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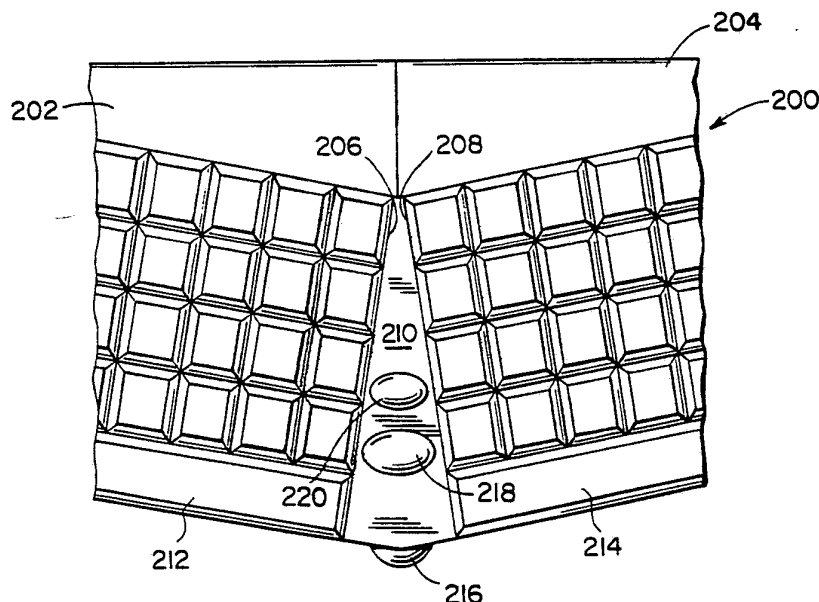
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(57) Abstract

A keyboard (200) for a computer is used with the hands of a user disposed substantially in a prehensile position with the thumb opposed to the fingers in a grasping position. The keyboard (200) includes a first slanting keyboard surface (202) for locating keys to be activated by a user's left hand adjacent and sloping downwardly away from a second slanting keyboard surface (204) for locating keys to be activated by a user's right hand. The first and second keyboard surfaces (202 and 204) are joined at a peaked central spine (210) forming a V-shape which slopes downwardly toward a user and laterally away from the user. A cursor control unit (216) on a front surface of the keyboard, below the space bar, is used for controlling the movement of a cursor and is operated by the thumb of the user in a direction transverse to the direction of operation of the keys. Ulnar abducted deviation and hand-pronation are reduced by using the keyboard, thus reducing the incidence of carpal tunnel syndrome.

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COMPUTER KEYBOARD

Technical Field

This invention relates to a V-shaped keyboard for a computer having first and second sides joined at a center peak or alternately spaced from each other to form an inverted-V and sloping downward and away from each other.

Background of the Invention

Office equipment utilizing a video display and keyboard input is known. The widespread use of these devices has proven that, in many cases, severe physical strain results from their daily use. Many attempts have been made to reduce the strain caused by these devices by positioning the keyboard, display screen, and other associated components appropriately. None of these solutions has been completely successful.

U.S. Utility Patents 4,313,122 (Foster), 4,496,943 (Greenblatt), and 4,504,055 (Wells) show work stations wherein an input terminal is vertically below and horizontally in front of a video screen.

U.S. Design patents 194,211 (Sanderson), 250,335 (Esslinger), 268,677 (Ohie) and 270,347 (Yomo) show various arrangements for consoles having video displays and keyboards.

U.S. Patent 4,562,482 shows an executive work station wherein an attempt has been made to accommodate

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the requirements of a person wearing bifocal spectacles.
U.S. Patent 3,990,565 (Felton) shows a typewriter having
an attachment for providing a keyboard in two sections.

Summary of the Invention

It is known that three ocular-neurological physiological functions are linked to form a "Near-Triad" when a subject is engaged in a task requiring the use of near vision, such as reading. These three functions are accommodation, convergence, and miosis. Accommodation is the focusing of the eye to form a clear image of the close subject, convergence is the angular relationship between the two eyes to observe that near subject, and miosis is a contraction of the pupils of the eyes.

Applicant has concluded that there are, in fact, two additional ocular-neurological physiological functions associated with a task at a close distance. These additional functions are the preferred depression of gaze and undesirable excyclotorsion which accompanies viewing targets which are both close to the observer and are placed relatively high in the visual field. The depression of gaze refers to the location of the work with respect to a horizontal line at eye level, and excyclotorsion refers to an outward rotation of the superior meridian of the eyes about their anterior-posterior geometric axes. While an individual

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can override the depression of gaze component and thereby focus clearly on a near object having a high placement in the visual field, this commonly produces symptoms such as eyestrain, headache, nausea and motion-sickness. Neck and shoulder discomfort also occur because the individual will posture into a capitas-extension position (head tipped backward-chin elevated) as a means of allowing an artificial (or false) depression of gaze and minimizing excyclotorsion.

The five factors may be referred to as a "near quintad."

One factor producing increased tension is that the typical word processing or personal computer keyboard has approximately 85 keys (or even more), compared with no more than 60 keys for a typewriter. An operator is required to look at these keys frequently because the locations of many of the keys are not automatically known, as are the locations of the alphabet keys. Also, virtually all software programs require the use of several unfamiliar keys simultaneously, such as "Alt-F5, Shift-F10 or Control-F2." Thus, the modern keyboard must be considered to be a tool having 85 or more choices for which the operator must repeatedly view the keyboard and then the screen to select one or more keys and to verify completion of an operation.

Studies indicate that excyclotorsion, which accompanies convergence, is reduced if the direction of gaze is depressed. The greatest subjective comfort is

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produced when the visual target is placed in a depressed position of gaze.

The prior art has failed to adequately address these physiological factors, and no apparatus has been provided which simultaneously addresses the five functions (the "near quintad") found by Applicant to be significant.

For example, U.S. Patent 4,562,482 (Brown) is concerned only with the angular extent of a bifocal segment and the optimum distance for focusing when viewing through that segment. U.S. Patent 3,990,565 (Felton) teaches an apparatus which allows one to view a document being worked on at a close distance, but the work product is at a substantial distance and is angularly displaced by a large degree.

In accordance with the invention, a preferred keyboard is designed such that a user may acquire total tactile familiarity with the keyboard, thus enabling the user to copy written material and look at the screen while typing without looking at the keyboard. Operator fatigue and frequency of error are reduced even further where the keyboard is superimposed on the screen and eye movement from screen to keyboard is minimized.

One embodiment of the keyboard of the invention is divided at its midpoint by a central peak and the outer portions slant away from the central peak and upwardly away from the user to form a shallow V-shape. The

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V-shaped keyboard configuration lessens ulnar abducted deviation and permits a relatively straight hand-wrist orientation. The center-peak design also lessens the amount of hand pronation, i.e. the rotation of the hands from a comfortable vertical posture into an uncomfortable horizontal posture. Further, the V-shaped arrangement enables the forearms to be separated, allowing for unobstructed visual access to a copy-viewing area placed centrally directly below the keyboard, as in the computer workstation of the invention. Strain on the hands and wrists is minimized and occupationally-induced injuries, such as carpal tunnel syndrome, are avoided.

The space bar is placed on the front edge of the keyboard and is activated by thumb pressure either vertically (conventionally), horizontally or at a selected angle. When the space bar is activated horizontally, the thumb moves in a natural grasping motion toward the forefinger.

The keyboard for the computer is used with the hands of a user disposed substantially in a prehensile position with the thumb opposed to the fingers in a grasping position. The keyboard includes a first slanting keyboard surface for locating keys to be activated by a user's left hand adjacent and sloping downwardly away from a second slanting keyboard surface for locating keys to be activated by a user's right

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hand. The first and second keyboard surfaces are joined at a peaked central edge forming a V-shape which slopes downwardly toward a user and laterally away from the user. Twelve numbered function keys are positioned in a circular array toward an outward end of the first keyboard surface. A keypad for locating numeric keys is positioned toward an outward end of the second keyboard surface.

A cursor control unit on a front surface of the keyboard, below the space bar, is used for controlling the movement of a cursor and is operated by the thumb of the user in a direction transverse to the direction of operation of the keys. The space bar may also be operated in the transverse direction or at a selected angle. Ulnar abduction and hand pronation are reduced by using the keyboard, thus reducing the incidence of carpal tunnel syndrome.

The keyboard may be supported on a workstation cabinet by a track which permits it to be moved along the video screen toward and away from the user. The keys preferably lie on a surface which is sloped downward toward the user by approximately 15° to 25° with respect to the horizontal.

In an alternate, and preferred, embodiment of the keyboard of the invention, the keyboard is divided at its midpoint by a central spine and the outer portions slant away from the central spine and upwardly away from

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the user to form a shallow V-shape. The spine area widens out as it approaches the user. Each of the key shapes differs from the previous embodiments in that the key shape has been restored to a standard rectangular shape. Located in the separation of the two keyboard portions are at least two cursor-mover control buttons in the horizontal plane of the keyboard. The cursor-mover control buttons have an oval shape with a long axis of the button extending parallel to the rear of the keyboard to permit each forefinger to access these control buttons. The height of these control buttons is slightly recessed below the adjacent edges of each of the two space bars.

A track ball located on a vertical front surface is maintained as in another embodiment. The hands of the operator are placed in a natural prehensile posture for utilization of the thumbs to actuate the track ball, while the forefingers move towards the thumbs in actuating the cursor-move control buttons. The forefinger actuation of the cursor-mover control buttons can either be simultaneous or sequential to the thumb actuation of the track ball.

In a pre-motion rest position, the two ventral surfaces of the thumb and forefinger are separated by a distance of less than 1.5 inches. At the moment of actuation of the cursor-control buttons, there is a very slight articulation of the metacarpophalangeal joint of

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the forefinger, while the thumb position remains stationary on the track ball. The pre-motion rest position gap between the thumb and forefinger being less than 1.5 inches, all possible movements of the trackball by the thumb, and all possible actuations of the cursor-control buttons by the forefinger require a very small range of travel of these digits. The ventral to ventral compressive force between the thumb and forefinger is thereby minimized. Physiological fatigue that accompanies repetitive precision gripping/grasping actions is also thereby minimized.

An object of this invention is to provide a unique keyboard wherein keys operated by fingers are on a first surface and keys operated by a thumb are on a transverse surface.

It is another object of the present invention to provide a unique keyboard having a trackball operated on a vertical side surface and cursor-mover control buttons located on a horizontal spine surface which separates the keyboard into two separate portions.

Brief Description of the Drawings

Figure 1 is a perspective view of a preferred embodiment of a work station in accordance with the invention.

Figure 2 is a side view of the apparatus shown in Figure 1.

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Figure 3 is a partial side view of a second embodiment of the device shown in Figure 1.

Figure 4 is a partial side view of a third embodiment of the device shown in Figure 1.

5 Figure 5 is a partial view of a work station in accordance with the invention providing electronic projection of a work document.

Figure 6 is a perspective view of a removable cartridge for use in the apparatus shown in Figure 1.

10 Figure 7 is a top plan view of a preferred keyboard of the invention.

Figure 8 is a front elevation view of a keyboard of Figure 7.

15 Figure 9 is a left side view of the keyboard of Figure 7.

Figure 10 is a section taken on line 10-10 of Figure 7.

20 Figure 11 is a schematic top plan view of a workstation of the invention using the keyboard shown in Figure 7.

Figure 12 is a partial front elevation view of a keyboard similar to the keyboard of Figure 8 having a ball-shaped cursor control unit.

25 Figure 13 is a schematic view showing use of a keyboard of Figure 12 with the hands in prehensile position.

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Figure 14 is a plan view of a preferred embodiment of a keyboard.

Figure 15 is a perspective view of the keyboard shown in Figure 14.

5 Figure 16 is a schematic view showing use of a keyboard of Figure 14 with the hands in a prehensile position.

Figure 17 is a front view of the keyboard shown in Figure 14.

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Detailed Description of the Preferred Embodiments

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A keyboard of the invention particularly reduces the onset and severity of, or prevents entirely, the repetitive strain injury known as carpal tunnel syndrome, as well as other neurological or orthopedic malfunctions, such as tendinitis and tenosynovitis, which can also be related to usage of a flat/rectangular keyboard. These malfunctions, particularly carpal tunnel syndrome, occur when using a flat/rectangular computer keyboard which requires the hands to be fully pronated into the horizontal plane and ulnar-deviated outward at the hand-wrist junction, with a finger-flexed position. In this position, there is mechanical compression of the median nerve against the transverse carpal ligament (complicated by venous congestion) as the median nerve passes from the forearm into the hand. In this position, percussion of each key is executed in

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a direction which is essentially away from the action and the range of motion of the opposable thumb.

In contrast, when the hands are positioned for using a biometrically formed, center-peaked keyboard, the hands are advantageously in a prehensile orientation with the ventral surfaces of the thumb and fingers of each hand in opposed positions similar to the positions used for grasping a small object between the thumb and a finger. Prehensility, because it increases the total tactile familiarity with the keyboard, can reduce the level of visual demand to accomplish the task as well as reducing the stress on the fingers, hands and wrists.

A moderately center-peaked keyboard of the invention having keyboard halves which slope downwardly and away from each other in a V-shape (having the apex of the V toward the user) allows the hands to be positioned in the optimum prehensile position with a straight hand-wrist posture. This position is substantially stressless when compared with the hand position used for operating a conventional keyboard because it permits a relatively straight hand-wrist position and less hand pronation. Carpal tunnel syndrome and other neurological or orthopedic malfunctions are not likely to be manifested while using the keyboard described.

A keyboard of the invention may further include a cursor control unit which is positioned on a surface

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substantially transverse to the key surface. This allows the user to actuate the cursor control unit in a natural grasp/palmar pinch motion with the hands in a prehensile position, without having to flex the fingers during use and without having to move either hand away from base position on the keyboard. The cursor control unit is operated by the user's thumbs by pressing the unit inward in a direction transverse to the direction of operation of the keys of the keyboard. Pressure on a portion of the unit causes the cursor to move on the display screen in the direction of the portion of the unit pressed. Both hands are in a prehensile position with the fingers and thumb of each hand in a grasping posture and both hands work together, reinforcing or opposing each other, when using the cursor control unit to effectuate precisely refined movement and placement of the cursor on the screen. The cursor control unit may include a concave or convex (trackball) surface which rotates around a universal joint and pressure of both thumbs, either reinforcing or opposing each other may be used.

With reference to the Figures, in which like numerals represent like elements, Figure 1 shows a workstation in accordance with the invention. A cabinet 2 includes a video display screen 4, a work document display area 6 and keyboard 10. A central processing

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unit (not shown) may be supported in the cabinet 2 or may be separate.

Figure 2 is a side view of the apparatus shown in Figure 1 and illustrates a first embodiment for allowing viewing of a work document 14. Cabinet 2 is supported by a stand 16 which provides a slot for receiving a document 14. Document 14 is placed in the slot under cabinet 2 by either sliding it in from the side, the rear, or the front, depending on the particular arrangement. Alternatively, a platen (not shown) may be used to continuously scroll a work document.

It has been discovered that the optimum arrangement for compliance with physiological demands, particularly the five interrelated factors discussed above, is to permit depression of the operator's head below a horizontal line by 15° to 20° and to provide for a depression of gaze below the angle of depression of the head by an additional 40° to 45° . Thus, the total depression below a horizontal plane would be 55° to 65° .

When an individual works at a near vision task, the head is preferably oriented downwardly with respect to a horizontal plane and the eyes are oriented further downwardly by movement with respect to the head. It is the resultant combination of head and depression of gaze which provides the most comfortable working position.

The apparatus shown in Figure 2 provides an optimum working position by positioning the display screen 4 and

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keyboard 10 to reduce physiologic strain during the operation of the apparatus. Display screen 4 is placed so that line 18, connecting the eyes of the operator with a midpoint of the video display screen, is preferably approximately 45° below a horizontal line 20.

In the preferred embodiment, this occurs when the operator's chin is even with the bottom of a glare-reducing hood 8. The angular extent of the display screen with respect to the operator is preferably no more than about 20°, or 10° on either side of the line 18. Keyboard 10 is located below the display screen, and line 22 connects a midpoint of the keyboard with the operator's eyes when the keyboard is at its lowermost position. Line 22 is preferably approximately 60° below the horizontal, and the keyboard has a small angular extent. The document viewing area 6 is just below keyboard 10 and requires little additional vertical angular excursion of the operator's eyes for viewing of a document.

Figure 2 shows an embodiment wherein a fluorescent lamp 28 illuminates document 14. A magnified image of the document is viewed through a magnifying lens 30. This lens is preferably cylindrical, extends across the work document display area 6, and may be made of any of several materials, for example, glass or plastic. Alternatively, magnifying lens 30 is a Fresnel lens. In this embodiment, the operator will see a magnified image

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of document 14 in display area 6, and the document may be moved in any direction to show different sections of the document.

Figure 3 shows a second embodiment wherein document 14 is viewed directly. Lamp 28 illuminates the area containing the document, and the document is viewed directly through a transparent door 32. The door may be hinged at 34 to permit direct access to the document through the front of the cabinet or a cartridge such as that described below. The lens 30 of Figure 2 may be similarly hinged. The display area 6, may alternatively be open, without any transparent screen or magnifying lens.

Figure 4 illustrates a third embodiment wherein an image of document 14 is projected onto a screen 36. A collimating lens 38 directs light from lamp 28 onto document 14. While the light is shown confined to a somewhat narrow area, it will be appreciated that it is within the contemplation of the invention for the light from lamp 28 to extend completely across the entire work document 14. A projection lens system 40 receives the light reflected from the work document 14 and projects an erect image thereof onto screen 36 for viewing by the operator.

Figure 5 shows another alternative for viewing a document 14. An electronic imaging device 62, such as a CCD camera, scans an image of document 14 and

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transmits signals representative of the document image to a central processing unit, e.g. the CPU of the computer. The processing unit receives these signals and generates signals to control the video screen to reproduce the image of document 14 on screen 4. The reproduced image is preferably located at an area such as that shown at 64 at the top of screen 4. Other locations may be found to be useful, and controls (not shown) are preferably provided to the user whereby the position of the electronic image can be changed.

Imaging device 62 reduces even further the required angular excursion for the operator's eyes and eliminates the necessity for separate viewing area 6.

Figure 6 shows a cartridge 24 which may be removably received in cabinet 2 and includes an operating lever 26 for controlling a projection lens system, such as that shown at 40 in Figure 4, to focus an image of document 14 on the display area 6. Other possible embodiments of cartridge 24 would contain the elements described above with reference to the other viewing embodiments.

With reference to Figure 1, keyboard 10 is mounted on racks 43 whereby it may be moved with respect to the cabinet 2 and consequently with respect to the screen 4. Accordingly, keyboard 10 may be placed at any desired location depending upon the individual operator's preference and the location of the document 14 or other

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work items. It will be appreciated that the setup described in figures 1 through 6 greatly reduces the angular excursions required by the operator when performing work to comply with the physiological requirements discussed above to greatly increase the operator's comfort.

With reference to Figure 1, area 8 may be adapted to contain a central processing unit and may include such devices as disk readers and/or internal memory devices. Area 8 is above and extends outwardly from the top of the video display screen 4 to a point vertically beyond the bottom of the screen to shield the screen from the room lights to reduce reflections from the face of display screen 4. In addition, side panels, such as that shown at 58 in figure 5, may be provided to extend along the sides of the display screen 4 to block light incident from the aides which would tend to create additional glare on screen 4.

The keyboard of the invention illustrated in Figures 7 to 11 may be used as a stand alone keyboard for any existing computer or may be used in a workstation in which the keyboard is partially or completely superimposed on the plane of the computer screen.

With reference to Figures 7 to 10, keyboard 102 includes a plurality of keys 104 arranged in the normal layout of a "QWERTY" typewriter keyboard. Keys 104 are

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located on keyboard halves 106 and 108 which are joined at central peak 110. Keyboard halves 106 and 108 slope downwardly away from each other on either side of central peak 110.

5 Figures 7 and 8 show keyboard 102 including calculator mnemonic 112 at its right end. The keys bearing numbers are arranged as known in the art, and in addition, key 114, bearing numeral 1, functions as the "END" key; key 116, bearing the numeral 3, functions as
10 the "PAGE DOWN" key; key 118, bearing the numeral 7, functions as the "HOME" key; and key 120, bearing the numeral 9, additionally functions as the "PAGE UP" key. Further keys are arranged around the calculator mnemonic 112 so that they are easily reached by fingers of the
15 right hand.

 The left end of keyboard 102 contains a clock-face mnemonic 122. Clock-face mnemonic 122 includes the twelve function keys F1 through F12 arranged in a circle, as in a clock face. Thus, F1 is at the one
20 o'clock position and F12 is at the twelve o'clock position, with the other function keys correspondingly arranged. The center of the clock face is divided into three segments. CONTROL key 124, ALTERNATE key 126 and SHIFT key 128 each occupy a respective 120° segment of
25 the central portion of clock face mnemonic 122. Use of the function keys generally requires use of either the CONTROL, ALTERNATE or SHIFT key simultaneously or in

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quick succession with the function key being used. A user having acquired total tactile familiarity with the keyboard will readily be able to touch-type the combinations associated with use of the function keys.

5 In contrast, known systems require the user to look at the keyboard when using the function keys, and significant time is lost in searching for the keys needed.

Figure 10 is a cross-section through clock face mnemonic 122, showing domed upper surfaces 130 on functions keys F6, F9 and F12. Function key F3 also has a domed upper surface. Thus, keys at the three o'clock, six o'clock, nine o'clock and twelve o'clock positions have domed surfaces 130 to facilitate total tactile familiarity with the clock-face mnemonic. Placement of fingers on domed surfaces 130 immediately communicates to the user that the proper positions have been reached. In this way, a user may develop total tactile familiarity with the keyboard and may thus need only observe the screen and the copy without diverting his gaze to the keyboard.

Keyboard 102 also includes V-shaped space bar 132 which is located at the central forward edge of keyboard 102. Space bar 132 may be activated either by pressing vertically on upper surface 134, by pressing horizontally on front surface 136, or by pressing at a selected angle between the vertical and horizontal

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directions. In particular, pressure on front surface 136 allows the user to press space bar 132 with a natural "grasping" motion of the thumb toward the forefinger.

5 A further aid to gaining total tactile familiarity with keyboard 102 is the CAPS LOCK key 138. This key performs the function of a SHIFT key when pressed in its central portion 140. Outer portions 142 and 144 of key 138 are raised, as shown in Figure 7, and the key is
10 pivotally mounted to the keyboard base. Pressure on portion 142 activates the CAPS LOCK function, and pressure on portion 144 deactivates the CAPS LOCK. When the CAPS LOCK function is activated, a portion of that key, or the entire key, illuminates and remains so until
15 the CAPS LOCK function is deactivated. Similarly, other keys, such as the NUM LOCK and SCROLL LOCK keys illuminate when those functions are activated.

 A cursor control unit 146 (see figure 8) is located on the vertical front face of keyboard 102 below central
20 peak 110. The linkage of the cursor control unit is, for example, similar to that of a track ball mouse or a joy stick. Cursor control unit 146 controls cursor movement according to a clock face system. Pressure on different parts of cursor control unit 146 moves the
25 cursor in different directions. For example, pressure on the twelve o'clock position of cursor control unit 146 moves the cursor upwards, pressure on the three

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o'clock position moves the cursor to the right and pressure on the nine o'clock position moves the cursor to the left. Pressure on other positions of cursor control unit 146 moves the cursor in corresponding directions. The cursor control unit may be activated by either thumb pressing inward toward its respective forefinger, or both thumbs being used together to effect a fine movement control over the cursor. One thumb, thus, acts as a counterforce to the action of the other thumb.

Figure 11 schematically illustrates a particularly advantageous use of keyboard 102 when used with a workstation 150 as described above. Keyboard 102 is mounted for movement over screen 152 and moves up and down with respect to screen 150 on tracks 41 on either side of the screen.

The keyboard is provided with a straight upper surface which forms a cursor bar 156. As the keyboard is moved along the screen, the cursor bar 156 provides a visual guide to the line on which the cursor is moving on the screen. As the operator inputs text to the terminal, the keyboard may be moved down the screen with the cursor bar aligned with the line being typed. Should the operator need to change his gaze from the copy viewing area to the screen, the cursor bar immediately points out the line being typed, without confusion.

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The arrangement shown in Figure 11 requires minimal shifting of the operator's gaze from cursor line to keyboard or from the copy viewing area to keyboard. Preferably, there is a maximum shift of 15° between the copy viewing area and the screen and less than 15° from the cursor line at the top of the keyboard to the center of the keys. Viewing the copy viewing area, keyboard, and screen is thus facilitated with minimal shift in gaze. Even if the user does not have total tactile familiarity with the keyboard, efficiency is greatly increased due to the decreased eye strain achieved with the juxtaposition of the three areas.

Figure 12 shows a keyboard similar to that shown in Figure 8 in which the cursor control unit 160 is substantially ball-shaped. Cursor control unit 160 has a convex surface which rotates around a universal joint (not shown) and pressure of both thumbs, either reinforcing or opposing each other may be used for moving the cursor. The hands of the user are in prehensile position, as shown in Figure 13, when the ball-shaped cursor control unit is used.

Because of the center-peaked configuration the front of the keyboard provides an area where other keys or controls may be located to permit further advantageous use of the grasping motion of the thumb toward the forefinger. All of these actions are accomplished while the hands are in a prehensile

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position. This ensures greater tactile familiarity and is therefore less visually demanding.

In Figure 14, a keyboard 200 is shown having keyboard halves 202 and 204. An innermost edge 206, 208 of the keyboards halves 202, 204 is shown located along an edge of a flat central spine 210. The spine 210 is of a triangular shape, tapering inwardly away from the user. The keyboard halves 202, 204 include a plurality of alphanumeric keys and a space bar separated into portions 212, 214. The two keyboard portions 202, 204 slant away from the central spine 210 and upwardly away from the user, as shown in Figure 17.

Cursor-control unit 216 is substantially ball-shaped. Cursor-control unit 216 has a convex surface which rotates around a universal joint (not shown) and pressure of both thumbs either reinforcing or opposing each other may be used for moving the cursor. When a desired position of the cursor is achieved, at least one of the cursor-control switches 218 or 220, is depressed by either forefinger to instruct a computer that a particular function to which the cursor has been moved is desired.

The cursor-control switch buttons lie substantially in the plane of the keyboard halves 202, 204. The cursor-control unit 216 is located in a front vertical surface 222 which extends substantially perpendicular to the surface defined by the central spine 210.

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With reference to Figure 16, the hands 224 of an operator are located in a prehensile position with respect to the keyboard 200. This positioning of the hands avoids many of the problems previously described with respect to use of standard-type keyboards.

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CLAIMS

1. A keyboard for a computer for operating with hands of a user disposed in a prehensile position comprising:

keyboard means having keys for depressing by movement of fingers of a user in a first direction;

spacing means mounted at a forward edge of said keyboard means for operating by movement of a thumb of the user;

activating means mounted on said keyboard means for operating by movement of at least one thumb of a user in a second direction substantially transverse to said first direction;

whereby each of the user's hands is disposed substantially in a prehensile position with the thumb opposed to the fingers in a grasping position when using the keyboard and whereby ulnar abducted deviation and hand-pronation are reduced.

2. A keyboard according to claim 1 further comprising:

circular means for locating twelve numbered function keys disposed toward a first outward end of said surface means; and

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keypad means for locating numeric keys disposed toward a second outward end of said surface means.

5 3. A keyboard according to claim 2 wherein said keyboard means comprises first slanting keyboard surface means comprising keys for depressing by fingers of the user's left hand and second slanting keyboard surface means comprising keys for depressing by fingers of the
10 user's right hand, said first and second keyboard surface means joined at a peaked central edge forming a V-shape which slopes downwardly toward the user and laterally away from the user..

15 4. A keyboard according to claim 3 wherein said activating means comprises cursor control means mounted on a front surface of said keyboard.

20 5. A keyboard according to claim 4 wherein said cursor control means comprises a plurality of areas responsive to thumb pressure whereby pressure on one of said areas moves the cursor in a selected direction.

25 6. A keyboard according to claim 2 wherein said twelve numbered function keys are positioned circumferentially around said circular means in numerical positions corresponding to numbers on a clock.

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7. A keyboard according to claim 6 further comprising alternate, control and shift function keys positioned in a central portion of said circular means.

5 8. A keyboard according to claim 7 wherein each of the centrally positioned keys substantially occupies a 120° segment of the central portion of said circular means.

10 9. A keyboard according to claim 6 wherein the function keys positioned at three-, six-, nine- and twelve-o'clock comprise domed upper surfaces.

15 10. A keyboard according to claim 9 wherein other numbered function keys comprise flat upper surfaces.

20 11. A keyboard according to claim 3 wherein said spacing means comprises means positioned on said first slanting keyboard surface means and on said second slanting keyboard surface means.

 12. A keyboard according to claim 11 wherein said spacing means further responds to thumb pressure in said first direction.

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13. A keyboard according to claim 11 wherein said spacing means further responds to thumb pressure at a selected angle.

5 14. A keyboard according to claim 4 wherein said cursor means is positioned below said spacing means.

10 15. A keyboard according to claim 3 further comprising key means for locking alphabet keys in upper case or lower case mode comprising a first raised portion, actuation of which causes said key means to stay in a locked position.

15 16. A keyboard according to claim 15 wherein said locking key means further comprises a second raised portion, depression of which releases said key means from said locked position.

20 17. A keyboard according to claim 16 wherein said locking means is located on the right-hand side of the keyboard.

25 18. A keyboard for a computer having function keys comprising a plurality of function keys surrounding at least one centrally positioned key for use in conjunction with said function keys.

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19. A keyboard according to claim 18 wherein said plurality of function keys comprises twelve keys and said at least one centrally located key comprises centrally located alternate, control and shift function keys.

20. A keyboard according to claim 19 wherein said twelve function keys are equally spaced in a circle.

21. A keyboard for a computer comprising:

first activating means on a first surface of a keyboard;

second activating means on a second surface of said keyboard substantially transverse to said first surface, said second activating means controlling movement of a cursor on a display screen of the computer;

wherein said first and second activating means are disposed substantially transverse to each other for operating by hands of a user in a prehensile substantially grasping motion.

22. A keyboard according to claim 21 wherein said second activating means is adapted for controlling by at least one thumb of a user.

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23. A keyboard according to claim 22 wherein said second activating means is adapted for controlling by both thumbs of a user substantially simultaneously.

5 24. A keyboard for a computer comprising:

first activating means located on first and second slanting keyboard surfaces of a keyboard comprising keys for depressing by fingers of a user's left and right hands respectively, said first and second
10 slanting keyboard surfaces joined at a peaked central edge forming a V-shape which slopes downwardly toward the user and laterally away from the user; and

second activating means on a second surface of said keyboard substantially transverse to said first
15 surface, said second activating means adapted for controlling movement of a cursor on a display screen of the computer by at least one thumb of a user;

wherein both hands of the user are disposed in a substantially prehensile position with substantially
20 straight wrists during use.

25. A keyboard according to claim 24 wherein said second activating means comprises a ball-shaped surface for activating by the at least one thumb of the user.

25

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26. A keyboard according to claim 25 further comprising:

circular means for locating twelve numbered function keys disposed toward an outward end of said first slanting keyboard surface, and

keypad means for locating numeric keys disposed toward an outward end of said second slanting keyboard surface.

27. A keyboard for a computer for operating with hands of a user disposed in a prehensile position comprising:

keyboard means having keys for depressing by movement of fingers of a user in a first direction;

spacing means mounted at a forward edge of said keyboard means for operating by movement of a thumb of the user;

activating means mounted on said keyboard means for controlling movement of a cursor by movement of at least one thumb of a user in a second direction substantially transverse to said first direction;

control means mounted on said keyboard for controlling a function of the cursor as positioned by said activating means;

whereby each of the user's hands is disposed substantially in a prehensile position with the thumb opposed to the fingers in a grasping position when using

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the keyboard and whereby ulnar abducted deviation and hand-pronation are reduced.

28. A keyboard according to claim 27 further comprising:

circular means for locating twelve numbered function keys disposed toward a first outward end of said surface means; and

keypad means for locating numeric keys disposed toward a second outward end of said surface means.

29. A keyboard according to claim 28 wherein said keyboard means comprises first slanting keyboard surface means comprising keys for depressing by fingers of the user's left hand and second slanting keyboard surface means comprising keys for depressing by fingers of the user's right hand, said first and second keyboard surface means being separated at a peaked central spine forming a V-shape which slopes downwardly toward the user and laterally down and away from the user.

30. A keyboard according to claim 29 wherein said activating means comprises cursor means mounted on a front surface of said keyboard.

-33-

31. A keyboard according to claim 30 wherein said cursor means is positioned below said spacing means.

32. A keyboard for a computer comprising:

5 first activating means on a first surface of the keyboard for depressing by movement of fingers of a user;

10 second activating means on a second surface of said keyboard substantially transverse to said first surface for controlling movement of a cursor on a display screen of the computer;

control means mounted on said keyboard for controlling actuation of said second activating means;

15 wherein said first and second activating means are disposed substantially transverse to each other for operating by hands of a user in a prehensile substantially grasping motion.

20 33. A keyboard according to claim 32 wherein said second activating means is adapted for controlling by at least one thumb of a user.

25 34. A keyboard according to claim 33 wherein said second activating means is adapted for controlling by both thumbs of a user substantially simultaneously.

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35. A keyboard for a computer comprising:

first activating means located on first and second slanting keyboard surfaces of a keyboard comprising keys for depressing by fingers of a user's left and right hands respectively, said first and second slanting keyboard surfaces being separated at a peaked central spine forming a V-shape which slopes downwardly toward the user and laterally down and away from the user; and

second activating means on a second surface of said keyboard substantially transverse to said first surface, said second activating means adapted for controlling movement of a cursor on a display screen of the computer by at least one thumb of a user;

wherein both hands of the user are disposed in a substantially prehensile position with substantially straight wrists during use.

36. A keyboard according to claim 35 wherein said second activating means comprises a ball-shaped surface for activating by the at least one thumb of the user.

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FIG. 1

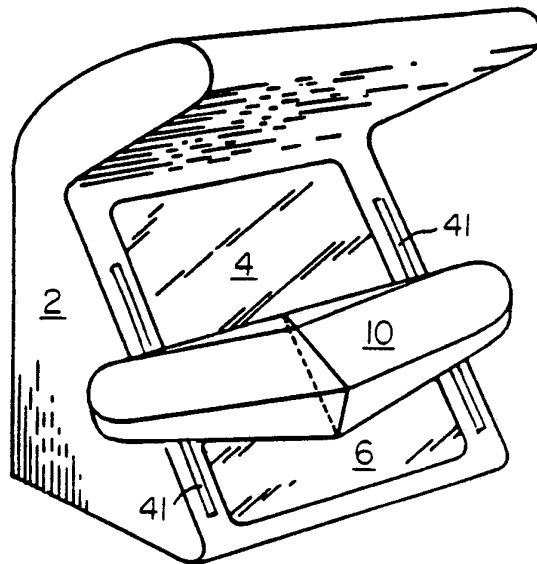
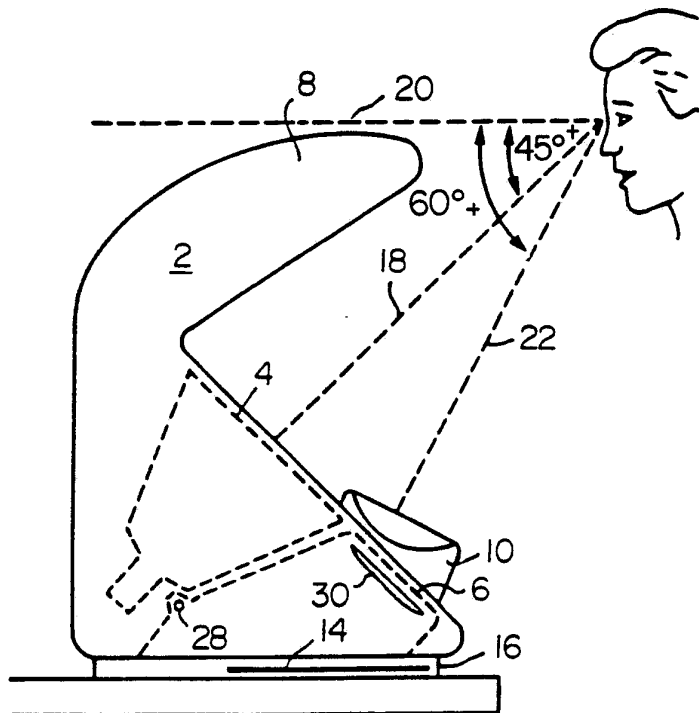


FIG. 2



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FIG. 3

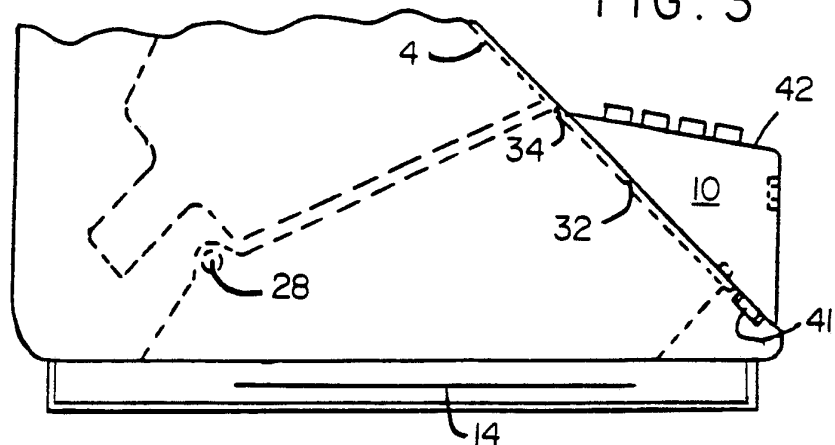


FIG. 4

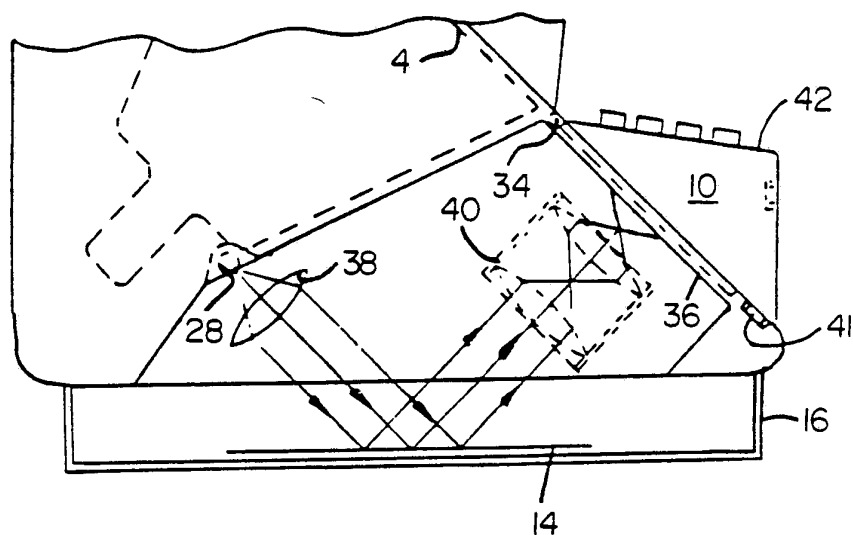
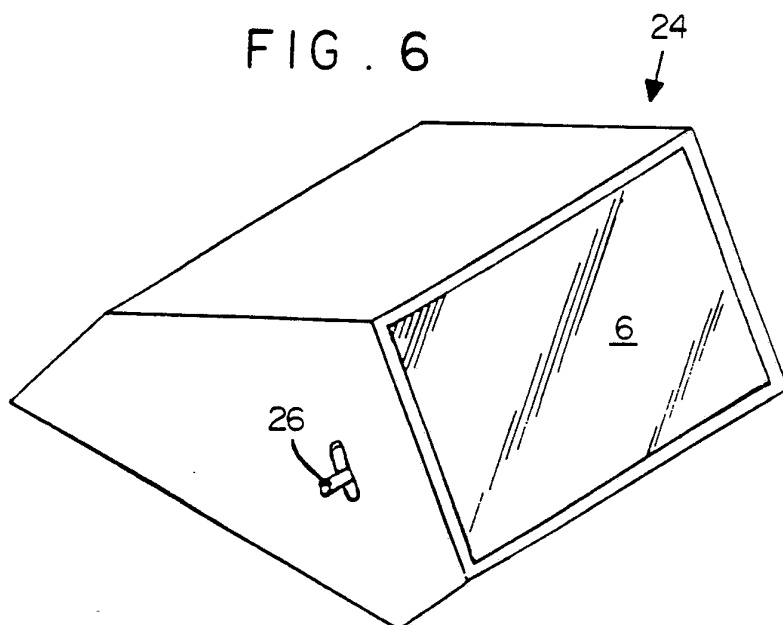


FIG. 6



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FIG. 5 ^{3/8}

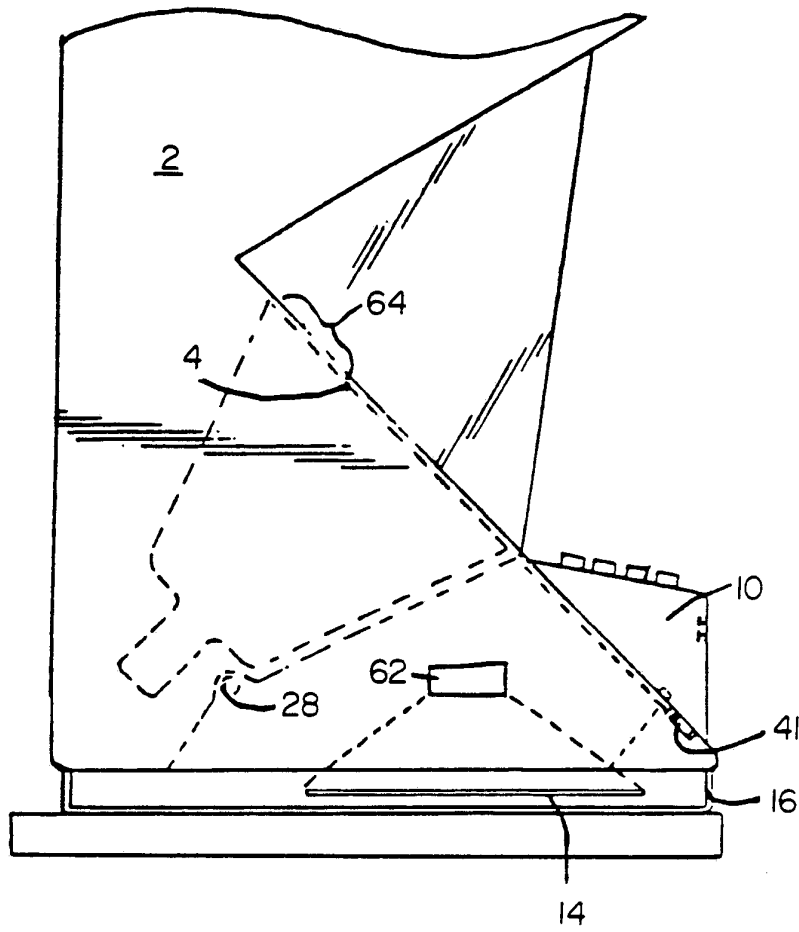
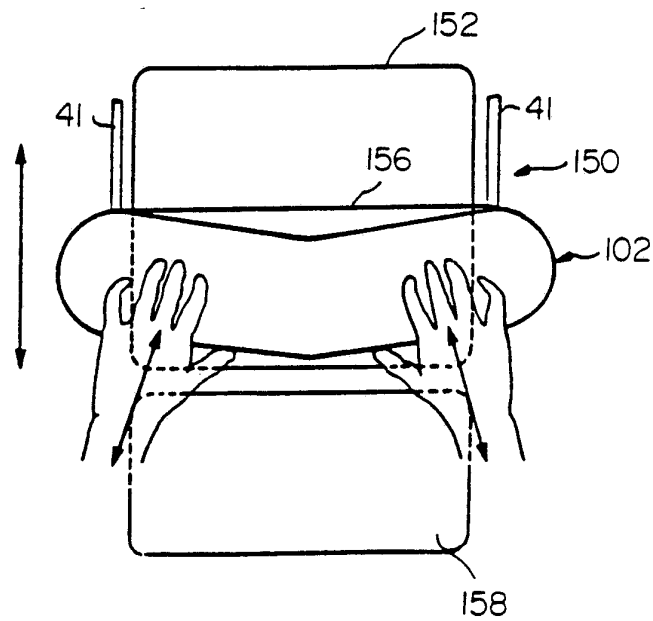


FIG. II



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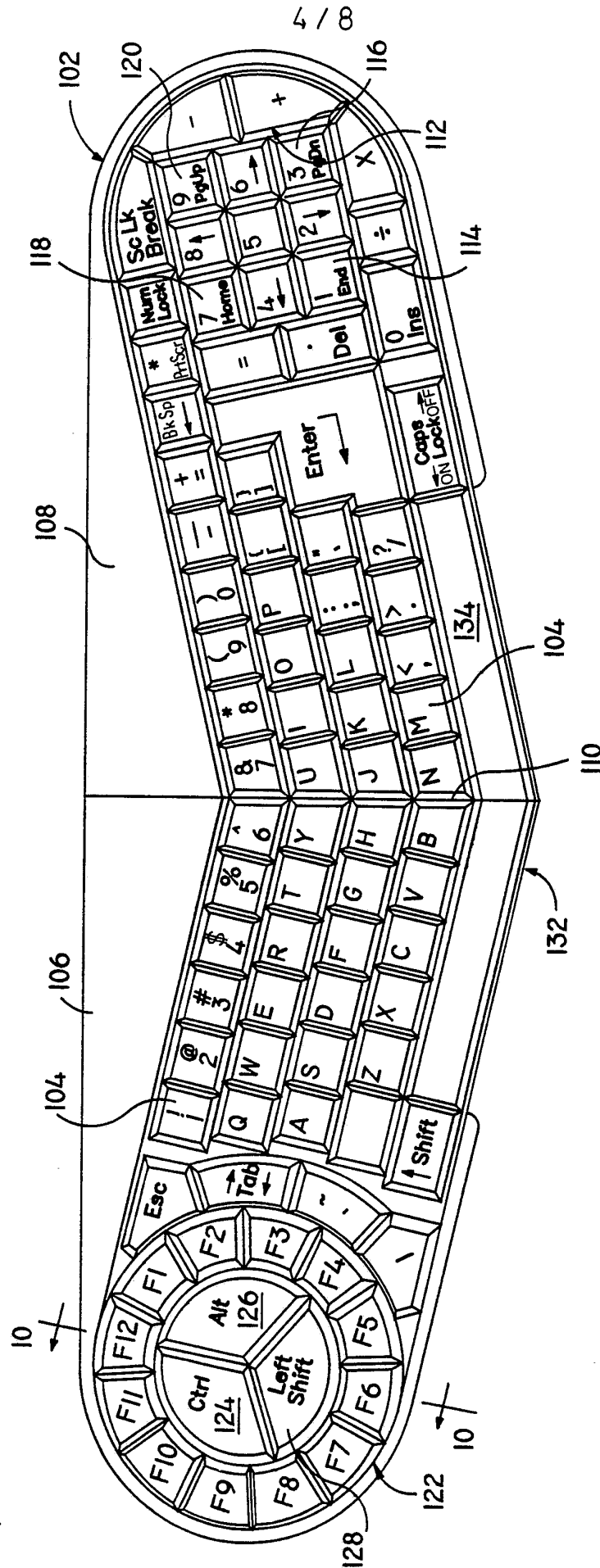


FIG. 7

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FIG. 8

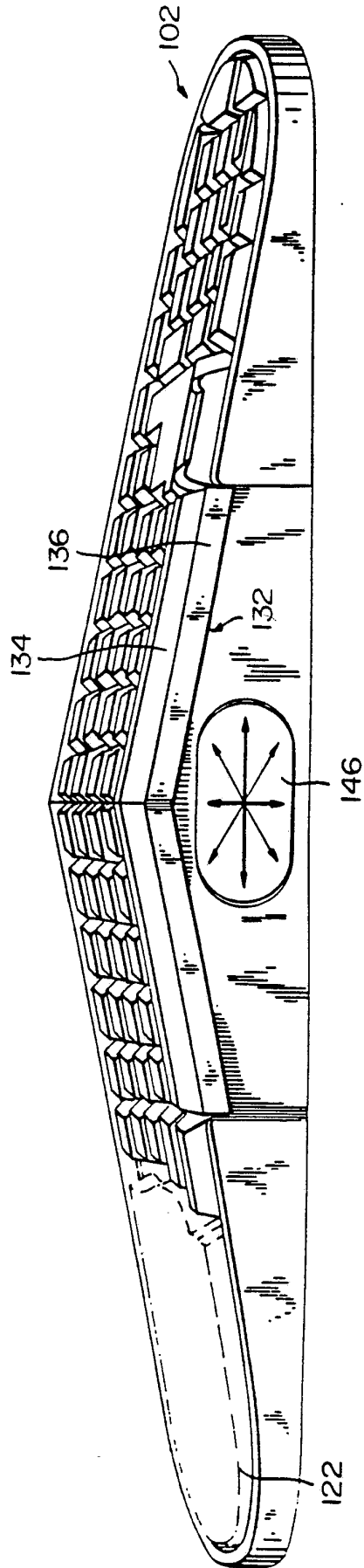


FIG. 9

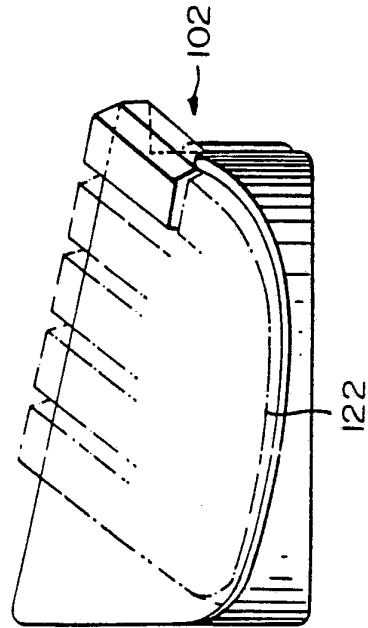
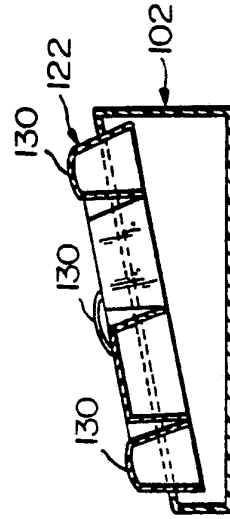


FIG. 10



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FIG. 12

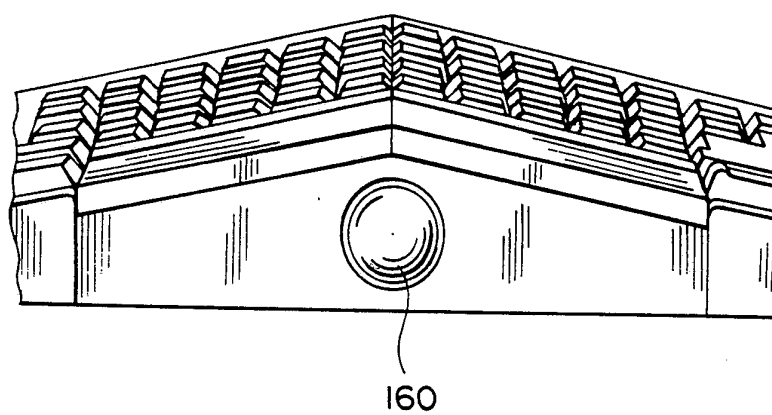
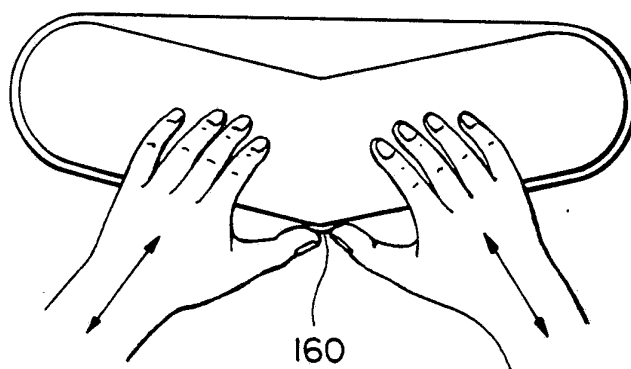


FIG. 13



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FIG. 14 7 / 8

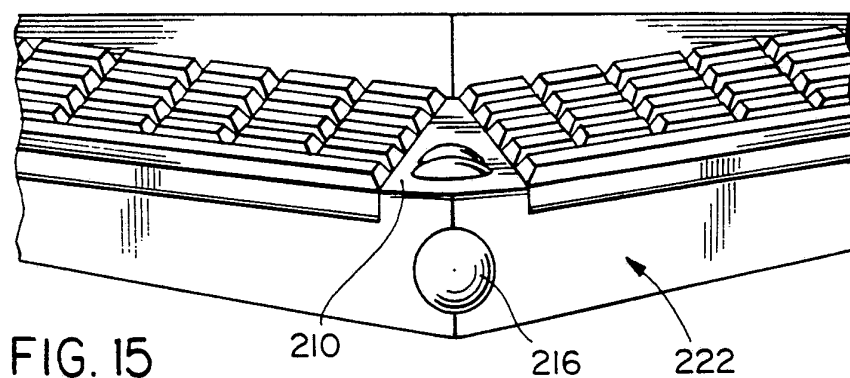
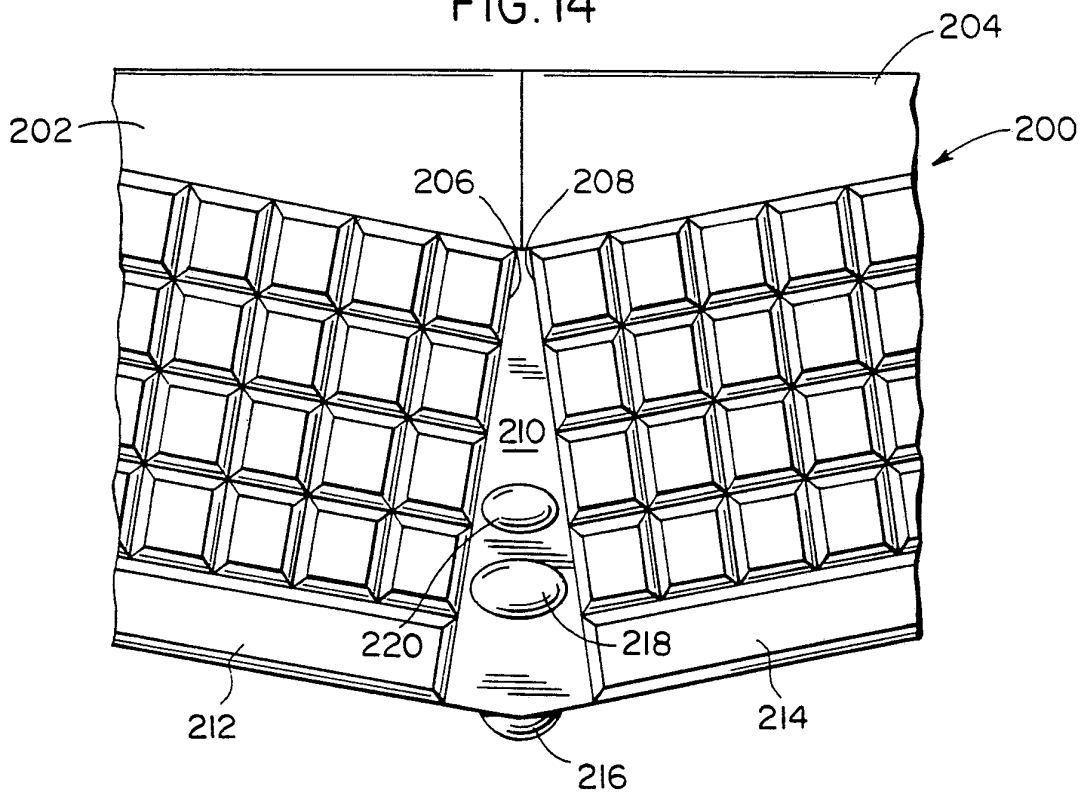


FIG. 15

FIG. 16

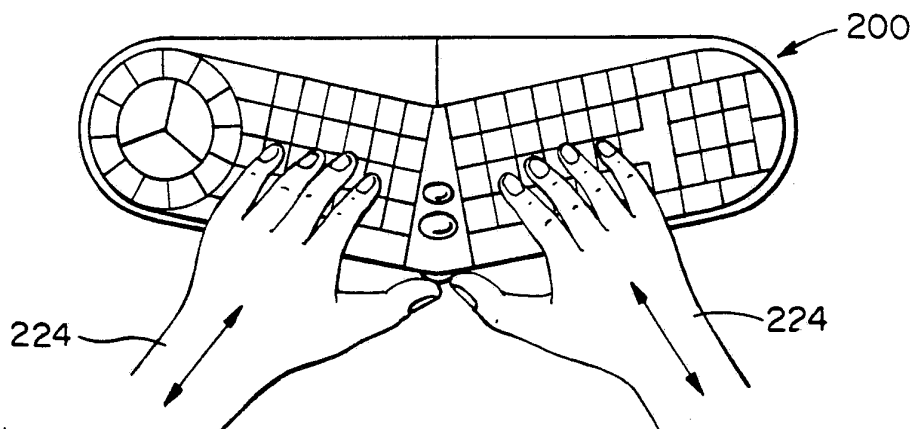
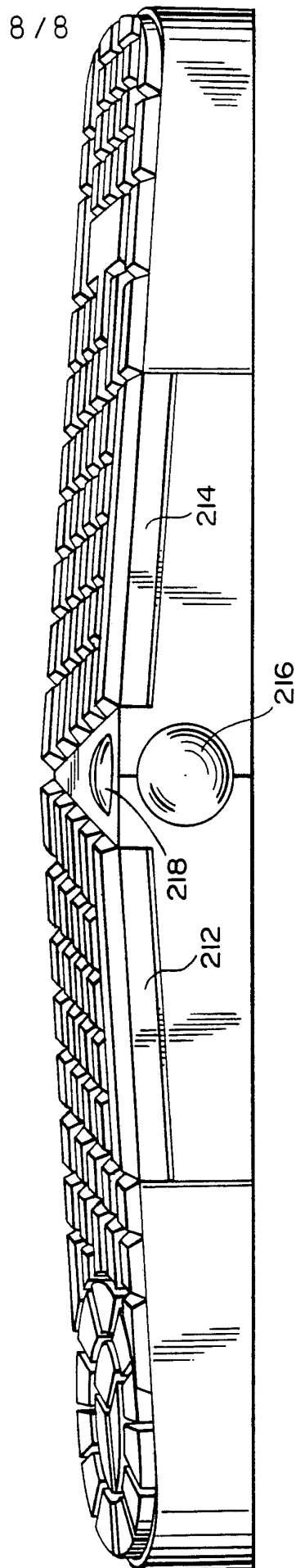


FIG. 17



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INTERNATIONAL SEARCH REPORT

PCT/US93/01873

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : G09G 3/02

US CL : 340/711

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 340/706, 710, 709; 341/20, 21, 23; 248/917, 918, 920, 922; 400/486, 487, 488, 489, 472, 91, 92, 195; 235/144, 146; 364/709.14; 340/711

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
<u>X</u> Y	US, A, 4,891,777 (Lapeyre) 02 January 1990 See column 4, lines 34-47 and see figures 1-2.	<u>18</u> 19-20
<u>X</u> Y	US, A, 4,928,093 (Rahman) 22 May 1990 See column 4, lines 37-46 and see figure 2.	<u>21-22 and 32-33</u> 1-17, 23-31, 34-36
Y	GB, A, 332,476 (Marloth) 24 July 1930 See page 2, lines 8-12, 41-45 and figures 1-2	24-25 and 35-36, 3-5, 11-14 and 29-31.
Y	GB, A, 2,034,043 (Collie) 29 May 1980 See page 2, lines 5 and 27-31.	2, 6, 20, 26 and 28

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:	*T	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be part of particular relevance	*X*	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y*	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Z*	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

13 MAY 1993

Date of mailing of the international search report

08 JUL 1993

 Name and mailing address of the ISA/US
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 THANH NGUYEN

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/01873

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	IBM Technical Disclosure Bulletin, Volume 27, No. 4B, September 1984, T.A. Azelone, "Mapping the Personal Computer 83 Key-Keyboard to a 62 Key Keyboard". See figure 2.	7-10 and 15-17