1 is optimum for a

right-handed user in that it gives complete visibility of the keyboard B when the hand is used to write on area A.

In the case of left-handed users, who normally write with the left hand above the line on which they are writing a sequence of characters, the most advantageous arrangement of area A and keyboard B is as diagrammatically shown in Fig. 2, where the writing area A is positioned in the left portion of panel 1. However, the arrangement illustrated in Fig. 3 may also be suitable for left-handed users.

Referring again to Fig. 1, in a first embodiment of the means according to the invention the writing area A can simply consist of a surface sensitive to tracing by a stylus S, without the trace being displayed and consequently without the possibility of checking the shape of the character while being traced. In that case the pressure-sensitive surface of device A can also be non-transparent and can be obtained e.g. by using conductive gums. Keyboard B may then advantageously also be of the kind comprising separate buttons 4 having surfaces bearing symbols or characters for identifying the respective functions or operating instructions associated with them.

Fig. 4 shows a variant of the means in Fig. 1, in which the keyboard B extends substantially between two contiguous sides of the writing area A and an arc of a circle 5 having its centre at a point O situated outside the area A, on the side opposite the keyboard B with respect to the diagonal d. From the ergonomic point of view, in the case of a writing position gripping with bent fingers and where the point of the pen S is at the centre of area A (substantially as shown in Fig. 1) it is possible, without moving the resting-place of the wrist but simply by extending the fingers and rotating the wrist, to reach all the keys on the keyboard quickly and without effort, provided that the dimensions $d_1$ and $d_{22}$ are not greater than 3 or 4 cm.

In the embodiment illustrated in Fig. 4, the keyboard B has 43 rectangular keys, the proportions of the sides being approximately 4 : 3 and the size being sufficient to show symbols or characters for recognising the function or instruction associated with each key. The number of keys illustrated is undoubtedly suitable for every likely need.

Referring to Figs. 1 to 4, if the pressure-sensitive surface of the writing area A is transparent, a dot matrix liquid-crystal display unit may advantageously be disposed underneath it, and can advantageously be used in known manner to display the trace which is periodically made on surface A by stylus S.

Fig. 5 shows a version of the means according to the invention in which the entire panel 1 has a pressure-sensitive transparent outer surface above a liquid-crystal display unit. Panel 1 is divided into two areas A and B, respectively for writing and recognition of characters and for use as a control keyboard. The portion of the liquid-crystal display unit corresponding to the writing area A has a dot matrix structure, whereas the portion corresponding to the keyboard area B is divided into a number of ordered compartments 6, each corresponding to a key of the keyboard. Each compartment 6 of the display unit is provided by known techniques with predetermined unchangeable symbols and/or characters for identifying the functions or operating instructions associated with each compartment or key.

Advantageously the portion of the liquid-crystal display unit associated with keyboard B can have a structure comprising two (or more) display layers which can be selectively and independently actuated, so that each compartment 6 of the keyboard area B can be associated with two (or more) symbols or characters or groups of symbols or characters relating to two (or more) different functions or commands which can be selectively actuated by applying a pressure

to that portion of the sensitive surface of panel 1 which faces the compartment.

Fig. 6 diagrammatically shows the structure of a compartment 6 of a liquid-crystal display unit having two display layers for displaying two different characters which, in the example illustrated, are the letters "L" and "N". The structure shown comprises three parallel spaced-apart transparent plates 7 - 9. L-shaped electrodes are applied to the facing surfaces of plates 7 and 8, whereas N-shaped electrodes are applied to the facing surfaces of plates 8 and 9. Layers of nematic crystals disposed between the two pairs of electrodes have a refractive index which can be varied by applying a potential difference between the electrodes. Liquid-crystal display units comprising a number of display layers are easily available commercially.

The multi-layer structure of the portion of the display unit associated with keyboard B makes it very easy to multiply the functions associated with the individual keys. In practice, of course, the possibility of superposing more than two display layers in this structure is limited by problems of parallax and the consequent possibility of error in selecting the keys, owing to their reduced size.

In the version diagrammatically shown in Fig. 7, the means according to the invention has a pressure-sensitive surface over the entire area of panel 1, under which a liquid-crystal display device is disposed and has a dot matrix structure on the portion corresponding to the writing and character recognition area A and also in the portion corresponding to the keyboard area B. In the version in Fig. 7, in contrast to the version in Figs. 5 and 6, there is no physical difference between the portions of the liquid-crystal display unit associated with the writing area A and the keyboard area B. The different purposes served by the two portions of the display unit are

defined only at the software level by suitably programming the monitoring and control unit 3. This in principle enables the user to program the use of the entire surface of panel 1, i.e. to program or select any of the configurations shown e.g. in Figs. 1 to 3. If, accordingly the configuration in Fig. 1 is adopted, the surface of panel 1 of the means in Fig. 7 will be divided into a writing area A in the bottom right quarter and a substantially L-shaped keyboard area divided into a number of compartments 16 having a dot matrix structure and for displaying one or more symbols for identifying the associated function or operating instruction.

In the version in Fig. 7 the use of the surface of panel 1 is completely programmable; in addition to the configurations in Figs. 1 to 3, area B can at command be divided into two separate areas B1 and B2 (Fig. 8), B1 being used e.g. to display characters traced on the writing area A and recognized by the monitoring unit 3 associated with the device. In that case the area B2 will be used for the control keyboard.

Fig. 9 shows a surface configuration of panel 1 similar to that shown in Fig. 8 but intended for left-handed users.

With reference to Fig. 10, we shall now describe an embodiment of the means according to the invention similar to that shown in Figs. 7 to 9 but where the panel 1 is a graphic panel in a large electronic "graphic table" having an outer surface which is sensitive to pressure exerted by the point of a stylus. In this embodiment the superior resolution, contrast and storage capacity of graphic-table devices associated with a liquid crystal display unit is used for offering maximum flexibility in terms of both attainable configurations and of practicable modes of operation. Present-day commercially available graphic tables have a display area comprising a dot matrix liquid-crystal panel having an outer transparent surface sensitive to the pressure of a stylus point and capable of storing

(dot by dot) any trace up to a maximum of n successive pages, where n is typically 50 or more.

In the present case, as in the version illustrated with reference to Figs. 7 to 9, the surface of the panel can be distributed at will as regards the position of the character writing and recognition area, the keyboard area, a display area if any, and an area of use more specifically for graphics. For example, a graphic panel containing 120 x 64 = 7680 points and of use for displaying eight rows of 20 characters, each made up of a network of 6 x 8 dots, can be used to obtain the following configuration shown in Fig. 10:

- A writing and character recognition area A measuring e.g. 24 x 24 dots (a total of 576 dots);

- A keyboard area B for selection of operating instructions, e.g. with 18 keys each measuring 12 x 8 dots (total 1728 dots);

- A character display area C (e.g. for displaying a written text) comprising two lines of 20 characters (total 1920 dots), and

- An area D reserved for normal graphics or, if required, for display of messages generated by the monitoring unit and measuring 72 x 48 dots (total 3456 dots).

The configuration shown in Fig. 10 is intended for right-handed users. Fig. 11 on a smaller scale shows the corresponding layout of the various areas in the panel for use by left-handed users.

Of course other and different methods of distributing the surface of the panel can be used, e.g. if more importance is attached to the compactness of the display and graphic areas than to the accessibility of the region for use as a keyboard or the region for writing and recognition of characters.

In all cases, some keys in region B can be used for combined graphic and alphanumeric actuation of the display unit. One of these keys can for example be associated with an "insertion" command for inserting a string of alphanumeric characters in a position in panel 1 which can be selected as the position of the initial character, using the point of the stylus. In that case, once the "insertion" key has been actuated, the position of the character comprising the dot touched by the stylus will become the position to which the cursor, which is movable from dot to dot, is transferred by the known "mouse" technique. Characters subsequently written in the writing area A can then be subsequently inserted in the line in which the cursor has been positioned. An additional key associated with the "return" function can then be actuated to complete the definition of the "label" for association with the cursor position previously selected by actuating the "insertion" key, and for completing the selection by the stylus of the initial position of the "label".

The method of operation now being described is completely similar to that attainable on a normal computer screen using two separate input elements, i.e. the conventional keyboard and the "mouse", but uses a single input/output element comprising the device according to the invention.

The means in Fig. 10 can be associated with a "page" memory having larger dimensions than the area actually used for graphics. It is therefore possible, of course, by using commands for shifting a page upwards or downwards or to left or right, to compose pages containing mixed graphic and alphanumeric information and also much larger than the effective display area, but still enabling the effective position of the region displayed in detail at a given instant to be identified by a request actuated by a suitable "panoramic vision" command.

Since the distribution and allocation of the various functions to the various areas of the pressure-sensitive graphic table can be handled completely at software level by the monitoring program, the user is free to choose how and where to dispose the writing area A, the keyboard area B and the other areas. If for example the entire panel is made up of a matrix of n x m dots distributed in modules or blocks of e.g. 24 x 24 dots (this module corresponds e.g. to the size previously given for the writing area A) all the modules which make up the panel can be processed by the monitoring unit program indirectly, e.g. as follows:

- A first section of the program comprises a description of the functions relating to each specific block in the panel; this program section is fixed for a given configuration of the device, e.g. as in Fig. 10;

- A second program section, which can be periodically composed by actuation of suitable commands, comprises a map of the functions allocated to the various blocks or modules, and the map is used to monitor the display unit so as to adapt the actual presentation to the chosen configuration, and

- When the position of the stylus is initially identified as belonging to a specific block or module, the function allocated thereto is identified in the corresponding address - i.e. the address of the program which, with reference to the origin of the block, describes the algorithm for recognizing the dot on the panel where pressure is being exerted by the stylus and the consequent operations provided within the limits of the specific module.

The panel can then be composed by providing a function-allocating sequence actuated by selecting a "configuration" program, which can put e.g. the following set of questions in sequence:

- Position of writing area?

- Position of group of keys?

- Position of character display blocks?

- Position of area for graphics?

etc.

In reponse to each question, the operator will fix the allocated area by using his stylus to touch a dot inside the region to which the block mentioned in the question is to be assigned.

An alternative possibility is to leave the arrangement of blocks completely free, or to restrict it to within certain areas, e.g. by stipulating that the writing A should always be positioned along the frame of the panel. In such cases, if an illicit allocation is made, the situation can be explicitly signalled.

We shall now, with reference to Figs. 12 to 14, describe another version of the means according to the invention obtained by using a dot matrix display panel without a pressure-sensitive surface and partly covered by a pressure-sensitive transparent panel 21 which is physically independent and separate and the surface of which can be divided e.g. into an area A for writing and recognition of characters and an area B for constructing a keyboard substantially as described hereinbefore.

In the embodiment shown in Fig. 12 the dot matrix display unit 20 has an elongate rectangular shape and the pressure-sensitive panel 21 is superposed on the right-hand portion of the display unit, for the benefit of course of a left-handed user.

Fig 13 shows an embodiment in which the dot matrix display unit is square and the pressure-sensitive panel 21 is superposed on the bottom right quarter of the display unit, likewise for the benefit of a right-handed user.

As diagrammatically shown in Fig. 14, the pressure-sensitive panel 21 usually comprises at least two transparent elements 30, 31 in the form of plates having their facing inner surfaces coated with a conductive film, and also comprises respective electrodes 30a, 31a along respective pairs of opposite sides for connection to external supply and developing circuits. The two elements 30, 31 are superposed so that electrodes 30a, 31a extend at right angles to one another. Consequently the only portion of panel 21 which is actually usable is inside the "frame" formed by the electrodes. It is therefore also impossible to use those portions of the dot matrix display unit 20 which are underneath the "frame" of the sensitive panel 21.

In the version in Fig. 12 the free surface portion C of display unit 20 can be used for display of texts, whereas in the version in Fig. 13 the free surface of the display unit can be divided into an area C1 for display of texts and an area C2 for display of messages for interaction with the operator.

In a pressure-sensitive panel such as the panel 21 in Figs. 13 and 14, the position of the stylus tip is recognized by applying a given voltage between the ends of a flat rectangular or square surface and along the X or Y axis, and by measuring the voltage at the intermediate dot where pressure is exerted by the stylus.

In an aforementioned sensitive panel it is advantageous to use a "zoom" technique for varying the size of the enabled sensitive area of the panel, thus varying the resolution to meet specific requirements.

This can be achieved e.g. in the manner which will now be illustrated with reference to Figs. 15 and 16. In these drawings, reference 21 denotes a sensitive panel comprising a set of vertical electrodes X1 - X5 and horizontal electrodes Y1 - Y4. VC is a switch for applying a voltage $V_x$ between electrodes X1 and Xi (i = 1... 5), Xi being determined by the signal applied to an input x of switch VC. Similarly VC is adapted to apply a voltage $V_y$ between Y1 and Yi (i = 1... 4), Yi being determined by the signal applied to an input y of VC. Signals applied at X and Y to VC can be used to vary the size of the sensitive area of panel 21 between a maximum (Fig. 15) and a minimum (Fig. 16). Minimum and maximum resolution are obtained correspondingly.

Of course, the invention extends to all embodiments which obtain equal advantages by using the same inventive ideas.

C L A I M S

1. A means for inserting symbols, alphanumeric characters and operating commands, more particularly for electronic computers and the like, characterised in that it comprises a control panel including
- a keyboard for inputting functions or operating commands, each key thereof being associated with symbols identifying the function or command which can be actuated by the key, and
- a device for writing and recognition of characters and having a writing surface adjacent the keyboard and adapted to receive a trace of characters when pressed by a manual writing stylus and comprising sensor means adapted to supply signals indicating the shape of each character traced on the aforementioned surface.

2. Means according to claim 1, characterised in that, for the benefit of right-handed or left-handed users, the device for writing and recognition of characters is disposed in the right-hand or left-hand portion of the panel, preferably in the bottom part thereof.

3. Means according to claim 1 or 2 for a right-handed user, characterised in that the control panel is substantially quadrilateral and the device for writing and recognition of characters is disposed in the bottom right-hand quarter of the panel.

4. Means according to claim 1 or 2 and for a left-handed user, characterised in that the control panel is substantially quadrilateral and the device for writing and recognition of characters is disposed in the top left-hand quarter of the panel.

5. Means according to claim 1 for left-handed users, characterised in that the control panel is quadrilateral and the device for writing and recognition of characters is disposed in the left-hand bottom quarter of the panel.

6. Means according to any of claims 1 to 4, characterised in that the sensitive surface of the device for writing and recognition of characters is substantially quadrilateral in shape and the keyboard extends adjacent two contiguous sides of the sensitive surface.

7. Means according to claim 6, characterised in that the keyboard extends substantially between two contiguous sides of the sensitive surface and an arc of a circle having its centre outside the sensitive surface and on the opposite side of the keyboard with respect to the diagonal which, in the sensitive surface, joins the ends of the two contiguous sides.

8. Means according to claim any of the preceding claims, characterised in that the device for writing and recognition of characters has a sensitive writing surface which is at least partially transparent and is disposed above a dot-matrix liquid-crystal device for displaying the trace made on the sensitive surface.

9. Means according to any of the preceding claims, characterised in that the keyboard is of conventional kind comprising individual separate distinct keys.

10. Means according to any of claims 1 - 7 and claim 9, characterised in that the sensitive surface of the writing and character recognition device is opaque.

11. Means according to any of claims 1 to 8, characterised in that the panel has an outer transparent pressure-sensitive surface above a liquid-crystal display panel, the liquid crystals being divided or divisible into at least a first area for use as a device for writing and recognition of characters and a second area for use as a control keyboard, at least a part of the second area being divided or

divisible into a number of ordered compartments, each constituting a key of the keyboard.

12. Means according to claim 11, characterised in that each compartment of the second area of the liquid-crystal display unit comprises electrodes which are disposed so as to display one or more predetermined immutable symbols identifying the function or command associated with the compartment.

13. Means according to claim 12, characterised in that the second area of the display unit has a structure made up of two or more display layers which can be selectively and independently actuated so that each compartment of the second area can be associated with two or more symbols or characters or groups of symbols or characters relating to two or more different functions or commands which can be selectively actuated via the compartment.

14. Means according to claim 11, characterised in that the first and also the second area of the liquid-crystal display panel have a dot matrix structure.

15. Means according to claim 14, characterised in that it comprises monitoring and control means enabling the user to select the position of the first and second area on the surface of the panel.

16. Means according to claim 15, characterised in that the monitoring and control means are adapted for dividing the second area of the panel into a first region for displaying characters placed in the first area of the panel and a second region serving as a keyboard.

17. Means according to claims 15 and 16, characterised in that the monitoring and control means are disposed so as to enable the user

to select the position of the first and second region within the limits of the second area in the panel.

18. Means according to any of claims 14 to 17, characterised in that the panel comprises a dot matrix graphic table having an outer surface which is sensitive to pressure.

19. Means according to claim 18, characterised in that the monitoring means for the graphic table are disposed so that the surface thereof can be selectively divided as aforementioned into at least three areas.

20. Means according to any of claims 1 to 8, characterised in that it comprises a two-dimensional dot matrix display unit, and

a pressure-sensitive transparent panel which is smaller than the display unit and can be superposed on part of the surface thereof;

the surface of the panel being divided or divisible into a first portion serving as a device for manual writing and recognition of characters, and a second portion of use as a keyboard;

the display unit being associated with monitoring and control means for dividing its surface into at least

a first and a second region disposed respectively under the first and second portion of the sensitive panel; the monitoring means being disposed so that the second region can be divided into a number of ordered compartments for display of symbols indicating the functions or commands associated with each compartment, and

a third region left uncovered by the panel and adapted to be actuated for purposes of graphic or alphanumeric display.

21. Means according to claim 20, characterised in that the monitoring means are disposed so that the third region of the display unit can be divided into at least two independently controllable display regions.

22. Means according to claim 20 or 21, characterised in that the pressure-sensitive panel is associated with switching means for varying the size of the enabled sensitive area of the panel between a minimum and a maximum.

23. Means substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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